APPENDIX VI

UPPER CONCENTRATION LEVEL CALCULATIONS

Data Sets for Calculation of 95th UCL of the Mean Concentration

IA01			
Sample ID	Arsenic	Qual	Units
IA01/B-01/3-5 10/09/2012	230		mg/kg
IA01/B-02/0-2 10/08/2012	8.8		mg/kg
IA01/B-03/0-2 10/08/2012	15		mg/kg
IA01/B-04/0-2 10/08/2012	19		mg/kg
IA01/B-05/4-6 10/09/2012	22		mg/kg
IA01/B-05/14-16 10/09/2012	61		mg/kg
IA01/B-06/6-8 10/09/2012	16		mg/kg
IA01/B-07/6-8 10/09/2012	22		mg/kg
IA01-B08/(2-4) 1/30/2013	48		mg/kg
IA01-B09/(2-4) 1/30/2013	33		mg/kg

IA03			
Sample ID	Arsenic	Qual	Units
IA03/B-01/02 10/08/2012	18.5	D2	mg/kg
IA03/B-01/12-14 10/08/2012	8.4		mg/kg
IA03/B-02/0-2 10/08/2012	72		mg/kg
IA03/B-02/10-12 10/08/2012	20		mg/kg
IA03/B-03/2-4 10/08/2012	17		mg/kg
IA03/B-03/10-12 10/08/2012	11		mg/kg
IA03/B-04/0-2 10/08/2012	26		mg/kg
IA03/B-04/6-8 10/08/2012	29		mg/kg
IA03/B-05/0-2 10/08/2012	17		mg/kg
IA03/B-05/10-12 10/08/2012	9.7		mg/kg
IA03/B-06/8-10 10/08/2012	93		mg/kg

IA04			
Sample ID	BaP	Qual	Units
IA04/B-01/2-4 10/09/2012	7,800		ug/kg
IA04/B-01/14-16 10/09/2012	9.6		ug/kg
IA04/B-02/6-8 10/09/2012	7.4	U	ug/kg
IA04/B-02/12-14 10/09/2012	7.7	U	ug/kg
IA04/B-03/3-5 10/10/2012	18		ug/kg
IA04/B-04/3-5 10/10/2012	8	U	ug/kg
IA04/B-05/6-8 10/09/2012	7.5	U	ug/kg
IA04/B-06/2-4 10/10/2012	7.9	U	ug/kg
IA04-B07/2_0-3_0 02/01/2013	190		ug/kg
IA04-B08/2_0-3_0 02/01/2013	150		ug/kg
IA04-B09/1_5-2_0 02/01/2013	400		ug/kg

IA07			
Sample ID	BaP	Qual	Units
STRAT-05/2-4 10/10/2012	9300	U	ug/kg
IA07/B-01/1-3 10/10/2012	9,700		ug/kg
IA07/B-01/16-18 10/10/2012	405	U2	ug/kg
IA07/B-02/6-8 10/10/2012	15		ug/kg
IA07-B03/2-4 1/30/2013	350	J	ug/kg
IA07-B03/16-18 1/30/2013	8	U	ug/kg
IA07-B04/24-25 01/31/2013	7.3	U2	ug/kg
IA07-B04/38-39 01/31/2013	7.5	U	ug/kg
IA07-B05/22-23 01/31/2013	7.5	U	ug/kg
IA07-B05/32-33 01/31/2013	20		ug/kg
IA07-B06/2-4 01/30/2013	520	U	ug/kg
IA07-B06/8-10 01/30/2013	410	U	ug/kg
IA07-B06/12-13 01/30/2013	87	U	ug/kg
IA07-B06/19-20 01/30/2013	390	U	ug/kg
IA07-B07/2-4 01/30/2013	8100	U	ug/kg
IA07-B07/10-12 01/31/2013	170		ug/kg
IA07-B08/2-4 1/30/2013	230		ug/kg
IA07-B08/10-12 1/30/2013	7.8	U	ug/kg
IA08-MW10/22-23 01/31/2013	1600		ug/kg

U = Nondetect

U2 = Nondetect in both initial and duplicate sample. Values averaged

D2 = Detected in both initial and duplicate sample. Values averaged

J = Estimated concentration due to postive dection below reporting limit or data quality issue.

CDF011948

ARSENIC (IA-01)
General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	WorkSheet.wst
Full Precision	ON
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	8.8	Minimum of Log Data	2.1747517
Maximum	230	Maximum of Log Data	5.4380793
Mean	47.48	Mean of log Data	3.3698576
Geometric Mean	29.07439	SD of log Data	0.9221645
Median	22		
SD	66.12945		
Std. Error of Mean	20.91197		
Coefficient of Variation	1.392785		
Skewness	2.833723		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.576642	Shapiro Wilk Test Statistic	0.9087677
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	85.814	95% H-UCL	110.00737
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	98.013262
95% Adjusted-CLT UCL (Chen-1995)	101.9003	97.5% Chebyshev (MVUE) UCL	122.20473
95% Modified-t UCL (Johnson-1978)	88.93721	99% Chebyshev (MVUE) UCL	169.72419

ARSENIC (IA-01)
General UCL Statistics for Data Sets with Non-Detects

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.877055	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	54.13571		
MLE of Mean	47.48		
MLE of Standard Deviation	50.69875		
nu star	17.5411		
Approximate Chi Square Value (.05)	9.060065	Nonparametric Statistics	
Adjusted Level of Significance	0.0267	95% CLT UCL	81.877126
Adjusted Chi Square Value	8.022028	95% Jackknife UCL	85.813999
		95% Standard Bootstrap UCL	79.347379
Anderson-Darling Test Statistic	0.86539	95% Bootstrap-t UCL	195.52017
Anderson-Darling 5% Critical Value	0.745419	95% Hall's Bootstrap UCL	205.24351
Kolmogorov-Smirnov Test Statistic	0.257653	95% Percentile Bootstrap UCL	84.7
Kolmogorov-Smirnov 5% Critical Value	0.272921	95% BCA Bootstrap UCL	108.08
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	138.63315
		97.5% Chebyshev(Mean, Sd) UCL	178.0752
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	255.55145
95% Approximate Gamma UCL (Use when n >= 40)	91.92556		
95% Adjusted Gamma UCL (Use when n < 40)	103.8206		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**91.925556**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

ARSENIC (IA-03)
General UCL Statistics for Full Data Sets

User Selected Options	
From File	WorkSheet_a.wst
Full Precision	ON
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	10
Raw Statistics		**Log-transformed Statistics**	
Minimum	8.4	Minimum of Log Data	2.128232
Maximum	93	Maximum of Log Data	4.5326
Mean	29.23636	Mean of log Data	3.073895
Geometric Mean	21.62596	SD of log Data	0.763866
Median	18.5		
SD	27.48361		
Std. Error of Mean	8.286619		
Coefficient of Variation	0.940049		
Skewness	1.820185		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.717138	Shapiro Wilk Test Statistic	0.908414
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	44.25554	95% H-UCL	53.86798
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	57.36682
95% Adjusted-CLT UCL (Chen-1995)	47.72598	97.5% Chebyshev (MVUE) UCL	70.05774
95% Modified-t UCL (Johnson-1978)	45.0135	99% Chebyshev (MVUE) UCL	94.98659

ARSENIC (IA-03)
General UCL Statistics for Full Data Sets

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.374836	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	21.26535		
MLE of Mean	29.23636		
MLE of Standard Deviation	24.93434		
nu star	30.24639		
Approximate Chi Square Value (.05)	18.6866	Nonparametric Statistics	
Adjusted Level of Significance	0.02783	95% CLT UCL	42.86664
Adjusted Chi Square Value	17.21914	95% Jackknife UCL	44.25554
		95% Standard Bootstrap UCL	42.19985
Anderson-Darling Test Statistic	0.756583	95% Bootstrap-t UCL	75.91753
Anderson-Darling 5% Critical Value	0.74018	95% Hall's Bootstrap UCL	127.1768
Kolmogorov-Smirnov Test Statistic	0.224606	95% Percentile Bootstrap UCL	42.64546
Kolmogorov-Smirnov 5% Critical Value	0.258973	95% BCA Bootstrap UCL	47.72727
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	65.3569
		97.5% Chebyshev(Mean, Sd) UCL	80.98628
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	111.6872
95% Approximate Gamma UCL (Use when n >= 40)	47.32238		
95% Adjusted Gamma UCL (Use when n < 40)	51.35532		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**47.32238**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Benzo(a)Pyrene (IA-04)
General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet_b.wst
Full Precision	ON
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

BaP

General Statistics

Number of Valid Data	11	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	5
		Percent Non-Detects	45.45%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	9.6	Minimum Detected	2.261763
Maximum Detected	7800	Maximum Detected	8.961879
Mean of Detected	1427.933	Mean of Detected	5.060523
SD of Detected	3124.902	SD of Detected	2.394457
Minimum Non-Detect	7.4	Minimum Non-Detect	2.00148
Maximum Non-Detect	8	Maximum Non-Detect	2.079442

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	6
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	45.45%

Warning: There are only 6 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.537051	Shapiro Wilk Test Statistic	0.943131
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Benzo(a)Pyrene (IA-04)
General UCL Statistics for Data Sets with Non-Detects

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	780.6227	Mean	3.372846
SD	2331.437	SD	2.574266
95% DL/2 (t) UCL	2054.701	95% H-Stat (DL/2) UCL	157300.8
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	2.003327
		SD in Log Scale	3.899233
		Mean in Original Scale	778.9587
		SD in Original Scale	2332.048
		95% t UCL	2053.371
		95% Percentile Bootstrap UCL	2173.523
		95% BCA Bootstrap UCL	2876.069
		95% H-UCL	2.12E+09
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.26666	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	5354.894		
nu star	3.199914		
A-D Test Statistic	0.602087	Nonparametric Statistics	
5% A-D Critical Value	0.764969	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.764969	Mean	783.2364
5% K-S Critical Value	0.356327	SD	2222.027
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	733.9112
		95% KM (t) UCL	2113.422
Assuming Gamma Distribution		95% KM (z) UCL	1990.413
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2053.754
Minimum	1.00E-06	95% KM (bootstrap t) UCL	23823.32
Maximum	7800	95% KM (BCA) UCL	2226.727
Mean	778.8727	95% KM (Percentile Bootstrap) UCL	2183.273
Median	9.6	95% KM (Chebyshev) UCL	3982.281
SD	2332.08	97.5% KM (Chebyshev) UCL	5366.511
k star	0.120067	99% KM (Chebyshev) UCL	8085.561
Theta star	6486.986		
Nu star	2.641473	**Potential UCLs to Use**	
AppChi2	0.27464	**95% KM (BCA) UCL**	**2226.727**
95% Gamma Approximate UCL (Use when n >= 40)	7491.151		
95% Adjusted Gamma UCL (Use when n < 40)	10675.18		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Benzo(a)pyrene (IA-07)
General UCL Statistics for Data Sets with Non-Detects

User Selected Options	
From File	WorkSheet_c.wst
Full Precision	ON
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

BaP

General Statistics			
Number of Valid Data	20	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	13
		Percent Non-Detects	65.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	15	Minimum Detected	2.7080502
Maximum Detected	9700	Maximum Detected	9.1798812
Mean of Detected	1726.429	Mean of Detected	5.5276048
SD of Detected	3558.816	SD of Detected	2.2873968
Minimum Non-Detect	7.3	Minimum Non-Detect	1.9878743
Maximum Non-Detect	9300	Maximum Non-Detect	9.1377697

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	1
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	95.00%

Warning: There are only 7 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.562984	Shapiro Wilk Test Statistic	0.9507554
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1085.685	Mean	4.4332379
SD	2422.443	SD	2.6420664
95% DL/2 (t) UCL	2022.312	95% H-Stat (DL/2) UCL	76868.137

Benzo(a)pyrene (IA-07)
General UCL Statistics for Data Sets with Non-Detects

Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	2.5661685
		SD in Log Scale	2.7352027
		Mean in Original Scale	606.98642
		SD in Original Scale	2170.2126
		95% t UCL	1446.0901
		95% Percentile Bootstrap UCL	1503.3437
		95% BCA Bootstrap UCL	2131.5045
		95% H-UCL	19149.636

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.294795	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	5856.361		
nu star	4.127136		
A-D Test Statistic	0.491466	Nonparametric Statistics	
5% A-D Critical Value	0.776086	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.776086	Mean	640.77206
5% K-S Critical Value	0.333158	SD	2110.0611
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	510.74491
		95% KM (t) UCL	1523.9178
Assuming Gamma Distribution		95% KM (z) UCL	1480.8727
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1477.616
Minimum	1.00E-06	95% KM (bootstrap t) UCL	9847.8969
Maximum	9700	95% KM (BCA) UCL	1628.8163
Mean	604.25	95% KM (Percentile Bootstrap) UCL	1623.0167
Median	1.00E-06	95% KM (Chebyshev) UCL	2867.0575
SD	2171.012	97.5% KM (Chebyshev) UCL	3830.373
k star	0.087378	99% KM (Chebyshev) UCL	5722.6198
Theta star	6915.321		
Nu star	3.495138	Potential UCLs to Use	
AppChi2	0.533072	95% KM (t) UCL	1523.9178
95% Gamma Approximate UCL (Use when n >= 40)	3961.822		
95% Adjusted Gamma UCL (Use when n < 40)	4646.621		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX VII

JOHNSON AND ETTINGER CALCULATIONS

Canton Drop Forge

Canton, Ohio

Project No. 196663.0000.00004

Johnson & Ettinger Model Input Values

Variables	Value	Units	Data Source
Depth below grade to bottom of enclosed space	15	cm	USEPA Default for Slab-on-Grade Construction
Depth below grade to bottom of enclosed space	200	cm	USEPA Default for Basement Scenario
Depth below grade to top of water table	1067	cm	Site-specific Estimate (approx. 35' bgs)
Soil gas sampling depth (depth below grade)	305	cm	Site-specific Estimate (10' bgs)
SCS Soil Type of Vadose Zone **(Stratum A)**	Loamy Sand (LS)		Property Specific Estimate
Dry Bulk Density	1.62	g/cm^3	Model default for Loamy Sand soil type
Total Porosity	0.390	cm^3/cm^3	Model default for Loamy Sand soil type
Water-filled Porosity	0.076	cm^3/cm^3	Model default for Loamy Sand soil type
Averaging time for Carcinogens	70	years	USEPA RAGS Part A
Averaging time for Non-carcinogens	30	years	USEPA RAGS Part A
Exposure Duration	30	years	USEPA RAGS Part A
Exposure Frequency (residential)	350	days/year	Soil Screening Guidance, USEPA 1996
Building Length	1000	cm	Residential default
Building Width	1000	cm	Residential default
Building Height	244	cm	Residential (slab on grade)
Building Height	366	cm	Residential (basement)
Building Floor Thickness	10	cm	Residential default
Crack Width	0.1	cm	USEPA Default
Indoor Air Exchange Rate	0.25	1/hr	USEPA Default
Pressure Differential	4	Pa	USEPA Default

Johnson & Ettinger Model Supporting Calculations

Soil to Indoor Air Spreadsheets

VLOOKUP TABLES

Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	η (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	0.40	0.01622	1.321	0.2430	0.481	0.111	0.0039	1.38	0.216	Silty Clay
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

Chemical Properties Lookup Table

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
67641	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03	3.87E-05	25	329.20	508.10	6,955	0.0E+00	3.1E+01	L
71432	Benzene	5.89E+01	8.80E-02	9.80E-06	1.79E+03	2.27E-01	5.54E-03	25	353.24	562.16	7,342	7.8E-06	3.0E-02	L
71556	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.03E-01	1.72E-02	25	347.24	545.00	7,136	0.0E+00	5.0E+00	L
75092	Methylene chloride	1.17E+01	1.01E-01	1.17E-05	1.30E+04	8.96E-02	2.18E-03	25	313.00	510.00	6,706	1.0E-08	6.0E-01	L
75150	Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.19E+03	1.24E+00	3.02E-02	25	319.00	552.00	6,391	0.0E+00	7.0E-01	L
78933	Methylethylketone (2-butanone)	2.30E+00	8.08E-02	9.80E-06	2.23E+05	2.29E-03	5.58E-05	25	352.50	536.78	7,481	0.0E+00	5.0E+00	L
79016	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.47E+03	4.21E-01	1.03E-02	25	360.36	544.20	7,505	4.1E-06	2.0E-03	L
91203	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	4.82E-04	25	491.14	748.40	10,373	3.4E-05	3.0E-03	S
95476	o-Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.12E-01	5.18E-03	25	417.60	630.30	8,661	0.0E+00	1.0E-01	L
100414	Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.22E-01	7.86E-03	25	409.34	617.20	8,501	2.5E-06	1.0E+00	L
100425	Styrene	7.76E+02	7.10E-02	8.00E-06	3.10E+02	1.12E-01	2.74E-03	25	418.31	636.00	8,737	0.0E+00	1.0E+00	L
106423	p-Xylene	3.89E+02	7.69E-02	8.44E-06	1.85E+02	3.13E-01	7.64E-03	25	411.52	616.20	8,525	0.0E+00	1.0E-01	L
108101	Methylisobutylketone (4-methyl-2-	9.06E+00	7.50E-02	7.80E-06	1.90E+04	5.64E-03	1.38E-04	25	389.50	571.00	8,243	0.0E+00	3.0E+00	L
108383	m-Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.00E-01	7.32E-03	25	412.27	617.05	8,523	0.0E+00	1.0E-01	L
108883	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01	6.62E-03	25	383.78	591.79	7,930	0.0E+00	5.0E+00	L
110543	Hexane	4.34E+01	2.00E-01	7.77E-06	1.24E+01	6.82E+01	1.66E+00	25	341.70	508.00	6,895	0.0E+00	7.0E-01	L
127184	Tetrachloroethylene	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.53E-01	1.84E-02	25	394.40	620.20	8,288	2.6E-07	4.0E-02	L

CDF011960

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_P (µg/kg)	Chemical
71556		1,1,1-Trichloroethane

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, L_2 (enter value of 0 if value is unknown) (cm)	ENTER Totals must add up to value of L_1 (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

User to calculate risk-based soil concentration.

END

CDF011961

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.33E+03	0.0E+00	5.0E+00	L

END

CDF011962

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7,885	8.48E-03	3.65E-01	1.75E-04	1.08E-02	0.00E+00	0.00E+00	1.08E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(P_e^T)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.20E-01	1.08E+03	0.10	1.56E+01	1.08E-02	4.00E+02	4.47E+15	8.06E-04	8.71E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	5.0E+00

END

CDF011963

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	5.98E+02	5.98E+02	4.50E+05	5.98E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERPOR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011964

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and input soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Total soil conc., C_R (µg/kg)	Chemical
67641		Acetone

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_2 (cm)	ENTER Totals must add up to value of L_T (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of vad stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil	1.62	0.39	0.076	0.002	Lookup Soil Parameters	1.5	0.43		0.002	Lookup Soil Parameters	1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/s)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011965

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01	L

END

CDF011966

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7,559	1.97E-05	8.47E-04	1.75E-04	1.72E-02	0.00E+00	0.00E+00	1.72E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.15E-03	1.76E+01	0.10	1.56E+01	1.72E-02	4.00E+02	6.84E+09	8.46E-04	1.49E-02	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	3.1E+01

END

CDF011967

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	2.18E+05	2.18E+05	4.82E+07	2.18E+05

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF011968

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES | x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES |

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_P (µg/kg)	Chemical
71432		Benzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination (enter value of 0 if value is unknown), L_2 (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Flow-wall crack width, w (cm)	ENTER Indoor air exchange rate, ER ($1/h$)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011969

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	7.8E-06	3.0E-02	L

END

CDF011970

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	8,122	2.68E-03	1.15E-01	1.75E-04	1.22E-02	0.00E+00	0.00E+00	1.22E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.18E-01	6.16E+02	0.10	1.56E+01	1.22E-02	4.00E+02	7.44E+13	8.18E-04	5.04E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC ($\mu g/m^3$)
NA	NA	NA	NA	7.8E-06	3.0E-02

END

CDF011971

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
6.19E-01	6.21E+00	6.19E-01	3.35E+05	6.19E-01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERPOR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011972

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_P (µg/kg)
75150	

Chemical: Carbon disulfide

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_E (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination (enter value of 0 if value is unknown), L_2 (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Thickness must add up to value of L_T (cell G28)					
10	15	120	0	120	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011973

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., R_fC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.04E-01	1.00E-05	3.02E-02	25	6,391	319.00	552.00	4.57E+01	1.19E+03	0.0E+00	7.0E-01	L

END

CDF011974

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building seperation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, ΔH_{vTS} (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	6,682	1.66E-02	7.16E-01	1.75E-04	1.44E-02	0.00E+00	0.00E+00	1.44E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(P_e^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
9.14E-02	2.58E+03	0.10	1.56E+01	1.44E-02	4.00E+02	5.47E+11	8.32E-04	2.15E+00	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	7.0E-01

END

CDF011975

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	3.39E+01	3.39E+01	3.28E+05	3.39E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011976

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_{is} (µg/kg)	Chemical
100414		Ethylbenzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_s (cm)	ENTER Depth below grade to bottom of contamination, L_b (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_s (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	720	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_s^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_s^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_s^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{slab} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER ($1/h$)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for non-carcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for non-carcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

User to calculate risk-based soil concentration.

END

CDF011977

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{v_b} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	2.5E-06	1.0E+00	L

END

CDF011978

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	10,155	3.17E-03	1.36E-01	1.75E-04	1.04E-02	0.00E+00	0.00E+00	1.04E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
7.26E-01	1.71E+02	0.10	1.56E+01	1.04E-02	4.00E+02	1.89E+16	8.02E-04	1.37E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	2.5E-06	1.0E+00

END

CDF011979

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
7.11E+00	7.61E+02	7.11E+00	1.35E+05	7.11E+00

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERPOR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011980

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and input soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
110543		H'_{TS} unit

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_2 (cm)	ENTER Totals must add up to value of L_T (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER ($1/h$)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (cm^3/s)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based soil concentration.	

END

CDF011981

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
2.00E-01	7.77E-06	1.66E+00	25	6,895	341.70	508.00	4.34E+01	1.24E+01	0.0E+00	7.0E-01	L

END

CDF011982

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7.737	8.32E-01	3.58E+01	1.75E-04	2.78E-02	0.00E+00	0.00E+00	2.78E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
8.67E-02	5.06E+03	0.10	1.56E+01	2.78E-02	4.00E+02	1.27E+06	8.73E-04	4.42E+00	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	7.0E-01

END

CDF011983

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	1.65E+01	1.65E+01	8.78E+04	1.65E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011984

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter 'X' in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_p (µg/kg)	Chemical
75092		Methylene chloride

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination (enter value of 0 if value is unknown), L_2 (cm)	ENTER Totals must add up to value of L_1 (cell G28): Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm)	ENTER Thickness of soil stratum C, h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER ($1/h$)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011985

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.01E-01	1.17E-05	2.18E-03	25	6,706	313.00	510.00	1.17E+01	1.30E+04	1.0E-08	6.0E-01	L

END

CDF011986

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	7,034	1.16E-03	5.01E-02	1.75E-04	1.40E-02	0.00E+00	0.00E+00	1.40E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
2.34E-02	6.26E+02	0.10	1.56E+01	1.40E-02	4.00E+02	1.22E+12	8.30E-04	5.20E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	1.0E-08	6.0E-01

END

CDF011987

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
4.68E+02	1.20E+02	1.20E+02	1.04E+06	1.20E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011988

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_B (µg/kg)	Chemical
78933		Methylethylketone (2-butanone)

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_B (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm)	ENTER Thickness of soil stratum C, h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Totals must add up to value of L_t (cell G28)					
10	15	120	0	120	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/s)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011989

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.08E-02	9.80E-06	5.58E-05	25	7,481	352.50	536.78	2.30E+00	2.23E+05	0.0E+00	5.0E+00	L

END

CDF011990

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	8,419	2.63E-05	1.13E-03	1.75E-04	1.12E-02	0.00E+00	0.00E+00	1.12E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(P_e^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
4.60E-03	2.19E+01	0.10	1.56E+01	1.12E-02	4.00E+02	1.24E+15	8.10E-04	1.77E-02	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	5.0E+00

END

CDF011991

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	2.95E+04	2.95E+04	1.15E+07	2.95E+04

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
108101		Methylisobutylketone (4-methyl-2-pentanone)

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, L_b (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm) (Enter value or 0)	ENTER Thickness of soil stratum C, h_C (cm) (Enter value or 0)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_s^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_s^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_s^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil	1.62	0.39	0.076	0.002	Lookup Soil Parameters	1.5	0.43		0.002	Lookup Soil Parameters	1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{floor} (cm)	ENTER Soil/bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011993

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.50E-02	7.80E-06	1.38E-04	25	8,243	389.50	571.00	9.06E+00	1.90E+04	0.0E+00	3.0E+00	L

END

CDF011994

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	9,862	5.70E-05	2.45E-03	1.75E-04	1.04E-02	0.00E-00	0.00E+00	1.04E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.81E-02	3.74E+01	0.10	1.56E+01	1.04E-02	4.00E+02	1.86E+16	8.02E-04	3.00E-02	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF $(µg/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	3.0E+00

END

CDF011995

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	1.04E+04	1.04E+04	1.24E+06	1.04E+04

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF011996

DATA ENTRY SHEET

SL-ADV
Version 3.1, 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_P (µg/kg)	Chemical
91203		Naphthalene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_E (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, L_2 (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_T (cell G28): Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm) (Enter value or 0)	ENTER Thickness of soil stratum C, h_C (cm) (Enter value or 0)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{floor} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor/wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF011997

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	3.4E-05	3.0E-03	S

END

CDF011998

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	12,913	1.52E-04	6.54E-03	1.75E-04	8.20E-03	0.00E+00	0.00E+00	8.20E-03	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
4.00E+00	1.61E+00	0.10	1.56E+01	8.20E-03	4.00E+02	4.86E+20	7.75E-04	1.25E-03	NA	NA	NA	NA

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	3.4E-05	3.0E-03

END

CDF011999

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
5.72E+01	2.50E+02	5.72E+01	1.25E+05	5.72E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012000

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chem ref
95476		o-Xylene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, L_b (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_t (cell C28): Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm) (Enter value or 0)	ENTER Thickness of soil stratum C, h_C (cm) (Enter value or 0)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A real dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil	1.62	0.39	0.076	0.002	Lookup Soil Parameters	1.5	0.43		0.002	Lookup Soil Parameters	1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF012001

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	1.0E-01	L

END

CDF012002

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	10,404	2.04E-03	8.79E-02	1.75E-04	1.21E-02	0.00E-00	0.00E+00	1.21E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
7.26E-01	1.11E+02	0.10	1.56E+01	1.21E-02	4.00E+02	1.07E+14	8.17E-04	9.09E-02	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	1.0E-01

END

CDF012003

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	1.15E+02	1.15E+02	1.41E+05	1.15E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012004

DATA ENTRY SHEET

SL-ADV
Version 3.1: 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter 'X' in 'YES' box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter 'X' in 'YES' box and initial soil conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc. C_S (µg/kg)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_s (cm)	ENTER Depth below grade to bottom of contamination, L_s (cm) (enter value of 0 if value is unknown)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm) (Enter value or 0)	ENTER Thickness of soil stratum C, h_C (cm) (Enter value or 0)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER ($1/h$)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF012005

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	2.6E-07	4.0E-02	L

END

CDF012006

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	9,553	7.81E-03	3.36E-01	1.75E-04	1.00E-02	0.00E+00	0.00E+00	1.00E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(P_e^*)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.10E-01	7.97E+02	0.10	1.56E+01	1.00E-02	4.00E+02	9.00E+16	7.98E-04	6.36E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	2.6E-07	4.0E-02

END

CDF012007

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
1.47E+01	6.56E+00	6.56E+00	8.44E+04	6.56E+00

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012008

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter 'X' in 'YES' box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter 'X' in 'YES' box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_S (µg/kg)	Chemical
106423		p-Xylene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, L_2 (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_1 (cell G28) Thickness of soil stratum A, H_A (cm)	ENTER Thickness of soil stratum B, H_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, H_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-gas pressure differential, ΔP ($g/cm\cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR (Leave blank to calculate) Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based soil concentration.	

END

CDF012009

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	3.89E+02	1.85E+02	0.0E+00	1.0E-01	L

END

CDF012010

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	10.248	3.06E-03	1.32E-01	1.75E-04	1.07E-02	0.00E+00	0.00E+00	1.07E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(P_e^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
7.78E-01	1.55E+02	0.10	1.56E+01	1.07E-02	4.00E+02	7.48E+15	8.05E-04	1.25E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	1.0E-01

END

CDF012011

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	8.38E+01	8.38E+01	1.57E+05	8.38E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012012

SL-ADV
Version 3.1, 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_p (µg/kg)	Chemical
100425		Styrene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_E (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_2 (cm)	ENTER Totals must add up to value of L_T (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{floor} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm \cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR (Leave blank to calculate) G_{in} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF012013

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.10E-02	8.00E-06	2.74E-03	25	8,737	418.31	636.00	7.76E+02	3.10E+02	0.0E+00	1.0E+00	L

END

CDF012014

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	10,450	1.08E-03	4.64E-02	1.75E-04	9.86E-03	0.00E+00	0.00E+00	9.86E-03	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(P_e')$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.55E+00	2.88E+01	0.10	1.56E+01	9.86E-03	4.00E+02	1.56E+17	7.97E-04	2.30E-02	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	1.0E+00

END

CDF012015

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	4.54E+03	4.54E+03	4.98E+05	4.54E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012016

DATA ENTRY SHEET

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc. C_R (µg/kg)	Chemical
79016		Trichloroethylene

MORE

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_2 (cm)	ENTER Totals must add up to value in L_T (cell G28) Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-gas pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF012017

CHEMICAL PROPERTIES SHEET

Dirrusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	4.1E-06	2.0E-03	L

END

CDF012018

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.10E-02	0.00E+00	0.00E+00	1.10E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.32E-01	4.91E+02	0.10	1.56E+01	1.10E-02	4.00E+02	2.83E+15	8.08E-04	3.97E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	4.1E-06	2.0E-03

END

CDF012019

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
1.50E+00	5.26E-01	5.26E-01	6.16E+05	5.26E-01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERPOR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012020

DATA ENTRY SHEET

SL-ADV
Version 3.1, 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [*]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_S (µg/kg)	Chemical
108883		Toluene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER D_{each} below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L (cm)	ENTER Depth below grade to bottom of contamination, L_s (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_s (cell G28): Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm) (Enter value or 0)	ENTER Thickness of soil stratum C, h_C (cm) (Enter value or 0)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil Parameters					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{floor} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF012021

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	5.0E+00	L

END

CDF012022

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	9.154	2.92E-03	1.26E-01	1.75E-04	1.21E-02	0.00E-00	0.00E+00	1.21E-02	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^3/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.64E-01	2.89E+02	0.10	1.56E+01	1.21E-02	4.00E-02	1.07E+14	8.17E-04	2.36E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	5.0E+00

END

CDF012023

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	2.21E+03	2.21E+03	2.29E+05	2.21E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012024

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and input soil conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_S (µg/kg)	Chemical
95501		1,2-Dichlorobenzene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, L_b (cm) (enter value of 0 if value is unknown)	ENTER Totals must add up to value of L_t (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm) (Enter value or 0)	ENTER Thickness of soil stratum C, h_C (cm) (Enter value or 0)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, EP (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for non-carcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for non-carcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Use to calculate risk-based soil concentration.

END

CDF012025

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
6.90E-02	7.90E-06	1.90E-03	25	9,700	453.57	705.00	6.17E+02	1.56E+02	0.0E+00	2.0E-01	L

END

CDF012026

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4.000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	11,687	6.67E-04	2.87E-02	1.75E-04	9.58E-03	0.00E+00	0.00E+00	9.58E-03	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
1.23E+00	2.23E+01	0.10	1.56E+01	9.58E-03	4.00E+02	4.91E+17	7.93E-04	1.77E-02	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	2.0E-01

END

CDF012027

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	1.18E+03	1.18E+03	2.01E+05	1.18E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012028

SL-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
108383		m-Xylene

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_1 (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_2 (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Thickness must add up to value of L_T (cell G28)					
10	15	120	0	120	0	0	LS		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
Lookup Soil					Lookup Soil Parameters					Lookup Soil Parameters				
LS	1.62	0.39	0.076	0.002		1.5	0.43		0.002		1.5	0.43		0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, EP (1/hr)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based soil concentration.

END

CDF012029

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
7.00E-02	7.80E-06	7.32E-03	25	8,523	412.27	617.05	4.07E+02	1.61E+02	0.0E+00	1.0E-01	L

END

CDF012030

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	105	0.314	ERROR	ERROR	0.079	1.62E-08	0.957	1.55E-08	4,000	1.00E+00	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.06E+06	3.77E-04	15	10,255	2.93E-03	1.26E-01	1.75E-04	9.72E-03	0.00E+00	0.00E+00	9.72E-03	105	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
8.14E-01	1.42E+02	0.10	1.56E+01	9.72E-03	4.00E-02	2.75E+17	7.95E-04	1.13E-01	NA	NA	NA	NA

Finite source indoor attenuation coefficient, $<\alpha>$ (unitless)	Mass limit bldg. conc., $C_{building}$ ($\mu g/m^3$)	Finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Final finite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	1.0E-01

END

CDF012031

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen ($\mu g/kg$)	Indoor exposure soil conc., noncarcinogen ($\mu g/kg$)	Risk-based indoor exposure soil conc., ($\mu g/kg$)	Soil saturation conc., C_{sat} ($\mu g/kg$)	Final indoor exposure soil conc., ($\mu g/kg$)
NA	9.22E+01	9.22E+01	1.43E+05	9.22E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012032

Johnson & Ettinger Model Supporting Calculations

Ground Water to Indoor Air Spreadsheets

VLOOKUP TABLES

Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	n (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	0.40	0.01622	1.321	0.2430	0.481	0.111	0.0039	1.38	0.216	Silty Clay
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

Properties Lookup Table

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
67641	Acetone	5.75E-01	1.24E-01	1.14E-05	1.00E+06	1.59E-03	3.87E-05	25	329.20	508.10	6,955	0.0E-00	3.1E+01
67663	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01	3.66E-03	25	334.32	536.40	6,988	2.3E-05	9.8E-02
71432	Benzene	5.89E+01	8.80E-02	9.80E-06	1.79E+03	2.27E-01	5.54E-03	25	353.24	562.16	7,342	7.8E-06	3.0E-02
71556	1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	1.33E+03	7.03E-01	1.72E-02	25	347.24	545.00	7,136	0.0E-00	5.0E+00
75274	Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.74E+03	6.54E-02	1.60E-03	25	363.15	585.85	7,800	3.7E-05	0.0E+00
78933	Methylethylketone (2-butanone)	2.30E+00	8.08E-02	9.80E-06	2.23E+05	2.29E-03	5.58E-05	25	352.50	536.78	7,481	0.0E+00	5.0E+00
79016	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.47E+03	4.21E-01	1.03E-02	25	360.36	544.20	7,505	4.1E-06	3.0E-03
91203	Naphthalene	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	4.82E-04	25	491.14	748.40	10,373	3.4E-05	3.0E-03
95476	o-Xylene	3.63E+02	8.70E-02	1.00E-05	1.78E+02	2.12E-01	5.18E-03	25	417.60	630.30	8,661	0.0E-00	1.0E-01
108383	m-Xylene	4.07E+02	7.00E-02	7.80E-06	1.61E+02	3.00E-01	7.32E-03	25	412.27	617.05	8,523	0.0E+00	1.0E-01
108883	Toluene	1.82E+02	8.70E-02	8.60E-06	5.26E+02	2.72E-01	6.62E-03	25	383.78	591.79	7,930	0.0E+00	5.0E+00

CDF012034

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
71556		1,1,1-Trichloroethene

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067			A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012035

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.33E+03	0.0E+00	5.0E+00

END

CDF012036

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,885	8.48E-03	3.65E-01	1.75E-04	1.08E-02	0.00E+00	0.00E+00	1.56E-04	4.88E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.65E+02	0.10	1.00E+01	1.08E-02	4.00E+02	1.18E+10	1.95E-04	7.11E-02	NA	5.0E+00

END

CDF012037

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	7.33E-03	7.33E+03	1.33E+06	7.33E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012038

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
67641	2.30E-01	Acetone

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067			A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012039

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01

END

CDF012040

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_s (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,559	1.97E-05	8.47E-04	1.75E-04	1.72E-02	0.00E+00	0.00E+00	1.90E-03	1.51E-02	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	8.47E-01	0.10	1.00E+01	1.72E-02	4.00E+02	2.13E+06	3.57E-04	3.02E-04	NA	3.1E+01

END

CDF012041

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	1.07E+07	1.07E+07	1.00E+09	1.07E+07

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of C_{source} and $C_{building}$ on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012042

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
71432	2.30E-01	Benzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm)	ENTER Thickness of soil stratum C, h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_W: (cell G28)							
10	15	1067	1067			A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CDF012043

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	7.8E-06	3.0E-02

END

CDF012044

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,122	2.68E-03	1.15E-01	1.75E-04	1.22E-02	0.00E+00	0.00E-00	1.83E-04	5.63E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.15E+02	0.10	1.00E+01	1.22E-02	4.00E+02	8.44E+08	2.14E-04	2.47E-02	7.8E-06	3.0E-02

END

CDF012045

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
1.26E+01	1.27E+03	1.26E-01	1.79E+06	1.26E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012046

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

MORE ↓

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
75274		Bromodichloromethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, hA (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) hB (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) hC (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
10	15	1067	1067			A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{rec} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012047

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
2.98E-02	1.06E-05	1.60E-03	25	7,800	363.15	585.85	5.50E+01	6.74E+03	3.7E-05	0.0E+00

END

CDF012048

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm-m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8.665	7.35E-04	3.17E-02	1.75E-04	4.14E-03	0.00E+00	0.00E+00	9.97E-05	2.40E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.17E+01	0.10	1.00E+01	4.14E-03	4.00E+02	2.27E+26	1.15E-04	3.64E-03	3.7E-05	NA

END

CDF012049

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
1.80E+01	NA	1.80E+01	6.74E+06	1.80E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012050

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
75150		Carbon disulfide

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012051

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., R_fC (mg/m^3)
1.04E-01	1.00E-05	3.02E-02	25	6,391	319.00	552.00	4.57E+01	1.19E+03	0.0E+00	7.0E-01

END

CDF012052

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	6,682	1.66E-02	7.16E-01	1.75E-04	1.44E-02	0.00E+00	0.00E+00	2.06E-04	6.47E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.16E+02	0.10	1.00E+01	1.44E-02	4.00E+02	3.57E+07	2.33E-04	1.67E-01	NA	7.0E-01

END

CDF012053

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	4.37E+02	4.37E-02	1.19E+06	4.37E+02

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS work sheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012054

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
124481		Chlorodibromomethane

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/h)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012055

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.96E-02	1.05E-05	7.81E-04	25	5,900	416.14	678.20	6.31E+01	2.60E+03	2.7E-05	0.0E+00

END

CDF012056

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	6,778	4.26E-04	1.83E-02	1.75E-04	2.72E-03	0.00E+00	0.00E+00	1.09E-04	1.91E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.83E+01	0.10	1.00E+01	2.72E-03	4.00E+02	1.17E+40	9.52E-05	1.75E-03	2.7E-05	NA

END

CDF012057

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
5.16E+01	NA	5.16E+01	2.60E+06	5.16E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of C_{source} and $C_{building}$ on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012058

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

MORE ↓

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
78933		Methylethylketone (2-butanone)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012059

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.08E-02	9.80E-06	5.58E-05	25	7,481	352.50	536.78	2.30E+00	2.23E+05	0.0E+00	5.0E+00

END

CDF012060

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,419	2.63E-05	1.13E-03	1.75E-04	1.12E-02	0.00E+00	0.00E-00	1.22E-03	9.80E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.13E+00	0.10	1.00E+01	1.12E-02	4.00E+02	5.16E+09	2.94E-04	3.32E-04	NA	5.0E+00

END

CDF012061

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	1.57E+06	1.57E+06	2.23E+08	1.57E+06

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012062

DATA ENTRY SHEET

GW-ADV Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
91203		Naphthalene

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm \cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012063

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	3.4E-05	3.0E-03

END

CDF012064

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	12,913	1.52E-04	6.54E-03	1.75E-04	8.20E-03	0.00E+00	0.00E+00	2.57E-04	5.28E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	6.54E+00	0.10	1.00E+01	8.20E-03	4.00E+02	2.05E-13	2.05E-04	1.34E-03	3.4E-05	3.0E-03

END

CDF012065

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
5.33E+01	2.33E+02	5.33E+01	3.10E+04	5.33E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of C_{source} and $C_{building}$ on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012066

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
79016	2.20E+01	Trichloroethylene

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_W - (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067			A	LS	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil	1.62	0.390	0.076	Lookup Soil Parameters	1.62	0.39	0.076	Lookup Soil Parameters	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\ s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based groundwater concentration.

END

CDF012067

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	4.1E-06	3.0E-03

END

CDF012068

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{tw} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	0.079	1.62E-08	0.957	1.55E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm-m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.10E-02	0.00E+00	0.00E+00	1.61E-04	4.99E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.06E+02	0.10	1.56E+01	1.10E-02	4.00E+02	2.83E+15	2.24E-04	4.62E-02	4.1E-06	3.0E-03

END

CDF012069

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
1.29E+01	6.78E-00	6.78E+00	1.47E+06	6.78E+00

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012070

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [x]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [ ]

MORE ↓

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108883		Toluene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012071

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	5.0E+00

END

CDF012072

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	9,154	2.92E-03	1.26E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.79E-04	5.54E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.26E+02	0.10	1.00E+01	1.21E-02	4.00E+02	1.07E-09	2.12E-04	2.66E-02	NA	5.0E+00

END

CDF012073

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	1.96E-04	1.96E+04	5.26E+05	1.96E+04

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

CDF012074

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
71556	3.20E-01	1,1,1-Trichloroethane

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067			A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based groundwater concentration.

END

CDF012075

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.80E-02	8.80E-06	1.72E-02	25	7,136	347.24	545.00	1.10E+02	1.33E+03	0.0E+00	5.0E+00

END

CDF012076

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,885	8.48E-03	3.65E-01	1.75E-04	1.08E-02	0.00E+00	0.00E+00	1.56E-04	4.88E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.17E+02	0.10	1.00E+01	1.08E-02	4.00E+02	1.18E-10	1.95E-04	2.28E-02	NA	5.0E+00

END

CDF012077

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	NA	NA	1.33E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	4.4E-06

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012078

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES x

MORE

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
67641	2.30E-01	Acetone

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
10	15	1067	1067			A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012079

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.24E-01	1.14E-05	3.87E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.1E+01

END

CDF012080

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{tw} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	7,559	1.97E-05	8.47E-04	1.75E-04	1.72E-02	0.00E+00	0.00E+00	1.90E-03	1.51E-02	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.95E-01	0.10	1.00E+01	1.72E-02	4.00E+02	2.13E+06	3.57E-04	6.95E-05	NA	3.1E+01

END

CDF012081

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	NA	NA	1.00E+09	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.2E-09

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012082

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
71432	2.30E-01	Benzene

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{W1} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067			A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, ATc (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CDF012083

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	7.8E-06	3.0E-02

END

CDF012084

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,122	2.68E-03	1.15E-01	1.75E-04	1.22E-02	0.00E+00	0.00E+00	1.83E-04	5.63E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.65E+01	0.10	1.00E+01	1.22E-02	4.00E+02	8.44E+08	2.14E-04	5.67E-03	7.8E-06	3.0E-02

END

CDF012085

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.8E-08	1.8E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012086

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [x]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
75274	1.30E+00	Bromodichloromethane

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012087

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
2.98E-02	1.06E-05	1.60E-03	25	7,800	363.15	585.85	5.50E+01	6.74E+03	3.7E-05	0.0E+00

END

CDF012088

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-cm^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8.665	7.35E-04	3.17E-02	1.75E-04	4.14E-03	0.00E+00	0.00E+00	9.97E-05	2.40E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.11E+01	0.10	1.00E+01	4.14E-03	4.00E+02	2.27E+26	1.15E-04	4.74E-03	3.7E-05	NA

END

CDF012089

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	NA	NA	6.74E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
7.2E-08	NA

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012090

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES x

MORE

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75150	1.00E+00	Carbon disulfide

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_E (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/h)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012091

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.04E-01	1.00E-05	3.02E-02	25	6.391	319.00	552.00	4.57E+01	1.19E+03	0.0E+00	7.0E-01

END

CDF012092

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm-m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^3/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	6,682	1.66E-02	7.16E-01	1.75E-04	1.44E-02	0.00E+00	0.00E+00	2.06E-04	6.47E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.16E+02	0.10	1.00E+01	1.44E-02	4.00E+02	3.57E+07	2.33E-04	1.67E-01	NA	7.0E-01

END

CDF012093

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μ_g/L)	Indoor exposure groundwater conc., noncarcinogen (μ_g/L)	Risk-based indoor exposure groundwater conc., (μ_g/L)	Pure component water solubility, S (μ_g/L)	Final indoor exposure groundwater conc., (μ_g/L)
NA	NA	NA	1.19E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.3E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012094

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
124481	1.40E+00	Chlorodibromomethane

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012095

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm-m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.96E-02	1.05E-05	7.81E-04	25	5,900	416.14	678.20	6.31E+01	2.60E+03	2.7E-05	0.0E+00

END

CDF012096

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{re} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	6,778	4.26E-04	1.83E-02	1.75E-04	2.72E-03	0.00E+00	0.00E+00	1.09E-04	1.91E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.57E+01	0.10	1.00E+01	2.72E-03	4.00E+02	1.17E+40	9.52E-05	2.44E-03	2.7E-05	NA

END

CDF012097

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μ_g/L)	Indoor exposure groundwater conc., noncarcinogen (μ_g/L)	Risk-based indoor exposure groundwater conc., (μ_g/L)	Pure component water solubility, S (μ_g/L)	Final indoor exposure groundwater conc., (μ_g/L)
NA	NA	NA	2.60E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.7E-08	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012098

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES | x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
78933	8.30E-01	Methylethylketone (2-butanone)

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012099

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.08E-02	9.80E-06	5.58E-05	25	7,481	352.50	536.78	2.30E+00	2.23E+05	0.0E+00	5.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,419	2.63E-05	1.13E-03	1.75E-04	1.12E-02	0.00E+00	0.00E+00	1.22E-03	9.80E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	9.38E-01	0.10	1.00E+01	1.12E-02	4.00E+02	5.16E+09	2.94E-04	2.76E-04	NA	5.0E+00

END

CDF012101

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μ_g/L)	Indoor exposure groundwater conc., noncarcinogen (μ_g/L)	Risk-based indoor exposure groundwater conc., (μ_g/L)	Pure component water solubility, S (μ_g/L)	Final indoor exposure groundwater conc., (μ_g/L)
NA	NA	NA	2.23E+08	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	5.3E-08

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012102

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES | x

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
91203	1.20E-01	Naphthalene

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm \cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012103

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature. T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	3.4E-05	3.0E-03

END

CDF012104

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	12,913	1.52E-04	6.54E-03	1.75E-04	8.20E-03	0.00E+00	0.00E+00	2.57E-04	5.28E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.84E-01	0.10	1.00E+01	8.20E-03	4.00E+02	2.05E+13	2.05E-04	1.61E-04	3.4E-05	3.0E-03

END

CDF012105

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μ_g/L)	Indoor exposure groundwater conc., noncarcinogen (μ_g/L)	Risk-based indoor exposure groundwater conc., (μ_g/L)	Pure component water solubility, S (μ_g/L)	Final indoor exposure groundwater conc., (μ_g/L)
NA	NA	NA	3.10E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.3E-09	5.1E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012106

DATA ENTRY SHEET

GW-ADV Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter 'X' in "YES" box and initial groundwater conc. below)

YES | x

MORE

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
79016	2.20E+01	Trichloroethylene

MORE

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Totals must add up to value of L_{WT} (cell G28) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	1067	1067			A	LS	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\,s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1

Used to calculate risk-based groundwater concentration.

END

CDF012107

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., R_fC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	4.1E-06	3.0E-03

END

CDF012108

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{re} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	0.079	1.62E-08	0.957	1.55E-08	18.75	0.39	0.087	0.303	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.10E-02	0.00E+00	0.00E-00	1.61E-04	4.99E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(P_e) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.53E+03	0.10	1.56E+01	1.10E-02	4.00E+02	2.83E+15	2.24E-04	1.02E+00	4.1E-06	3.0E-03

END

CDF0121109

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μ_g/L)	Indoor exposure groundwater conc., noncarcinogen (μ_g/L)	Risk-based indoor exposure groundwater conc., (μ_g/L)	Pure component water solubility, S (μ_g/L)	Final indoor exposure groundwater conc., (μ_g/L)
NA	NA	NA	1.47E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.7E-06	3.2E-01

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012110

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [x]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
108883	3.60E-01	Toluene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (cm)	ENTER Thickness of soil stratum C, h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
10	15	1067	1067	0	0	A	LS			1.00E-08

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.390	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	0.1
				Used to calculate risk-based groundwater concentration.	

END

CDF012111

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., R_fC (mg/m^3)
8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	5.0E+00

END

CDF012112

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{ra} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
9.46E+08	1052	0.314	0.314	0.314	#N/A	#N/A	#N/A	1.00E-08	18.75	0.39	0.087	0.303	4.000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.69E+04	1.06E+06	3.77E-04	15	9.154	2.92E-03	1.26E-01	1.75E-04	1.21E-02	0.00E+00	0.00E+00	1.79E-04	5.54E-03	1052

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(P_e)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.53E+01	0.10	1.00E+01	1.21E-02	4.00E+02	1.07E+09	2.12E-04	9.58E-03	NA	5.0E+00

END

CDF012113

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen ($\mu g/L$)	Indoor exposure groundwater conc., noncarcinogen ($\mu g/L$)	Risk-based indoor exposure groundwater conc., ($\mu g/L$)	Pure component water solubility, S ($\mu g/L$)	Final indoor exposure groundwater conc., ($\mu g/L$)
NA	NA	NA	5.26E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.8E-06

MESSAGE AND ERROR SUMMARY BELOW, (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012114

Johnson & Ettinger Model Supporting Calculations

Soil Gas to Indoor Air Spreadsheets

VLOOKUP TABLES

Soil Properties Lookup Table

SCS Soil Type	K_s (cm/h)	α_1 (1/cm)	N (unitless)	M (unitless)	n (cm^3/cm^3)	θ_r (cm^3/cm^3)	Mean Grain Diameter (cm)	Bulk Density (g/cm^3)	θ_w (cm^3/cm^3)	SCS Soil Name
C	0.61	0.01496	1.253	0.2019	0.459	0.098	0.0092	1.43	0.215	Clay
CL	0.34	0.01581	1.416	0.2938	0.442	0.079	0.016	1.48	0.168	Clay Loam
L	0.50	0.01112	1.472	0.3207	0.399	0.061	0.020	1.59	0.148	Loam
LS	4.38	0.03475	1.746	0.4273	0.390	0.049	0.040	1.62	0.076	Loamy Sand
S	26.78	0.03524	3.177	0.6852	0.375	0.053	0.044	1.66	0.054	Sand
SC	0.47	0.03342	1.208	0.1722	0.385	0.117	0.025	1.63	0.197	Sandy Clay
SCL	0.55	0.02109	1.330	0.2481	0.384	0.063	0.029	1.63	0.146	Sandy Clay Loam
SI	1.82	0.00658	1.679	0.4044	0.489	0.050	0.0046	1.35	0.167	Silt
SIC	0.40	0.01622	1.321	0.2430	0.481	0.111	0.0039	1.38	0.216	Silty Clay
SICL	0.46	0.00839	1.521	0.3425	0.482	0.090	0.0056	1.37	0.198	Silty Clay Loam
SIL	0.76	0.00506	1.663	0.3987	0.439	0.065	0.011	1.49	0.180	Silt Loam
SL	1.60	0.02667	1.449	0.3099	0.387	0.039	0.030	1.62	0.103	Sandy Loam

CAS No.	Chemical	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Pure component water solubility, S (mg/L)	Henry's law constant H' (unitless)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
67663	Chloroform	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01	3.66E-03	25	334.32	536.40	6,988	2.3E-05	9.8E-02	1.19E+02
71432	Benzene	5.89E+01	8.80E-02	9.80E-06	1.79E+03	2.27E-01	5.54E-03	25	353.24	562.16	7,342	7.8E-06	3.0E-02	7.81E+01
79016	Trichloroethylene	1.66E+02	7.90E-02	9.10E-06	1.47E+03	4.21E-01	1.03E-02	25	360.36	544.20	7,505	4.1E-06	2.0E-03	1.31E+02
107028	Acrolein	2.76E+00	1.05E-01	1.22E-05	2.13E+05	4.99E-03	1.22E-04	25	325.60	506.00	6,731	0.0E+00	2.0E-05	5.61E+01

CDF012116

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	
107028	2.93E+01			Acrolein					CA

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	305	10	305	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
LS	1.62	0.39	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm \cdot s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CDF012117

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., R_fC (mg/m^3)
1.05E-01	1.22E-05	1.22E-04	25	6,731	325.60	506.00	56.10	0.0E+00	2.0E-05

CDF012118

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{re} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	290	0.314	0.314	0.314	0.079	1.62E-08	0.957	1.55E-08	4,000	2.93E+01	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	7,263	6.36E-05	2.74E-03	1.75E-04	1.46E-02	0.00E+00	0.00E+00	1.46E-02	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.93E+01	0.10	1.56E+01	1.46E-02	4.00E+02	4.18E+11	7.13E-04	2.09E-02	NA	2.0E-05

END

CDF012119

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

ELCR = 1.0E-05
HQ = 1.0

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.0E+00

Indoor exposure, soil gas concentration, carcinogen ($\mu g/m^3$)	Indoor exposure, soil gas concentration, noncarcinogen ($\mu g/m^3$)	Final indoor exposure, soil gas concentration ($\mu g/m^3$)
NA	2.93E+01	2.9E+01

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012120

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	
71432	4.57E+03			Benzene					CA

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	305	10	305	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.39	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.075

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CDF012121

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm \cdot m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	78.11	7.8E-06	3.0E-02

CDF012122

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	290	0.314	0.314	0.314	0.079	1.62E-08	0.957	1.55E-08	4,000	4.57E+03	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,122	2.68E-03	1.15E-01	1.75E-04	1.22E-02	0.00E+00	0.00E+00	1.22E-02	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.57E+03	0.10	1.56E+01	1.22E-02	4.00E+02	7.44E+13	6.83E-04	3.12E+00	7.8E-06	3.0E-02

END

CDF012123

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

ELCR = 1.0E-05
HQ = 1.0

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	Indoor exposure, soil gas concentration, carcinogen ($\mu g/m^3$)	Indoor exposure, soil gas concentration, non-carcinogen ($\mu g/m^3$)	Final indoor exposure, soil gas concentration ($\mu g/m^3$)
1.0E-05	1.0E-01	4.57E+03	4.58E+04	4.6E+03

MESSAGE AND ERROR SUMMARY BELOW. (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012124

SG-ADV
Version 3.1; 02/04

Reset to

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	
67663	1.49E+03			Chloroform					CA

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of L_s (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	305	10	305	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.39	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CDF012125

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.04E-01	1.00E-05	3.66E-03	25	6,988	334.32	536.40	119.38	2.3E-05	9.8E-02

CDF012126

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{et} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	290	0.314	0.314	0.314	0.079	1.62E-08	0.957	1.55E-08	4,000	**1.49E+03**	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm-m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} ($g/cm-s$)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	7,554	1.86E-03	8.02E-02	1.75E-04	1.44E-02	0.00E+00	0.00E+00	1.44E-02	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(P_e)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.49E+03	0.10	1.56E+01	1.44E-02	4.00E+02	5.47E+11	7.11E-04	1.06E+00	2.3E-05	9.8E-02

END

CDF012127

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

ELCR = 1.0E-05
HQ = 1.0

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.0E-05	1.0E-02

Indoor exposure, soil gas concentration, carcinogen ($\mu g/m^3$)	Indoor exposure, soil gas concentration, non-carcinogen ($\mu g/m^3$)	Final indoor exposure, soil gas concentration ($\mu g/m^3$)
1.49E+03	1.44E+05	1.5E+03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

CDF012128

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	
79016	3.14E+03			Trichloroethylene					CA

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of L_s (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, h_B (Enter value or 0) (cm)	ENTER Thickness of soil stratum C, h_C (Enter value or 0) (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	305	10	305	0	0	LS		

MORE

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil				Lookup Soil Parameters				Lookup Soil Parameters			
LS	1.62	0.39	0.076	LS	1.62	0.39	0.076	LS	1.62	0.39	0.076

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	1000	1000	244	0.1	0.25	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	30	30	350

END

CDF012129

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	4.1E-06	2.0E-03

CDF012130

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{tw} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
9.46E+08	290	0.314	0.314	0.314	0.079	1.62E-08	0.957	1.55E-08	4,000	3.14E+03	1.69E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.06E+06	3.77E-04	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.10E-02	0.00E+00	0.00E+00	1.10E-02	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe') (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.14E+03	0.10	1.56E+01	1.10E-02	4.00E+02	2.83E+15	6.63E-04	2.09E+00	4.1E-06	2.0E-03

END

CDF012131

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS.

ELCR = 1.0E-05
HQ = 1.0

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)	Indoor exposure, soil gas concentration, carcinogen ($\mu g/m^3$)	Indoor exposure, soil gas concentration, non-carcinogen ($\mu g/m^3$)	Final indoor exposure, soil gas concentration ($\mu g/m^3$)
3.5E-06	1.0E+00	8.95E+03	3.14E+03	3.1E+03

MESSAGE AND ERROR SUMMARY BELOW (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

CDF012132

APPENDIX VIII

PROPERTY SPECIFIC RISK ASSESSMENT AND PRELIMINARY REMEDIATION GOAL CALCULATIONS

APPENDIX VIII
TABLE 1
VALUES USED FOR DAILY INTAKE CALCULATIONS
Canton Drop Forge

Scenario Timeframe:	Current/Future
Medium:	Water
Exposure Medium:	Water
Exposure Point:	Retention Basin
Receptor Population:	Outdoor Maintenance Worker
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference (see numbered references below)	CT Value	CT Rationale/	Intake Factor Equation
Ingestion	IW	Water ingestion rate	mL/hour	10	(1)	-	-	**Intake Factor (L/kg/day) =** $\frac{(IW \times FC \times EF \times ED \times ET \times CF)}{(BW \times AT)}$
	Cw	Chemical Concentration in water	mg/l	mean	Chemical Specific	-	-	
	FC	Fraction contacted from contaminated source	unitless	1.0	USEPA Region IV, 2000	-	-	**cancer:** 5.03E-06
	EF	Exposure frequency	days/year	36	(2)	-	-	**noncancer:** 1.41E-05
	ED	Exposure duration	years	25	USEPA, 1997	-	-	Note: To calculate chemical-specific daily intake, the above intake factors are multiplied by the chemical concentration (Cw).
	ET	Exposure time	hours/day	1	(3)	-	-	
	CF	Conversion factor: water	(L/mL or cm3)	1.E-03	-	-	-	
	AT	Averaging time (noncancer effects) = ED x 365 day/yr	days	9125	(4)	-	-	
		Averaging time (cancer effects) = 70 years x 365 day/yr	days	25550	(4)	-	-	
	BW	Body weight (adult or youth)	kg	70	(5)	-	-	
Dermal	SA	Skin surface area	cm^2	2500	(6)	-	-	**Intake Factor (L-event/cm / kg-day) =** $\frac{(SA \times EV \times ED \times EF \times CF)}{(BW \times AT)}$
	Cw	Chemical Concentration in water	mg/l	mean	Chemical Specific	-	-	
	PC	Permeability constant, water	cm/hr	chem-specific	(7)	-	-	**cancer:** 1.26E-03
	DA_{event}	Absorbed dose per event	mg/cm^2-event	chem-specific	USEPA Region IV, 2000	-	-	**noncancer:** 3.52E-03
	EV	Event frequency	event/day	1	(3)	-	-	Note: To calculate chemical-specific daily intake, the above intake factors are multiplied by the chemical-specific DA value and the chemical concentration (Cw).
	EF	Exposure frequency	days/year	36	(2)	-	-	
	ED	Exposure duration	years	25	USEPA, 1997	-	-	
	CF	Conversion factor: water	(L/mL or cm3)	1E-03		-	-	
	AT	Averaging time (noncancer effects) = ED x 365 day/yr	days	9125	(4)	-	-	
		Averaging time (cancer effects) = 70 years x 365 day/yr	days	25550	(4)	-	-	
	BW	Body weight (adult or youth)	kg	70	(5)	-	-	

CDF012134

APPENDIX VIII
TABLE 1
VALUES USED FOR DAILY INTAKE CALCULATIONS
Canton Drop Forge

Scenario Timeframe:	Current/Future
Medium:	Water
Exposure Medium:	Water
Exposure Point:	Retention Basin
Receptor Population:	Outdoor Maintenance Worker
Receptor Age:	Adult

(1) Groundwater ingestion rate: Althought construction/maintenance workers are assumed to be exposed to water only while in contact with the water at the site, a 10 mL/hour ingestion rate is estimated for the RME assuming that splashing or hand-to-face contact will result in a small amount of water ingested.

(2) Exposure frequency is based on worker coming in contact with water 1 day per week excluding winter months (approximately 9 months or 36 days).

(3) Exposure time: Professional judgment. A 1-hour exposure time in direct contact with water per event for a 9-month period is considered conservative.

(4) Averaging time: Noncarcinogens = ED expressed in days. Carcinogens = 70-year lifetime expressed in days.

(5) Body weight: Average adult body weight (USEPA, 1989)

(6) Skin Surface Area: This value corresponds to head, hands, and forearms for adult men and women (Table 6.4 in 1997 USEPA Exposure Factors Handbook).

(7) Permeability Constant: Chemical-specific values obtained from Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table November 2012.

REFERENCES:

USEPA, 1997. Expsoure Factors Handbook. Office of Research and Development. Washington, D.C. EPA/600/P-95/002Fa. August.

USEPA, 2000. Region IV Guidance.

USEPA, 2004. Dermal Guidance, RAGS Part E

CDF012135

APPENDIX VIII
TABLE 2
Worksheet to Calculate Dermal Absorption of Organic Chemicals from Aqueous Media (latest version 04/01)
Canton Drop Forge

Dermal Absorbed Dose per event for Organic Compounds – Water Contact

DA_{event} (mg/cm²-event) is calculated for organic compounds as follows :

$$If\ t_{event} \le t^*,\ then:\ DA_{event} = 2\ FA \times K_p \times C_w \sqrt{\frac{6\ \tau_{event} \times t_{event}}{\pi}} \qquad (3.2)$$

$$If\ t_{event} > t^*,\ then:\ DA_{event} = FA \times K_p \times C_w \left[\frac{t_{event}}{1+B} + 2\ \tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right] \qquad (3.3)$$

where:

Parameter		Definition (units)	Default Value
DA_{event}	=	Absorbed dose per event (mg/cm²-event)	–
FA	=	Fraction absorbed water (dimensionless)	Chemical-specific, See Appendix B
K_p	=	Dermal permeability coefficient of compound in water (cm/hr)	Chemical-specific, See Appendix B
C_w	=	Chemical concentration in water (mg/cm³)	Site-specific, non-ionized fraction, See Appendix A for more discussion
τ_{event}	=	Lag time per event (hr/event)	Chemical-specific, See Appendix B
t_{event}	=	Event duration (hr/event)	See Exhibit 3-2
t^*	=	Time to reach steady-state (hr) = 2.4 τ_{event}	Chemical-specific, See Eq. A.5 to A.8
B	=	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (dimensionless)	Chemical-specific, See Eq. A.1

Reference: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R/99/005 OSWER 9285.7-02EP PB99-963312 July 2004
Appendix A, Water Pathway
Appendix B, Screening Tables and Reference Values for the Water Pathway

Refer to Appendix A for equations to evaluate DA_event and DAD
FOR ORGANIC CHEMICALS IN WATER (latest version 04/01)

CHEMICAL	CAS No.	MWT	logKow	Kp 95% LCI	Kp (cm/hr) predicted	Kp (cm/hr) measured	Kp 95% UCI	Derm/ Drink	Derm/ Total Dose	B	tau (hr)	t_star (hr)	FA	Kp used in DA_event	DA_event (mg/cm2-evt)	DAD (mg/kg-day)	log(Ds/lsc)	Dsc/lsc	Dsc	b	c	t_star1 B>0.6	t_star3 B<=0.6
Benzo(a)anthracene	56553	228.3	5.66	0.0168	0.4735		13.3537	3.0788	0.0054	2.7517	2.0328	8.5271	1.0000	0.4735	1.87E+00	0.0031	-4.0862	0.0001	0.0000	6.1201	2.8406	8.5271	4.8786
Benzo(a)pyrene	50328	250	6.1	0.0241	0.7014		20.3927	5.2470	0.0092	4.2654	2.6907	11.6708	1.0000	0.7014	3.18E+00	0.0053	-4.2080	0.0001	0.0000	13.3213	4.3287	11.6708	6.4576
Benzo(b)fluoranthene	205992	252.3	6.12	0.0241	0.7020		20.4333	5.3303	0.0094	4.2888	2.7718	12.0273	1.0000	0.7020	3.23E+00	0.0054	-4.2209	0.0001	0.0000	13.4553	4.3518	12.0273	6.6524
Chrysene	218019	228.3	5.66	0.0168	0.4735		13.3537	3.0788	0.0054	2.7517	2.0328	8.5271	1.0000	0.4735	1.87E+00	0.0031	-4.0862	0.0001	0.0000	6.1201	2.8406	8.5271	4.8786
Dibenzo(a,h)anthracene	53703	278.4	6.84	0.0488	1.5079		46.5979	8.1314	0.0143	9.6771	3.8836	17.5727	0.6000	1.5079	4.93E+00	0.0082	-4.3674	0.0000	0.0000	62.8665	9.7083	17.5727	9.3207
Fluoranthene	206440	202.3	4.95	0.0083	0.2235		6.0304	1.2288	0.0022	1.2229	1.4527	5.6753	1.0000	0.2235	7.45E-01	0.0012	-3.9403	0.0001	0.0000	1.7729	1.3729	5.6753	3.4865
Indeno(1,2,3-CD)pyrene	193395	276.3	6.58	0.0345	1.0408		31.3827	5.5369	0.0098	6.6542	3.7797	16.8272	0.6000	1.0408	3.36E+00	0.0056	-4.3556	0.0000	0.0000	30.5994	6.6977	16.8272	9.0712
Naphthalene	91203	128.2	3.3	0.0018	0.0466		1.1809	0.1588	0.0003	0.2031	0.5576	1.3383	1.0000	0.0466	9.62E-02	0.0002	-3.5245	0.0003	0.0000	0.4413	0.4801	#NUM!	1.3383
Phenanthrene	85018	178.2	4.46	0.0055	0.1442		3.7995	0.6783	0.0012	0.7404	1.0640	4.1101	1.0000	0.1442	4.11E-01	0.0007	-3.8051	0.0002	0.0000	0.9964	0.9319	4.1101	2.5536

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APPENDIX VIII
TABLE 3
Worksheet to Calculate Dermal Absorption of Inorganic Chemicals from Aqueous Media (latest version 04/01)
Canton Drop Forge

FOR INORGANIC CHEMICALS IN WATER (latest version 04/01)
Worksheet to Calculate Dermal Absorption of Inorganic Chemicals from Aqueous Media

Dermal Absorbed Dose Per Event for Inorganic Compounds – Water Contact

DA_{event} (mg/cm²-event) is calculated for inorganics or highly ionized organic chemicals as follows:

$$DA_{event} = K_p \times C_w \times t_{event} \quad (3.4)$$

where:

Parameter		Definition (units)	Default Value
DA_{event}	=	Absorbed dose per event (mg/cm²-event)	–
K_p	=	Dermal permeability coefficient of compound in water (cm/hr)	Chemical-specific, see Exhibit A-6 and Appendix B
C_w	=	Chemical concentration in water (mg/cm³)	Site-specific, non-ionized fraction, see Appendix A for more discussion
t_{event}	=	Event duration (hr/event)	See Exhibit 3-2

Reference: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R/99/005 OSWER 9285.7-02EP PB99-963312 July 2004
Appendix A, Water Pathway
Appendix B, Screening Tables and Reference Values for the Water Pathway

Theoretical Derivation of Permeability Coefficient for Organic Chemicals

$$K_p = \frac{K_{sc/w} \times D_{sc}}{l_{sc}} \quad (3.5)$$

or:

$$\log K_p = \log K_{sc/w} + \log \frac{D_{sc}}{l_{sc}} \quad (3.6)$$

Empirically it has been shown that (Kasting, et al., 1987):

$$\log K_{sc/w} = a \log K_{ow} + b$$

and $D_{sc} = D_o \exp(-\beta MV)$

where:
D_o and β are constants, characteristic of the medium through which diffusion is occurring. For hydrocarbons, MV will be related directly to molecular weight (MW). Combining these two relationships with Equation 3.6 leads to the general form:

$$\log K_p = b + a \log K_{ow} - c\,MW \quad (3.7)$$

where:

Parameter		Definition (units)	Default Value
K_p	=	Dermal permeability coefficient of compound in water (cm/hr)	Chemical-specific, see Appendix B
K_{ow}	=	Octanol/water partition coefficient (dimensionless)	Chemical-specific, see Appendix B
$K_{sc/w}$	=	equilibrium partition coefficient between the stratum corneum and water (dimensionless)	Chemical-specific
D_o	=	Diffusivity of a hypothetical molecule with a molecular volume (MV) = 0 (cm²/hr)	Chemical specific
β	=	Constant specific for the medium through which diffusion is occurring	Medium specific
D_{sc}	=	Effective diffusion coefficient for chemical transfer through the stratum corneum (cm²/hr)	Chemical-specific, see Spreadsheet ORG04_01.XLS (on website given in Section 3.1.1)
l_{sc}	=	Apparent thickness of stratum corneum (cm)	10^{-3} cm
a,b,c	=	correlation coefficients which have been fitted to the Flynn's data to give Equation 3.8.	–
MV	=	Molar volume (cm³/mol)	Chemical-specific
MW	=	Molecular weight (g/mole)	Chemical specific

Refer to Appendix A for equations to evaluate DA_event and DAD

CHEMICAL	Kp (cm/hr)	Source of Kp (exp or default)	Conc (mg/cm3)	DA_event (mg/cm2-event)	DAD (mg/kg-day)	ABSGI (chemical specific)	Screening	Chemicals to be assessed	Derm/ Total Dose
Arsenic (arsenite)	0.001	default	1	1.00E-03	1.66E-06	0.95	0.001736842	N	2.90621E-06

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APPENDIX VIII
TABLE 4
NONCANCER TOXICITY DATA -- ORAL/DERMAL
Canton Drop Forge

Chemical of Potential Concern	Oral RfD Value	Oral RfD Units	Oral Absorption Efficiency[1]	Adjusted Dermal RfD[2]	Units	Primary Target Organ	Combined Uncertainty / Modifying Factors	Sources of RfD	Look Up Date(s)
Acenaphthene	6.00E-02	mg/kg/d	100%	6.00E-02	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Acenaphthylene	NA	mg/kg/d	100%	NA	-	-	-	-	-
Anthracene	3.00E-01	mg/kg/d	100%	3.00E-01	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Arsenic	3.00E-04	mg/kg/d	100%	3.00E-04	mg/kg/d	-	-	IRIA	RSL Nov. 2012
Benzo(a)anthracene	NA	mg/kg/d	100%	NA	-	-	-	-	
Benzo(a)pyrene	NA	mg/kg/d	100%	NA	-	-	-	IRIS	RSL Nov. 2012
Benzo(b)fluoranthene	NA	mg/kg/d	100%	NA	-	-	-	-	-
Benzo(g,h,i)perylene [3]	3.00E-02	mg/kg/d	100%	3.00E-02	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Benzo(k)fluoranthene	NA	mg/kg/d	100%	NA	-	-	-	-	-
Chrysene	NA	mg/kg/d	100%	NA	-	-	-	-	-
Dibenz(a,h)anthracene	NA	mg/kg/d	100%	NA	-	-	-	-	-
Fluoranthene	4.00E-02	mg/kg/d	100%	4.00E-02	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Fluorene	4.00E-02	mg/kg/d	100%	4.00E-02	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Indeno(1,2,3-cd)pyrene	NA	mg/kg/d	100%	NA	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Methylnaphthalene, 2-	4.00E-03	mg/kg/d	100%	4.00E-03	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Naphthalene	2.00E-02	mg/kg/d	100%	2.00E-02	mg/kg/d	-	-	IRIS	RSL Nov. 2012
Phenanthrene	3.00E-02	mg/kg/d	100%	3.00E-02	-	-	-	-	-
Pyrene	3.00E-02	mg/kg/d	100%	3.00E-02	mg/kg/d	-	-	IRIS	RSL Nov. 2012

NA = Not Available
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment

(1) The Oral Absorption Efficiency displays the GIABS used for dermal calculations consistent with USEPA Regional Screening Levels, November 2012. Use of oral RfDs in dermal risk calculations involves adjusting the RfDs in accordance with Risk Assessment Guidance for Superfund (RAGS), Part A, Appendix A and RAGS Part
(2) Adjusted Dermal RfD = RfDo x oral absorption efficiency
(3) Pyrene toxicity values are assumed for benzo(g,h,i)perylene and phenanthrene.

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APPENDIX VIII
TABLE 5
CANCER TOXICITY DATA -- ORAL/DERMAL
Canton Drop Forge

Chemical of Potential Concern	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Oral to Dermal Adjustment Factor [1]	Adjusted Dermal Cancer Slope Factor [2]	Units	Weight of Evidence/ Cancer Guideline Description	Oral CSF	
						Source(s)	Look Up Date(s)
Acenaphthene	NA	1.0E+00	NA	-	-	-	-
Acenaphthylene	NA	1.0E+00	NA	-	-	-	-
Anthracene	NA	1.0E+00	NA	-	-	-	-
Arsenic	1.5E+00	1.0E+00	1.5E+00	$(mg/kg/d)^{-1}$	A	IRIS	RSL Nov. 2012
Benzo(a)anthracene	7.3E-01	1.0E+00	7.3E-01	$(mg/kg/d)^{-1}$	B2	ECEO	RSL Nov. 2012
Benzo(a)pyrene	7.3E+00	1.0E+00	7.3E+00	$(mg/kg/d)^{-1}$	B2	IRIS	RSL Nov. 2012
Benzo(b)fluoranthene	7.3E-01	1.0E+00	7.3E-01	$(mg/kg/d)^{-1}$	B2	ECEO	RSL Nov. 2012
Benzo(g,h,i)perylene	NA	1.0E+00	NA	-	-	-	-
Benzo(k)fluoranthene	7.3E-02	1.0E+00	7.3E-02	$(mg/kg/d)^{-1}$	B2	ECEO	RSL Nov. 2012
Chrysene	7.3E-03	1.0E+00	7.3E-03	$(mg/kg/d)^{-1}$	B2	ECEO	RSL Nov. 2012
Dibenz(a,h)anthracene	7.3E+00	1.0E+00	7.3E+00	$(mg/kg/d)^{-1}$	B2	ECEO	RSL Nov. 2012
Fluoranthene	NA	1.0E+00	NA	-	-	-	-
Fluorene	NA	1.0E+00	NA	-	-	-	-
Indeno(1,2,3-cd)pyrene	7.3E-01	1.0E+00	7.3E-01	$(mg/kg/d)^{-1}$	B2	ECEO	RSL Nov. 2012
Methylnaphthalene, 2-	NA	1.0E+00	NA	-	-	-	-
Naphthalene	NA	1.0E+00	NA	-	-	-	-
Phenanthrene	NA	1.0E+00	NA	-	-	-	-
Pyrene	NA	1.0E+00	NA	-	-	-	-
				-	-	-	-

NA = Not Available
IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment
ECEO = Environmental Criteria and Assessment Office

[1] The Oral Absorption Efficiency displays the GIABS used for dermal calculations consistent with USEPA Regional Screening Levels, November 2012. Use of oral RfDs in dermal risk calculations involves adjusting the RfDs in accordance with Risk Assessment Guidance for Superfund (RAGS), Part A, Appendix A and RAGS Part E.

[2] Adjusted Dermal SF = SFo / oral absorption efficiency

EPA Weight of Evidence Group:
A - Human carcinogen

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

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APPENDIX VIII
TABLE 6
CALCULATION OF NONCANCER HAZARDS, OUTDOOR MAINTENANCE WORKER (POND WATER)
REASONABLE MAXIMUM EXPOSURE
Canton Drop Forge

Scenario Timeframe:	Future
Medium:	Water
Exposure Medium:	Water
Exposure Point:	Retention Basins
Receptor Population:	Outdoor Maintenance Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Intake Factor (IF) [2] (Noncancer)	DA_{event} (cm/event)	Daily Intake [3] (Noncancer) mg/kg-day	Reference Dose (RfD) [4]	Reference Dose Units
Ingestion						
	Acenaphthene	1.41E-05	-	2.67E-03	6.00E-02	(mg/kg-day)
	Acenaphthylene	1.41E-05	-	NA	NA	(mg/kg-day)
	Anthracene	1.41E-05	-	8.22E-03	3.00E-01	(mg/kg-day)
	Arsenic	1.41E-05	-	1.49E-05	3.00E-04	(mg/kg-day)
	Benzo(a)anthracene	1.41E-05	-	8.20E-08	NA	(mg/kg-day)
	Benzo(a)pyrene	1.41E-05	-	4.82E-09	NA	(mg/kg-day)
	Benzo(b)fluoranthene	1.41E-05	-	4.74E-08	NA	(mg/kg-day)
	Benzo(g,h,i)perylene	1.41E-05	-	8.33E-04	3.00E-02	(mg/kg-day)
	Benzo(k)fluoranthene	1.41E-05	-	2.21E-06	NA	(mg/kg-day)
	Chrysene	1.41E-05	-	8.20E-06	NA	(mg/kg-day)
	Dibenz(a,h)anthracene	1.41E-05	-	3.11E-09	NA	(mg/kg-day)
	Fluoranthene	1.41E-05	-	2.14E-04	4.00E-02	(mg/kg-day)
	Fluorene	1.41E-05	-	2.14E-04	4.00E-02	(mg/kg-day)
	Indeno(1,2,3-cd)pyrene	1.41E-05	-	4.57E-08	NA	(mg/kg-day)
	Methylnaphthalene, 2-	1.41E-05	-	1.67E-04	4.00E-03	(mg/kg-day)
	Naphthalene	1.41E-05	-	7.98E-04	2.00E-02	(mg/kg-day)
	Phenanthrene	1.41E-05	-	2.89E-04	3.00E-02	(mg/kg-day)
	Pyrene	1.41E-05	-	5.85E-04	3.00E-02	(mg/kg-day)
Dermal [5]						
	Acenaphthene	3.52E-03	8.60E-02	5.73E-02	6.00E-02	(mg/kg-day)
	Acenaphthylene	3.52E-03		NA	NA	(mg/kg-day)
	Anthracene	3.52E-03	1.42E-01	2.92E-01	3.00E-01	(mg/kg-day)
	Arsenic	3.52E-03	1.00E-03	3.73E-06	3.00E-04	(mg/kg-day)
	Benzo(a)anthracene	3.52E-03	1.87E+00	3.83E-05	NA	(mg/kg-day)
	Benzo(a)pyrene	3.52E-03	3.18E+00	3.83E-06	NA	(mg/kg-day)
	Benzo(b)fluoranthene	3.52E-03	3.23E+00	3.83E-05	NA	(mg/kg-day)
	Benzo(g,h,i)perylene	3.52E-03	1.40E-01	2.92E-02	3.00E-02	(mg/kg-day)
	Benzo(k)fluoranthene	3.52E-03		0.00E+00	NA	(mg/kg-day)
	Chrysene	3.52E-03	1.87E+00	3.83E-03	NA	(mg/kg-day)
	Dibenz(a,h)anthracene	3.52E-03	4.93E+00	3.83E-06	NA	(mg/kg-day)
	Fluoranthene	3.52E-03	7.45E-01	3.98E-02	4.00E-02	(mg/kg-day)
	Fluorene	3.52E-03	7.45E-01	3.98E-02	4.00E-02	(mg/kg-day)
	Indeno(1,2,3-cd)pyrene	3.52E-03	3.36E+00	3.83E-05	NA	(mg/kg-day)
	Methylnaphthalene, 2-	3.52E-03	9.17E-02	3.83E-03	4.00E-03	(mg/kg-day)
	Naphthalene	3.52E-03	9.62E-02	1.92E-02	2.00E-02	(mg/kg-day)
	Phenanthrene	3.52E-03	4.11E-01	2.97E-02	3.00E-02	(mg/kg-day)
	Pyrene	3.52E-03	2.01E-01	2.94E-02	3.00E-02	(mg/kg-day)

APPENDIX VIII
TABLE 6
CALCULATION OF NONCANCER HAZARDS, OUTDOOR MAINTENANCE WORKER (POND WATER)
REASONABLE MAXIMUM EXPOSURE
Canton Drop Forge

Target Concentration - noncancer (TC_{nc})

$$TC_{nc} = \frac{HQ}{[(IF_{oral}/RFD_{oral}) + (IF_{derm} * DA_{event}/RfD_{derm})]}$$

Chemical of Concern	TC_{nc}
Acenaphthene	1.89E+02
Acenaphthylene	NA
Anthracene	5.83E+02
Arsenic	1.70E+01
Benzo(a)anthracene	NA
Benzo(a)pyrene	NA
Benzo(b)fluoranthene	NA
Benzo(g,h,i)perylene	5.91E+01
Benzo(k)fluoranthene	NA
Chrysene	NA
Dibenz(a,h)anthracene	NA
Fluoranthene	1.52E+01
Fluorene	1.52E+01
Indeno(1,2,3-cd)pyrene	NA
Methylnaphthalene, 2-	1.19E+01
Naphthalene	5.66E+01
Phenanthrene	2.05E+01
Pyrene	4.15E+01

(1) Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Calculated from Table 1. Units are L/kg-day (oral, dermal) or m^3/kg-day (inhalation).

(3) Values derived from the Intake Factor equations presented in Table 1 are multiplied by the chemical-specific DA value (dermal pathway) and, where applicable (for risk determination) the chemical concentration to determine the chemical-specific daily intakes and risks. Calculations performed here are to determine standards based on the target HQ or ELCR. Therefore, chemical specific intakes are not utilized in determination of target concentrations.

(4) From Tables 2 and 3.

(5) RfC values converted to RfD for use in the calculation of noncancer hazards (Table 5).

(6) Chemical-specific Permeability Constants (PC) were utilized for the DA value for acenaphthene, anthracene, benzo(ghi)perylene, and pyrene.

APPENDIX VIII
TABLE 7
CALCULATION OF CANCER HAZARDS, OUTDOOR MAINTENANCE WORKER (POND WATER)
REASONABLE MAXIMUM EXPOSURE
Canton Drop Forge

Scenario Timeframe:	Future
Medium:	Water
Exposure Medium:	Water
Exposure Point:	Retention Basins
Receptor Population:	Outdoor Maintenance Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Intake Factor (IF) [2] (Cancer)	DA_{event} (cm/event)	Daily Intake [3] (Cancer) mg/kg-day	Cancer Slope Factor (SF)[4]	Cancer Slope Factor Units
Ingestion						
	Acenaphthene	5.03E-06	-	9.52E-04	NA	$(mg/kg\text{-}day)^{-1}$
	Acenaphthylene	5.03E-06	-	NA	NA	$(mg/kg\text{-}day)^{-1}$
	Anthracene	5.03E-06	-	2.94E-03	NA	$(mg/kg\text{-}day)^{-1}$
	Arsenic	5.03E-06	-	5.33E-06	1.5E+00	$(mg/kg\text{-}day)^{-1}$
	Benzo(a)anthracene	5.03E-06	-	2.93E-08	7.3E-01	$(mg/kg\text{-}day)^{-1}$
	Benzo(a)pyrene	5.03E-06	-	1.72E-09	7.3E+00	$(mg/kg\text{-}day)^{-1}$
	Benzo(b)fluoranthene	5.03E-06	-	1.69E-08	7.3E-01	$(mg/kg\text{-}day)^{-1}$
	Benzo(g,h,i)perylene	5.03E-06	-	2.98E-04	NA	$(mg/kg\text{-}day)^{-1}$
	Benzo(k)fluoranthene	5.03E-06	-	7.88E-07	7.3E-02	$(mg/kg\text{-}day)^{-1}$
	Chrysene	5.03E-06	-	2.93E-06	7.3E-03	$(mg/kg\text{-}day)^{-1}$
	Dibenz(a,h)anthracene	5.03E-06	-	1.11E-09	7.3E+00	$(mg/kg\text{-}day)^{-1}$
	Fluoranthene	5.03E-06	-	7.63E-05	NA	$(mg/kg\text{-}day)^{-1}$
	Fluorene	5.03E-06	-	7.63E-05	NA	$(mg/kg\text{-}day)^{-1}$
	Indeno(1,2,3-cd)pyrene	5.03E-06	-	1.63E-08	7.3E-01	$(mg/kg\text{-}day)^{-1}$
	Methylnaphthalene, 2-	5.03E-06	-	5.97E-05	NA	$(mg/kg\text{-}day)^{-1}$
	Naphthalene	5.03E-06	-	2.85E-04	NA	$(mg/kg\text{-}day)^{-1}$
	Phenanthrene	5.03E-06	-	1.03E-04	NA	$(mg/kg\text{-}day)^{-1}$
	Pyrene	5.03E-06	-	2.09E-04	NA	$(mg/kg\text{-}day)^{-1}$
Dermal[5]						
	Acenaphthene	1.26E-03	0.086	2.05E-02	NA	$(mg/kg\text{-}day)^{-1}$
	Acenaphthylene	1.26E-03		NA	NA	$(mg/kg\text{-}day)^{-1}$
	Anthracene	1.26E-03	0.142	1.04E-01	NA	$(mg/kg\text{-}day)^{-1}$
	Arsenic	1.26E-03	1.00E-03	1.33E-06	1.5E+00	$(mg/kg\text{-}day)^{-1}$
	Benzo(a)anthracene	1.26E-03	1.87E+00	1.37E-05	7.3E-01	$(mg/kg\text{-}day)^{-1}$
	Benzo(a)pyrene	1.26E-03	3.18E+00	1.37E-06	7.3E+00	$(mg/kg\text{-}day)^{-1}$
	Benzo(b)fluoranthene	1.26E-03	3.23E+00	1.37E-05	7.3E-01	$(mg/kg\text{-}day)^{-1}$
	Benzo(g,h,i)perylene	1.26E-03	1.40E-01	1.04E-02	NA	$(mg/kg\text{-}day)^{-1}$
	Benzo(k)fluoranthene	1.26E-03	0.691	1.36E-04	7.3E-02	$(mg/kg\text{-}day)^{-1}$
	Chrysene	1.26E-03	1.87E+00	1.37E-03	7.3E-03	$(mg/kg\text{-}day)^{-1}$
	Dibenz(a,h)anthracene	1.26E-03	4.93E+00	1.37E-06	7.3E+00	$(mg/kg\text{-}day)^{-1}$
	Fluoranthene	1.26E-03	7.45E-01	1.42E-02	NA	$(mg/kg\text{-}day)^{-1}$
	Fluorene	1.26E-03	7.45E-01	1.42E-02	NA	$(mg/kg\text{-}day)^{-1}$
	Indeno(1,2,3-cd)pyrene	1.26E-03	3.36E+00	1.37E-05	7.3E-01	$(mg/kg\text{-}day)^{-1}$
	Methylnaphthalene, 2-	1.26E-03		0.00E+00	NA	$(mg/kg\text{-}day)^{-1}$
	Naphthalene	1.26E-03	9.62E-02	6.86E-03	NA	$(mg/kg\text{-}day)^{-1}$
	Phenanthrene	1.26E-03	4.11E-01	1.06E-02	NA	$(mg/kg\text{-}day)^{-1}$
	Pyrene	1.26E-03	2.01E-01	1.05E-02	NA	$(mg/kg\text{-}day)^{-1}$

APPENDIX VIII
TABLE 7
CALCULATION OF CANCER HAZARDS, OUTDOOR MAINTENANCE WORKER (POND WATER)
REASONABLE MAXIMUM EXPOSURE
Canton Drop Forge

Target Concentration - cancer (TC_c)

$$TC_c = \frac{\text{Risk}}{[(IF_{oral} \times SF_{oral}) + (IF_{derm} \times DA_{event} \times SF_{derm})]}$$

Chemical of Concern	TC_c
Acenaphthene	NA
Acenaphthylene	NA
Anthracene	NA
Arsenic	1.06E+00
Benzo(a)anthracene	5.82E-03
Benzo(a)pyrene	3.42E-04
Benzo(b)fluoranthene	3.37E-03
Benzo(g,h,i)perylene	NA
Benzo(k)fluoranthene	1.57E-01
Chrysene	5.82E-01
Dibenz(a,h)anthracene	2.21E-04
Fluoranthene	NA
Fluorene	NA
Indeno(1,2,3-cd)pyrene	3.24E-03
Methylnaphthalene, 2-	NA
Naphthalene	NA
Phenanthrene	NA
Pyrene	NA

(1) Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Calculated from Table 1. Units are L/kg-day (oral, dermal) or m^3/kg-day (inhalation).

(3) Values derived from the Intake Factor equations presented in Table 1 are multiplied by the chemical-specific DA value (dermal pathway) and, where applicable (for risk determination) the chemical concentration to determine the chemical-specific daily intakes and risks. Calculations performed here are to determine standards based on the target HQ or ELCR. Therefore, chemical specific intakes are not utilized in determination of target concentrations.

(4) From Tables 4 and 5.

(5) Chemical-specific Permeability Constants (PC) were utilized for the DA value for acenaphthene, anthracene, benzo(ghi)perylene, benzo(k)fluoranthene, and pyrene.

APPENDIX VIII
TABLE 8
SUMMARY OF PRELIMINARY REMEDIATION GOALS (PRGs)
OUTDOOR MAINTENANCE WORKER EXPOSURE TO POND WATER
Canton Drop Forge

Chemical of Concern	Noncancer Standard (mg/l)	Cancer Standard (mg/l)	Risk-Based Standard[1] (mg/l)
Acenaphthene	189	NA	189
Acenaphthylene	NA	NA	NA
Anthracene	583	NA	583
Arsenic	17	1.060	1.1
Benzo(a)anthracene	NA	0.0058	0.0058
Benzo(a)pyrene	NA	0.00034	0.00034
Benzo(b)fluoranthene	NA	0.0034	0.0034
Benzo(g,h,i)perylene	59	NA	59
Benzo(k)fluoranthene	NA	0.16	0.16
Chrysene	NA	0.58	0.58
Dibenz(a,h)anthracene	NA	0.00022	0.00022
Fluoranthene	15	NA	15
Fluorene	15	NA	15
Indeno(1,2,3-cd)pyrene	NA	0.0032	0.0032
Methylnaphthalene, 2-	12	NA	12
Naphthalene	57	NA	57
Phenanthrene	21	NA	21
Pyrene	42	NA	42

[1] Single-Chemical, Risk-Based Standards are based on a noncancer risk (Hazard Quotient) of 1 and an Excess Lifetime Cancer Risk (ELCR) or 1E-05, whichever is lower.

APPENDIX VIII
TABLE 9
SUMMARY OF PRELIMINARY REMEDIATION GOALS (PRGs)
PROTECTION OF POND WATER
Leach-Based Concentrations for Pond Bottom Materials
Canton Drop Forge

$PRG_s = C_{pw} \times DF$

where:

PRG_s = Preliminary Remediation Goal
C_{pw} = Concentration in sediment pore water (mg/l) = $C_w \times f_{oc} \times K_{oc}$
C_w = Site-Specific Risk-based Standard for Pond Water (mg/l)
DF = Dilution Factor = V_{pond}/V_{pw}
V_{pond} = Volume of Pond (L) = $A_{pond} \times Depth_{pond} \times CF$
V_{pw} = Volume of Pore Water (L) = $A_{pond} \times Depth_{sed} \times Porosity_{sed} \times CF$
ρ_b = Dry Soil Bulk Density (kg/L); 1.5 default assumed
ρ_s = Soil particle density (kg/L); 2.65 default assumed
n = Total Porosity = $1 - (\rho_b/\rho_s)$

Chemical of Concern	C_w Site-Specific Risk-Based Standard	f_{oc} Fraction Organic Carbon	K_{oc} soil organic carbon-water partition	C_{pw} Concentration Sediment Pore Water	A_{pond} Estimated Area of Pond[4]	$Depth_{pond}$ Estimated Depth of Pond[5]	$Depth_{pond}$ Estimated Depth of Sediment[5]	CF Conversion Factor	V_{pond} Estimated Volume of Pond	P_b Dry Soil Density	P_s Soil Particle Density	n Total Porosity	V_{pw} Estimated Volume of Pore Water	DF Dillution Factor	PRG_s Preliminary Remediation Goal
	mg/l	g/g	L/kg	mg/kg	ft^2	ft	ft	L/ft^3	L	(kg/L)	(kg/L)		L		mg/kg
Arsenic	1.1	2.00E-03	2.90E+01	32	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	184
2-Methylnaphthalene	12	2.00E-03	2.48E+03	59	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	343
Acenaphthene	189	2.00E-03	5.03E+03	1,900	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	10,947
Acenaphthylene	NA	2.00E-03	NA	NA	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	NA
Anthracene	583	2.00E-03	1.64E+04	19,076	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	109,893
Benzo(a)anthracene	0.0058	2.00E-03	1.77E+05	2.1	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.434	2.7E+05	5.8	12
Benzo(a)pyrene	0.00034	2.00E-03	5.87E+05	0.40	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	2.3
Benzo(b)fluoranthene	0.0034	2.00E-03	5.99E+05	4.1	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	23
Benzo(g,h,i)perylene	NA	2.00E-03	NA	NA	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	NA
Benzo(k)fluoranthene	0.16	2.00E-03	5.87E+05	188	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	1,083
Chrysene	0.58	2.00E-03	1.81E+05	209	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	1,206
Dibenzo(a,h)anthracene	0.00022	2.00E-03	1.91E+06	0.84	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	4.8
Fluoranthene	15	2.00E-03	5.55E+04	1,664	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	9,583
Fluorene	15	2.00E-03	9.16E+03	275	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	1,583
Indeno(1,2,3-cd)pyrene	0.0032	2.00E-03	3.47E+06	22	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	128
Naphthalene	57	2.00E-03	1.54E+03	176	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	1,014
Phenanthrene	21	2.00E-03	NA	NA	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	NA
Pyrene	42	2.00E-03	5.43E+04	4,565	11,000	5	2	28.317	1.6E+06	1.5	2.65	0.43	2.7E+05	5.8	26,296

NA = Not Available

[1] Site-specific, risk-based standards for outdoor maintenance worker exposure to pond water.

[2] Preliminary Remediation Goals for Ecological Endpoints; U.S. Department of Energy Office of Environmental Management; ES/ER/TM-162/R2 August 1997.

[3] C_{pw} for inorganics (i.e., arsenic) was calculated as follows: $C_w \times K_d$ where the Kd values as based on pH between 7.6 to 7.1 (Appendix C, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, USEPA Office of Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002.

[4] Based on estimated size of Pond 1 (smallest).

[5] Approximated average depths of pond and bottom materials (e.g., sediments).

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APPENDIX IX

REFERENCES

PETROLOGY OF THE MASSILLON SANDSTONE AT THE TYPE LOCALITY

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The Massillon sandstone, an arenite of commercial importance in northeastern Ohio, is a winnowed low-rank graywacke at its type locality, Massillon, Stark County, Ohio. High quartz content, medium granularity, and good sorting indicate a high-energy environment of deposition. Consistent north-northeast dip-direction of cross- and incline-beds suggests longshore currents as the agent of deposition and makes a southwestern source of the sediment probable. Petrographically similar Mississippian arenites may have been the source materials.

In the summer of 1951 the author began a general study of the Massillon sandstone of northeastern Ohio under the auspices of the Ohio Division of Geological Survey. The object of this investigation was the determination of stratigraphic relationships, areal extent, range in lithologic character, and origin of the Massillon sandstone. Early in this project observations were made and a suite of specimens was collected from the abandoned Warthorst or Everhard quarry of the Industrial Silica Corporation, located in NE¼ NW¼ section 7, Perry Township, Stark County, Ohio, in the outskirts of the town of Massillon. The rocks in

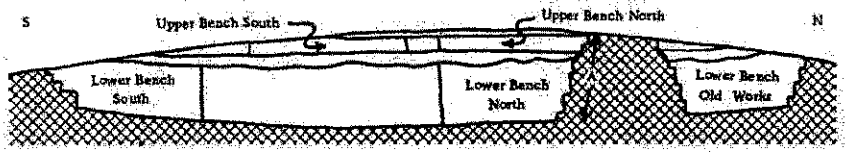

FIGURE 1. Profile of west wall of Warthorst quarry, not to scale. Length of diagram approximately 2,000 feet. Stratigraphic section was measured and lithologic samples were collected at locality A. Areas in which dip-directions of cross- and incline-beds were measured are labeled.

this quarry were designated by Newberry (1878, p. 166–167) as typical Massillon sandstone. A section measured in the north end of the newer workings shows 51 ft. of low-rank graywacke (defined by Krynine, 1948, table 3). When the quarry was in operation as much as 75 ft. of the rock was exposed, overlying the Number 1 (Sharon) coal and shale unconformably (Newberry, 1878, p. 166–167).

The quarry face consists of two benches. The lower bench, of which 30 ft. is exposed, is medium-grained quartzose graywacke. Above this lies 6 to 9 ft. of fine-grained graywacke interbedded with thin light-gray shale. The upper bench, which is as much as 12 ft. thick, is medium-grained quartzose graywacke. Glacial drift a few feet thick constitutes the overburden.

A stratigraphic section was measured by tape and hand-level and samples were collected in the north end of the newer workings (fig. 1). The units of subdivision used for description and sampling were sets of beds (defined by McKee and Weir, 1953), which are about the equivalent of "courses" of stone in quarrymen's nomenclature. Conspicuous horizontal or nearly horizontal parting surfaces separate the units. Composition, texture, and structure of each unit were described.

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TABLE 1

Comparison of field and laboratory estimates of composition and texture. Units (sets of beds) are listed in ascending order. Lower bench, units 1–20; shaly break, units 21–30; upper bench, units 31–38.

Unit number	Thickness (feet)	Quartz content		Median grain size		Sorting coefficient
		Field est.	Thin section	Field estimate	Sieve analysis	Sieve analysis
1.	1.0	80%	—	Coarse	.4 mm.	1.1
2.	2.2	75	—	Medium-coarse	.38	1.2
3.	1.4	75	77%	Medium-coarse	.35	1.2
4.	0.7	75	—	Coarse	.36	1.3
5.	1.0	80	—	Medium-coarse	.35	1.2
6.	1.0	80	87	Medium-coarse	.28	1.2
7.	1.3	84	—	Medium-coarse	.38	1.2
8.	2.2	85	—	Medium	.31	1.2
9.	1.6	85	—	Medium-coarse	.36	1.2
10.	5.0	85	—	Medium-coarse	.31	1.2
11.	1.1	85	—	Medium-coarse	.33	1.1
12.	2.7	85	88	Medium-coarse	.30	1.2
13.	0.5	85	—	Medium-fine	.22	1.2
14.	1.4	85	—	Medium-coarse	.27	1.3
15.	0.6	85	86	Medium-fine	.21	1.3
16.	1.6	78	—	Medium-coarse	.28	1.2
17.	1.3	78	—	Medium-coarse	.26	1.2
18.	1.5	78	—	Medium	.28	1.2
19.	1.3	80	—	Medium-coarse	.29	1.1
20.	1.1	80	87	Medium-coarse	.26	1.2
21.	0.1	Shale	—	———	———	———
22.	0.4	80	—	Medium-coarse	.33	1.2
23.	0.4	85	—	Medium-coarse	.29	1.2
24.	1.7	85	88	Medium-coarse	.30	1.2
25.	1.3	75	—	Medium-fine	.17	1.4
26.	0.2	Shale	—	———	———	———
27.	1.4	75	—	Medium-fine	.14	1.6
28.	0.4	Covered	—	———	———	———
29.	0.8	80	73	Medium-fine	.13	1.8
30.	2.5	Covered	—	———	———	———
31.	2.9	85	—	Medium-coarse	.34	1.3
32.	1.6	85	—	Medium-coarse	.27	1.3
33.	2.0	82	—	Medium	.21	1.3
34.	0.5	82	—	Medium-coarse	.36	1.4
35.	1.9	82	—	Medium-coarse	.32	1.1
36.	0.6	82	88	Medium	.19	1.3
37.	0.6	82	—	Medium	.20	1.3
38.	1.5	82	—	Medium-coarse	.23	1.3
Total	51.3					
Weighted average		81.5%	85.0%	Medium-coarse (.46 mm.)	.29 mm.	1.2
Portion of thickness represented.		94%	19%	94%	94%	94%

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PETROLOGY

Composition. Composition was estimated in the field by examination of hand specimens. Quartz grains make up most of the rock, (table 1), but considerable clay is present as coatings on the quartz grains, as matrix, and as detrital aggregates of about the same size as the grains. Selective staining of some of the clay by limonite gives a speckled appearance to the coarser graywackes. Muscovite, secondary quartz crystal overgrowths, and unidentified dark grains are present in small quantities and iron oxides are abundant locally.

Eight thin sections were analyzed under the petrographic microscope by the point-count method (Chayes, 1949). Six to eight traverses, totaling more than 1,100 individual points, were made across each slide. This allows 95 percent confidence limits of ± 2.5 percent for the major constituents. Quartz content ranges from 73 to 88 percent and averages about 85 percent (table 1). Of this, approximately 70 percent is individual quartz grains, 14 percent is aggregates (mostly quartzites with sutured contacts between the grains), and 1 percent is either very fine-grained quartzite or chert.

Clay content ranges from 11 to 26 percent and averages about 15 percent. Six clay types are recognized, but the distinctions between them are too slight to allow quantitative determination. These types include 1) fairly large (up to 0.1 mm.) flakes of sericite (?) that have medium relief and high birefringence and show no compactional disturbance; 2) finely crystalline, parallel-oriented aggregates of sericite (?) or illite (?) flakes that show slight iron-staining and some crushing due to compaction; 3) very finely crystalline, iron-stained, parallel-oriented aggregates of illite (?) or sericite (?) flakes that commonly are much distorted due to squeezing between the enclosing quartz grains; 4) amorphous (?) ferruginous clay masses that may be exceedingly fine-grained illitic or sericitic aggregates; 5) undisturbed aggregates of kaolinite (?) that have a mosaic pattern, low relief, very low birefringence, and undulatory extinction, and 6) clear, undisturbed, apparently amorphous aggregates which may be exceedingly fine-grained kaolinite mosaics. Type 3 appears to be most abundant.

Comparison of field and laboratory estimates of composition shows that minor constituents were consistently over-estimated in the field. Accessory minerals, such as muscovite and secondary quartz crystal overgrowths, were reported in quantities up to 2 percent in the field but were rarely seen in thin section. Field estimates seem fairly reliable for the major component, however (table 1); of the eight field estimates of quartz content which were checked microscopically, half fall within 5 percent and all fall within 10 percent of the value determined by point-count. A t test of the significance of the differences (Snedecor, 1946, p. 62–68) indicates that the mean difference, about 3 percent, is probably not significant ($t = 1.71$, p. $= 0.14$). The t test allows an evaluation of the probability that two different groups of observations could have been drawn by chance from two larger groups (populations) that are not different.

Seven of eight field estimates showed lower quartz content than was measured in thin section. If the single over-estimate (unit 29) is disregarded, the mean difference between field and microscopic estimates becomes highly significant ($t = 4.45$, $P < 0.01$). It seems probable, therefore, that an over-estimate of less abundant constituents, notably clay, led to a rather consistent under-estimate of the quartz content.

Texture. Grain size was estimated in the field by comparison with standard samples (table 1). A spot-sample collected from each unit was analyzed by sieving. Disaggregation under water and preliminary wet-sieving reduced losses to less than 0.5 percent. Dry sieving of the $+0.062$ mm. portion of the sample was done with standard 8 inch sieves (Wentworth classes, 1 phi intervals) on a Cenco-Meinzer machine with automatic timing (20 min. interval). The family of cumulative curves thus determined is represented in figure 2 by the limiting curves

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and the mean of all curves. Comparison of the field estimate of grain size and the median size as determined by sieving shows a very consistent bias of 0.7 phi or about ¾ of a Wentworth class in favor of the coarser sizes. This bias probably is a result of overestimation of the quantity of the larger and more conspicuous grains, estimation based on the long axes rather than on the intermediate axes of inequidimensional grains, or both. A t test indicates a probability of less than 1 percent that this bias does not exist.

The median grain size of the graywackes ranges from 0.13 mm. to 0.40 mm. The mean of the medians, weighted for thickness of the unit represented by each, is 0.29 mm. Distribution of the medians about the mean approaches log-normal,

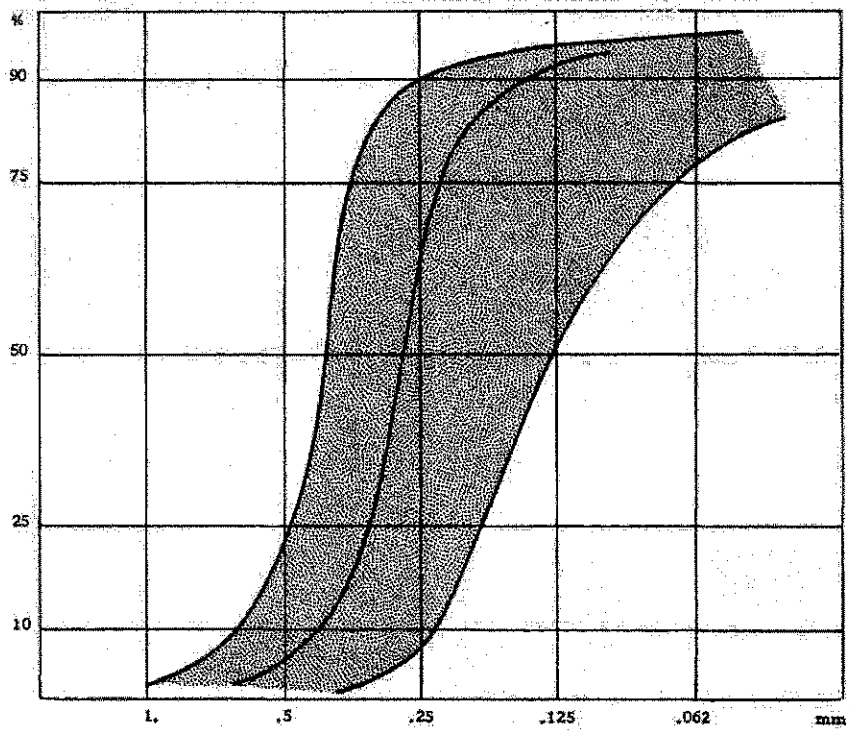

FIGURE 2. Limiting and mean cumulative curves in family of 34, Warthorst quarry, Massillon, Ohio.

but is skewed toward the fine sizes. Median size generally decreases from bottom to top of the quarry face, with local increases at the base of the upper bench and at the bottom of zones of cut-and-fill bedding such as units 16 and 22 (table 1). Grain size of the shales is not reported because shales are quantitatively insignificant and cannot be analyzed by a comparable technique.

Sorting coefficients (Trask, 1932, p. 71–72) range from 1.1 to 1.8. The mean is about 1.2, which indicates good sorting. Fine material is generally poorly sorted, but some of the coarser arenites also exhibit large coefficients of sorting (table 1).

Sphericity and roundness of 25 grains from each of eight thin-sections were estimated by visual comparison with a standard chart (Krumbein and Sloss, 1951, fig. 4–9). Sphericity of individual grains ranges from 0.3 to 0.9 and round-

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ness ranges from 0.1 to 0.9; both characters thus run the gamut of the chart. Variations from slide to slide are small, however. Mean sphericity per slide ranges from 0.54 to 0.66; the grand mean is 0.60. Mean roundness per slide ranges from 0.20 to 0.31; the grand mean is 0.26. A series of t tests indicates that none of the sphericity and roundness means per slide departs significantly from the corresponding grand mean (For both sphericity and roundness, maximum $t = 1.3$; minimum $P = 0.20$). The shape of the quartz grains in the Massillon may therefore be characterized as sub-equant and angular to sub-angular.

Grain-contact types were investigated by the method proposed by Taylor (1950). Tangential and long contacts were readily determined, but concavo-convex and sutured types were not. The last two types were therefore combined for analysis. Contacts of 25 grains on each of eight thin sections were counted. The number of contacts per grain ranges from 0 to 8, the mean per slide ranges from 2.7 to 3.7, and the grand mean of eight slides is 3.2. About 14 percent of the contacts are tangential, 49 percent are long, and 37 percent are concavo-convex or sutured. Variation from slide to slide is somewhat larger than expectable sample variation, probably due at least in part to uncertainties arising from the irregular shape of many grains and the abundance of clay matrix.

TABLE 2

Long-axis orientation of elongate grains in thin-section. Two slides, 100 grains each, 30° classes. Zero arbitrarily defined as the long dimension of the slide.

Class (degrees)	Unit 3	Unit 6
0– 29	22%	19%
30– 59	33	19
60– 89	21	12
90–119	9	10
120–149	6	26
150–179	9	14
Total	100%	100%

Elongate grains show a tendency toward orientation in thin-section. Long-axis directions of 100 grains from each of two slides are shown in table 2. A chi-square test (Snedecor, 1946, p. 21–23) indicates that the distribution differs significantly from a random arrangement (Max. x^2, unit 3, 16.4, unit 6, 5.2; min. P, unit 3, <0.01, unit 6, 0.02). The chi-square test allows an evaluation of the probability that a group of observations of apparently non-random distribution could have been drawn by chance from a larger group (population) with random distribution. Accurate and efficient measurement of this property requires the use of oriented thin sections. Work was therefore suspended pending the collection of oriented specimens.

Structure. Most of the lower bench consists of continuous incline-bedded banks (defined by Andersen, 1931, *in* Pettijohn, 1949, p. 126) from 0.5 to 5 ft. in thickness. Individual beds range from 1.0 to 20 mm. thick. In the upper part of the lower bench bedding is less regular and some shallow cut-and-fill channels may be seen. Above the lower bench trough-type cross-bedding (defined by McKee and Weir, 1953, p. 387) in lenticular sets up to 3 ft. thick is the rule.

Thickness of the sets of cross- and incline-beds show a nearly log-normal distribution about a mean of 1.2 ft. In general, the thickness of the sets decreases from the bottom of the exposure to the base of the upper bench, where it increases abruptly and remains fairly constant to the top of the quarry wall (table 1). Median grain size shows somewhat similar variation, but there ap-

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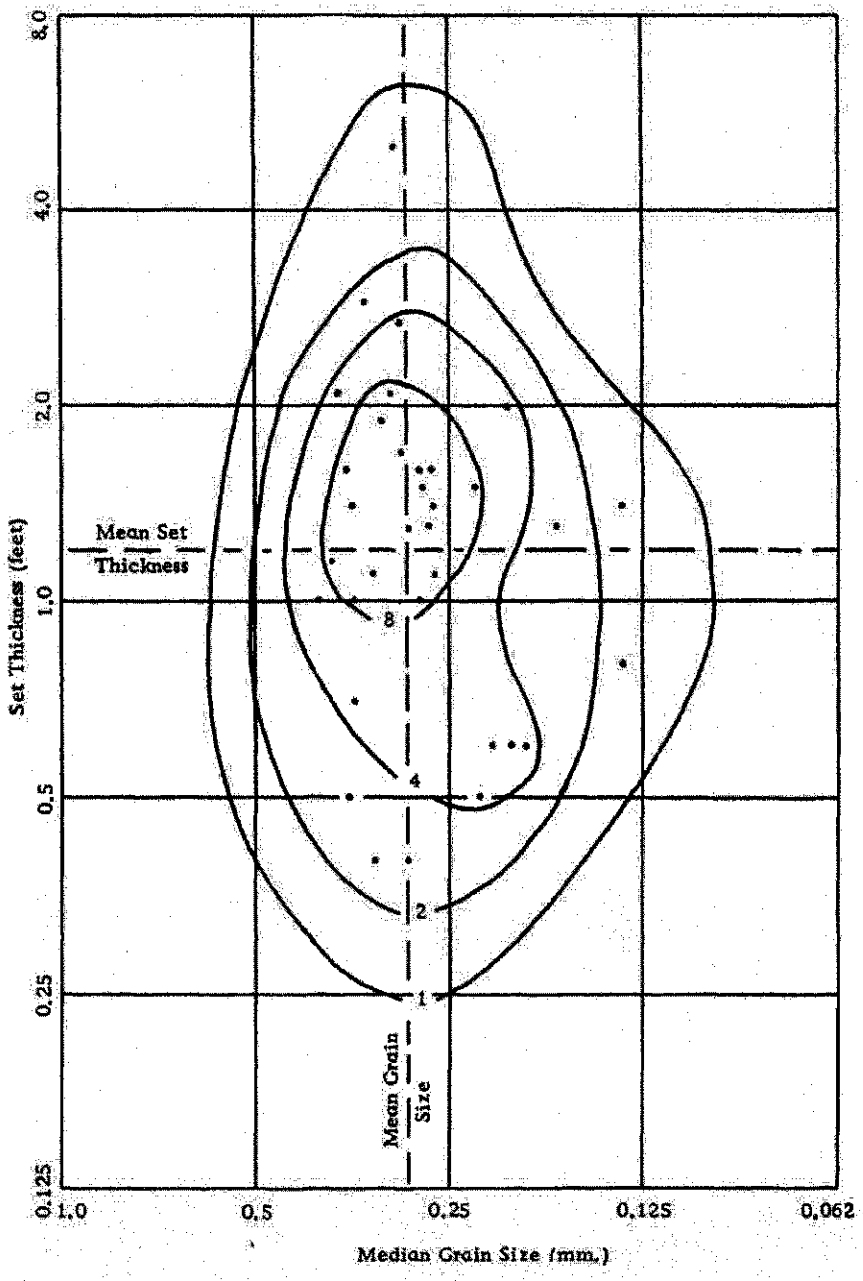

FIGURE 3. Thickness of Sets and Median Grain Size. Contours indicate relative density of observations.

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pears to be no direct correlation between set thickness and median size (fig. 3). This suggests independence of the two measures.

Dip-direction distribution of cross- and incline-beds was investigated primarily as a possible criterion for correlation. Five groups of measurements were made, three in the lower bench and two in the upper bench, as shown in the sketch (fig. 1). From 11 to 24 measurements were made in each group. These groups were reduced to equal size by random selection of 11 items from each. Statistics derived are shown in table 3.

TABLE 3

Statistics of samples of dip-directions of cross- and incline-beds.

	Lower Bench			Upper Bench	
Statistic (see Snedecor, 1946, chs. 3 and 4)	South	North	Old Works	South	North
Mean direction ($\bar{x}$)	N 56° W	N 23° W	N 84° W	N 81° E	N 64° E
Number of measurements (n)	11	11	11	11	11
Standard deviation (s)	15°	26°	43°	15°	30°
Standard error ($s_{\bar{x}}$)	4.5°	7.8°	12.9°	4.5°	9°

TABLE 4

Test of precision of individual measurements of dip-direction on the same bedding surface.

Statistic	Gray	Schlein
Mean ($\bar{x}$)	N 76.95° W	N 78.10° W
Number of measurements (n)	20	20
Standard deviation (s)	3.21°	3.18°
Standard error ($s_{\bar{x}}$)	0.72°	0.71°
Difference of means	1.15°	
Standard error of difference of means	1.01°	
t	1.14	
	(not significant)	

Values of t and corresponding probabilities were calculated for geologically significant combinations of these groups of measurements. In most cases the value of t, which ranges from 1.65 to more than 40.0, indicates significant differences in the means of the populations sampled. Only the two groups from the upper bench indicate a significant probability that two more divergent groups than these could have been drawn from identical populations ($t = 1.65$, $P = 0.20$). It may therefore be inferred that only these groups (which were more closely spaced than any other correlative pair) were drawn from populations which were not significantly different and that cross-bedding studies will probably be of little value in correlation.

The mean direction of the groups of incline-bedding measurements seems not to show any systematic variation, but the standard deviation (table 3) shows a consistent increase northward in both benches. From nearby exposures it is seen

CDF012153

that the medium-grained, incline-bedded graywacke disappears a few hundred feet north of the old works and its place is taken by interbedded gray shale and very fine-grained graywacke. The increased dispersion of incline-bedding dip-directions may result from proximity to the edge of the body of graywacke.

In order to test the precision of dip-direction measurements, a series of 20 measurements was made on the same incline-bedding surface by the author and by Mr. Frederick A. Schlein, who assisted in part of the field work. The statistics

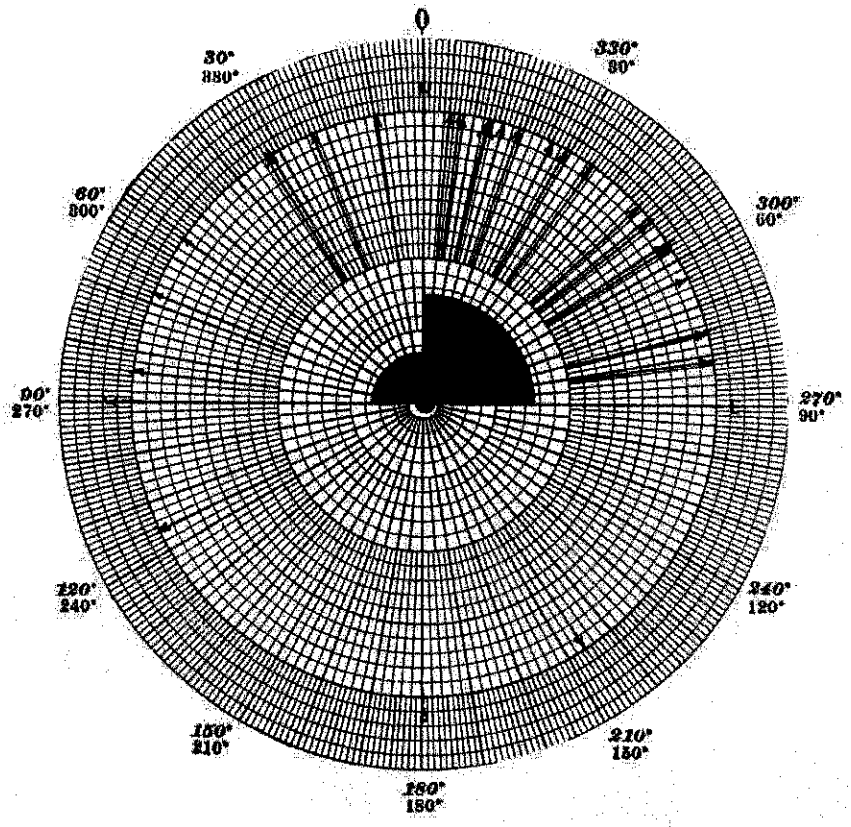

FIGURE 4. Mean dip-directions of cross- and incline-beds in twenty-four exposures of Massillon arenite near the type locality. Summations in each quadrant also show. Heavy arrow shows direction of grand mean.

(table 4) indicate small limits of error for individual measurements and insignificant operator variation.

PETROGENESIS

The source materials of the Massillon arenite cannot be determined on the basis of mineral composition alone because most of the components are of common types and too few grains reveal their origin. The direction of the source may be indicated, however, by a vector property such as dip-direction of cross- and incline-beds. A source material may then be sought in the indicated source area.

In addition to the five groups of dip-direction measurements made at the Warthorst quarry, nineteen other exposures, all within 20 miles of Massillon, were tested (fig. 4). The mean dip-direction for each exposure was calculated from

CDF012154

9 to 30 individual measurements. Fifteen of these means (63 percent) fall in the northeast quadrant and 7 (29 percent) fall in the northwest quadrant. The remaining 2 fall in the southeast and southwest quadrants (4 percent each). A southwestern or southern source of the Massillon of this area is therefore indicated.

Southwest of the type area the Massillon arenite lies at or near the base of the Pennsylvanian system and unconformably overlies Mississippian arenites. Some of the coarser Mississippian clastics may have been a source of the Massillon. The Black Hand sandstone, for example, is a low-rank graywacke similar to the Massillon in composition and texture and is indicated as a possible source because it is well developed in the area from which the Massillon may have been derived.

The environment of deposition of the Massillon arenite can be suggested on the basis of the composition, texture, and structure of the rock. The Massillon is among the most quartzose, best sorted, and most coarse-grained of the many lithologic types in the lower Pennsylvanian; this, together with the numerous unconformities and zones of cut-and-fill, both at the base and within the arenite, indicates a high-energy environment of deposition, such as is characteristic of beaches and stream channels.

Consistency of dip-direction in the cross- and incline-beds is favorable to the hypothesis of a beach environment; marine currents are generally more uniform than fluvial currents. The mean dip-direction is about N 13° E, and is approximately parallel to the strike of the rocks and to the general trend of the contact of the Pennsylvanian with the underlying Mississippian rocks. Longshore currents are therefore probable agents of transport and the physiographic environment may have been an offshore or longshore bar.

Diagenetic changes included the deposition of a small amount of secondary quartz as crystalline overgrowths and the development of flakes and aggregates of sericite (?) and kaolinite (?) which are not distorted and hence probably formed after compaction of the rock. Locally a hydrous iron oxide tentatively identified as goethite was introduced. In one thin-section where goethite is abundant it apparently has shattered and partially replaced the quartz and clay. Replacement of quartz by sericite (?) was indicated in one thin-section, but the time of this replacement could not be determined. It is considered diagenetic (?) primarily because of associated undisturbed interstitial sericite (?) flakes.

Taylor (1950) considers the number and type of grain contacts as an indication of the probable depth of burial of the arenites. Comparison with Taylor's data allows the suggestion that the Massillon may have been buried to a depth of 4,000 ft. or more. Because this is more than twice the known thickness of all possible overlying Pennsylvanian and Permian rocks in the Appalachian Basin, it seems likely that other factors, such as grain shape, may have more influence on grain-contact relations than Taylor recognized.

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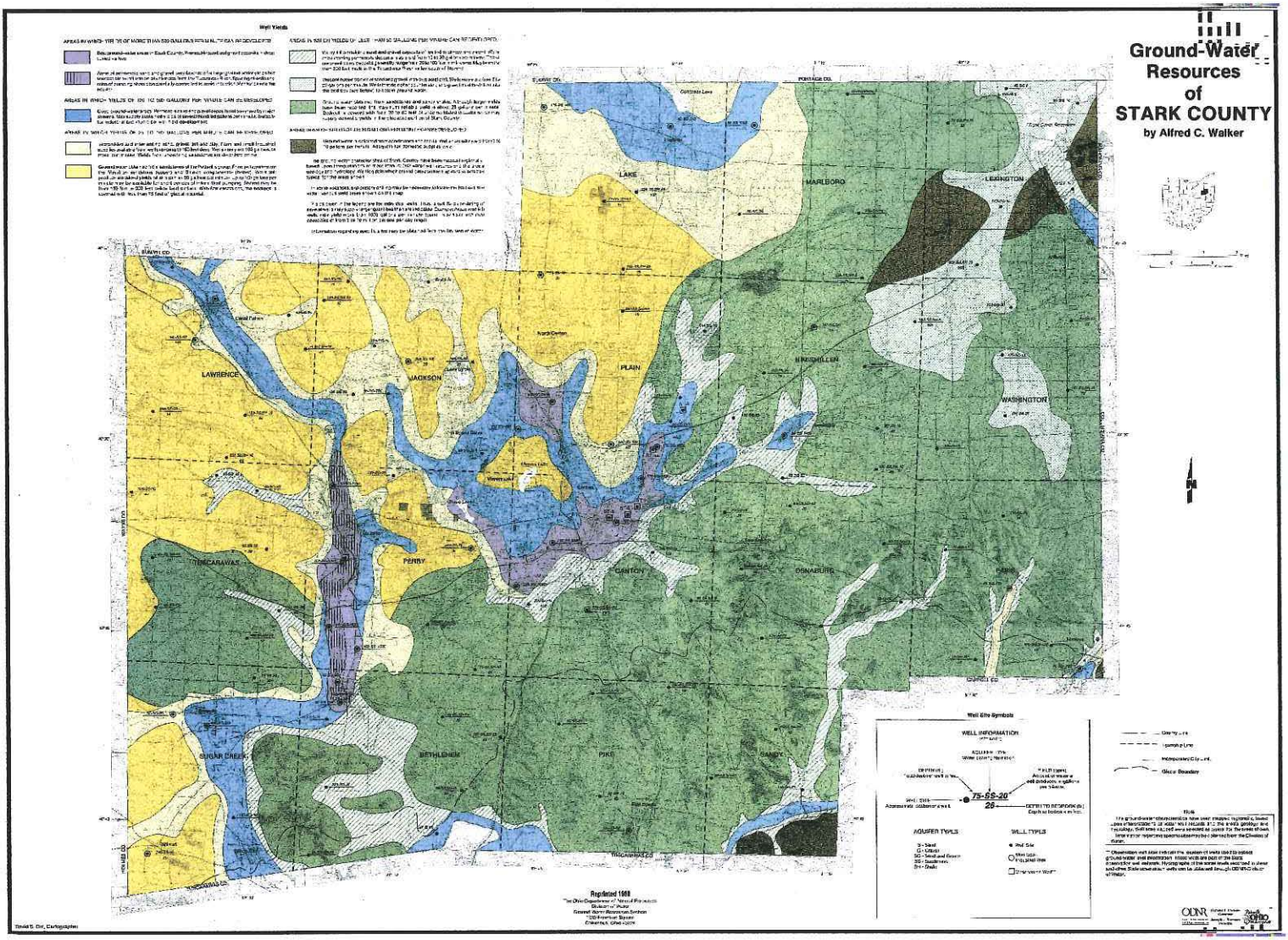
CDF012155


Ground-Water Resources of STARK COUNTY
by Alfred C. Walker
Well Yields
LAKE
MARLBORO
LEXINGTON
LAWRENCE
JACKSON
PLAIN
NIMISHILLEN
WASHINGTON
TUSCARAWAS
PERRY
CANTON
OSNABURG
SUGAR CREEK
BETHLEHEM
PIKE
SANDY
Well Site Symbols
WELL INFORMATION
75-SS-20
26
AQUIFER TYPES
WELL TYPES
Glacial Boundary
Reprinted 1988

CDF012156

Canton Drop Forge
Project 1032

CLOSURE REPORT
FOR
ONE UNDERGROUND STORAGE TANK
AT
CANTON DROP FORGE
CANTON, OHIO
BY
THE JOSEPH A. JEFFRIES COMPANY INC.
LOUISVILLE, OHIO

INTRODUCTION

This Closure Report describes the procedures followed and services rendered in the closure of one (1) 1000 gallon underground tank previously used for gasoline storage.

BACKGROUND

The Canton Drop Forge site is located at 4575 Southway SW, Canton, Ohio, Perry Township, Stark County. The site is located in a industrial area with city water, storm and sanitary sewers. Canton Drop Forge decided to remove the tank since their need for gasoline has declined. The Joseph A. Jeffries Company Inc. was contracted to remove the tank according to API 1604, State, and Local codes.

BACKGROUND OF CONTRACTOR

The Joseph A. Jeffries Company Inc. is a general contractor specializing in outdoor construction such as excavation, paving, utility installation, demolition, and tank removal. The company, established in 1933, has assisted in numerous tank installations for many major companies, and has removed numerous tanks over the years. It employs two certified tank installers along with its staff of construction specialists.

CLOSURE OPERATIONS

On the initial visual walk-over of the site with the representatives of Canton Drop Forge, it was determined there was one underground storage tank. The tank has been used for a number of years with no history of leakage. The tank was in a drive lane approximately 37' from the building. The fill

CDF012157

line was directly above the tank. There were no signs of contamination present. Canton Drop Forge contracted for removal of all product from the tank. The tank was purged with dry ice. After carefully exposing the top of the tank to the full horizontal diameter, and monitoring the excavated soil with a HNU Model HW-101 Photo Ionization Detection (PID) meter and finding no soil reading above background levels at the site, the supply and vent lines were cut and piping removed. The tank was removed from the excavation, scraped, and inspected. No visible holes were found on the tank. The tank was then immediately taken off site to be sheared for disposal.

James V. Jeffries Jr., of The Joseph A. Jeffries Company Inc., monitored with the HNU Model HW-101 PID meter and took the samples. Sampling was done according to the procedures set forth by BUSTR. Samples selected were taken from the north end of the tank, south end of the tank, and the center of the tank according to the procedures outlined by the State. All samples were placed in clean laboratory prepared containers with Teflon lids furnished by Wadsworth Testing Laboratory. The samples were then sealed and placed in an ice chest furnished by the laboratory. A site drawing is attached for reference showing excavated area and soil sampling points.

NOTIFICATION

The Joseph A. Jeffries Company Inc. filed the notice with the State, and secured a permit from the State Fire Marshal. Bryan Peterman representing the State Fire Marshal's office was on site to supervise the closure on February 15, 1990.

ANALYTICAL DATA

The preserved soil samples were taken to Wadsworth/Alert Laboratories, 4101 Shuffel Drive N.W., North Canton, Ohio 44720. The contact person is Denise Pohl, 497-9396. The analysis is attached.

The HNU Model HW-101 PID meter calibration frequency was set between 0-20 and the span which was pre-set at the factory is at 9.8.

BACKFILL

The Joseph A. Jeffries Company Inc. backfilled the excavated areas with clean limestone.

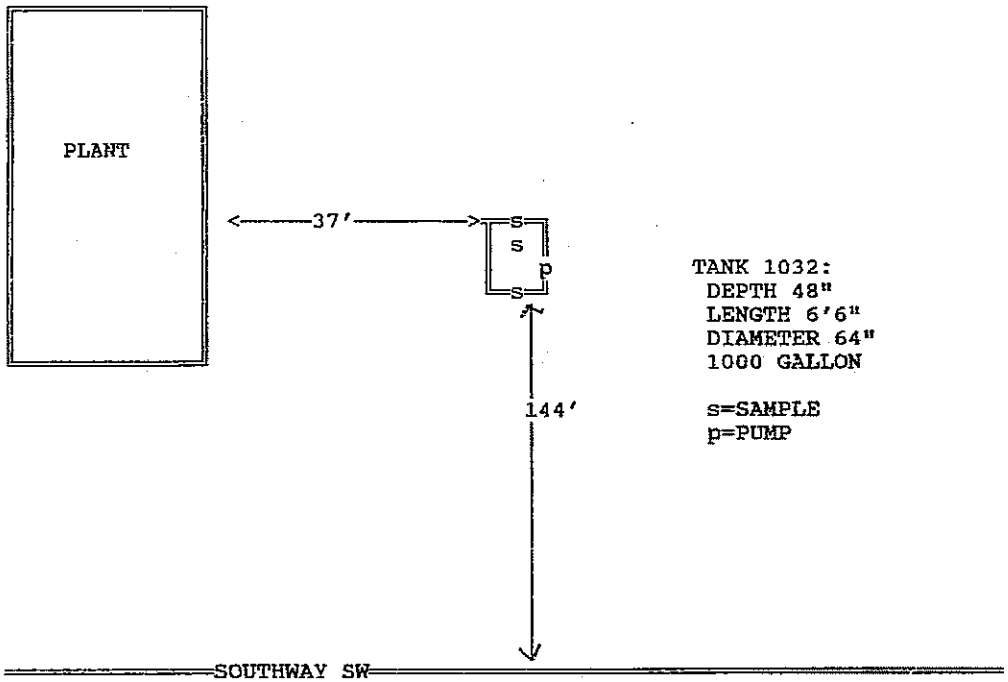
CONCLUSION

The contractor has properly decommissioned the UST located at the Canton Drop Forge, Canton, Ohio by following the Contractor's Standard Operating Procedure and the State of Ohio Fire Marshal Procedures for Underground Storage Tank Removal. The analytical results from Wadsworth Testing indicated a TPH consistent with background levels at the plant.

The Canton Drop Forge representative was on site to observe the closure activities and was made aware by the Contractor of the activities.

The State Fire Marshal representative, Bryan Peterman was also on site to observe closure activities.

Canton Drop Forge
Project 1032



TANK 1032:
DEPTH 48"
LENGTH 6'6"
DIAMETER 64"
1000 GALLON

s=SAMPLE
p=PUMP

ANALYSIS SUMMARY

	BTEX	LEAD	TPH
NORTH	ND	28	390
CENTER	ND	27	440
SOUTH	ND*	36	70

Richard F. Celeste
Governor

STATE OF OHIO
DEPARTMENT OF COMMERCE
DIVISION OF STATE FIRE MARSHAL
2395 East Main St., Reynoldsburg, OH 41042

Lincoln Cope
Director

UNDERGROUND STORAGE TANK INSTALLER CERTIFICATE

CERTIFICATE NUMBER: 90 - 137 VALID: January 3, 1990 through January 7, 1991

This is to certify that the below named person does hereby meet the requirements pursuant to Section 3737.881 of the Ohio Revised Code for installing, repairing, abandoning and removing underground storage tanks in Ohio.

JAMES W (JR) JEFFRIES
JOSEPH A JEFFRIES CO INC
5211 LOUISVILLE ST NE
LOUISVILLE OH 44641

NON-TRANSFERABLE

William A. Hennosy

William A. Hennosy, State Fire Marshal

CDF012161

SUSPECTED RELEASE REPORT

REPORT # 7600833.00.F900 DATE: 4/2/90

[1] PERSON REPORTING THE RELEASE TIME: ___:___

NAME: Bill Jeffries TITLE: ___ PHONE: (216) 454-6103

AGENCY/COMPANY: Joseph Jeffries Co. Inc. RELATION TO SITE: ___

ADDRESS: 5211 Louisville Road N.E. CITY: Louisville ST: OH ZIP: 44641

REMARKS: ___

[2] SUSPECTED RELEASE LOCATION

MULTIPLE SUSPECTED SOURCES? ___ YES ___ NO ___ UNDETERMINED COUNTY: Stark

FACILITY: Canton Drop Forge USTR ID# 76-606

ADDRESS: 4575 Southway Street S.W.

CITY: Canton ST: OH ZIP: ___ PHONE: ( ) ___

UST OWNER: ___ PHONE: ( ) ___

UST OPERATOR: ___ PHONE: ( ) ___

REMARKS: ___

FIRE DEPT: Perry Twp CONTACT: ___ PHONE: (216) 833-2505

[3] CONDITIONS LEADING TO REPORT OF SUSPECTED RELEASE (*Check all that apply*)

___ Inventory control results indicate a release may have occurred.

___ Testing, monitoring or sampling results indicate a release may have occurred.

___ Unusual operating conditions observed (e.g., sudden drop in tank volume).

___ Impacts noticed in area surrounding tank (e.g., vapors, well contaminated, run-off).

___ Spill or overfill of petroleum in excess of 25 gallons.

___ Soil/Groundwater contamination discovered during non-closure related investigation.

✓ Closure (or replacement) assessment results indicate that a release has occurred.

OTHER CONDITIONS: ___

*******COMPLETE REVERSE SIDE*******

[10] REPORT DISPOSITION (*Indicate actions taken on reverse side*)

TAKEN BY: White EMERGENCY ACTION? ___ YES ___ NO BY: ___ FM ___ OEPA ( )

COORD: Prevention REPORT/ACTION APPROVED: BI/St DATE: 4/4/90

LOGGED BY: St DATE: 4/4/90 ENTERED BY: St DATE: 4/4/90

CIRCLE STATUS: RPT (SUS) DIS CON ICA ICR PRIORITY: 1 (2) 3 4 CLASS: A B C (D) LTF NON-LTF

ICC SAS SAC CAS CAP NFA

Closure

CDF012162

[4] RELEASE INFORMATION

DATE FIRST DETECTED: ____/____/____ TIME: ___:___ EST. QUANTITY: _____

SUBSTANCE RELEASED/DETECTED: ___ GASOLINE ___ DIESEL FUEL ___ KEROSINE ___ USED OIL

___ OTHER PETRO ___ HAZ SUBST ___ UNKNOWN EST. DURATION: _____

MEDIA EFFECTED (*Check all that apply*): ____ SOIL ____ PAVEMENT ____ BASEMENT ____ SEWERS

____ GROUNDWATER ____ SURFACE WATER ____ OTHER: _____

LTF ELIGIBLE? ✓ YES ____ NO *If no, why?*: _____

[5] UST INFORMATION

FACILITY REGISTRATION CURRENT? __ YES __ NO __ UNKNOWN (*Attach USTR's for all facilities*)

NUMBER OF TANKS: ____ RELEASE DETECTION METHOD: _____

AGE	CAPACITY	-CONST.- MATERIAL	SUBSTANCE STORED	STATUS	AGE	CAPACITY	-CONST.- MATERIAL	SUBSTANCE STORED	STATUS
___	1,000	_____	Gasoline	Removed	___	_____	_____	_____	_____
___	_____	_____	_____	_____	___	_____	_____	_____	_____
___	_____	_____	_____	_____	___	_____	_____	_____	_____

PROBABLE LOCATION OF RELEASE: TANK NO.__ PIPE BETWEEN _____ AND _____

PROBABLE CAUSE: _____

OTHER POTENTIAL SOURCES AT THIS LOCATION: _____

[6] SITE/HAZARD INFORMATION

IMPORTANT SITE OR SURROUNDING AREA CHARACTERISTICS: _____

PROXIMITY TO DRINKING WATER SOURCES: _____

OTHER FIRE/WATER/HEALTH HAZARDS AT THE SITE: _____

[7] INITIAL RESPONSE ACTIONS BY OWNER/OPERATOR (*Check all that apply*)

____ Release confirmation/Investigation
____ Initial corrective action procedures
____ Free product removal
____ Long term corrective action plan
____ Initial site investigation
____ Site/Assessment/Exposure Assessment
____ Unknown/undetermined
____ None

[8] WERE ANY OTHER AGENCIES NOTIFIED PRIOR TO BUSTR? (*As Reported*)

AGENCY: SFM NAME: Brain Peterman DATE: 2/15/90

[9] BUSTR ACTIONS TAKEN

SENT TO CORRECTIVE ACTIONS

CALLS TO: FD, LHD, LPW, ODH, OEPA/ER, OEPA/DPDW, OEPA/DGW, OTHER

1938-1988
50 YEARS
WADSWORTH/ALERT
LABORATORIES, INC.
Sampling, testing, mobile labs
4101 Shuttel Drive N.W. / North Canton, Ohio 44720

ANALYTICAL REPORT

PROJECT NO. 1032

CANTON DROP FORGE

Presented to :

BILL F. JEFFRIES

JOSEPH A. JEFFRIES CO. 7600833

WADSWORTH/ALERT LABORATORIES, INC.

Denise Pohl
Project Manager

Marvin W. Stephens, Ph.D.
Vice President & Corporate Technical Director

March 6, 1990

CORPORATE AND LABORATORY: North Canton, Ohio (216) 497-9396
LABORATORY: Cleveland, Ohio (216) 642-5151
LABORATORY: Bartow, Florida (813) 533-2150
SOUTHEAST REGIONAL OFFICE: Lexington, South Carolina (803) 957-6590

WADSWORTH/ALERT
LABORATORIES, INC.

NARRATIVE

The following report contains the analytical results for three soil samples submitted to Wadsworth/ALERT Laboratories, Inc. by Joseph A. Jeffries Company from the Canton Drop Forge Site, project number 1032. The samples were received on February 19, 1990, in accordance with documented sample acceptance procedures.

Wadsworth/ALERT Laboratories, Inc. utilizes USEPA approved methods and instrumentation in all analytical work. The methods used for the analyses presented in this study can be found in the following chart. A summary of QC data for all analyses is included at the rear of the report.

ANALYTICAL METHODS

Parameters	Methods
BTEX	SW846 8020
Lead	SW846 6010
Tot Recoverable Pet Hydrocarbons	USEPA 418.1 (modified)

References:

SW846. "Test methods for Evaluating Solid Waste Physical/Chemical Methods," Third Edition, September, 1986.

USEPA. 600/4-79-02, "Methods for Chemical Analysis of Water and Wastes," March, 1983.

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY: JOSEPH A. JEFFRIES CO.
LAB #: 5644-49089
MATRIX: SOLID

DATE RECEIVED: 2/19/90
DATE EXTRACTED: 2/28/90
DATE ANALYZED: 2/28/90

SAMPLE ID: NORTH END OF TANK 2-15-90 1:00

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

PARAMETER	RESULT (ug/kg)	DETECTION LIMIT
Xylenes	ND	2
Benzene	ND	2
Toluene	ND	2
Ethylbenzene	ND	2

NOTE: ND (None Detected)
J (Detected, but below quantitation limit; quantitation suspect)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : JOSEPH A. JEFFRIES CO.
LAB #: 5644-49089
MATRIX : SOLID

DATE RECEIVED: 2/19/90

SAMPLE ID : NORTH END OF TANK 2-15-90 1:00

METALS ANALYTICAL REPORT
SELECTED LIST

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Lead	2/20- 2/21/90	28	2.5	mg/kg

NOTE: ND (None Detected)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : JOSEPH A. JEFFRIES CO.
LAB #: 5644-49089
MATRIX : SOLID

DATE RECEIVED: 2/19/90

SAMPLE ID : NORTH END OF TANK 2-15-90 1:00

ANALYTICAL REPORT

PARAMETER	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Tot Recoverable Pet Hydrocarbons	2/20- 2/21/90	390	70	mg/kg

NOTE: ND (None Detected)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY: JOSEPH A. JEFFRIES CO.
LAB #: 5644-49090
MATRIX: SOLID

DATE RECEIVED: 2/19/90
DATE EXTRACTED: 2/28/90
DATE ANALYZED: 2/28/90

SAMPLE ID: CENTER CAVITY 2-15-90 1:00

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

PARAMETER	RESULT (ug/kg)	DETECTION LIMIT
Xylenes	2	2
Benzene	ND	2
Toluene	ND	2
Ethylbenzene	ND	2

NOTE: ND (None Detected)
J (Detected, but below quantitation limit; quantitation suspect)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : JOSEPH A. JEFFRIES CO.
LAB #: 5644-49090
MATRIX : SOLID

DATE RECEIVED: 2/19/90

SAMPLE ID : CENTER CAVITY 2-15-90 1:00

METALS ANALYTICAL REPORT
SELECTED LIST

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Lead	2/20- 2/21/90	27	2.5	mg/kg

NOTE: ND (None Detected)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : JOSEPH A. JEFFRIES CO.
LAB #: 5644-49090
MATRIX : SOLID

DATE RECEIVED: 2/13/90

SAMPLE ID : CENTER CAVITY 2-15-90 1:00

ANALYTICAL REPORT

PARAMETER	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Tot Recoverable Pet Hydrocarbons	2/20- 2/21/90	440	70	mg/kg

NOTE: ND (None Detected)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY: JOSEPH A. JEFFRIES CO.
LAB #: 5644-49091
MATRIX: SOLID

DATE RECEIVED: 2/19/90
DATE EXTRACTED: 2/28/90
DATE ANALYZED: 2/28/90

SAMPLE ID: SOUTH END OF TANK 2-15-90 1:00

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

PARAMETER	RESULT (ug/kg)	DETECTION LIMIT
Xylenes	400	9
Benzene	ND	9
Toluene	ND	9
Ethylbenzene	17	9

NOTE: ND (None Detected)
J (Detected, but below quantitation limit; quantitation suspect)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : JOSEPH A. JEFFRIES CO.
LAB #: 5644-49091
MATRIX : SOLID

DATE RECEIVED: 2/19/90

SAMPLE ID : SOUTH END OF TANK 2-15-90 1:00

METALS ANALYTICAL REPORT
SELECTED LIST

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Lead	2/20- 2/21/90	36	2.5	mg/kg

NOTE: ND (None Detected)

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WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : JOSEPH A. JEFFRIES CO. DATE RECEIVED: 2/19/90
LAB #: 5644-49091
MATRIX : SOLID

SAMPLE ID : SOUTH END OF TANK 2-15-90 1:00

ANALYTICAL REPORT

PARAMETER	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Tot Recoverable Pet Hydrocarbons	2/20- 2/21/90	430	70	mg/kg

NOTE: ND (None Det. mg)

WADSWORTH/ALERT
LABORATORIES, INC.

QUALITY CONTROL SECTION

WADSWORTH/ALERT
LABORATORIES, INC.

MATRIX SPIKE DATA

LAB ID	PARAMETER	SPIKE PERCENT RECOVERY	SPK/DUP PERCENT RECOVERY	SPIKE MATRIX	QC CONTROL LIMITS
	SELECTED ORGANIC COMPOUNDS				
900223	Benzene	106	104	SOLID	(74-120)
	Toluene	107	108		(72-119)
	Xylene	97	91		(75-125)

WADSWORTH/ALERT
LABORATORIES, INC.

MATRIX SPIKE DATA

LAB ID	PARAMETER	SPIKE PERCENT RECOVERY	SPK/DUP PERCENT RECOVERY	SPIKE MATRIX	QC CONTROL LIMITS
49090	Lead	93	90	SOLID	(52-124)

WADSWORTH/ALERT
LABORATORIES, INC.

MATRIX SPIKE DATA

LAB ID	PARAMETER	SPIKE PERCENT RECOVERY	SPK/DUP PERCENT RECOVERY	SPIKE MATRIX	QC CONTROL LIMITS
900219	Tot Recoverable Pet Hydrocarbons	84	92	SOLID	(27-144)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY: Wadsworth/Alert Laboratories
LAB #: 9290-92228
MATRIX: SOLID

DATE RECEIVED: 2/23/90
DATE EXTRACTED: 2/28/90
DATE ANALYZED: 2/28/90

SAMPLE ID: INTRA-LAB BLANK , 2 /28/90

SELECTED ORGANIC COMPOUNDS ANALYTICAL BLANK REPORT

PARAMETER	RESULT (ug/kg)	DETECTION LIMIT
Xylenes	ND	2
Benzene	ND	2
Toluene	ND	2
Ethylbenzene	ND	2

NOTE: ND (None Detected)

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY : Wadsworth/Alert Laboratories, Inc. RECEIVING DATE : 2/20/90
LABORATORY ID : 9290-92:20
SAMPLE MATRIX : SOLID

SAMPLE ID : INTRA-LAB BLANK , 2 /20/90

METALS ANALYTICAL BLANK REPORT
SELECTED LIST

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT
Lead	2/20- 2/21/90	ND	2.5 mg/kg

ND - NONE DETECTED

WADSWORTH/ALERT
LABORATORIES, INC.

COMPANY: Wadsworth/Alert Laboratories
LAB ID: 9290-92220
MATRIX : SOLID

DATE RECEIVED: 2/20/90
DATE EXTRACTED: 2/20/90
DATE ANALYZED: 2/21/90

SAMPLE ID: INTRA-LAB BLANK , 2 /20/90

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS BLANK REPORT

	RESULT	UNITS	LOWER DETECTION LIMIT
Total Recoverable Petroleum Hydrocarbons	ND	mg/kg	10

NOTE: ND (None Detected)

WADSWORTH/ALERT LABORATORIES

4101 SHUFFEL DRIVE N.W./NORTH CANTON, OHIO 44720
(216) 497-9396

Chain-of Custody Record

№ 6012

PROJ. NO.	PROJECT NAME/LOCATION
1032	Citation Drop Forge

SAMPLERS: (Signature) Joseph V. Jeffries Jr.

STA. NO.	DATE	TIME	COMP.	GRAB.	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS: Lead Gas	BTEX 8020	TPH 418.1			REMARKS
1	2-15-90	1:40		✓	North End of tank	2	✓	✓	✓			low level
2	2-15-90	1:20		✓	Center of tank	2	✓	✓	✓			
3	2-15-90	1:00		✓	South End of tank	2	✓	✓	✓			

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Joseph V. Jeffries Jr.	2-15-90 17:50				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		R Bloom	2-19-90 10:54		

Distribution Original Accompanies Shipment. Copy returned with Report.

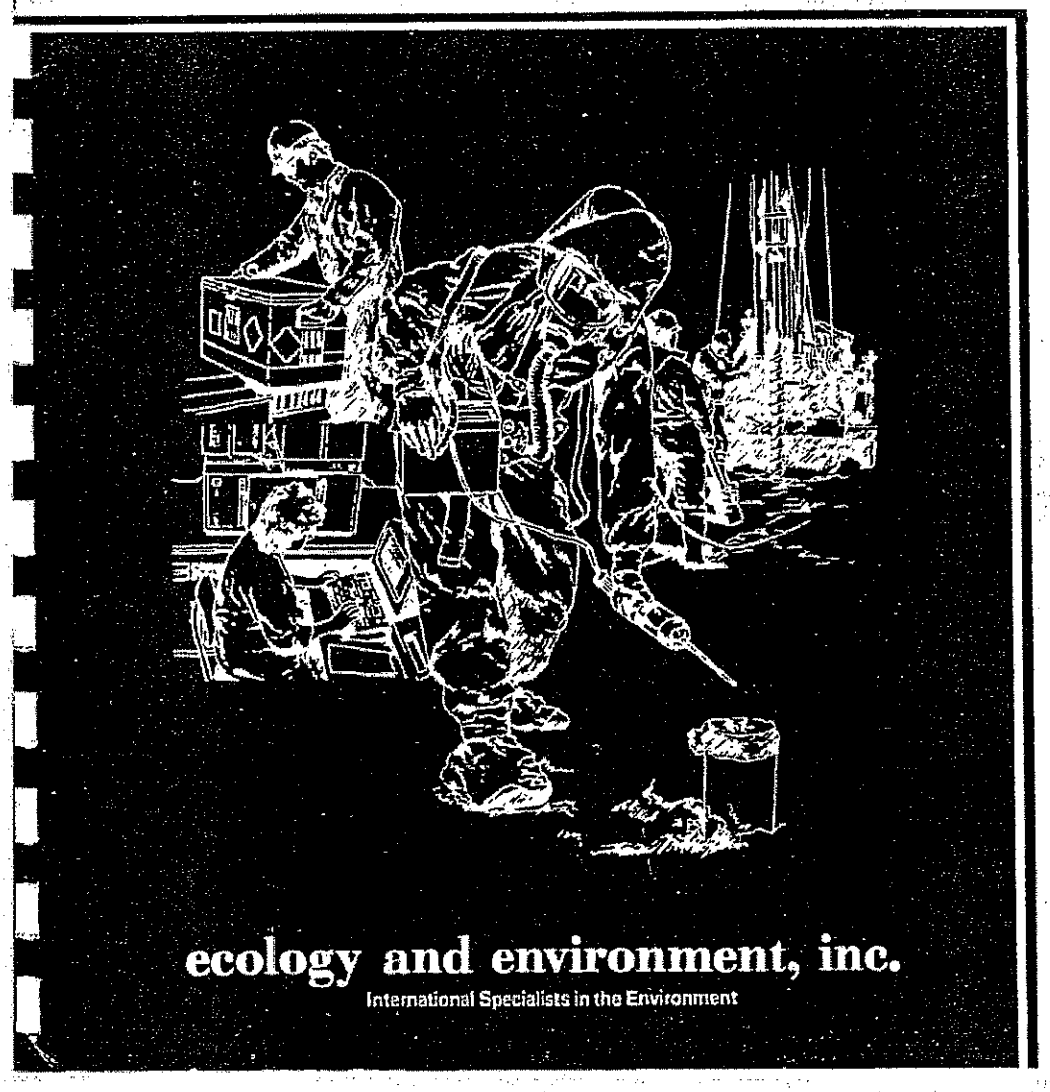
Joseph A Jeffries Co 454-6103

CDF012182

EPA

HAZARDOUS
SITE
EVALUATION
DIVISION

Field Investigation Team Zone II



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CONTRACT NO.
68-01-7347

CDF012183

SCREENING SITE INSPECTION REPORT
FOR
CANTON DROP FORGE & MFG. COMPANY
CANTON, OHIO
U.S. EPA ID: OHD004465142
SS ID: NONE
TDD: F05-9004-001
PAN: F0H0625SA

APRIL 8, 1991

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International Specialists in the Environment

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1. INTRODUCTION

Ecology and Environment, Inc., Field Investigation Team (FIT) was tasked by the United States Environmental Protection Agency (U.S. EPA) to conduct a screening site inspection (SSI) of the Canton Drop Forge & Mfg. Company (CDF) site under contract number 68-01-7347.

The site was initially discovered when Canton Drop Forge and Manufacturing submitted a Resource Conservation and Recovery Act (RCRA) Notification Form 3001 as a Generator of Hazardous Waste on August 8, 1980. The site came to the attention of the Ohio Environmental Protection Agency (OEPA) during a June 30, 1983 site inspection conducted in response to a complaint about buried drums and sludge on-site.

The site was evaluated in the form of a preliminary assessment (PA) that was submitted to U.S. EPA. The PA was prepared by Pam Wicks of the Ohio Division of Solid Hazardous Waste Management (ODSHWM) and is dated June 6, 1985.

FIT prepared an SSI work plan for the CDF site under technical directive document (TDD) F05-8706-232, issued on June 19, 1987. The SSI work plan was approved by U.S. EPA on February 14, 1990. The SSI of the CDF site was conducted on May 16, 1990, under TDD F05-9004-001, issued on April 10, 1990.

The FIT SSI included an interview with site representatives, a reconnaissance inspection of the site, and the collection of nine soil/sediment samples.

The purposes of an SSI have been stated by U.S. EPA in a directive outlining Pre-Remedial Program strategies. The directive states:

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> All sites will receive a screening SI to 1) collect additional data beyond the PA to enable a more refined preliminary HRS [Hazard Ranking System] score, 2) establish priorities among sites most likely to qualify for the NPL [National Priorities List], and 3) identify the most critical data requirements for the listing SI step. A screening SI will not have rigorous data quality objectives (DQOs). Based on the refined preliminary HRS score and other technical judgement factors, the site will then either be designated as NFRAP [no further remedial action planned], or carried forward as an NPL listing candidate. A listing SI will not automatically be done on these sites, however. First, they will go through a management evaluation to determine whether they can be addressed by another authority such as RCRA [Resource Conservation and Recovery Act].... Sites that are designated NFRAP or deferred to other statutes are not candidates for a listing SI.
>
> The listing SI will address all the data requirements of the revised HRS using field screening and NPL level DQOs. It may also provide needed data in a format to support remedial investigation work plan development. Only sites that appear to score high enough for listing and that have not been deferred to another authority will receive a listing SI. (U.S. EPA 1988)

U.S. EPA Region V has also instructed FIT to identify sites during the SSI that may require removal action to remediate an immediate human health or environmental threat.

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2. SITE BACKGROUND

2.1 INTRODUCTION

This section presents information obtained from SSI work plan preparation, the site representative interview, and the reconnaissance inspection of the site.

2.2 SITE DESCRIPTION

The CDF site is an active drop forge and manufacturing plant that currently manufactures parts for airplane, locomotive, and off-road transportation. The site is located at 4575 Southway SW, Stark County, Canton, Ohio (SW1/4NE1/4, sec. 13, T.10N., R.9W.). The CDF site is located in a manufacturing and urban area of Canton (see Figure 2-1 for site location). The CDF site is approximately 25 acres in size. The manufacturing plant occupies 6 of the site's 25 acres of land. An on-site landfill for manufacturing-derived wastes is located on 8 acres of the site. The remaining 11 acres of the site are used as parking and storage areas.

A 4-mile radius map of the CDF site is provided in Appendix A.

2.3 SITE HISTORY

The Canton Drop Forge and Manufacturing plant began operation in 1945. The site was owned by the United States Army Air Corps (U.S. AAC). Canton Drop Forge and Manufacturing operated the site for U.S. AAC. The manufacturing plant forged airplane propeller hubs. It is not known what the land was used for, nor who owned the site prior to U.S. AAC (Bressanelli et al. 1990).

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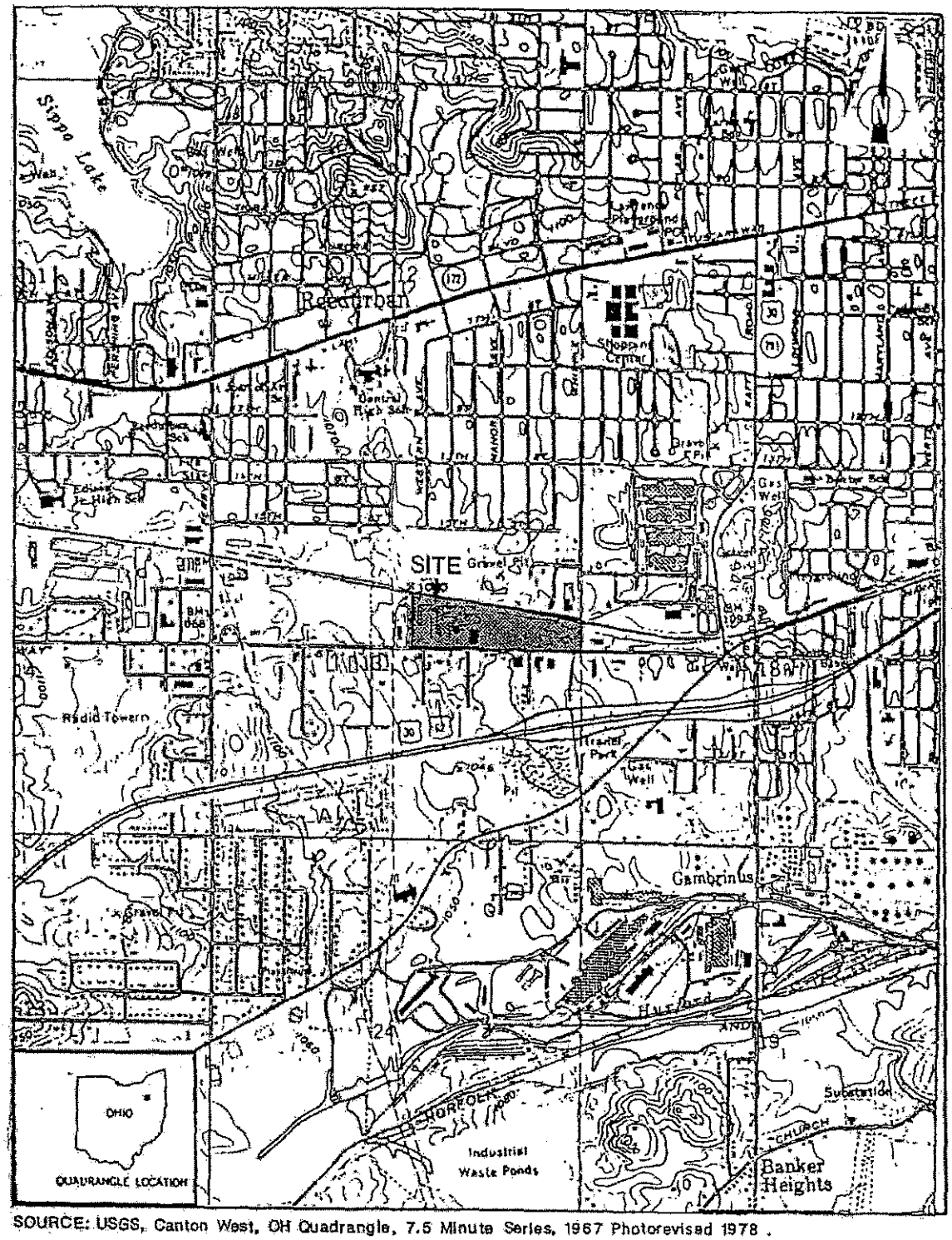

SOURCE: USGS, Canton West, OH Quadrangle, 7.5 Minute Series, 1967 Photorevised 1978 .

SCALE
0 0.5 1 MILE

FIGURE 2-1 SITE LOCATION

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In 1950, Canton Drop Forge and Manufacturing bought the site from U.S. AAC and continued on-site operations. In 1981, the Corder Group bought the CDF site and is the current site owner and operator (Bressanelli et al. 1990).

From 1950 to the present, various drop-forged parts for airplane, locomotive, and off-road transportation have been manufactured on-site. The manufacturing process, called drop forging, begins with the selection of feedstock. The feedstocks are composed of different types of steel alloys, such as carbon, nickel, and titanium. The feedstock is then cut to size and heated to 1,700 to 2,400° F. A steam-driven hammer forges the piece into the desired shape as formed by a die. Lubricating oils are used to coat the dies. The drop-forged product may then be heat-treated and cooled by quench oils or cleaned by shot blasting or grit cleaning. Prior to 1981, pickle liquor was used for scaling the steel. A small amount of grinding may be done on the product, or the product may be quality-tested. The tests performed on the product are magnaflux or zyglow, which are described as nondestructive. The product is then shipped to the customer (Bressanelli et al. 1990).

The on-site plant currently has 40 air permits for various plant operations (Bressanelli et al. 1990). Appendix B includes the various permit numbers, descriptions, issuing dates, and expiration dates.

Various waste disposal practices were used at the CDF site, including on- and off-site landfilling, collection of process water and oils in lagoons, and the reclaiming of waste oils and sludge.

The on-site landfill was licensed by the Stark County Health Department (SCHD) in June 1976 (Bozerke 1977). The license number is not known. It is not known when the landfill began operating. Canton Drop Forge and Manufacturing closed the landfill in 1979 because it had reached its capacity. The on-site landfill was approximately 8 acres in size and was located in a natural depression east of the plant buildings. The landfill was divided into two zones, Zone A and Zone B. A scrap and salvage area was located in the middle of the landfill. Zone A was closed in October 1978, and Zone B in 1979 (Bressanelli et al. 1990). According to file information, a discrepancy exists regarding

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the closing date of Zone B. File information indicates that the landfill was still being used in late 1981. Canton Drop Forge and Manufacturing petitioned OEPA for an order of exemption under R.C. Section 3734.02(G) for the disposal of brickbats, concrete, and wood pallets on June 3, 1981 (OEPA 1981). OEPA granted the company's petition in a Director's Final Findings and Orders on October 15, 1981 (OEPA 1981a).

The landfilling method used on-site was the dump and cover method. Cover material for the landfill included slag, ash, lime/soda softener sludge, and demolition wastes (Cavender 1978). According to Jerome P. Bressanelli, President of Canton Drop Forge and Manufacturing, the landfill was covered with a clay soil of unknown thickness. Zone A of the landfill was used for the disposal of all wastes generated on-site. These wastes included oil sludge and waste oil in 55-gallon drums, demolition wastes (bricks and concrete), slag, ashes, lime/soda softener sludge, boiler stack scrubber sludge (gypsum), floor sweepings, trash, and rags (Cavender 1978). Zone B of the landfill was used for the disposal of demolition wastes, concrete, and other exempt wastes. These wastes were piled around Lagoon #3, one of three on-site lagoons (Cavender 1978).

In 1981, wastes generated on-site were hauled from the site by the following waste transporters: Buckeye Sanitation of Canton, Ohio (general trash); Carl Pandoli of Canton, Ohio (scrubber sludges); and R. E. Slutz Trucking of Canton, Ohio (ashes). All three transporters dumped at Breitenstine Landfill in Waynesburg, Ohio. Reclaimable oil was picked up by Northway Environmental Services of Ashtabula, Ohio, and was transported to one of three different sites. The sites were located in Harpersfield, Cleveland, and Waynesburg (Breitenstine Landfill), all in Ohio. Pickle liquor was picked up by Industrial Wastes Corporation of New Brighton, Pennsylvania, and dumped at a location in Darlington Township, Pennsylvania (OEPA 1981b). In 1990, wastes generated on-site were hauled from the site by the following waste transporters: Browning Ferris Industries of Akron, Ohio (general trash), and Advance Drain and Sewer of Wooster, Ohio (scrubber sludges) (Bressanelli et al. 1990).

A scrap and salvage area was located in the middle of the landfill area. This area was used to store scrap metal, old machinery, and other

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salvageable materials. The scrap is sold whenever the market price is high (Cavender 1978; Bressanelli et al. 1990).

There are three man-made lagoons at the CDF site that are used to collect and treat plant process water. Used process water containing spent lubricating oil is dumped into Lagoon #1, where some of the oil is then skimmed off the water and collected in a 2,000-gallon tank. The lubricating oil is used to lubricate dies (Bressanelli et al. 1990). The water is then pumped via an underground pipe to Lagoon #2, where the rest of the oil is skimmed off the water. The waste oil is collected in two 2,000-gallon tanks. The water is then pumped through another underground pipe to Lagoon #3 for evaporation and infiltration. Lagoon #1 is located in the southwest corner of the site. Lagoons #2 and #3 were excavated from and are located in the landfill area (Cavender 1978). It is not known from what type of material Lagoon #1 was excavated. None of the lagoons were lined (Bressanelli 1990). FIT did not observe any drums in the lagoons at the time of the SSI.

Beginning in 1976, Canton Drop Forge and Manufacturing was required by both SCHD and OEPA to file solid waste disposal operation reports for the on-site landfill and to apply for a landfill license (Bozerke 1977; Cavender 1978; Bressanelli et al. 1990). Canton Drop Forge and Manufacturing submitted a RCRA 3001 Notification as a Generator of Hazardous Waste for its F010 quench oil sludge on August 8, 1980. The F010 quench oil sludge was later reclassified to include only those oils that contain cyanide. The quench oil used on-site in the manufacturing process does not contain cyanide.

The company filed a petition on June 3, 1981, with OEPA requesting an order of exemption under R.C. Section 3734.02(G) for the disposal of brickbats, concrete, and wood pallets in the on-site landfill. OEPA granted the exemption in a Director's Final Findings and Orders on June 15, 1983 (OEPA 1981a).

OEPA conducted a site inspection of the CDF site on June 30, 1983, in response to a complaint regarding buried drums and sludges. OEPA officials observed 15 to 20 partially exposed and leaking drums buried along the edges of Lagoon #2. The drums were buried in the late 1960s. OEPA recommended that Canton Drop Forge and Manufacturing cover the

sides of Lagoon #2 with 2 feet of compacted clay-type material (OEPA 1983). No drums were observed in the pit lagoons during the FIT SSI. The fate of these drums is not known. FIT did not collect any soil samples because the exact location of the exposed drums was not known.

No additional enforcement actions regarding the CDF site had taken place as of the date of the SSI.

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3. SCREENING SITE INSPECTION PROCEDURES AND FIELD OBSERVATIONS

3.1 INTRODUCTION

This section outlines procedures and observations of the SSI of the CDF site. Individual subsections address the site representative interview, reconnaissance inspection, and sampling procedures.

Rationales for specific FIT activities are also provided. The SSI was conducted in accordance with the U.S. EPA-approved work plan with one exception. Nine soil/sediment samples were collected instead of the 10 soil/sediment samples proposed in the work plan. FIT believed that 9 soil/sediment samples were adequate to characterize the CDF site.

The U.S. EPA Potential Hazardous Waste Site Inspection Report (Form 2070-13) for the CDF site is provided in Appendix C.

3.2 SITE REPRESENTATIVE INTERVIEW

John Nordine, FIT team leader, conducted an interview with Jerome P. Bressanelli, President; Larry Stalnaker, Manufacturing manager; and Ed England, Personnel Manager, all with Canton Drop Forge and Manufacturing. Fred Zollinger and Stephen Reilly, attorneys with Day, Ketterer, Raley, Wright, and Rybolt, representing Canton Drop Forge and Manufacturing, were also present at the interview. The interview was conducted on May 16, 1990, at 8:30 a.m. on-site at the plant office located at 4575 Southway St. SW, in Canton, Ohio. Henry Adamiak of FIT also attended the interview. The interview was conducted to gather information that would aid FIT in conducting SSI activities.

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3.3 RECONNAISSANCE INSPECTION

Following the site representative interview, FIT conducted a reconnaissance inspection of the CDF site and surrounding area in accordance with Ecology and Environment, Inc. (E & E), health and safety guidelines. The reconnaissance inspection began on May 16, 1990, at 10:00 a.m., and included a walk-through of the site to determine appropriate health and safety requirements for conducting on-site activities and to make observations to aid in characterizing the site. FIT also determined sampling locations during the reconnaissance inspection. FIT was accompanied by Stalnaker, England, Reilly, and Don Lenk of Wadsworth Alert Labs, Inc., during the reconnaissance inspection.

Reconnaissance Inspection Observations. The CDF site is located in the southwest section of Canton, Ohio. Land use surrounding the CDF site is industrial and residential. Penn Central Railroad tracks and a gravel pit operation are located immediately north of the site (see Figure 3-1 for site features). Industries are located to the east, west, and south of the site. Residential areas are located 1/4 mile north, east, and west of the site.

The site is completely surrounded by a 10-foot-high chain link fence with three strands of barbed wire on top. There are two entrances to the CDF site, both located on Southway St. SW. There was a 24-hour guard on duty during the FIT SSI.

There are five buildings located on the CDF site. The largest building, located in the western portion of the site, is used for manufacturing purposes. The remaining buildings are located in the west-central portion of the site and immediately north and south of the manufacturing building. These buildings include the power house, chip house, die shop, and office building. The manufacturing building is divided into three departments: a drop forge area in the middle, an upsetter area in the building's west wing, and a grinding and shipping area in the east wing. Two die stacks were located in the northwest corner of the site, with stained soil observed near one of the stacks. A water tank is located north of the chip house. A lime tank was located near the power house. Four buried, 25,000-gallon tanks used for the storage of fuel oil and other bulk liquids were located west of the

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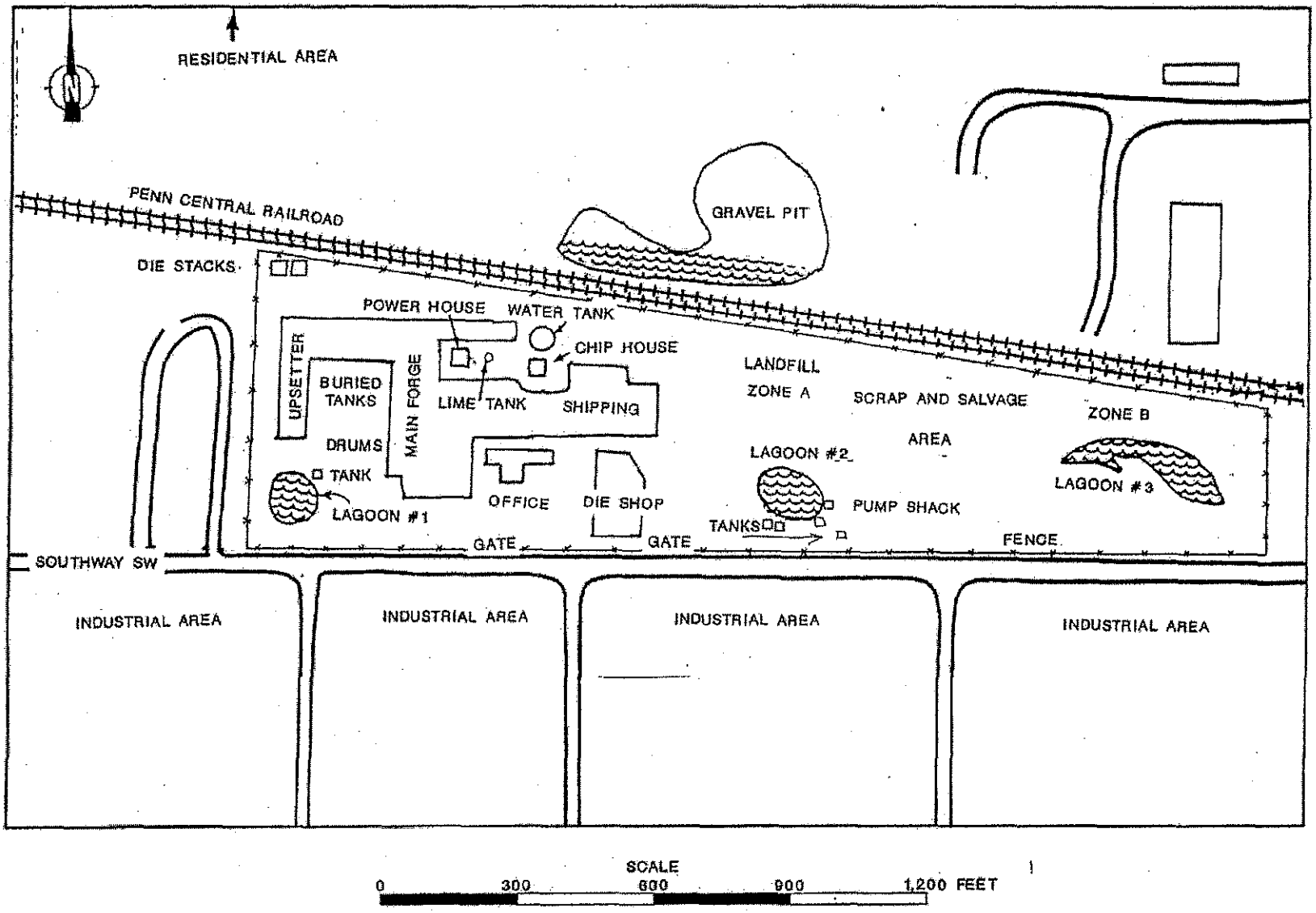

FIGURE 3-1 SITE FEATURES

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drop forge area of the manufacturing building. Approximately 20, 55-gallon drums of lubricating oil were stored on a concrete pad just south of the buried tanks. The drums appeared to be in good condition.

Lagoon #1 is located in the southwest corner of the site. Lagoon #1 is approximately 100 feet in diameter. FIT observed an oily sheen on the water in Lagoon #1. The ground around Lagoon #1 appeared to be covered with black ash or cinders. This lagoon is used to skim waste oil from process water. Skimmed waste oil is collected in a 2,000-gallon tank immediately northwest of the lagoon. Water from Lagoon #1 is then pumped into Lagoon #2, which is located approximately 300 feet east of the die shop. Lagoon #2 is oval shaped and is approximately 100 feet by 125 feet in diameter. Lagoon #2 is the second stage of the water treatment process. Water in Lagoon #2 had oil floating on it. The banks of Lagoon #2 were coated with oil sludge. An oil skimmer is used to collect the rest of the oil from the water surface. Waste oil is then pumped into two 20,000-gallon tanks. Water from Lagoon #2 is then pumped into a third lagoon (Lagoon #3). A pump shack was located on the east edge of Lagoon #2. Piles of oily, scale-type material were located northwest of Lagoon #2. Lagoon #3 is located in the eastern half of the site and is crescent shaped. Lagoon #3 is used for the filtration of processed wastewater. Water in some areas of the lagoon had an oily sheen. No drums were observed by FIT in any of the lagoons during the SSI.

The on-site landfill is located in the eastern half of the site and is approximately 18 acres in size. The landfill is divided into a Zone A and a Zone B, with a scrap and salvage area between the two zones. The landfill had a fresh clay soil cap. The parts of the landfill that did not have a fresh cover appeared to be covered with black cinders and ash.

Piles of iron and steel are stored in the scrap and salvage area until the price of the materials is high enough to justify being sold. Dies and other used machinery were also observed in this area.

FIT photographs from the SSI of the CDF site are provided in Appendix D.

3.4 SAMPLING PROCEDURES

Samples were collected by FIT at locations selected during the reconnaissance inspection to determine whether U.S. EPA Target Compound List (TCL) compounds or Target Analyte List (TAL) analytes were present at the site. The TCL and TAL are included with corresponding quantitation/detection limits in Appendix E. Portions of the samples were offered to and accepted by the site representatives.

Soil/Sediment Sampling Procedures. Sediment sample S1 was collected from the east bank of Lagoon #1 (see Figure 3-2 for soil/sediment sampling locations). Soil sample S2 was collected from an oily pile of scales or cinders near Lagoon #1. Soil sample S3 was collected from the stained soil near one of the die stacks in the northwest corner of the site. Soil sample S4 was collected from an oily area in a low area east of Lagoon #3. Sediment sample S5 was collected from the west bank of Lagoon #3. Soil sample S6 was collected in an area of stained soil north of Lagoon #2 where the clay soil cap had not been applied on the landfill. Soil sample S7 was collected from the bank of Lagoon #2 near the pump shack. Soil sample S8 was collected from an area of stained soil near the scrap and salvage area. Soil sample S9 was collected as a potential background sample from a grassy area located between the office and the manufacturing buildings. All sediment samples were collected from oil-stained areas on the banks of the lagoons. All soil/sediment samples were surface samples and were collected with a trowel.

Standard E & E decontamination procedures were adhered to during the collection of all soil/sediment samples. The procedures included the scrubbing of all equipment (e.g., gloves, trowels, and bowls) with a solution of detergent (Alconox) and distilled water, and triple-rinsing the equipment with distilled water before the collection of each sample (E & E 1987). All soil/sediment samples were packaged and shipped in accordance with U.S. EPA-required procedures.

As directed by U.S. EPA, all soil/sediment samples were analyzed using the U.S. EPA Contract Laboratory Program (CLP).

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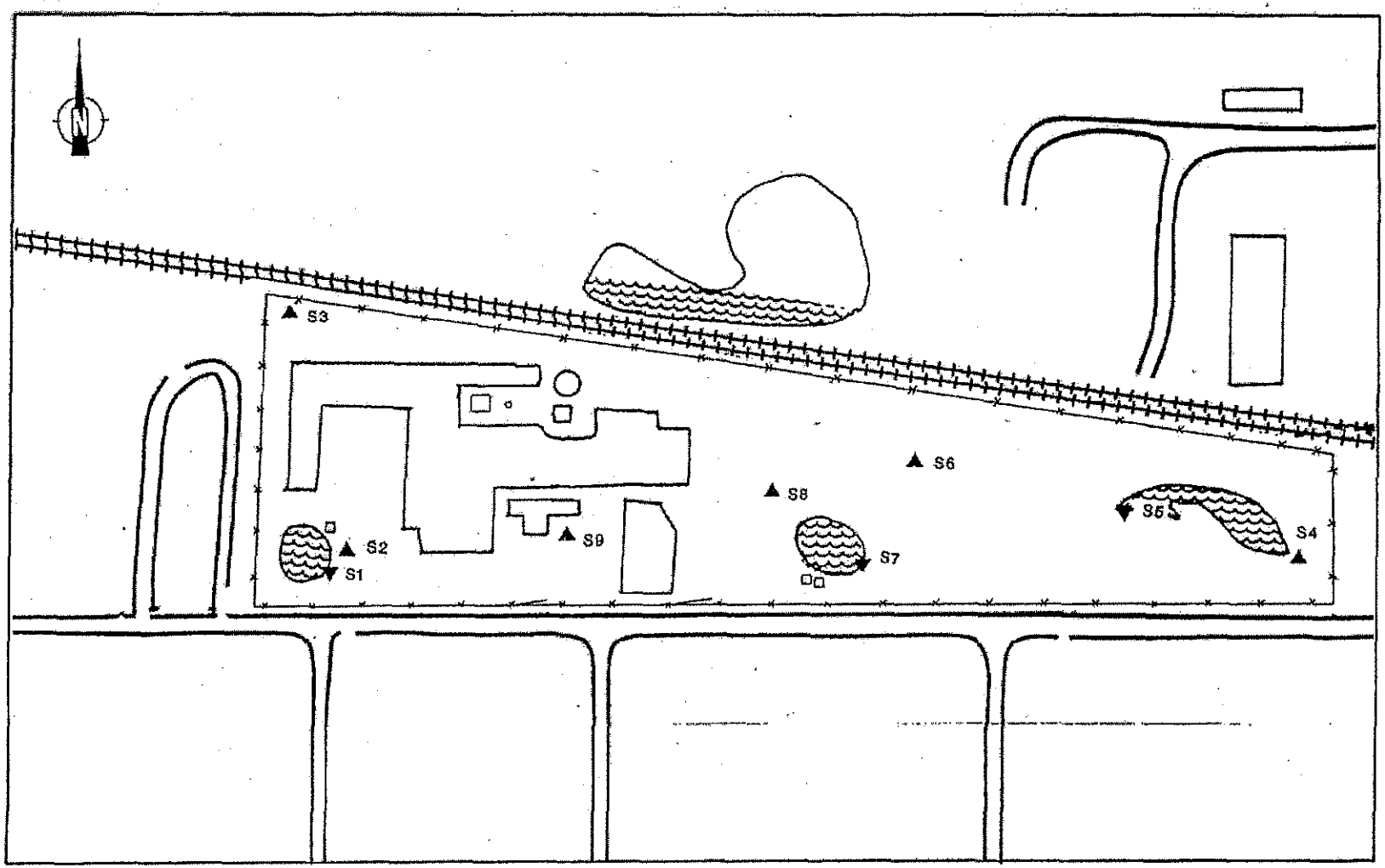

FIGURE 3-2 SOIL/SEDIMENT SAMPLING LOCATIONS

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4. ANALYTICAL RESULTS

This section presents results of the chemical analysis of FIT-collected soil/sediment samples for TCL compounds and TAL analytes. All samples were analyzed for volatile organics, semivolatile organics, pesticides/polychlorinated biphenyls (PCBs), metals, and cyanides. Complete chemical analysis results of FIT-collected soil/sediment samples are provided in Table 4-1. In addition, significant tentatively identified compounds (TICs) detected in the analysis of FIT-collected samples are also provided in Table 4-1.

Quantitation/detection limits used in the analysis of soil/sediment samples are provided in Appendix E.

The analytical data for the chemical analysis of soil/sediment samples collected for this SSI have been reviewed by U.S. EPA for compliance with terms of CLP, and the review has been approved by U.S. EPA. The analytical data have also been reviewed by FIT for validity and usability. Any additions, deletions, or changes to the data have been incorporated in the chemical analysis results tables presented in this section.

CDF012204

Sample Collection Information
and Parameters

Date
Time
CLP Organic Traffic Report Number
CLP Inorganic Traffic Report Number

Compound Detected
(values in ug/kg)

Volatile Organics
methylene chloride
1,1,1-trichloroethane
toluene
ethylbenzene
xylenes (total)

Semivolatile Organics
benzoic acid
naphthalene
2-methylnaphthalene
fluorene
phenanthrene
di-n-butylphthalate
fluoranthene
pyrene
benzo[a]anthracene
chrysene
bis(2-ethylhexyl)phthalate
benzo[b]fluoranthene
benzo[k]fluoranthene

TICs†
hexanone,4-ethyl-2-methyl
(3074-75-7)
benzene,1-ethyl-3-methyl
(620-19-4)
benzene,1,3,5-trimethyl
(108-67-8)
11H-benzo[a]fluorene
(238-34-6)
phenanthrene,2,5-dimethyl
(3674-66-6)
benzo[J]fluoranthene
(205-82-3)
benzo[e]acephenanthrylene
(205-99-2)

5. DISCUSSION OF MIGRATION PATHWAYS

5.1 INTRODUCTION

This section presents discussions of data and information pertaining to potential migration pathways and targets of TCL compounds and TAL analytes that are possibly attributable to the CDF site.

The five migration pathways of concern discussed are groundwater, surface water, air, fire and explosion, and direct contact.

5.2 GROUNDWATER

Groundwater sampling was not conducted at the CDF site because no monitoring wells were installed at the site. However, a potential exists for TCL compounds and TAL analytes to migrate from the site to groundwater in the vicinity of the site, based on the following information.

- TCL compounds and TAL analytes were detected in on-site soil/sediment samples, including xylenes (total) (140J µg/kg in S2), phenanthrene (4,000 µg/kg in S7), chromium (405 mg/kg in S8), and nickel (1,550 mg/kg in S8).

- Several TICs were detected in the soil/sediment samples.

- The three on-site lagoons are unlined, and Lagoon #2 and Lagoon #3 were excavated from landfill material (Bressanelli et al. 1990).

CDF012206

- The landfill is not lined (Bressanelli et al. 1990).

- Fifteen to 20 drums of used lubricants were buried in the landfill and some of the drums were observed to be leaking (OEPA 1983).

The potential for migration of TCL compounds and TAL analytes to area groundwater is also based on the following geological information.

The geology of the site area consists of unconsolidated glacially derived deposits that overlie sedimentary bedrock. The glacially derived deposits in the site area have been identified as till deposited during the Pleistocene epoch, Wisconsinan age. The till is an unsorted, unstratified mixture of sand, silt, and clay containing pebbles, cobbles, and boulders (DeLong and White 1963).

Well logs of the area indicate that these deposits occur in some areas as discontinuous lenses and layers. A well log for an on-site production well indicates the thickness of the till to be 71 feet before reaching bedrock (see Appendix F for well logs of the area of the site). Access to this well was not available at the time of the FIT SSI. Area well logs indicate the depth to groundwater to be approximately 24 feet in the sand and gravel layers. Where saturated, these sand and gravel deposits are used as a source of drinking water.

The bedrock in the area of the site consists of sedimentary rock deposited during the Pennsylvanian period. These rock units include members of the Upper Pottsville groups, which have shales, coals, clays, limestones, sandstones, and siltstones (DeLong and White 1963). Well logs for the site area indicate that bedrock wells drav from water-producing sandstones.

The aquifer of concern (AOC) includes both the glacial deposits and the upper parts of the bedrock. Area well logs indicate that private drinking water vells use both the glacial sand and gravel deposits and the bedrock sandstones. Because there is no evidence of a continuous confining layer within a 3-mile radius of the site, the two systems are considered to be hydraulically connected. The depth to the AOC is the same as the depth to groundwater, that is, approximately 24 feet. The

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direction of groundwater flow is assumed to be to the northwest, toward Sippo Lake. Sippo Lake is approximately 2 miles northwest of the site. Targets of groundwater contamination include those persons who use private wells within a 3-mile radius of the CDF site. The Canton well fields are located to the southwest of the CDF site and outside of a 3-mile radius of the site. The total population using groundwater is approximately 4,227 persons. This population was calculated by counting houses within a 3-mile radius of the site on United States Geological Survey (USGS) topographic maps of the area of the site (USGS 1961, 1967), and then multiplying this total by the Stark County persons-per-household value of 2.77 (U.S. Bureau of the Census 1982).

5.3 SURFACE WATER

Sippo Lake and Lake Meyers are located within 2 miles of the site. Some water-filled gravel pits are also located within 2 miles of the site. Both lakes Sippo and Meyers are used for recreational purposes. No potential exists, however, for TCL compounds and TAL analytes from the CDF site to migrate to surface water in the area. This lack of potential is based on the fact that the site is relatively flat. Surface water runoff from the site would be diverted before reaching the lakes by intervening streets and railroads.

5.4 AIR

A release of TCL compounds or TAL analytes to the air was not dcoumented during the SSI of the CDF site. During the reconnaissance inspection, FIT site-entry instruments (OVA 128 and colorimetric monitoring tubes for hydrogen cyanide) did not detect levels above background concentrations at the site. In accordance with the U.S. EPA-approved work plan, further air monitoring was not conducted by FIT.

A potential does not exist for TCL compounds and TAL analytes to migrate from the site via windblown particulates because the on-site landfills have been capped.

5.5 FIRE AND EXPLOSION

According to federal, state, and local file information reviewed by FIT, and an interview with Bressanelli, no documentation exists of an

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incident of fire or explosion at the site (Bressanelli et al. 1990). According to FIT observations and site-entry equipment readings, no potential for fire or explosion existed at the site at the time of the SSI.

5.6 DIRECT CONTACT

According to federal, state, and local file information revieved by FIT, observations made during the SSI, and the interview with the site representatives, no incidents of direct contact with TCL compounds or TAL analytes at the CDF site have been documented. The site is completely fenced and there is a 24-hour guard on duty at all times (Bressanelli et al. 1990). There is a potential, however, for the 378 employees that work on-site to come into direct contact with TCL compounds and TAL analytes detected in on-site soil/sediment samples.

CDF012209

6. REFERENCES

Bozerke, Stephen, June 6, 1977, report form, regarding on-site disposal of solid wastes, for Ohio Health Department.

Bressanelli, Jerome P., Larry Stalnaker, Ed England, Fred Zollinger, and Stephen Reilly, May 16, 1990, President, Manufacturing Manager, and Personnel Manager, all from Canton Drop Forge and Manufacturing; and attorneys, Day, Ketterer, Raley, Wright, and Rybolt, Esq., site representative interview, conducted by John Nordine of E & E.

Cavender, Carl, June 21, 1978, President, Canton Drop Forge and Manufacturing, operational report, regarding solid vaste disposal at the CDF site, Report No. COF-58515.

DeLong, R., and George White, 1963, Geology of Stark County, Bulletin 61, Ohio Department of Natural Resources, Division of Geological Survey, Columbus, Ohio.

E & E, 1987, Quality Assurance Project Plan Region V FIT Conducted Site Inspections, Chicago, Illinois.

OEPA, October 16, 1981, letter, to Carl Cavender, President, Canton Drop Forge and Manufacturing, from Wayne Nichols, OEPA.

_____, October 15, 1981a, Director's Final Findings and Orders, written by Wayne Nichols, OEPA.

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_____, March 11, 1981b, letter, to R. Rebillot, Chief Engineer, Canton Drop Forge and Manufacturing, regarding 1981 Industrial Waste Survey, by Mark Schmidt, Office of Land Pollution Control.

_____, July 28, 1983, letter, from Rodney Beals, Division of Hazardous Materials Management, to Ed England, Canton Drop Forge and Manufacturing.

U.S. Bureau of the Census, 1982, 1980 Census of Population, Characteristics of the Population, General Population Characteristics, Ohio, Washington, D.C.

U.S. EPA, February 12, 1988, Office of Solid Waste and Emergency Response, Pre-Remedial Strategy for Implementing SARA, Directive number 9345.2-01, Washington, D.C.

USGS, 1961, photorevised 1978, Bolivar, Ohio Quadrangle, 7.5 Minute Series: 1:24,000.

_____, 1967, photorevised 1978, Canton West, Ohio Quadrangle, 7.5 Minute Series: 1:24,000.

5983:2

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APPENDIX A

SITE 4-MILE RADIUS MAP

CDF012212

APPENDIX B

CDF012213

Exa. Prioritys.		MTR Description	Company I.D.	Issued	Expires
1576000073	B001	Boiler #1 Coal	B001	9.23.88	9.22.91
"	B002	Boiler #2 Gas/Oil	B002	11.08.88	11.07.91
"	B003	Boiler #3 Gas/Oil	B003	11.08.88	11.07.91
"	P028	Tumble blast	BH-0B02	5.20.88	5.20.91
"	P032	Pangborn Unit	BH-0B06	5.20.88	5.20.91
"	P029	Tumble blast	BH-0B07	5.20.88	5.20.91
"	P036	Super II Tumblast	BH-0B08	12.12.89	12.11.92
"	P045	Super II Tumblast	BH-0B09	11.18.88	11.18.91
"	F001	Alt Roadway & Parking Area	—	2.26.88	2.26.91
"	P037	Box Furnace	BF-FB09	3.30.84	On Registration
"	P038	Box Furnace	BF-FB10	3.30.84	On Registration
"	P039	Box Furnace	BF-FB14	3.30.84	On Registration
"	P001	17' Rotary Furnace	BF-FR01	9.24.76	On Registration
"	P002	17' Rotary Furnace	BF-FR02	9.24.76	On Registration
"	P003	17' Rotary Furnace	BF-FR03	9.24.76	On Registration
"	P004	17' Rotary Furnace	BF-FR04	9.24.76	On Registration
"	P005	17' Rotary Furnace	BF-FR05	9.24.76	On Registration
"	P006	17' Rotary Furnace	BF-FR06	9.24.76	On Registration
"	P007	14' Rotary Furnace	BF-FR07	9.24.76	On Registration
"	P009	17' Rotary Furnace	BF-FR10	9.24.76	On Registration
"	P010	14' Rotary Furnace	BF-FR09	9.24.76	On Registration
"	P015	Box Furnace	BF-FB07	9.24.76	On Registration
"	P016	Box Furnace	BF-FB11	9.24.76	On Registration
"	P017	Box Furnace	BF-FB08	9.24.76	On Registration
"	P019	Box Furnace	BF-FB12	9.24.76	On Registration
"	P020	Box Furnace	BF-FB05	9.24.76	On Registration
"	P021	Box Furnace	BF-FB21	9.24.76	On Registration
"	P022	Annealing Furnace	BH-0F01	9.24.76	On Registration
"	P023	Annealing Furnace	BH-0F02	9.24.76	On Registration
"	P024	Annealing Furnace	BH-0F05	9.24.76	On Registration
"	P025	Cay Type Furnace	BH-0F07	9.24.76	On Registration
"	P026	Quench & Draw Furnace	BH-0F06	9.24.76	On Registration
"	P027	Quench & Draw Furnace	BH-0F08	9.24.76	On Registration

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EPA Premise No.		Description	Company ID	Issued	Expires
1576000 73	P030	Tablet	BH-0B03	9-24-76	On Registration
"	P040	Gas Heat Treat Furnace	BH-0F09	2-17-84	On Registration
"	P041	17' Rotary Furnace	BF-FP11	10-04-85	On Registration
"	P043	Gas Hardening Furnace	BH-0F10	4-25-86	On Registration
"	P033	Hardine Grinders	Grinding Area #1	7-02-87	Reclassified On Registration
"	P034	Hand Grinders	Grinding Area #2	7-02-87	Reclassified On Registration
"	P035	Hand Grinders	Grinding Area #3	7-02-87	Reclassified On Registration

APPENDIX C

U.S. EPA FORM 2070-13

CDF012216

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

EPA

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: D004651412

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER				
Canton Drop Forge	4575 Sourbury Street SW				
03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
Canton	OH	44706	Stark	151	16

09 COORDINATES: LATITUDE 40 46 45.N | LONGITUDE 081 23 45.W

10 TYPE OF OWNERSHIP (Check one)
☒ A. PRIVATE ☐ B. FEDERAL _____ ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER _____ ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION	02 SITE STATUS	03 YEARS OF OPERATION
05 16 90 (MONTH DAY YEAR)	☒ ACTIVE ☐ INACTIVE	1945 (BEGINNING YEAR) / present (ENDING YEAR) ___ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply)
☐ A. EPA ☒ B. EPA CONTRACTOR Ecology + Environment Inc. (Name of firm) ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR _____ (Name of firm)
☐ E. STATE ☐ F. STATE CONTRACTOR _____ (Name of firm) ☐ G. OTHER _____ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO.
Dom Nordine	Ecologist	E+E Inc.	(312) 663-9415
09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO.
Henry Adamiak	Civil Engineer	"	( ) "
Joe Corns	Civil Engineer	"	( ) "
Sherrie Stevens	Health + Safety Specialist	"	( ) "
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
Jerome P. Bressanelli	President	4575 Sourbury St SW	(216) 477-4571
Larry L. Stalnaker	Manager	" " "	(") "
Ed England	Manager	" " "	(") "
Stephen J. Reilly	Attorney	50 West Broad St	(614) 228-3511
Fred H. Zollinger, Jr.	Attorney	121 Cleveland Ave. S.	(216) 455-5073
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
☒ PERMISSION ☐ WARRANT	830	cloudy, light rain, 50°F

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO.
Rod Beals	OEPA NE District	(216) 425-9171
04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	**05 AGENCY**	**06 ORGANIZATION**	**07 TELEPHONE NO.**	**08 DATE**
John Nordine	U.S. EPA	E&E, Inc	312-663-9415	10, 8, 90 (MONTH DAY YEAR)

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
OH	D0046514 2

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- ☒ A. SOLID
- ☐ B. POWDER, FINES
- ☒ C. SLUDGE
- ☐ D. OTHER _____ (Specify)
- ☐ E. SLURRY
- ☒ F. LIQUID
- ☐ G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS Unknown
CUBIC YARDS _____
NO. OF DRUMS Unknown

03 WASTE CHARACTERISTICS (Check all that apply)

- ☑ A. TOXIC
- ☐ B. CORROSIVE
- ☐ C. RADIOACTIVE
- ☑ D. PERSISTENT
- ☒ E. SOLUBLE
- ☐ F. INFECTIOUS
- ☐ G. FLAMMABLE
- ☐ H. IGNITABLE
- ☐ I. HIGHLY VOLATILE
- ☐ J. EXPLOSIVE
- ☐ K. REACTIVE
- ☐ L. INCOMPATIBLE
- ☐ M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE	unknown		
OLW	OILY WASTE	unknown		
SOL	SOLVENTS	unknown		See Section 4 of Narrative
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS	unknown		
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS	unknown		

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
	See Section 4 of Narrative				

V. FEEDSTOCKS (See Appendix for CAS numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS	Steel	NA	FDS		
FDS	carbon alloy	NA	FDS		
FDS	nickel alloy	NA	FDS		
FDS	Titanium	NA	FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E&E FIT files Federal and State files
Site Inspection 5/16/90

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
OH	D004654142

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☒ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE ____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 4,227
04 NARRATIVE DESCRIPTION

See narrative section 5.2 for information.

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE ____) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 0
04 NARRATIVE DESCRIPTION

See narrative section 5.3 for information.

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE ____) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 0
04 NARRATIVE DESCRIPTION

See narrative section 5.4 for information

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE ____) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 0
04 NARRATIVE DESCRIPTION

See narrative section 5.5 for information.

01 ☒ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE ____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 378
04 NARRATIVE DESCRIPTION

See narrative section 5.6 for information

01 ☐ F. CONTAMINATION OF SOIL — 02 ☒ OBSERVED (DATE 5/16/90) — ☐ POTENTIAL — ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: 25 (Acres)
04 NARRATIVE DESCRIPTION

See narrative sections 4 and 5 for information

01 ☒ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE ____) — ☒ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 4227
04 NARRATIVE DESCRIPTION

See narrative section 5.2 for information.

01 ☒ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE ____) — ☒ POTENTIAL — ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: 378
04 NARRATIVE DESCRIPTION

There is a potential that workers may come in contact with the TCL compounds and TAL analytes found in on-site soils

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE ____) — ☐ POTENTIAL — ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 4227
04 NARRATIVE DESCRIPTION

See narrative section 5 for information

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: DOO 465142

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
The landfilled area had a new clay cover applied no flora had been established at the time of the inspection 5/16/90

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include number(s) of species)
The site is fenced. No damage to fauna has been reported and none was observed by FIT.

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
The site is in the city and is fenced.

01 ☒ M. UNSTABLE CONTAINMENT OF WASTES (Spills/Runoff/Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE: 6/23/83, 2/15/90) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: 4277 — 04 NARRATIVE DESCRIPTION OEPA observed leaking oil drums during a site inspection. On-site soil samples collected TAL analytes and TCL compounds.

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
None observed by FIT.

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION
N/A

01 ☒ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☒ ALLEGED
04 NARRATIVE DESCRIPTION
None observed by FIT. June 30, 1983 a complaint was filed with the OEPA about buried drums and sludge disposal on-site.

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS
None

III. TOTAL POPULATION POTENTIALLY AFFECTED: 4277

IV. COMMENTS
None

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)
FIT files, Federal and State files
Site inspection 5/16/90

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: 000465142

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
☐ A. NPDES				
☐ B. UIC				
☒ C. AIR	see appendix B			
☐ D. RCRA				
☐ E. RCRA INTERIM STATUS				
☐ F. SPCC PLAN				
☒ G. STATE (Specify)	unknown			permit for landfill
☐ H. LOCAL (Specify)				
☐ I. OTHER (Specify)				
☐ J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
☒ A. SURFACE IMPOUNDMENT	unknown	
☐ B. PILES		
☒ C. DRUMS, ABOVE GROUND	2,20	55 gallon
☒ D. TANK, ABOVE GROUND	8,000	gallons
☒ E. TANK, BELOW GROUND	150,000	gallons
☒ F. LANDFILL	unknown	
☐ G. LANDFARM		
☐ H. OPEN DUMP		
☐ I. OTHER (Specify)		

04 TREATMENT (Check all that apply)
- ☐ A. INCINERATION
- ☐ B. UNDERGROUND INJECTION
- ☐ C. CHEMICAL/PHYSICAL
- ☐ D. BIOLOGICAL
- ☐ E. WASTE OIL PROCESSING
- ☐ F. SOLVENT RECOVERY
- ☒ G. OTHER RECYCLING/RECOVERY
- ☐ H. OTHER (Specify)

05 OTHER
- ☒ A. BUILDINGS ON SITE

5 buildings

06 AREA OF SITE
25 (Acres)

07 COMMENTS

See narrative sections 2 and 3 for information

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

☐ A. ADEQUATE, SECURE ☐ B. MODERATE ☒ C. INADEQUATE, POOR ☐ D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

See narrative section 2 and 3 for information

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: ☐ YES ☒ NO

02 COMMENTS

See narrative sections 2, 3, and 5 for information

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

E&E FIT, Federal and State files, site inspection 5/16/90

EPA FORM 2070-13 (7-81)

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EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: 000465142

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)	SURFACE	WELL	02 STATUS ENDANGERED	AFFECTED	MONITORED	03 DISTANCE TO SITE
COMMUNITY	A. ☐	B. ☒	A. ☐	B. ☐	C. ☒	A. _____ (mi)
NON-COMMUNITY	C. ☐	D. ☒	D. ☐	E. ☐	F. ☐ unknown	B. on site (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☒ A. ONLY SOURCE FOR DRINKING ☐ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available) ☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available) ☐ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER	03 DISTANCE TO NEAREST DRINKING WATER WELL
~4,277	on site (mi)

04 DEPTH TO GROUNDWATER	05 DIRECTION OF GROUNDWATER FLOW	06 DEPTH TO AQUIFER OF CONCERN	07 POTENTIAL YIELD OF AQUIFER	08 SOLE SOURCE AQUIFER
24 (ft)	northwest	24 (ft)	3,456,000 (gpd)	☐ YES ☒ NO

09 DESCRIPTION OF WELLS (Including usage, depth, and location relative to population and buildings)

See narrative section 5.2

10 RECHARGE AREA		11 DISCHARGE AREA	
☒ YES ☐ NO	COMMENTS: The 3 lagoons on-site are used for infiltration	☒ YES ☐ NO	COMMENTS: discharge to near by gravel pits.

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE ☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES ☐ C. COMMERCIAL, INDUSTRIAL ☒ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME:	AFFECTED	DISTANCE TO SITE
NA Lake Lipser	☐	1 1/4 (mi)
Lake Meyers	☐	2 (mi)
	☐	(mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE	02 DISTANCE TO NEAREST POPULATION
A. 1,853 NO. OF PERSONS	B. ~24,000 NO. OF PERSONS	C. ~36,000 NO. OF PERSONS	1/4 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE	04 DISTANCE TO NEAREST OFF-SITE BUILDING
~9,000	200 feet (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, density, population center)

The population within the vicinity of the site is residential with some industrial areas.

EPA FORM 2070-13 (7-81)

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EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: D004965142

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

☐ A. 10^{-6} – 10^{-8} cm/sec ☐ B. 10^{-4} – 10^{-6} cm/sec ☒ C. 10^{-3} – 10^{-5} cm/sec ☐ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE (10^{-4} – 10^{-6} cm/sec) ☒ C. RELATIVELY PERMEABLE (10^{-2} – 10^{-4} cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK	04 DEPTH OF CONTAMINATED SOIL ZONE	05 SOIL pH	
71 (ft)	unknown	unknown	

06 NET PRECIPITATION	07 ONE YEAR 24 HOUR RAINFALL	08 SLOPE: SITE SLOPE	DIRECTION OF SITE SLOPE	TERRAIN AVERAGE SLOPE
4 (in)	2.3 (in)	0 %	NA	0 %

09 FLOOD POTENTIAL
SITE IS IN NA YEAR FLOODPLAIN

10
NA = SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)
ESTUARINE: A. N/A (mi) OTHER: B. N/A (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species)
N/A (mi)
ENDANGERED SPECIES: None

13 LAND USE IN VICINITY
DISTANCE TO:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS, NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AG LAND
A. 200¼ feet (mi)	B. ¼ (mi)	C. NA (mi)	D. NA (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

See 4-mile radius map in Appendix A

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E&E FIT files, Federal and State files

EPA FORM 2070-13(7-81)

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EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: OOD044657142

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER			Available
SURFACE WATER			
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL		See section 3.4	
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
OVA 128	No Readings above background
Radiation Mini Alert	No readings above background
Explosion Meter	0% LEL
Oxygen Meter	21% O2
Drager Tubes (HCN)	No readings above background

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☒ GROUND ☐ AERIAL | 02 IN CUSTODY OF Ecology & Environment, Inc. Chicago, IL (Name of organization or individual)

03 MAPS ☒ YES ☐ NO | 04 LOCATION OF MAPS Ecology & Environment, Inc Chicago, IL

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

N/A

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E+E, Inc. FIT site inspection 5/16/90

EPA FORM 2070-13 (7-81)

CDF012224

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: D004465142

II. CURRENT OWNER(S)

01 NAME	02 D+B NUMBER	04 SIC CODE
Corbier Group		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
unknown		
05 CITY	06 STATE	07 ZIP CODE
Hudson	OH	

01 NAME	02 D+B NUMBER	04 SIC CODE
N/F		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
NA		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
NA		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first)

01 NAME	02 D+B NUMBER	04 SIC CODE
Canton Drop Forge		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
4575 Southway St. SW		
05 CITY	06 STATE	07 ZIP CODE
Canton	OH	44706

01 NAME	02 D+B NUMBER	04 SIC CODE
U.S. Army Air Corp		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
Unknown		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
NA		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

IV. REALTY OWNER(S) (If applicable, list most recent first)

01 NAME	02 D+B NUMBER	04 SIC CODE
NA		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
NA		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

01 NAME	02 D+B NUMBER	04 SIC CODE
NA		
03 STREET ADDRESS (P.O. Box, RFD #, etc.)		
05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E+E FIT files Federal and State files
site inspection 5/16/90

EPA FORM 2070-13 (7-81)

CDF012225

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: D004465142

II. CURRENT OPERATOR (Provide if different from owner)

01 NAME	02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY (If applicable)

10 NAME	11 D+B NUMBER
NA	

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner)

01 NAME	02 D+B NUMBER
Canton Drop Forge	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
4575 Lathaway St. SW,	

05 CITY	06 STATE	07 ZIP CODE
Canton	OH	44706

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD
36	

PREVIOUS OPERATORS' PARENT COMPANIES (If applicable)

10 NAME	11 D+B NUMBER
NA	

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

01 NAME	02 D+B NUMBER
NA	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER
NA	

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

01 NAME	02 D+B NUMBER
NA	

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE

05 CITY	06 STATE	07 ZIP CODE

08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

10 NAME	11 D+B NUMBER
NA	

12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE

14 CITY	15 STATE	16 ZIP CODE

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E+E, FIT, Federal, and State files
site inspection 5/16/90

EPA FORM 2070-13 (7-81)

CDF012226

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION
01 STATE: OH | 02 SITE NUMBER: D004465142

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER
Canton Drop Forge	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
4575 Southway St SW	
05 CITY	06 STATE / 07 ZIP CODE
Canton	OH / 44706

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
NA				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
05 CITY				

01 NAME	02 D—B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
NA				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
05 CITY				

01 NAME	02 D+B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
NA				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
05 CITY				

01 NAME	02 D—B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
NA				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
05 CITY				

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
Browning Ferris Industries				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
1447 Manton Road				
05 CITY			06 STATE	07 ZIP CODE
Akron			OH	44319

01 NAME	02 D—B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
Advance Drain + Sewer				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
3113 Lincoln Way West				
05 CITY			06 STATE	07 ZIP CODE
Wooster			OH	

01 NAME	02 D+B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
Research Oil Reclamation				
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
2655 Transport Road				
05 CITY			06 STATE	07 ZIP CODE
Cleveland			OH	43216

01 NAME	02 D—B NUMBER	04 SIC CODE	06 STATE	07 ZIP CODE
03 STREET ADDRESS (P.O. Box, RFD #, etc.)				
05 CITY			06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E+E FIT, Federal and State files
site inspection 5/16/90

EPA FORM 2070-13 (7-81)

CDF012227

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
OH	OOD044657942

II. PAST RESPONSE ACTIVITIES

01 ☐ A. WATER SUPPLY CLOSED 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ D. SPILLED MATERIAL REMOVED 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ E. CONTAMINATED SOIL REMOVED 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ F. WASTE REPACKAGED 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ G. WASTE DISPOSED ELSEWHERE 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ H. ON SITE BURIAL 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ I. IN SITU CHEMICAL TREATMENT 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ J. IN SITU BIOLOGICAL TREATMENT 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ K. IN SITU PHYSICAL TREATMENT 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ L. ENCAPSULATION 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ M. EMERGENCY WASTE TREATMENT 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ N. CUTOFF WALLS 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ O. EMERGENCY DIKING/SURFACE WATER DIVERSION 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ P. CUTOFF TRENCHES/SUMP 04 DESCRIPTION NA	02 DATE	03 AGENCY
01 ☐ Q. SUBSURFACE CUTOFF WALL 04 DESCRIPTION NA	02 DATE	03 AGENCY

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
OH	D004465142

II. PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ S. CAPPING/COVERING — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ T. BULK TANKAGE REPAIRED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ U. GROUT CURTAIN CONSTRUCTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ V. BOTTOM SEALED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ W. GAS CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ X. FIRE CONTROL — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ Y. LEACHATE TREATMENT — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ Z. AREA EVACUATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ 1. ACCESS TO SITE RESTRICTED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ 2. POPULATION RELOCATED — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

01 ☐ 3. OTHER REMEDIAL ACTIVITIES — 02 DATE _____ — 03 AGENCY _____
04 DESCRIPTION
NA

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E & E FIT, Federal and State files
site inspection 5/16/90

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
OH	000446542

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY/ENFORCEMENT ACTION ☐ YES ☒ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY/ENFORCEMENT ACTION

NA

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E+E FIT, Federal and State files
site inspection 5/16/90

EPA FORM 2070-13 (7-81)

APPENDIX D

FIT SITE PHOTOGRAPHS

CDF012231

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG. Company PAGE 1 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: FOH0625SA

DATE: 5-16-90

TIME: 0945

DIRECTION OF PHOTOGRAPH: South

WEATHER CONDITIONS: 50's cloudy, some rain

PHOTOGRAPHED BY: John Nodine

SAMPLE ID (if applicable): NA

DESCRIPTION: Inside Main Forge building.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG Co. PAGE 2 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9604-001 PAN: F0H0625SA

DATE: 5/16/96

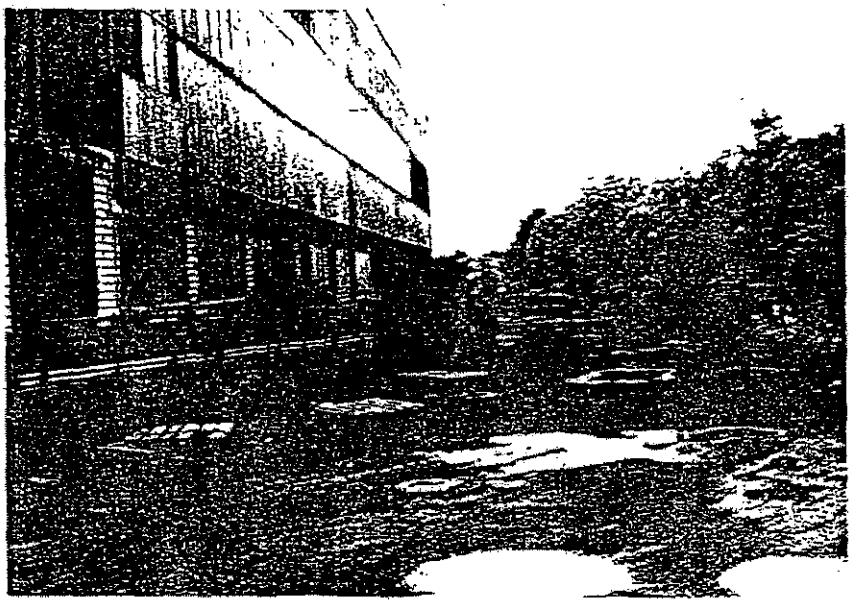
TIME: 235

DIRECTION OF PHOTOGRAPH: West

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): N/A



DESCRIPTION: North side of CDF plant.

DATE: 5/16/96

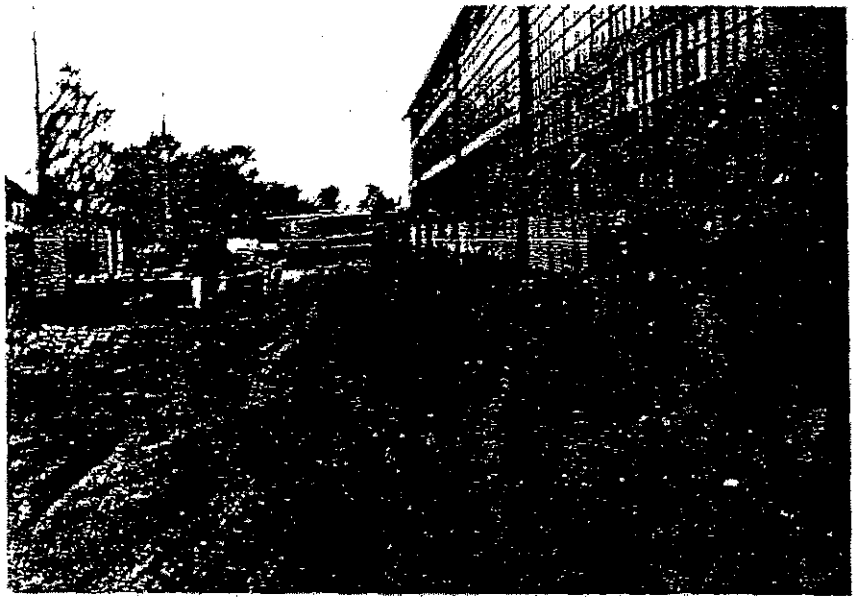
TIME: 1240

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): N/A



DESCRIPTION: Same as above. Note house on left side of picture.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG. Co. PAGE 3 OF 15

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: F[illegible]25SA

DATE: 5/16/90

TIME: 1550

DIRECTION OF PHOTOGRAPH: Northeast

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): N/A

DESCRIPTION: Gate by gravel house (east gate).

DATE: 5/16/90

TIME: 3:45

DIRECTION OF PHOTOGRAPH: east

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

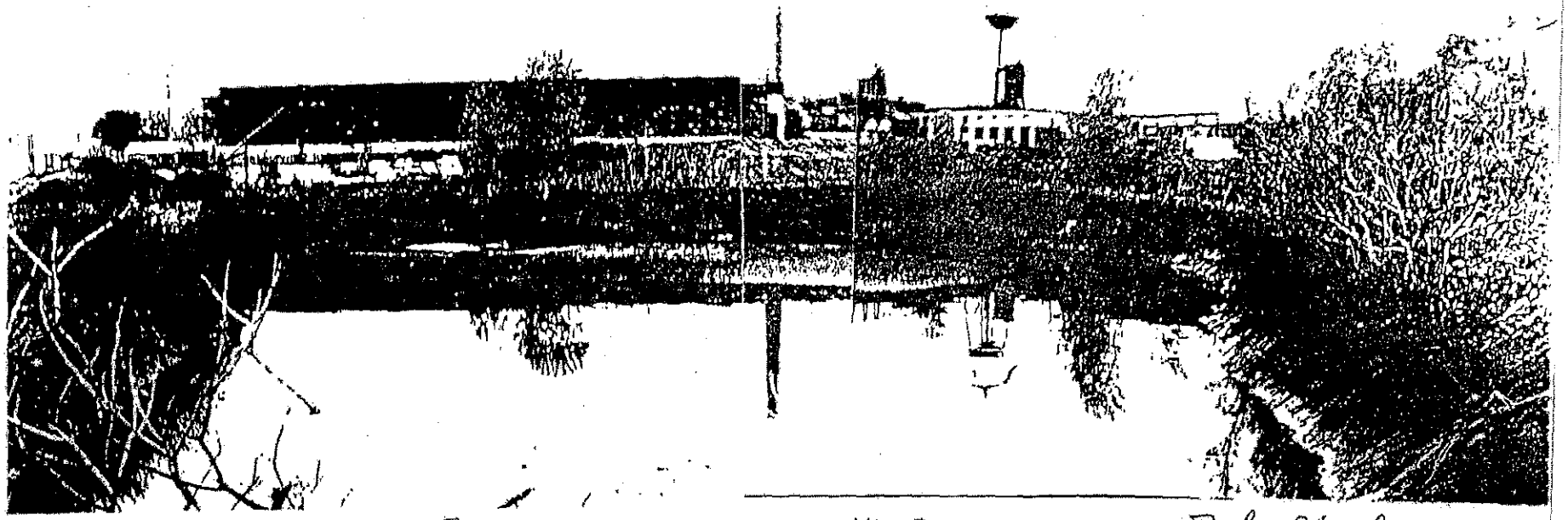
SAMPLE ID (if applicable): N/A

DESCRIPTION: Lagoon #3

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge & MFG. Company PAGE 4 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: F0H0625SA



DATE: 5-16-90 TIME: 1500 DIRECTION OF PHOTOGRAPH: West PHOTOGRAPHED BY: John Nordine

WEATHER CONDITIONS: 70's Cloudy, warm, humid SAMPLE ID (If applicable): N/A

DESCRIPTION: Lagoon #2 with plant in background.

CDF012235

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge & MFG. Co. PAGE 5 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: F0H06255A

DATE: 6/16/90

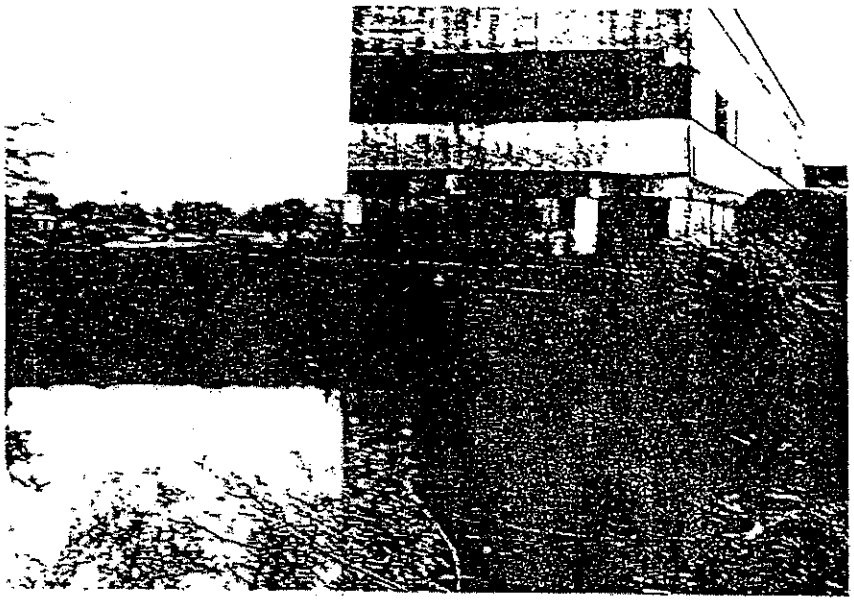
TIME: 1140

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): NA



DESCRIPTION: Lagoon #1 with [illegible] building in background.

DATE: 6/16/90

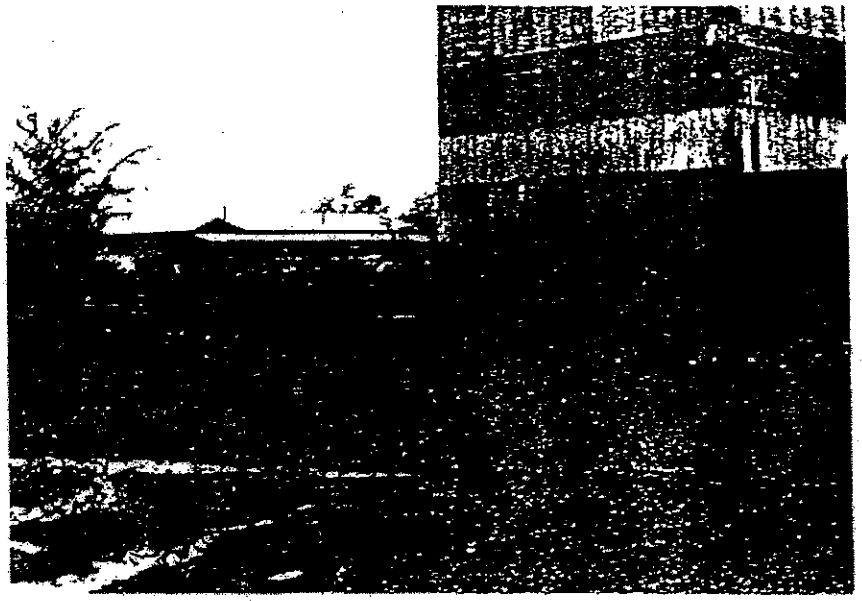
TIME: 1140

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): NA



DESCRIPTION: Waste oil tank to lagoon #1.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG. Co. PAGE 2 OF 18

U.S. EPA ID: EHD004465412 TDD: F05-9004-001 FAN: F0H0625SA

DATE: 5/6/90

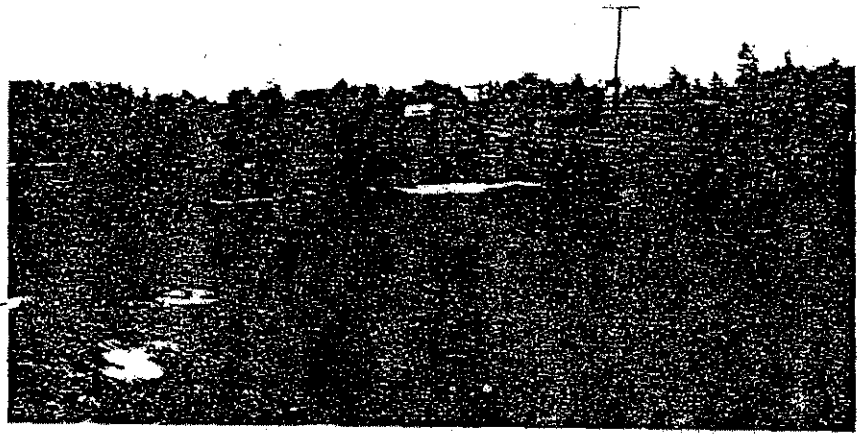
TIME: 1550

DIRECTION OF PHOTOGRAPH: east

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): N/A



DESCRIPTION: Landfilled area west of the CIF facility. Note fresh cover material.

DATE: 5/6/90

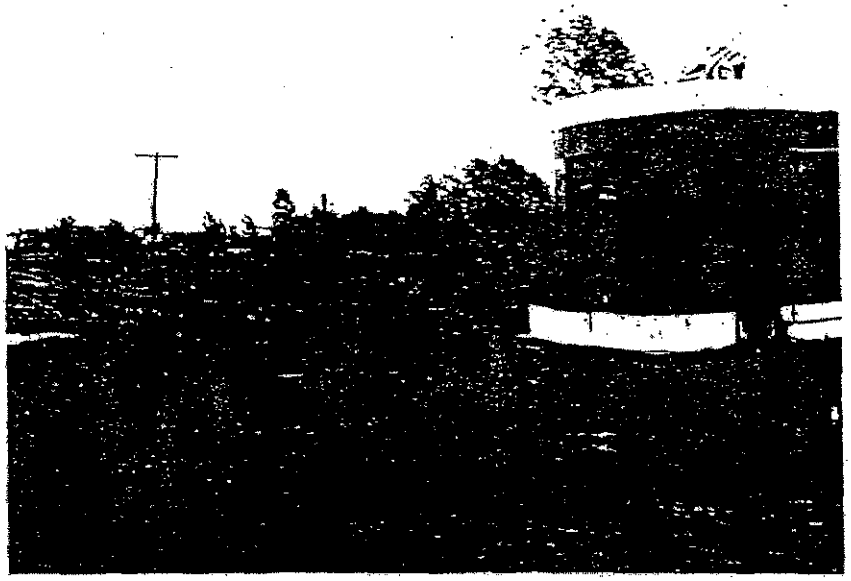
TIME: 1550

DIRECTION OF PHOTOGRAPH: east

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): N/A



DESCRIPTION: Same as above.

FIELD PHOTOGRAPH LOG SHEET

SITE NAME: Canton Drop Forge & MFG. Co. PAGE 7 OF 18

U.S. EPA ID: OHD004467412 TDD: F05-9004-001 PAN: FOHG625SA

DATE: 5/16/90

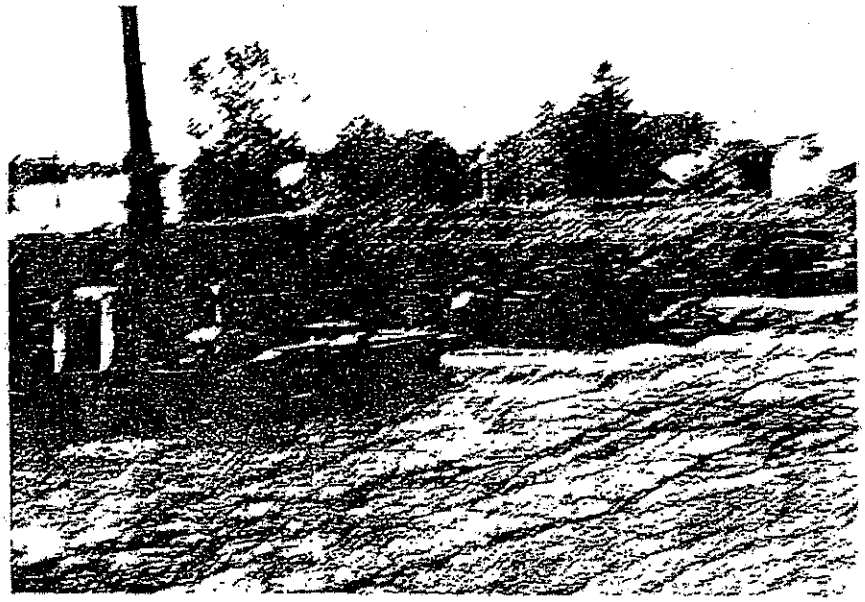
TIME: 1515

DIRECTION OF PHOTOGRAPH: Southeast

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): NF



DESCRIPTION: Drop forge building area.

DATE: 5/16/90

TIME: 1515

DIRECTION OF PHOTOGRAPH: Southeast

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable):

DESCRIPTION: Drop forge building

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG Co. PAGE 8 OF 19

U.S. EPA ID: OHD004465[illegible] TDD: F05-0004-001 PAN: F0[illegible]

DATE: 5/16/90

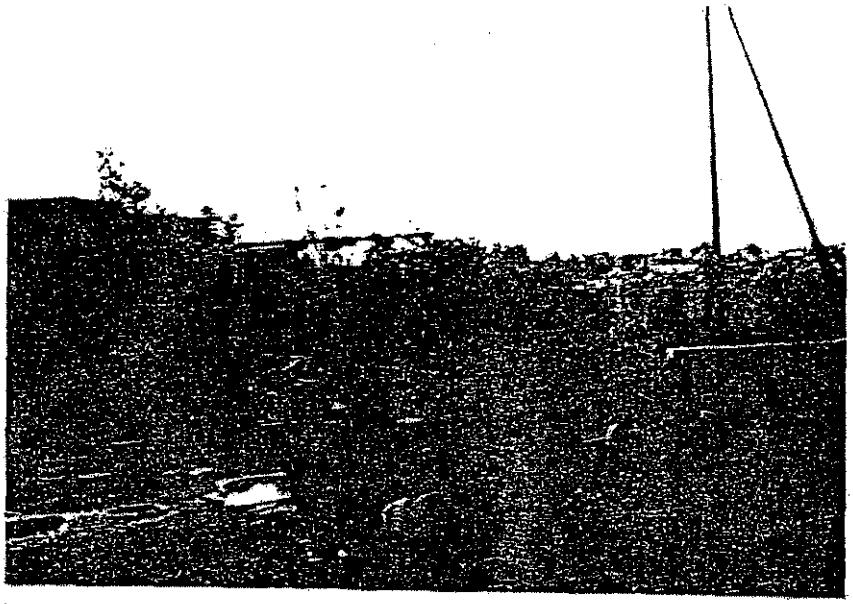
TIME: 1515

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): NA



DESCRIPTION: Scrap and cabbage area.

DATE: 5/16/90

TIME: 1515

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

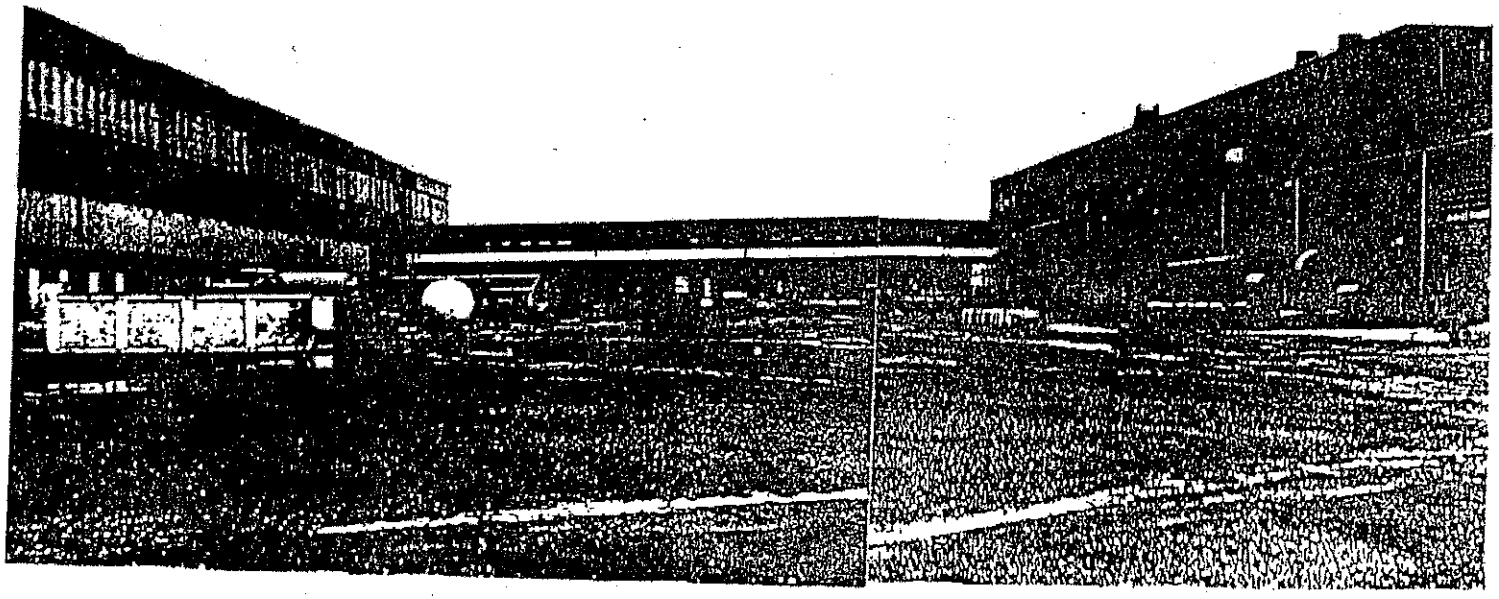
SAMPLE ID (if applicable): NA

DESCRIPTION: Same as above

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge & MFG. Company PAGE 9 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9005-0011 PAN: FOHPA2554



DATE: > 5/16/96 TIME: > 1141 DIRECTION OF PHOTOGRAPH: > North PHOTOGRAPHED BY: > John Nordin

WEATHER CONDITIONS: > 50's cloudy, some rain SAMPLE ID (if applicable): > NA

DESCRIPTION: > Area between upper tier and main forge area. In this area, the underground storage tank and drum storage area are located.

CDF012240

FIELD PHOTOGRAPHT LOG SHEET

SITE NAME: Canton Drop Forge + MFG Co. PAGE 10 OF 18

U.S. EPA ID: OHD0044-5412 TDD: F05-9004-001 PAN: FOHC-255A

DATE: 5/18/90

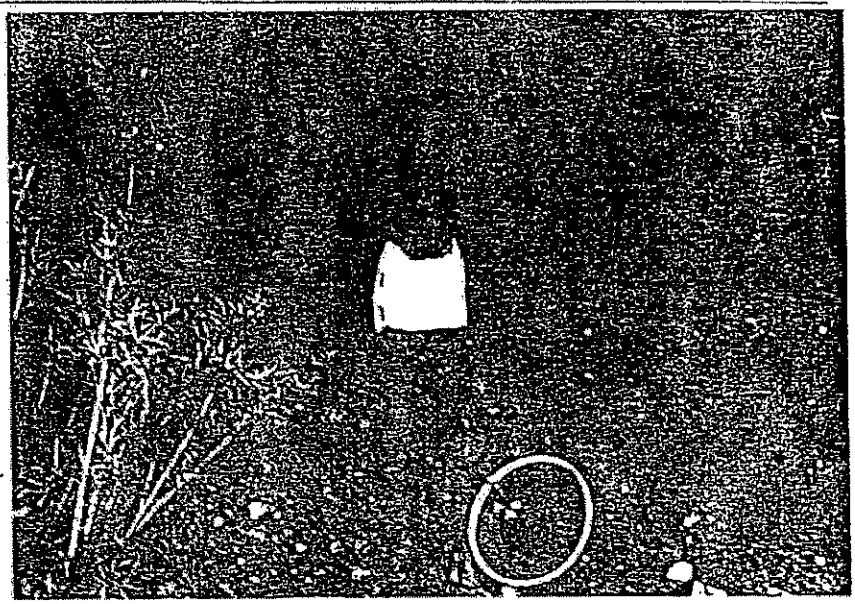
TIME: 11:30

DIRECTION OF PHOTOGRAPH: Northwest

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S1



DESCRIPTION: Sediment sample S1 from lagoon #1

DATE: 5/16/90

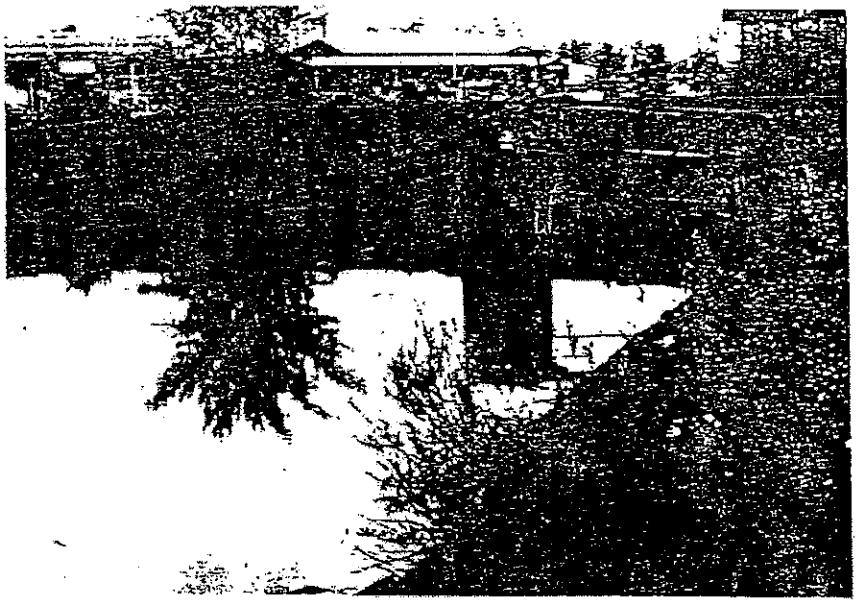
TIME: 1130

DIRECTION OF PHOTOGRAPH: Northwest

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-1



DESCRIPTION: Same as above

CDF012241

FIELD PHOTOGRAPH LOG SHEET

SITE NAME: Canton Drop Forge & MFG. Co. PAGE 11 OF 18

U.S. EPA ID: OHD004654512 TDD: F05-9004-001 PAN: For 3625A

DATE: 5/16/90

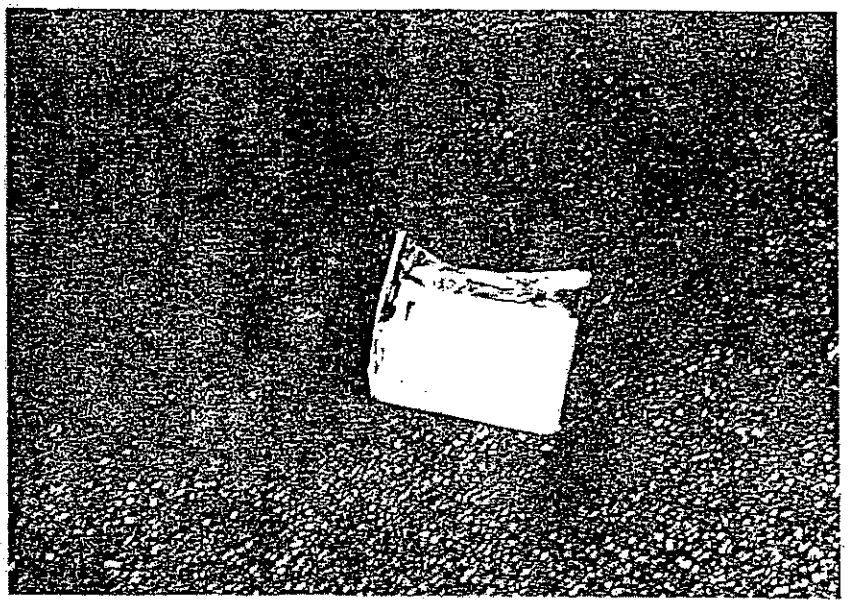
TIME: 1145

DIRECTION OF PHOTOGRAPH: Northwest

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-2



DESCRIPTION: Soil sample S-2 from west side near lagoon #1.

DATE: 5/16/90

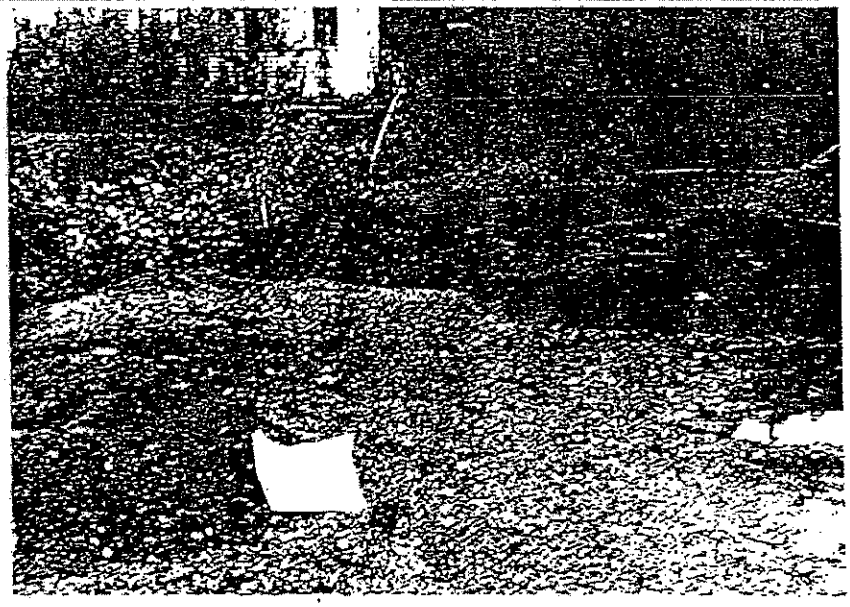
TIME: 1145

DIRECTION OF PHOTOGRAPH: Northwest

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-2



DESCRIPTION: Same as above.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge & MPG Co. PAGE 12 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: F0H0625SA

DATE: 5/16/90

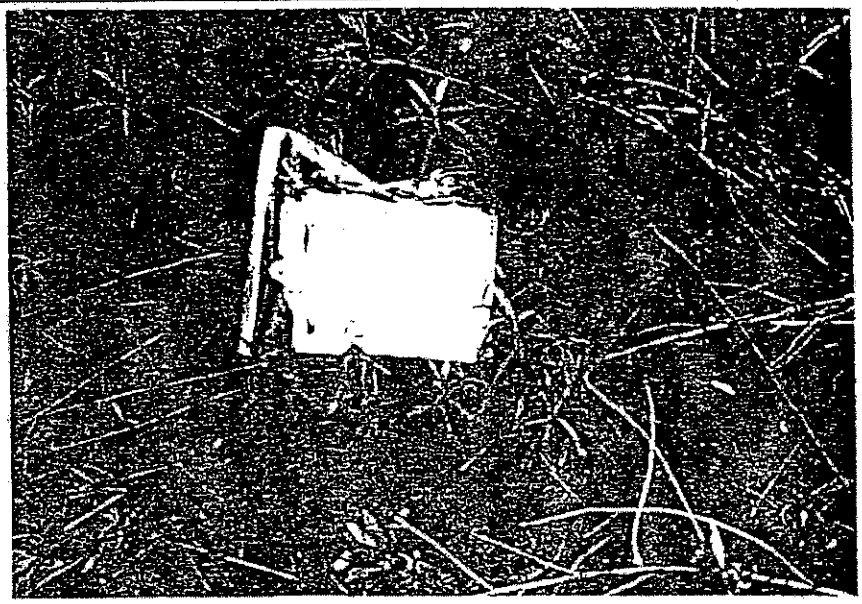
TIME: 1235

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-3



DESCRIPTION: Soil sample S-3 collect near dies in northwest corner of the site property.

DATE: 5/16/90

TIME: 1235

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-3

DESCRIPTION: Same as above

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge & Mills Cr. PAGE 13 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9504-021 PAN: FOH0625SA

DATE: 5/16/90

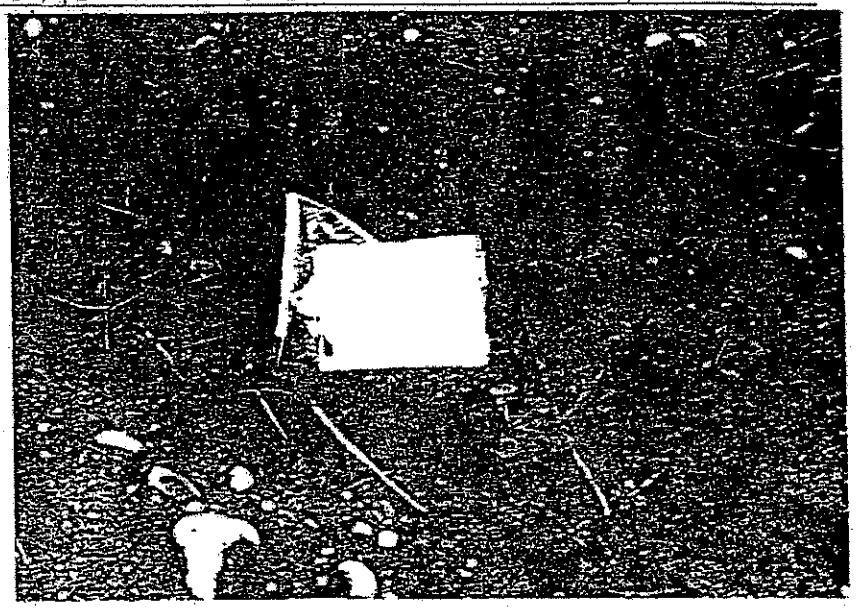
TIME: 330

DIRECTION OF PHOTOGRAPH: N E

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-4



DESCRIPTION: In sample S-4 pit in L. Lagoon #3.

DATE: 5/16/90

TIME: 330

DIRECTION OF PHOTOGRAPH: N E

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-4

DESCRIPTION: Same as above

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG. Co. PAGE 4 OF 18

U.S. EPA ID: [illegible]-DC[illegible]-465412 TDD: F05-9604-[illegible] PAN: FCHD6255A

DATE: 5/[illegible]

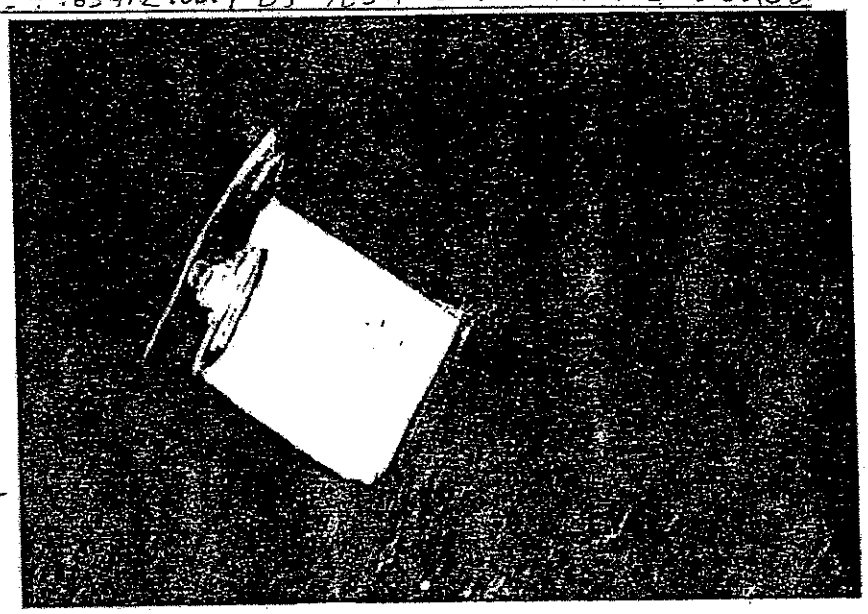
TIME: 1335

DIRECTION OF PHOTOGRAPH: Northeast

WEATHER CONDITIONS: 50° cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-5



DESCRIPTION: Sediment sample S-5 collected near the inlet in lagoon #3 from lagoon #2.

DATE: 5-[illegible]

TIME: 1335

DIRECTION OF PHOTOGRAPH: Northeast

WEATHER CONDITIONS: 50° cloudy, some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-5

DESCRIPTION: Same as above.

SIO11(2/25 89

CDF012245

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge & MFG. Co. PAGE 15 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: F0H06255A

DATE: 5/16/90

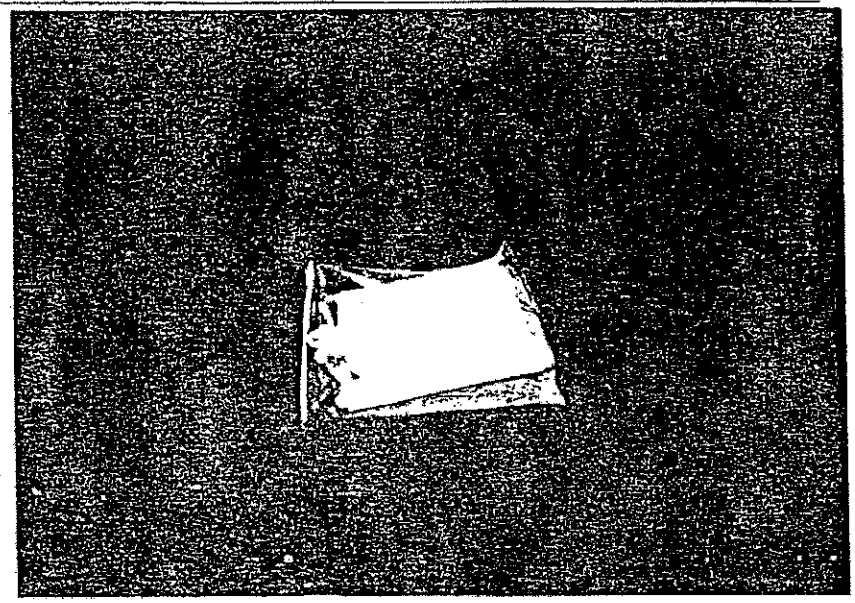
TIME: 1400

DIRECTION OF PHOTOGRAPH: South

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-6



DESCRIPTION: Soil sample S-6 collected from zone A landfill cover material. Oil sheen on water.

DATE: 5/16/90

TIME: 1400

DIRECTION OF PHOTOGRAPH: South

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-6

DESCRIPTION: Same as above, note fresh cover

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG Co. PAGE 16 OF 18

U.S. EPA ID: PHD004465412 TDD: F05-9004-001 PAN: F0H0625SA

DATE: 5/16/90

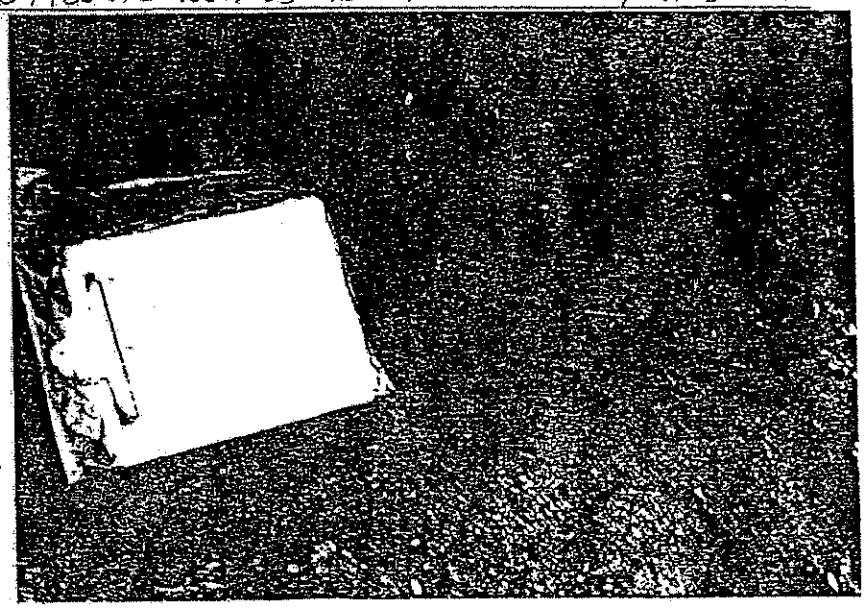
TIME: 1440

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-7



DESCRIPTION: Soil sample S-7 collected near the pump shack on iron #2. Note fly substance on the bank.

DATE: 5/16/90

TIME: 1440

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-7

DESCRIPTION: Same as above.

FIELD PHOTOGRAPH LOG SHEET

SITE NAME: Canton Drop Forge + Mfg. Co. PAGE 17 OF 18

U.S. EPA ID: OHD004465412 TDD: F05-9004-001 PAN: FOH0625SA

DATE: 5/16/90

TIME: 450

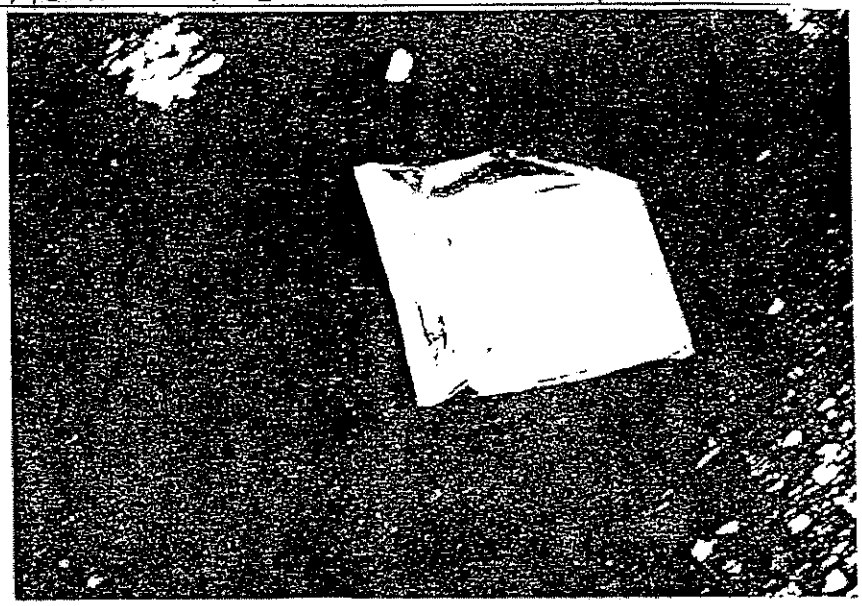
DIRECTION OF PHOTOGRAPH: South

WEATHER CONDITIONS: 50's cloudy

intermittent rain

PHOTOGRAPHED BY: John Nadeau

SAMPLE ID (if applicable): S-9



DESCRIPTION: Soil sample S-9 collected from drop area.

DATE: 5/16/90

TIME: 1450

DIRECTION OF PHOTOGRAPH: South

WEATHER CONDITIONS: 50's cloudy

intermittent rain

PHOTOGRAPHED BY: John Nadeau

SAMPLE ID (if applicable): S-9

DESCRIPTION: Same as above.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Canton Drop Forge + MFG. Co. PAGE 18 OF 18

U.S. EPA ID: PHD0C4465412 TDD: F05-9004-001 PAN: F0H6255A

DATE: 5/16/90

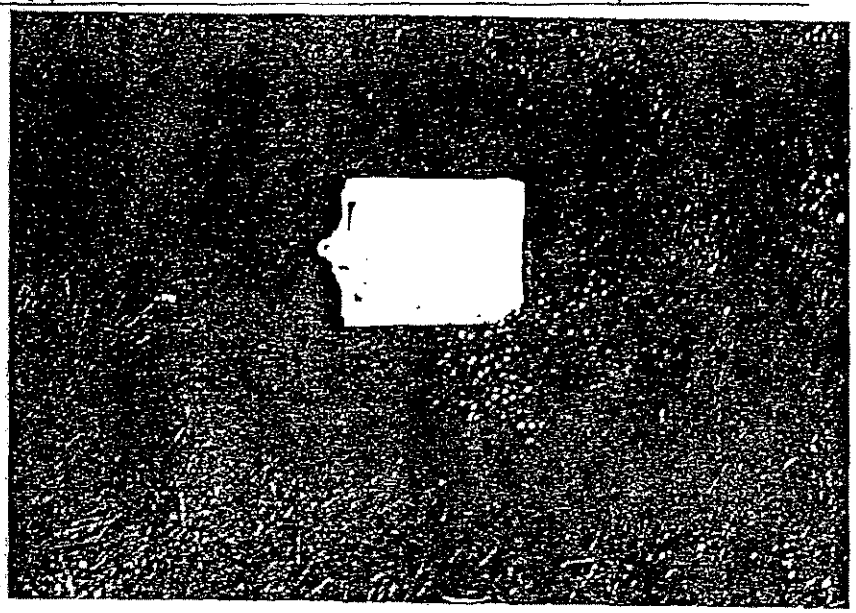
TIME: 1315

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-9



DESCRIPTION: Soil sample S-9 collected near the Spice building.

DATE: 5/16/90

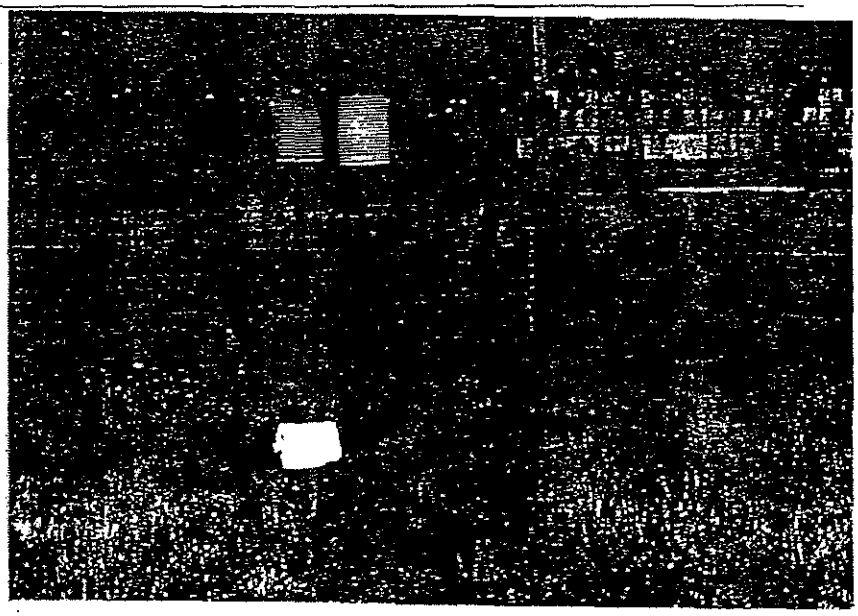
TIME: 1315

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: 50's cloudy some rain

PHOTOGRAPHED BY: John Nordine

SAMPLE ID (if applicable): S-19



DESCRIPTION: Same as above.

APPENDIX E

U.S. EPA TARGET COMPOUND LIST AND
TARGET ANALYTE LIST
QUANTITATION/DETECTION LIMITS

CDF012250

Contract Laboratory Program
Target Compound List
Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SEDIMENT SLUDGE
Chloromethane	74-87-3	10 ug/L	10 ug/Kg
Bromomethane	74-83-9	10	10
Vinyl chloride	75-01-4	10	10
Chloroethane	75-00-3	10	10
Methylene chloride	75-09-2	5	5
Acetone	67-64-1	10	5
Carbon disulfide	75-15-0	5	5
1,1-dichloroethene	75-35-4	5	5
1,1-dichloroethane	75-34-3	5	5
1,2-dichloroethene (total)	540-59-0	5	5
Chloroform	67-66-3	5	5
1,2-dichloroethane	107-06-2	5	5
2-butanone (MEK)	78-93-3	10	10
1,1,1-trichloroethane	71-55-6	5	5
Carbon tetrachloride	56-23-5	5	5
Vinyl acetate	108-05-4	10	10
Bromodichloromethane	75-27-4	5	5
1,2-dichloropropane	78-87-5	5	5
cis-1,3-dichloropropene	10061-01-5	5	5
Trichloroethene	79-01-6	5	5
Dibromochloromethane	124-48-1	5	5
1,1,2-trichloroethane	79-00-5	5	5
Benzene	71-43-2	5	5
Trans-1,3-dichloropropene	10061-02-6	5	5
Bromoform	75-25-2	5	5
4-Methyl-2-pentanone	108-10-1	10	10
2-Hexanone	591-78-6	10	10
Tetrachloroethene	127-18-4	5	5
Tolene	108-88-3	5	5
1,1,2,2-tetrachloroethane	79-34-5	5	5
Chlorobenzene	108-90-7	5	5
Ethyl benzene	100-41-4	5	5
Styrene	100-42-5	5	5
Xylenes (total)	1330-20-7	5	5

CDF012251

Table A
Contract Laboratory Program
Target Compound List
Semivolatiles Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SEDIMENT SLUDGE
Phenol	108-95-2	10 ug/L	330 ug/Kg
bis(2-Chloroethyl) ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
Benzyl Alcohol	100-51-6	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol	95-48-7	10	330
bis(2-Chloroisopropyl) ether	108-60-1	10	330
4-Methylphenol	106-44-5	10	330
N-Nitroso-di-n-dipropylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
Benzoic Acid	65-85-0	50	1600
bis(2-Chloroethoxy) methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	300
4-Chloro-3-methylphenol	59-50-7	10	330
2-Methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	50	1600
2-Chloronaphthalene	91-58-7	10	330
2-Nitroaniline	88-74-4	50	1600
Dimethylphthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
2,6-Dinitrotoluene	606-20-2	10	330
3-Nitroaniline	99-09-2	50	1600
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	50	1600
4-Nitrophenol	100-02-7	50	1600
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl-phenyl ether	7005-72-3	10	330

Table A
Contract Laboratory Program
Target Compound List
Semivolatiles Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SLUDGE SEDIMENT
Fluorene	86-73-7	10 ug/L	330 ug/Kg
4-Nitroaniline	100-01-6	50	1600
4,6-Dinitro-2-methylphenol	534-52-1	50	1600
N-nitrosodiphenylamine	86-30-6	10	330
4-Bromophenyl-phenylether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	50	1600
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butylbenzylphthalate	85-68-7	10	330
3,3'-Dichlorobenzidine	91-94-1	20	660
Benzo(a)anthracene	56-55-3	10	330
Chrysene	218-01-9	10	330
bis(2-Ethylhexyl)phthalate	117-81-7	10	330
Di-n-octylphthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,b)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

CDF012253

Table A
Contract Laboratory Program
Target Compound List
Pesticide and PCB Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SEDIMENT SLUDGE
alpha-BHC	319-84-6	0.05 ug/L	8 ug/Kg
beta-BHC	319-85-7	0.05	8
delta-BHC	319-86-8	0.05	8
gamma-BHC (Lindane)	58-89-9	0.05	8
Heptachlor	76-44-8	0.05	8
Aldrin	309-00-2	0.05	8
Heptachlor epoxide	1024-57-3	0.05	8
Endosulfan I	959-98-8	0.05	8
Dieldrin	60-57-1	0.10	16
4,4'-DDE	72-55-9	0.10	16
Endrin	72-20-8	0.10	16
Endosulfan II	33213-65-9	0.10	16
4,4'-DDD	72-54-8	0.10	16
Endosulfan sulfate	1031-07-8	0.10	16
4,4'-DDT	50-29-3	0.10	16
Methoxychlor (Mariate)	72-43-5	0.5	80
Endrin ketone	53494-70-5	0.10	16
alpha-Chlordane	5103-71-9	0.5	80
gamma-chlordane	5103-74-2	0.5	80
Toxaphene	8001-35-2	1.0	160
AROCLOR-1016	12674-11-2	0.5	80
AROCLOR-1221	11104-28-2	0.5	80
AROCLOR-1232	11141-16-5	0.5	80
AROCLOR-1242	53469-21-9	0.5	80
AROCLOR-1248	12672-29-6	0.5	80
AROCLOR-1254	11097-69-1	1.0	160
AROCLOR-1260	11096-82-5	1.0	160

CDF012254

TABLE A (Cont.)
CONTRACT LABORATORY PROGRAM
HAZARDOUS SUBSTANCE LIST (HSL)
INORGANIC DETECTION LIMITS

COMPOUND	PROCEDURE	DETECTION LIMITS		
		WATER	SOIL SEDIMENT SLUDGE	
ALUMINUM	ICP	200 ug/L	40	mg/KG
ANTIMONY	FURNACE	60	2.4	
ARSENIC	FURNACE	10	2	
BARIUM	ICP	200	40	
BERYLLIUM	ICP	5	1	
CADMIUM	ICP	5	1	
CALCIUM	ICP	5000	1000	
CHROMIUM	ICP	10	2	
COBALT	ICP	50	10	
COPPER	ICP	25	5	
IRON	ICP	100	20	
LEAD	FURNACE	5	1	
MAGNESIUM	ICP	5000	1000	
MANGANESE	ICP	15	3	
MERCURY	COLD VAPOR	0.2	0.008	
NICKEL	ICP	40	8	
POTASSIUM	ICP	5000	1000	
SELENIUM	FURNACE	5	1	
SILVER	ICP	10	2	
SODIUM	ICP	5000	1000	
THALLIUM	FURNACE	10	2	
TIN	ICP	40	8	
VANADIUM	ICP	50	10	
ZINC	ICP	20	4	
CYANIDE	COLOR	10	2	

CDF012255

APPENDIX F

WELL LOGS OF THE AREA OF THE SITE

CDF012256

WATER WELLS
PUMPS

WELL SCREENS
AND
TEST HOLES

M. J. ENGEL DRILLING CO.

well log 1

MASSILLON, OHIO R. D. 2

PHONE MASSILLON [illegible]

DRILLED FOR The Canton Drop Forge and Manufacturing Co.

ADDRESS Canton, Ohio

DATE April 8, 1942

LOCATION 450 feet North of House - back Canton-Massillon Rd.

250 feet from Pennsylvania Railroad.

Well #1

Thickness	Strata	Total	Water Level
30 feet	gravel, sand, and clay	30 feet	
50 feet	sand and clay	80 feet	
10 feet	sand, clay and gravel	90 feet	
15 feet	gravel	105 feet	
19 feet	sand	124 feet	
15 feet	clay and sand	139 feet	
7 feet	sand rock	146 feet	71 feet

Set 30 feet of 10" perforated pipe for screen.

CDF012257

WATER WELLS and PUMPS

WELL SCREENS and TEST HOLES

M. J. ENGEL DRILLING CO.

well log 2

MASSILLON, OHIO, R. D. 2

PHONE: MASSILLON 2-1620

DRILLED FOR The Canton Drop Forge and Manufacturing Co.

ADDRESS Canton, Ohio

DATE June 7, 1943

LOCATION

Well #1

Thickness	Strata	Total	Water Level
	Moved back, pulled screen, and drove 12" pipe to rock. Depth at start - 146 feet.		
2 feet	sand rock	148 feet	
4 feet	clay and sand	152 feet	
8 feet	shale and sand rock	160 feet	
20 feet	sand rock and shale	180 feet	
42 feet	soft black shale	222 feet	
2 feet	sand rock	224 feet	
10 feet	soft black shale	234 feet	
3 feet	sand rock	237 feet	
21 feet	soft black shale	265 feet	
17 feet	sand rock and shale	282 feet	
8 feet	sand rock	290 feet	
2 feet	shale	292 feet	
133 feet	sand rock	425 feet	75 feet

160 feet 12" drive pipe
Well was shot with 60 quarts of Nitro.

Measurements- ground level

CDF012258

WELL LOG AND DRILLING REPORT

ORIGINAL

well log 3

LOCATED

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Columbus, Ohio

Nº 95245

County Stark Township Canton Section of Township or Lot Number 6

Owner Frank Kirby Address 1658 Whipple Rd N.W.

Location of property 800 Lakeview ave N.W.

CONSTRUCTION DETAILS

Casing diameter 4" Length of casing 94'

Type of screen ..... Length of screen .....

Type of pump .....

Capacity of pump .....

Depth of pump setting .....

PUMPING TEST

Pumping rate ..... G.P.M. Duration of test .....

Drawdown ..... ft. Date .....

Developed capacity .....

Static level—depth to water 70'

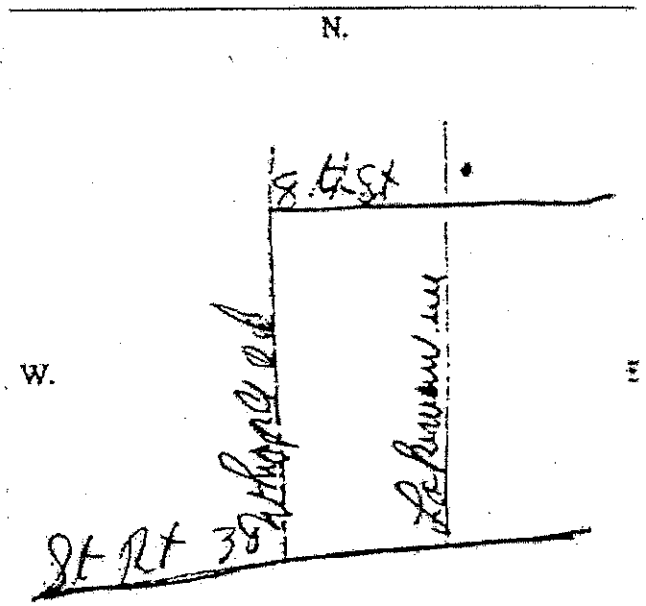
Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Sand + Gravel	0 Feet	40 Ft.
Brown sand	40'	60'
Sand + Gravel	60'	85'
Blue Muck	85'	94'
Blue Clay	94'	104'
White sandstone	104'	109'

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm Holland + Stoffer Date July 15, 1953

Address 4916, 2nd St N.W. Signed John L Holland

3

CDF012259

WELL LOG AND DRILLING REPORT

ORIGIN

well log 4
474500

NO CARBON PAPER NECESSARY - SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
Fountain Square
Columbus, Ohio 43224 Phone (614) 466-5344

COUNTY STARK TOWNSHIP CANTON SECTION OF TOWNSHIP OR LOT NUMBER 30

OWNER KENNETH WALTER ADDRESS 4238 DUEZER AVE

LOCATION OF PROPERTY 3/4 MI NORTH OF FAIRCREST ON DUEZER AVE

CONSTRUCTION DETAILS

Casing diameter 5" Length of casing 126'

Type of screen — Length of screen —

Type of pump —

Capacity of pump —

Depth of pump setting —

Date of completion

BAILING OR PUMPING TEST
(Strike out one by circling)

Test rate 15 gpm Duration of test 1 1/4

Drawdown 42 ft. Date 1-2-76

Static level (depth to water) 121

Quality (clear, cloudy, taste, odor) CLEAR

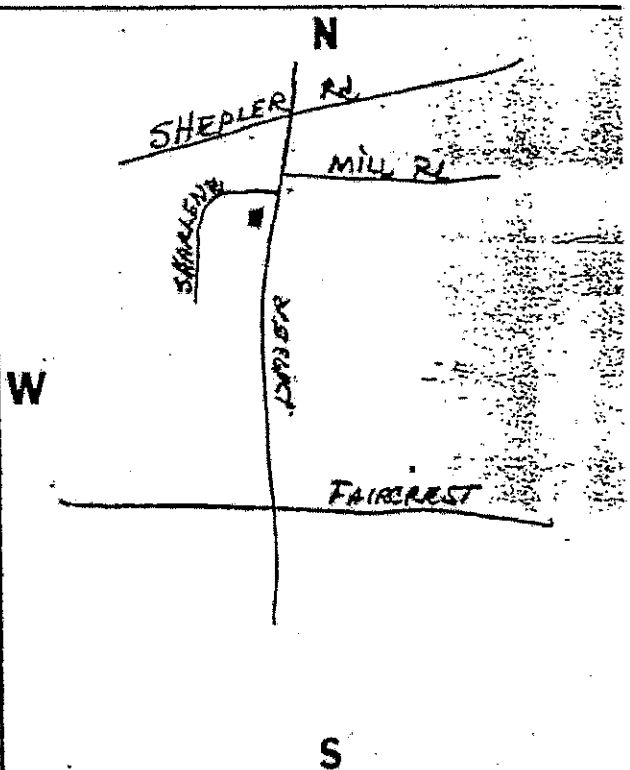
Pump installed by —

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
BROWN CLAY	0 ft	25 ft
LITE SHALE	25	51
LIMESTONE	51	54
COAL	54	55
LITE SHALE	55	72
GRAY SHALE	72	112
LIMESTONE	112	115
COAL	115	116
LITE SHALE	116	126
GRAY SHALE	126	137
LIMESTONE	137	139
SANDY SHALE	139	165
SANDSTONE	165	223

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM McKee Well Drilling DATE 1-2-76

ADDRESS 61 39TH ST SW Canton Ohio SIGNED Ted McKee

*If additional space is needed to complete well log, use next consecutive numbered form.

CDF012260

WELL LOG AND DRILLING REPORT

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

620668
well log 5

COUNTY Stark TOWNSHIP Canton SECTION OF TOWNSHIP 19

OWNER Edward Moffat ADDRESS 491 R Field Ave S.W Canton Ohio 44708

LOCATION OF PROPERTY 3151 Hackett

CONSTRUCTION DETAILS

Casing diameter 7" Length of casing 65 ft
Type of screen 5" Length of screen 150 ft
Type of pump
Capacity of pump
Depth of pump setting
Date of completion

BAILING OR PUMPING TEST
(specify one by circling)

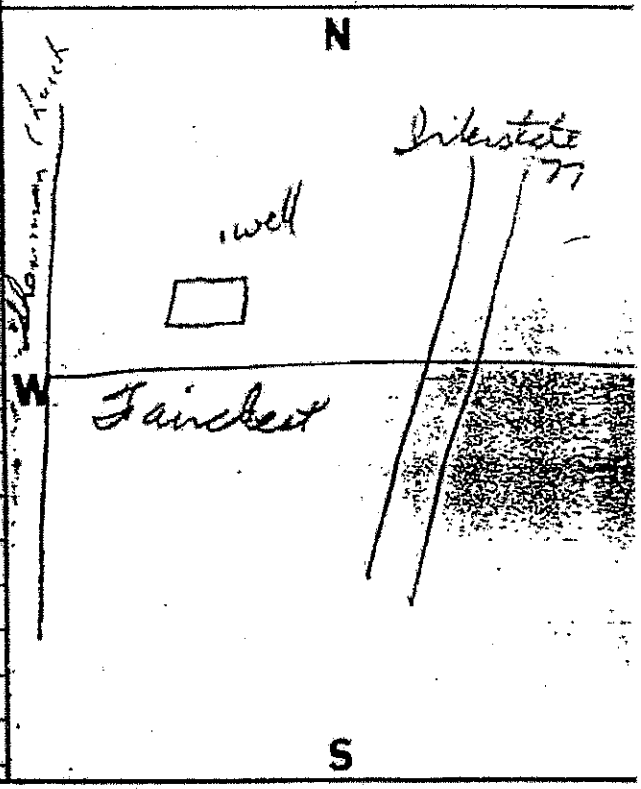
Test rate 15 gpm Duration of test 2
Drawdown [illegible] ft Date Nov 2-82
Static level (depth to water) 60
Quality (clear, cloudy, taste, odor) Clear
Pump installed by

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
drift	0 ft	30 ft
clay	30	65
broken limestone	65	70
shale	70	120
limestone	120	123
shale	123	175
sandrock	175	205
shale	205	215

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM Williams Well Drilling DATE Nov 2-82
ADDRESS 4345 Swaffer Rd Louisville SIGNED Herbert Williams

*If additional space is needed to complete well log, use next consecutive numbered form.

ORIGINAL COPY–ODNR, DIVISION OF WATER, FOUNTAIN SQ., COLS., OHIO 43224

CDF012261

WELL LOG AND DRILLING REPORT

ORIGIN: well log 6

495890

NO CARBON PAPER NECESSARY- SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
Fountain Square
Columbus, Ohio 43224 Phone (614) 466-5344

COUNTY Stark TOWNSHIP Perry SECTION OF TOWNSHIP OR LOT NUMBER Sec. 24

OWNER The Timken Co. Dames & Moore Well No. 7

LOCATION OF PROPERTY Industrial waste ponds south of Gambrinus Steel Mill, Canton, Ohio

CONSTRUCTION DETAILS

Casing diameter 5 1/8" I.D. Length of casing 32 ft.

Type of screen Stainless Steel Length of screen 3 ft.

Type of pump Submersible

Capacity of pump 12 gpm (measured)

Depth of pump setting 34 ft. (bottom)

Date of completion 1/16/80

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 12 gpm Duration of test 0.01

Drawdown 10.28 ft Date 1/17/80

Static level (depth to water) 21.72 Ft. below ground su:

Quality (clear, cloudy, taste, odor) Clear, becoming muddy just prior to dewatering

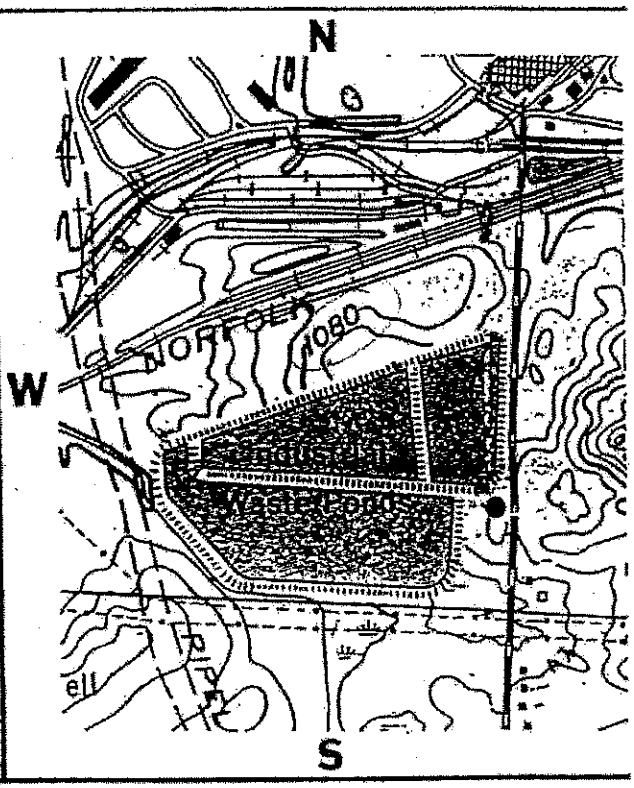
Pump installed by Stockert Drilling Co.

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Silty clay with some gravel, bricks, wire, foundation of old house (fill)	0 ft	5 ft
Medium to coarse sand and fine to medium gravel, clayey	5	20
Medium to coarse sand with some silt, clayey	20	25
Fine to medium gravel with fine to coarse sand, clayey	25	30
Fine to coarse sand, very clayey	30	34 1/2
Gray clay with fine to medium sand (till)	34 1/2	35

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM Stockert Drilling Co.

ADDRESS Strasburg, Ohio 44680

BY: Dames & Moore

Cincinnati, Ohio

*If additional space is needed to complete well log, use next consecutive numbered form.

CDF012262

PRC Environmental Management, Inc.
233 North Michigan Avenue
Suite 1621
Chicago, IL 60601
312-856-8700
Fax 312-938-0118

PRC

35 11

FILED

May 18, 1992

Ms. Jeanne Griffin
Work Assignment Manager
U.S. Environmental Protection Agency
77 West Jackson Boulevard, 5th Floor
Chicago, Illinois 60604

Re: Canton Drop Forge and Manufacturing Company
Site Inspection Prioritization (SIP) Report
Work Assignment No. 35-5JZZ (11)

Dear Ms. Griffin:

PRC Environmental Management, Inc. (PRC), is submitting the above SIP report for your review. PRC has incorporated the report format changes that were verbally requested by U.S. EPA on May 12, 1992.

If you have any questions or comments concerning the enclosed SIP report, please call me at (312) 856-8762.

Sincerely,

Steven S. Clark

Steven S. Clark

Enclosure

cc: Brigitte Manzke, U.S. EPA CO
Carl Norman, U.S. EPA PO
Laura Fay, Ohio EPA

contains recycled fiber and is recyclable

PRC Environmental Management, Inc.
233 North Michigan Avenue
Suite 1621
Chicago, IL 60601
312-856-8700
Fax 312-938-0118

May 18, 1992

Ms. Jeanne Griffin
Work Assignment Manager
Site Assessment Section (HSM - 5J)
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604

RE: Work Assignment No. 35-5JZZ
Expanded Site Inspection Prioritization
Canton Drop Forge and Manufacturing Company
EPA ID No. OHD 004 465 142

Dear Ms. Griffin:

PRC Environmental Management, Inc. (PRC), was tasked by the U.S. Environmental Protection Agency (EPA) under Contract No. 68-W8-0084 to conduct an expanded site inspection prioritization at Canton Drop Forge and Manufacturing Company (CDF) in Canton, Ohio. PRC reviewed EPA and state file material and collected target information from local agencies. This letter report summarizes the site history, results of the EPA screening site inspection (SSI), and information relevant to the ground-water, surface water, soil, and air pathways. References are listed in Attachment A.

Site Background

The CDF site is an active drop forge and manufacturing plant that currently manufactures parts for airplane, locomotive, and off-road transportation. The site is located at 4575 Southway Street, Stark County, Canton, Ohio. The manufacturing plant occupies 6 of the site's 25 acres of land. An on-site landfill for wastes generated from manufacturing operations is located on 8 acres of the site. The remaining 11 acres of the site are used as parking and storage areas for the materials used in the manufacturing process [Ecology & Environment, Inc. (E & E), 1991]. Adjacent land use is primarily light industrial and residential. A 4-mile radius map of the CDF site is provided in Attachment B.

The CDF plant began operation in 1945. From 1945 to 1950, the site was owned by the United States Army Air Corps (US AAC) and operated by CDF. During that time, the manufacturing plant forged airplane propeller hubs for the US AAC. It is not known what the surrounding land was used for, nor who owned the site prior to 1945. In 1950, CDF bought the site from US AAC and continued on-site operations. In 1981, the Corder Group bought the CDF site and is currently the site owner and operator (E & E, 1991).

From 1950 to the present, various parts for airplane, locomotive, and off-road transportation have been manufactured on site. The manufacturing process, called drop forging, begins with the selection of feedstock. Feedstocks are composed of different types of steel alloys, such as carbon, nickel, and titanium. The feedstock is first cut to size and heated to between 1,700 to 2,400°F. A steam-driven hammer forges pieces of feedstock into the desired shapes, as

contains recycled fiber and is recyclable

formed by a die. Lubricating oils are used to coat the dies. The drop-forged product may then be heat-treated and cooled by quench oils or cleaned by shot blasting or grit cleaning. Prior to 1981, pickle liquor was used to scale the steel. A small amount of grinding may be performed, or the product may be quality-tested. Tests performed on the product include magnaflux and zyglow tests, which are nondestructive. The final product is then shipped to the customer (E & E, 1991).

Waste Disposal Practices

Various waste disposal practices were used at the CDF site, including on- and off-site landfilling, collection of process water and lubricating oils in lagoons, and waste oil and sludge reclamation. Waste disposal areas are shown in Figure 1 of Attachment C.

The on-site landfill was licensed by the Stark County Health Department (SCHD) in June 1976. The exact date the landfill began operating is not known. CDF closed the landfill in 1979, because the landfill had reached its capacity. The on-site landfill was approximately 8 acres in size and was located in a natural depression east of the plant buildings. The landfill consisted of two zones, Zone A and Zone B. Zone A was closed in 1978, and Zone B closed in 1979. However, file information indicates that Zone B was still being used in late 1981. An active scrap and salvage area is located in the middle of the landfill area. This area is used to store scrap metal, old machinery, and other salvageable materials. CDF sells scrap whenever the market price is high (E & E, 1991).

Wastes were disposed of in the unlined, on-site landfill by dumping and bulldozing, before being covered. Cover material for the landfill consisted of by-products from site operations, including slag, ash, lime-soda softener sludge, and demolition wastes. According to Jerome P. Bressanelli, President of CDF, the landfill was covered with a clay cap of unknown thickness. Zone A of the landfill was used to dispose of waste oil in 55-gallon drums, brick and concrete demolition wastes, slag, ash, lime-soda softener sludge, boiler stack scrubber sludge (gypsum), floor sweepings, trash, and rags. Zone B of the landfill was used to dispose of demolition wastes, concrete, and unspecified nonhazardous wastes. Other wastes generated on site were hauled off site by waste transporters (E & E, 1991).

Three man-made, unlined, active lagoons at the CDF site are used to collect and treat plant process wastewater. Process wastewater containing spent lubricating oil is first dumped into Lagoon No. 1 (located in the southwest corner of the site). Oil is then skimmed off and collected in a 2,000-gallon tank. Process wastewater is then pumped via an underground pipe to Lagoon No. 2, where any remaining oil is skimmed off. Waste oil from Lagoon No. 2 is collected in two, 2,000-gallon tanks. Finally, process wastewater is pumped through another underground pipe to Lagoon No. 3 for evaporation and infiltration into the ground. Each lagoon has an area of approximately 314 square feet (E & E, 1991).

Beginning in 1976, SCHD and the Ohio Environmental Protection Agency (OEPA) required CDF to file solid waste disposal operation reports for the on-site landfill and to apply for a landfill license. On August 8, 1980, CDF submitted a Resource Conservation and Recovery Act (RCRA) 3001 Notification as a Generator of Hazardous Waste for its quench oil sludge (F010). The quench oil sludge was later reclassified to include only those oils that contain cyanide. The quench oil used on site in the manufacturing process does not contain cyanide (E & E, 1991).

drinking water wells use both the glacial sand and gravel deposits and the bedrock sandstones. Well-logs indicate that no continuous confining layer exists within a 2-mile radius of the site. Therefore, the two systems are considered hydraulically connected.

All populations within the 4-mile radius of the CDF site are served by drinking water wells. However, municipal well fields for the surrounding communities of Canton, Perry, and Massillon are all outside the 4-mile radius of the CDF site (Massillon Water Department, 1992; Canton Water Department, 1992). Thus, targets of ground-water contamination from CDF are those persons who use private wells within a 4-mile radius of the CDF site. The nearest private residential well is within 200 feet of the CDF site. Based on a topographic map house count (United States Geological Survey, 1971) and on a Stark County average of 2.58 persons per household (United States Census Bureau, 1992), the following population distribution was estimated:

Radial Distance From CDF Site	Population Using Residential Well Water
0 - 1/4 mile	44
1/4 - 1/2 mile	105
1/2 - 1 mile	477
1 - 2 miles	748
2 - 3 miles	1819
3 - 4 miles	2712

The total estimated population using ground-water is approximately 5,905 people.

Two wells are located on-site. One well is used to provide steam for production. The other well is used to provide drinking water for the 378 on-site workers (Nordine, 1992). These workers may be subject to contamination. However, without sampling, this information cannot be verified. This information gap should be addressed.

An observed release to ground-water is suspected for a multitude of reasons. These reasons include that:

- Wastes were disposed of on site in three unlined lagoons and one unlined landfill.
- 15 to 20 drums of used lubricants were buried along the edge of Lagoon No. 2; OEPA inspectors observed some drums to be leaking.
- Other sources could potentially contaminate the ground-water including three 2,000-gallon oil storage tanks and the scrap and salvage pile.
- The on-site hazardous waste quantity is large.
- The sources have been in use for many years.
- The soils in the CDF area are highly permeable.
- The aquifer in the area is shallow at only 24 feet below surface level.

Soil Pathway

No incidents of direct contact with contaminants at the CDF site have been documented. The site is completely fenced and protected by a guard 24 hours per day. However, the 378 employees who work on-site could potentially come into direct contact with surficial contamination. Furthermore, residences are located within 200 feet south and north of the observed on-site contamination.

Previous Investigations

OEPA inspected the CDF site on June 30, 1983, in response to a anonymous complaint regarding buried drums and sludges. OEPA officials observed 15 to 20 partially exposed and leaking drums buried along the edges of Lagoon No. 2. CDF reported that the drums had been buried in the late 1960s. OEPA recommended that CDF cover the sides of Lagoon No. 2 with 2 feet of compacted clay (E & E, 1991). The fate of these drums is unknown. This was the only enforcement action taken until the OEPA preliminary assessment in 1985 and the SSI in 1990.

On May 16, 1990, the EPA Field Investigation Team (FIT) conducted an SSI at the CDF site. EPA FIT collected six on-site soil and three on-site lagoon sediment samples. Sampling locations are identified in Figure 2 of Attachment C. All soil and lagoon sediment samples were collected at a depth of 2 to 6 inches. Soil sample S9, the designated background sample, was collected from an on-site grassy area, located between the office and the manufacturing buildings (E & E, 1991).

Analytical results are summarized in Attachment D. EPA Contract Laboratory Program analysis revealed contaminants in some soil and lagoon sediment samples at elevated levels above background (concentrations greater than 3 times the background concentration). In particular, polynuclear aromatic hydrocarbons (PAH) were detected. Other contaminants included the following:

- Xylenes (total) [140 micrograms per kilogram (µg/kg)]
- Benzoic acid (1,400 µg/kg)
- Fluorene (430 µg/kg)

Compounds identified may be attributed to the site. These compounds include xylene, which may be a component of metal cleaning solvents used by CDF on site. Numerous tentatively identified compounds (TIC) were also detected in all samples. TICs included PAHs and components of fuel oil. The following heavy metals were detected:

- Antimony [50.6 milligrams per kilogram (mg/kg)]
- Barium (1,790 mg/kg)
- Chromium (405 mg/kg)
- Copper (1,490 mg/kg)
- Lead (1,130 mg/kg)
- Nickel (1,550 mg/kg)
- Selenium (25.3 mg/kg)

The heavy metals detected are iron alloys and are consistent with site-related activities.

Ground-Water Pathway

The geology of the CDF site consists of outwash, or till, that overlies sedimentary bedrock. The outwash is an unsorted, unstratified mixture of sand, silt, and clay containing pebbles, cobbles, and boulders deposited during the Wisonsinan age of the Pleistocene Epoch. Bedrock in the area consists of sedimentary rock such as shales and sandstones, deposited during the Pennsylvanian Period. Well logs of the area indicate that clay may appear in some areas as discontinuous lenses and layers in the sand and gravel. Area well logs indicate the depth to ground-water to be approximately 24 feet below ground surface in the sand and gravel layers. Where saturated, these sand and gravel deposits are used as a source of drinking water. Well logs for the site area indicate that bedrock wells draw from water-producing sandstones. Private

Air Migration Pathway

The air migration pathway was evaluated because the CDF site is located in a heavily populated area. The nearest residence is within 200 feet south and north of the CDF site. Furthermore, there are 378 workers on-site every day. However, it appears that very little potential exists for contaminants to be released to the air. Although analytical results of samples taken during the SSI indicated soil contamination in the top 1 foot of landfill cover, the landfill has been capped and should retard any potential air migration of contaminants from the site.

Surface Water Pathway

Several water bodies are located within a 4-mile radius of the CDF site. Sippo Lake, Lake Meyers, and Hurford Run are all located within 2 miles of the site. They are used for recreational purposes, including fishing. Some water-filled gravel pits are also located within 2 miles of the site. However, contaminants from the CDF site are not expected to have the potential to migrate to surface water in the area, because the site is relatively flat and is located in a natural depression relative to the surrounding land. Surface water runoff from the site most likely would be diverted by intervening streets and railroads before reaching the nearby lakes. The CDF site is not located in a floodplain.

If you have any questions or need further information or clarification, please contact me at (312) 856-8762 or Tonia C. Garbowsky at (312) 856-8768.

Sincerely,

Steven S. Clark
Project Manager

Attachments (4)

cc: Laura Fay, Ohio EPA

ATTACHMENT A

REFERENCES

REFERENCES

Canton Water Department, 1992, Telephone Conversation with Tonia C. Garbowsky, PRC Environmental Management, Inc. (PRC), (April 22).

Ecology & Environment, Inc. (E & E), 1991, Screening Site Inspection Report for Canton Drop Forge, Canton, Ohio.

Masillon Water Department, 1992, Telephone Conversation with Tonia C. Garbowsky, PRC, (April 22).

Nordine, J., 1992, John Nordine, E & E, Telephone Conversation with Tonia C. Garbowsky, (May 8).

United States Census Bureau, 1992, Chicago Office Bureau Representative, Telephone Conversation with Tonia C. Garbowsky, PRC, Regarding Population Per Household Based on the Stark County Ohio, 1990 Census (May 12).

United States Geological Survey (USGS), 1971, Topographical Map of Canton, Ohio.

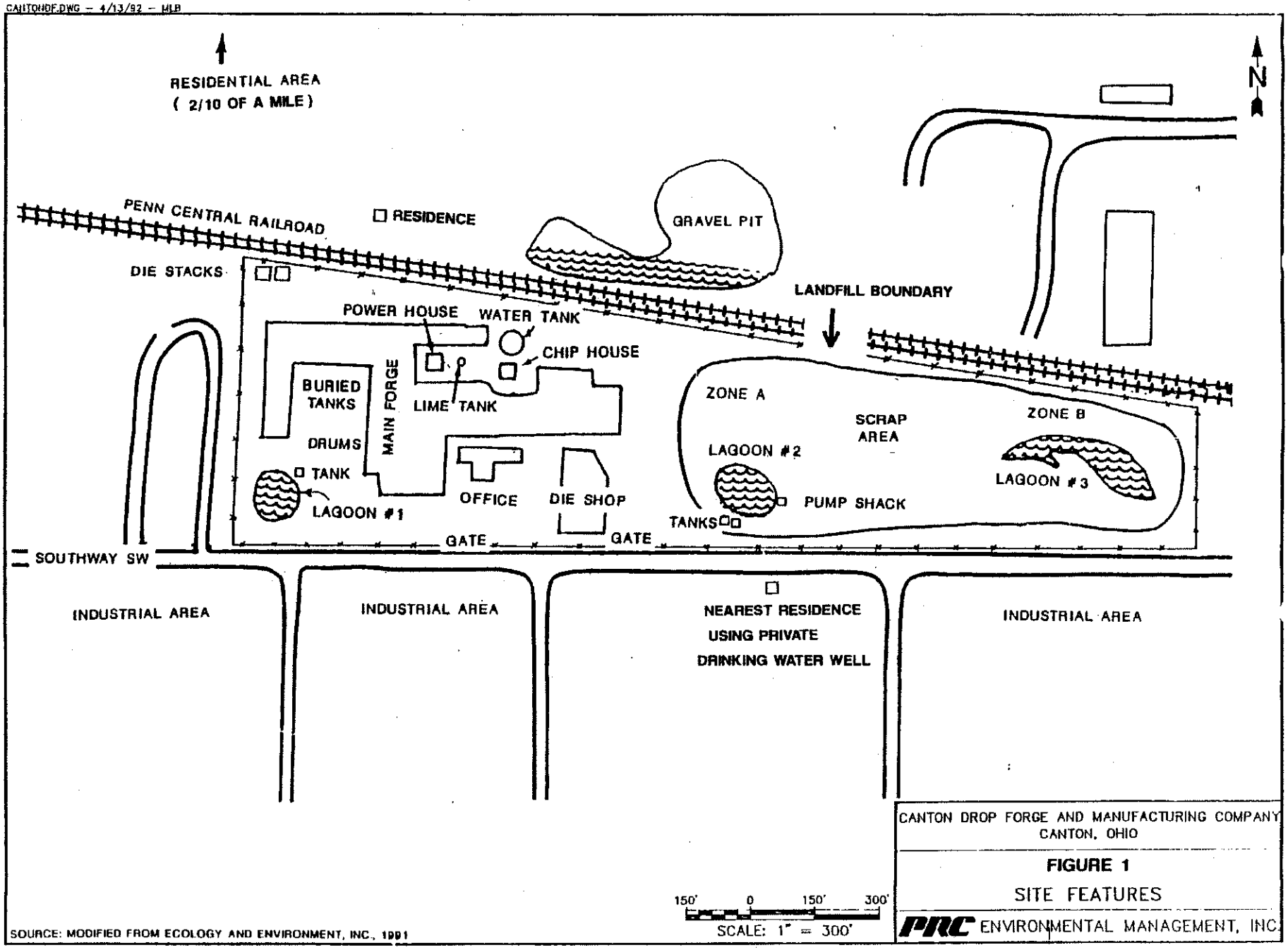
ATTACHMENT B

SITE 4-MILE RADIUS MAP

ATTACHMENT C

SAMPLING LOCATIONS

CANTONDF.DWG – 4/13/92 – MLB



SOURCE: MODIFIED FROM ECOLOGY AND ENVIRONMENT, INC., 1991

CANTON DROP FORGE AND MANUFACTURING COMPANY
CANTON, OHIO

FIGURE 1

SITE FEATURES

PRC ENVIRONMENTAL MANAGEMENT, INC.

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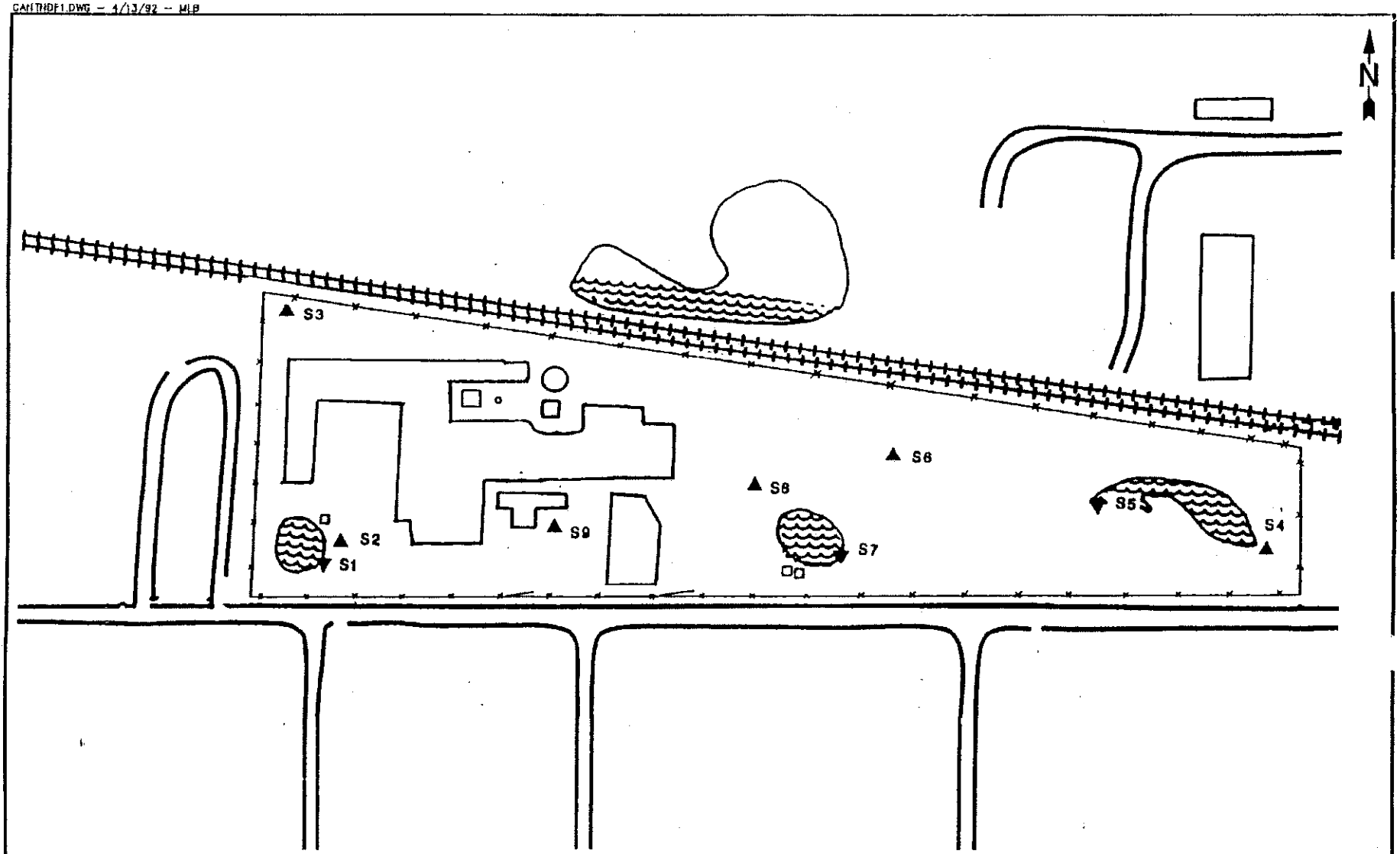
CANTHDF1.DWG – 4/13/92 – MLB



LEGEND

▲ SOIL ▼SEDIMENT

150' 0 150' 300'

SCALE: 1" = 300'

SOURCE: MODIFIED FROM ECOLOGY AND ENVIRONMENT, INC., 1991

CANTON DROP FORGE AND MANUFACTURING COMPANY
CANTON, OHIO

FIGURE 2

SOIL AND SEDIMENT SAMPLING LOCATIONS

PRC ENVIRONMENTAL MANAGEMENT, INC.

CDF012274

ATTACHMENT D

ANALYTICAL SAMPLING RESULTS

Table 4-1
RESULTS OF CHEMICAL ANALYSIS OF
FIT-COLLECTED SOIL/SEDIMENT SAMPLES

Sample Collection Information and Parameters	Sample Number S1	S2	S3	S4	S5	S6	S7	S8	S9
Date	5/16/90	5/16/90	5/16/90	5/16/90	5/16/90	5/16/90	5/16/90	5/16/90	5/16/90
Time	1130	1145	1235	1330	1335	1400	1440	1450	1315
CLP Organic Traffic Report Number	EEN53	EEN54	EEN55	EEN56	EEN57	EEN58	EEN59	EEN60	EEN[illegible]
CLP Inorganic Traffic Report Number	MEE053	MEE054	MEE055	MEE056	MEE057	MEE058	MEE059	MEE060	MEE061
Compound Detected (values in µg/kg)									
Volatile Organics									
methylene chloride	--	--	--	--	45B	--	--	--	--
1,1,1-trichloroethane	--	20J	--	--	--	--	--	--	--
toluene	--	38J	--	--	--	--	--	--	--
ethylbenzene	--	17J	--	--	--	--	--	--	--
xylenes (total)	--	140J	--	--	--	--	--	--	--
Semivolatile Organics									
benzoic acid	--	--	--	1,100J	--	620J	1,400J	--	--
naphthalene	--	830	--	--	--	580	--	--	--
2-methylnaphthalene	--	--	--	--	--	990	--	--	--
fluorene	--	430	--	--	--	--	--	--	--
phenanthrene	--	1,200	--	--	--	1,000	4,000	--	--
di-n-butylphthalate	--	680	--	--	--	--	--	--	--
fluoranthene	--	--	--	--	--	850	--	--	770
pyrene	--	530	--	--	--	1,100	--	--	690
benzo[a]anthracene	--	--	--	--	--	460	--	--	390J
chrysene	--	--	--	740J	--	730	1,500	--	70
bis(2-ethylhexyl)phthalate	--	--	--	--	840	--	--	--	--
benzo[b]fluoranthene	--	--	--	--	--	450J	--	--	310J
benzo[k]fluoranthene	--	--	--	--	--	--	--	--	280J
TICs†									
hexanone,4-ethyl-2-methyl (3074-75-7)	20J	--	--	--	--	--	--	--	--
benzene,1-ethyl-3-methyl (620-14-4)	--	200J	--	--	--	--	--	--	--
benzene,1,3,5-trimethyl (108-67-8)	--	100J	--	--	--	--	--	--	--
11H-benzo[a]fluorene (238-34-6)	--	--	--	--	--	400J	--	--	--
phenanthrene,2,5-dimethyl (3674-66-6)	--	--	--	--		400J	--	--	--
benzo[j]fluoranthene (205-82-3)	--	--	--	--	--	--	--	--	400J
benzo[e]acephenanthrylene (205-99-2)	--	--	--	--	--	--	--	--	400J

CDF012276

Table 4-1 (Cont.)

Sample Collection Information and Parameters	Sample Number S1	S2	S3	S4	S5	S6	S7	S8	S9
naphthalene,1,3-dioxthyl (575-41-7)	--	--	--	--	--	400J	--	--	--
decane (124-18-5)	100J	800J	--	--	--	--	--	--	--
nonane,2,6,-dimethyl- (17302-28-2)	60J	200J	--	--	--	--	--	--	--
hexane,2,3,4-trimethyl- (921-47-1)	--	100J	--	--	--	--	--	--	--
decane,3-methyl- (6975)	--	100J	--	--	--	--	--	--	--
undecane,4,7,-dimethyl- (17301-32-5)	6,000J	10,000J	--	--	--	--	--	--	--
undecane,2-methyl- (7045-71-8)	2,000J	--	--	--	--	--	--	--	--
octane,2,3,7-trimethyl (62016-34-6)	4,000J	4,000J	--	--	--	--	--	--	--
hexadecane (544-76-3)	5,000J	9,000J	--	--	--	--	1,000J	3,000J	--
dodecane,2,7,10-trimethyl- (74645-98-0)	1,000J	--	--	--	--	--	--	--	--
sulfur, mol. (S8) (10544-50-0)	--	--	1,000J	--	--	2,000J	--	--	--
2(5H)-furanone,5,5-dimethyl (20019-64-1)	--	--	2,000J	--	--	--	--	--	--
2-cyclohexen-1-one (930-68-7)	--	--	--	1,000J	--	--	--	--	--
ethanone, 1-phenyl- (98-86-2)	--	--	--	700J	--	--	900J	--	--
heptadecane (629-78-7)	--	--	--	--	--	--	2,000J	1,000J	--
Analyte Detected (values in mg/kg)									
aluminum	2,180	2,730	11,100	12,400	9,860	2,500	9,780	2,710	11,500
antimony	14.2BNJ	16.8NJ	8BNJ	--	8.7BNJ	6.5BNJ	--	50.6NJ	11.4B
arsenic	32.7AJ	19.9BWAJ	27.3AJ	28.4AJ	37.6AJ	29.5WAJ	16.6AJ	35.6AJ	19.3+
barium	48.7B	11.3B	413	252	415	1,790	197	50.1	121
beryllium	0.26B	--	1.5	0.59B	0.92B	--	--	--	0.41
cadmium	--	--	1B	--	--	--	--	--	--
calcium	8,210	625B	4,360	11,200	4,460	7,120	2,530	4,030	3,670
chromium	247	251	72.9	32.7	40.6	220	53.8	405	37.9
cobalt	25NJ	40.2NJ	23.4NJ	16.9NJ	12.7BNJ	23.3NJ	10.9BNJ	62.3NJ	16
copper	562EJ	1,490EJ	79.3EJ	39.2EJ	106EJ	125EJ	87.7EJ	572EJ	31.6
iron	67,800	124,000	45,300	31,800	26,200	73,600	26,300	114,000	30,500
lead	19.1	3WJ	57.2	31.5	65.4	76	71.6	1,130+J	61.6
magnesium	1,770	208B	1,640	3,320	2,210	399B	1,680	758	2,410
manganese	755	1,110	3,060	612	242	337	409	1,050	1,140

CDF012277

ble 4-1 (Cont.)

ple Collection Information d Parameters	Sample Number S1	S2	S3	S4	S5	S6	S7	S8	S9
rcury	--	--	--	0.21	0.27	0.16	--	--	0.15
ckel	1,200	1,320	149	67.2	110	219	208	1,550	69.2
tassium	259B	--	804B	1,450B	915B	628B	987B	261B	1,7
lenium	--	--	--	3.6	25.3	0.79BWJ	--	--	0.5
lver	--	1.5B	--	--	--	1.3B	--	--	--
dium	34.3B	189B	89.3B	122B	202B	120B	32.4B	120B	78.5B
llium	--	--	--	--	5.1	0.73BWJ	--	--	--
nadium	10.2B	6B	30.7	30.1	34.3	19.1	22.7	23.4	25.5
nc	97.4	36.1	136	160	132	68	69.7	107	114
yanide	--	--	1.3	--	--	--	--	--	--

- Not detected.
TIC Chemical Abstracts Service (CAS) numbers, if available, are provided in parentheses.

CDF012278

COMPOUND QUALIFIER	DEFINITION	INTERPRETATION
J	Indicates an estimated value.	Compound value may be semiquantitative.

ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
E	Estimated or not reported due to interference. See laboratory narrative.	Analyte or element was not detected, or value may be semiquantitative.
N	Spike recoveries outside QC protocols, which indicates a possible matrix problem. Data may be biased high or low. See spike results and laboratory narrative.	Value may be quantitative or semi-quantitative.
*	Duplicate value outside QC protocols which indicates a possible matrix problem.	Value may be quantitative or semi-quantitative.
B	Value is real, but is above instrument DL and below CRDL.	Value may be quantitative or semi-quantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.
W	Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is <50% of spike absorbance.	Value may be semiquantitative.

CDF012279

ESI PRIORITIZATION QUESTIONNAIRE
FOR THE
CANTON DROP FORGE AND MANUFACTURING COMPANY IN CANTON, OHIO

ESI PRIORITIZATION QUESTIONNAIRE

Site Name: Canton Drop Forge & Manufacturing Company ID No. OHD004465142
Date Prepared: April 3, 1992 Prepared By: Tonia C. Garbowsky
Site Location: Canton, Stark County, Ohio (SW1/4NE1/4, sec. 13, T.10N, R.9W.)

Brief Site History: See Attached - Section 2.0 of the Screening Site Inspection (E & E, 1991)

SUPERFUND PRELIMINARY ASSESSMENT

PA Date (State): June 6, 1985 PA Rating: low

Hazardous Substances of Concern:
N/A

Migration Pathway(s) of Concern:
N/A

Type of Documentation of Hazardous Substances:
N/A

SUPERFUND SITE INSPECTION

Date of Inspection (FIT): May 16, 1990

Migration Pathways Investigated:
SOIL - Eight on-site soil and sediment samples were collected; one background soil sample was collected.

Type/Contaminants of Concern Found for Each Migration Pathway:
Target compound list compounds and target analyte list analytes were detected in on-site soil and lagoon sediment samples, and included xylenes, phenanthrene, chromium, and nickel. Furthermore, several tentatively identified compounds were also detected.

Data Gaps/Migration Pathways Not Investigated:
Ground water, air, surface water

Superfund HRS Score: N/A Actual SI Score: N/A Project HRS Score: See Other Attachment

CDF012281

TARGET POPULATION:

Distance to nearest public water supply source (well) Greater than 4 miles
Distance to nearest private water supply source On site

Provide population estimates for the following pathways:

Ground Water

0 - 1/4 mile	422
1/4 - 1/2 mile	105
1/2 - 1 mile	477
1 - 2 miles	749
2 - 3 miles	1819
3 - 4 miles	2712

Soil Exposure

On Site	378 (workers)
0 - 1/4 mile	500
1/4 - 1/2 mile	2000
1/2 - 1 mile	9000

Air

0 - 1/4 mile	878
1/4 - 1/2 mile	2000
1/2 - 1 mile	9000
1 - 2 miles	12000
2 - 3 miles	12000
3 - 4 miles	12000

Surface Water

Distance to nearest intake N/A Population served N/A
Total population served within 15 miles downstream N/A
Distance to nearest fishery about 1.9 miles Name Sippo Lake
Distance to nearest sensitive environment N/A Type N/A
Distance to nearest perennial surface water body N/A Type N/A

OTHER (NON-SUPERFUND) SITE INSPECTION ACTIVITIES (OTHER PROGRAMS):

Migration Pathways Investigated: N/A

Types/Contaminants of Concern Found for Each Migration Pathway:
N/A

Is there PRP/State RI/FS or other remediation underway? (Describe):
No

STATE COMMENT/REMEDIATION (to be completed by State):

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2. SITE BACKGROUND

2.1 INTRODUCTION

This section presents information obtained from SSI work plan preparation, the site representative interview, and the reconnaissance inspection of the site.

2.2 SITE DESCRIPTION

The CDF site is an active drop forge and manufacturing plant that currently manufactures parts for airplane, locomotive, and off-road transportation. The site is located at 4575 Southway SW, Stark County, Canton, Ohio (SW1/4NE1/4, sec. 13, T.10N., R.9W.). The CDF site is located in a manufacturing and urban area of Canton (see Figure 2-1 for site location). The CDF site is approximately 25 acres in size. The manufacturing plant occupies 6 of the site's 25 acres of land. An on-site landfill for manufacturing-derived wastes is located on 8 acres of the site. The remaining 11 acres of the site are used as parking and storage areas.

A 4-mile radius map of the CDF site is provided in Appendix A.

2.3 SITE HISTORY

The Canton Drop Forge and Manufacturing plant began operation in 1945. The site was owned by the United States Army Air Corps (U.S. AAC). Canton Drop Forge and Manufacturing operated the site for U.S. AAC. The manufacturing plant forged airplane propeller hubs. It is not known what the land was used for, nor who owned the site prior to U.S. AAC (Bressanelli et al. 1990).

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In 1950, Canton Drop Forge and Manufacturing bought the site from U.S. AAC and continued on-site operations. In 1981, the Corder Group bought the CDF site and is the current site owner and operator (Bressanelli et al. 1990).

From 1950 to the present, various drop-forged parts for airplane, locomotive, and off-road transportation have been manufactured on-site. The manufacturing process, called drop forging, begins with the selection of feedstock. The feedstocks are composed of different types of steel alloys, such as carbon, nickel, and titanium. The feedstock is then cut to size and heated to 1,700 to 2,400° F. A steam-driven hammer forges the piece into the desired shape as formed by a die. Lubricating oils are used to coat the dies. The drop-forged product may then be heat-treated and cooled by quench oils or cleaned by shot blasting or grit cleaning. Prior to 1981, pickle liquor was used for scaling the steel. A small amount of grinding may be done on the product, or the product may be quality-tested. The tests performed on the product are magnaflux or zyglov, which are described as nondestructive. The product is then shipped to the customer (Bressanelli et al. 1990).

The on-site plant currently has 40 air permits for various plant operations (Bressanelli et al. 1990). Appendix B includes the various permit numbers, descriptions, issuing dates, and expiration dates.

Various waste disposal practices were used at the CDF site, including on- and off-site landfilling, collection of process water and oils in lagoons, and the reclaiming of waste oils and sludge.

The on-site landfill was licensed by the Stark County Health Department (SCHD) in June 1976 (Bozerke 1977). The license number is not known. It is not known when the landfill began operating. Canton Drop Forge and Manufacturing closed the landfill in 1979 because it had reached its capacity. The on-site landfill was approximately 8 acres in size and was located in a natural depression east of the plant buildings. The landfill was divided into two zones, Zone A and Zone B. A scrap and salvage area was located in the middle of the landfill. Zone A was closed in October 1978, and Zone B in 1979 (Bressanelli et al. 1990). According to file information, a discrepancy exists regarding

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the closing date of Zone B. File information indicates that the landfill was still being used in late 1981. Canton Drop Forge and Manufacturing petitioned OEPA for an order of exemption under R.C. Section 3734.02(G) for the disposal of brickbats, concrete, and wood pallets on June 3, 1981 (OEPA 1981). OEPA granted the company's petition in a Director's Final Findings and Orders on October 15, 1981 (OEPA 1981a).

The landfilling method used on-site was the dump and cover method. Cover material for the landfill included slag, ash, lime/soda softener sludge, and demolition wastes (Cavender 1978). According to Jerome P. Bressanelli, President of Canton Drop Forge and Manufacturing, the landfill was covered with a clay soil of unknown thickness. Zone A of the landfill was used for the disposal of all wastes generated on-site. These wastes included oil sludge and waste oil in 55-gallon drums, demolition wastes (bricks and concrete), slag, ashes, lime/soda softener sludge, boiler stack scrubber sludge (gypsum), floor sweepings, trash, and rags (Cavender 1978). Zone B of the landfill was used for the disposal of demolition wastes, concrete, and other exempt wastes. These wastes were piled around Lagoon #3, one of three on-site lagoons (Cavender 1978).

In 1981, wastes generated on-site were hauled from the site by the following waste transporters: Buckeye Sanitation of Canton, Ohio (general trash); Carl Pandoli of Canton, Ohio (scrubber sludges); and R. E. Slutz Trucking of Canton, Ohio (ashes). All three transporters dumped at Breitenstine Landfill in Waynesburg, Ohio. Reclaimable oil was picked up by Northway Environmental Services of Ashtabula, Ohio, and was transported to one of three different sites. The sites were located in Harpersfield, Cleveland, and Waynesburg (Breitenstine Landfill), all in Ohio. Pickle liquor was picked up by Industrial Wastes Corporation of New Brighton, Pennsylvania, and dumped at a location in Darlington Township, Pennsylvania (OEPA 1981b). In 1990, wastes generated on-site were hauled from the site by the following waste transporters: Browning Ferris Industries of Akron, Ohio (general trash), and Advance Drain and Sewer of Wooster, Ohio (scrubber sludges) (Bressanelli et al. 1990).

A scrap and salvage area was located in the middle of the landfill area. This area was used to store scrap metal, old machinery, and other

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salvageable materials. The scrap is sold whenever the market price is high (Cavender 1978; Bressanelli et al. 1990).

There are three man-made lagoons at the CDF site that are used to collect and treat plant process water. Used process water containing spent lubricating oil is dumped into Lagoon #1, where some of the oil is then skimmed off the water and collected in a 2,000-gallon tank. The lubricating oil is used to lubricate dies (Bressanelli et al. 1990). The water is then pumped via an underground pipe to Lagoon #2, where the rest of the oil is skimmed off the water. The waste oil is collected in two 2,000-gallon tanks. The water is then pumped through another underground pipe to Lagoon #3 for evaporation and infiltration. Lagoon #1 is located in the southwest corner of the site. Lagoons #2 and #3 were excavated from and are located in the landfill area (Cavender 1978). It is not known from what type of material Lagoon #1 was excavated. None of the lagoons were lined (Bressanelli 1990). FIT did not observe any drums in the lagoons at the time of the SSI.

Beginning in 1976, Canton Drop Forge and Manufacturing was required by both SCHD and OEPA to file solid waste disposal operation reports for the on-site landfill and to apply for a landfill license (Bozerke 1977; Cavender 1978; Bressanelli et al. 1990). Canton Drop Forge and Manufacturing submitted a RCRA 3001 Notification as a Generator of Hazardous Waste for its F010 quench oil sludge on August 8, 1980. The F010 quench oil sludge was later reclassified to include only those oils that contain cyanide. The quench oil used on-site in the manufacturing process does not contain cyanide.

The company filed a petition on June 3, 1981, with OEPA requesting an order of exemption under R.C. Section 3734.02(G) for the disposal of brickbats, concrete, and wood pallets in the on-site landfill. OEPA granted the exemption in a Director's Final Findings and Orders on June 15, 1983 (OEPA 1981a).

OEPA conducted a site inspection of the CDF site on June 30, 1983, in response to a complaint regarding buried drums and sludges. OEPA officials observed 15 to 20 partially exposed and leaking drums buried along the edges of Lagoon #2. The drums were buried in the late 1960s. OEPA recommended that Canton Drop Forge and Manufacturing cover the

sides of Lagoon #2 with 2 feet of compacted clay-type material (OEPA 1983). No drums were observed in the pit lagoons during the FIT SSI. The fate of these drums is not known. FIT did not collect any soil samples because the exact location of the exposed drums was not known.

No additional enforcement actions regarding the CDF site had taken place as of the date of the SSI.

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PRELIMINARY
SOIL AND GROUNDWATER ASSESSMENT
OF CANTON DROP FORGE, INC.
4575 SOUTHWAY STREET, SW
CANTON, OHIO

February, 1993

Prepared for:
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Exhibits:

A. R & R International, Inc. - Soil & Groundwater Assessment
B. Environmental Risk Information and Imaging Services - Database

I. INTRODUCTION

Hammontree & Associates, Limited has been retained as a Consultant by Frederick Zollinger, Attorney at Law, to conduct a Phase II environmental assessment of the soil and groundwater on the 30 acre parcel located on the north side of Southway Street, S.W., Canton, Ohio. The purpose of this assessment was to determine the levels of contaminants, if any, on the property at locations at or near the most likely sources of contamination. Of special interest were the industrial lagoons, oily waste, and the area north of Lagoon #2. Wetlands, asbestos, vapor wastes, and other environmental compliance issues were not a part of this study.

II. EXECUTIVE SUMMARY

Hammontree & Associates, Limited after review of environmental information including soils and groundwater analysis has determined that certain environmental issues should be summarized. A list of our comments are as follows:

- The purpose of this summary of a Soil and Groundwater Assessment is to evaluate the environmental soundness of the soil and groundwater within the boundary lines of your facility north of Southway Street, SW, Canton, Ohio.

- Eight (8) monitoring wells were advanced on the site to depths up to 50 feet and found to contain insignificant soil or water contamination. Soil samples for B-5, B-6, and B-8 showed high hydrocarbons ranging from 4400 mg/kg to 6800 mg/kg. No groundwater remediation is indicated, because the total petroleum hydrocarbons are low and no related regulated constituents were found such as BETX.

- Very limited quantities of Polychlorinated Biphenyls (PCB's) were found in the soil at Test Hole B-6 @ 0.31 mg/kg. PCB #1260 was also found on the surface near one of the transformer locations, HB-1, at 0.88 mg/kg. The maximum concentration limit goals (MCLG) = zero (40 CFR 141.50).

- A moderate hydrocarbon odor and sheen was found on MW-8. This test well also indicated a small concentration of hydrocarbons at 34 mg/kg in the groundwater. USEPA and OEPA has no established limit at this time.

- Barium (1.9 mg/l) at MW-8 does not exceed the OEPA limit of 2.0 mg/l although 1.0 mg/l has been used. We believe that this material will be remediated along with the hydrocarbons. USEPA Barium limits are referenced below:

  40 CFR 141.11: MCL = 1.0 mg/l
  40 CFR 141.62: MCL = 2.0 mg/l
  40 CFR 141.51: MCLG = 2.0 mg/l
  40 CFR 264.94: MCL = 1.0 mg/l

- A water sample from Lagoon #3 was better than current safe drinking water regulations for the metals series, VOC's, and semi-VOC's.

- The area around B-8 should be remediated. Bio-remediation or disposal at a certified landfill are options that are currently available. Additional tests will be required to verify the most economical process to be used.

- The material on the bottom and around the embankments of Lagoons 1 and 2 should be remediated. Bio-remediation or disposal at a certified landfill are options. Additional tests will be required to verify the most economical best process to be used.

- Industrial pretreatment to treat process water is required by Federal Regulations. The closure of Lagoons 1 and 2 will be required as a result if the lagoons are abandoned. The effluent will be discharged to the City of Massillon sanitary sewer system.

III. SCOPE OF SERVICES

Objective

An additional objective of the soil/groundwater Phase II site assessment was to identify, if possible, an impermeable clay/rock layer between the groundwater and any possible contamination. In order to complete this objective and to determine the levels of contamination, if any, the following tasks were performed:

Task 1 - Drilling and Monitoring Well Installation

This work was performed by R & R International (R&R) of Copley, Ohio and coordinated by Hammontree & Associates, Limited (H&A). A total of eight (8) soil borings were advanced utilizing a truck mounted drilling rig at locations shown on the Location Map (see appendix). Soil samples were collected on a continuous basis utilizing a "split-spoon" soil sampling device in accordance with the ASTM D-1586 test method. All drilling and sampling equipment which encounters the soil materials was thoroughly decontaminated using high pressure steam cleaning between each boring location.

The borings were advanced to a depth of approximately seven (7) feet below the first saturated soil interval or rock refusal.

Subsequent to the completion of the drilling operations, monitoring wells were installed in each of the soil borings so that groundwater samples could be recovered for laboratory analysis. Each monitoring well was constructed of two (2) inch (outside diameter) PVC well screen and riser. The monitoring wells were installed as per the recommendations of the U.S. EPA's Technical Enforcement Guidance Document (TEGD). Each monitoring well was supplied with locking covers to prevent un-authorized access. Upon completion, the monitoring wells were properly developed by removing three (3) to five (5) times the calculated well volumes.

All monitoring wells were gauged using an interface probe capable of detecting phase separated hydrocarbons. Groundwater levels were obtained and are accurate to within 0.01 feet. The elevations and locations of all well casings were established by survey thus enabling the preparation of a groundwater surface map showing the local groundwater flow direction.

Soil cuttings and well development water generated during the course of the investigation were staged at the site for subsequent removal and disposal. The scope did not include soil analysis which may be necessary for acceptance of any contaminated soils into an approved sanitary landfill, or any groundwater analysis which may be necessary for acceptance of the development water at a treatment/recycling facility. A cost estimate for the removal and disposal of the soil and groundwater (if necessary) can be prepared at your request.

Task 2 - Soil and Groundwater Sampling

This task was completed by R & R and H & A analyzed sampling requirements for each location. Representative soil materials recovered from each split-spoon sample were promptly placed in laboratory supplied glass jars equipped with Teflon lined lids and tightly sealed. The headspace gas which collects in the sample jar above each soil sample was analyzed using a field calibrated photoionization detector (PID) capable of detecting volatile organic compounds (VOCs). The soil sample field screening was used as an aid in the determination of which of the collected soil samples will be submitted for laboratory analysis. One sample per core drilling was submitted to an outside laboratory service for testing.

Subsequent to monitoring well development activities and after a period of stabilization, groundwater samples were recovered from the installed monitoring wells using a clean teflon bailer. All samples were promptly labeled and placed in an ice-filled cooler for transport to the laboratory. A chain-of-custody form was prepared to document sampling handling from the field to the laboratory. All sampling equipment was properly decontaminated between sampling locations. One water sample per monitoring well was tested by an outside laboratory.

Task 3 - Soil Sample Analysis

H & A coordinated sampling and analyze of all test results. The soil sample from each boring which exhibits the highest concentration of VOCs as determined with the PID was submitted to an independent laboratory for analysis. Soil samples submitted to the laboratory were analyzed for total petroleum hydrocarbons (TPH) - EPA Method 418.1, volatile and semi-volatile organic compounds - Methods SW846-8240 and SW846-8270, polychlorinated biphenyls (PCBs) - Method SW846-8080, the Target Compound List (TCL)of 23 metals - Method SW846-7000 Series, total cyanide - Method SW846-9010, and total recoverable phenolics - Method SW846 -9065.

Task 4 - Groundwater Sample Analysis

H & A coordinated sampling and analyze of all test results. Groundwater samples obtained from the monitoring wells were submitted to an independent laboratory for analysis of total petroleum hydrocarbons (TPH) - EPA Method 418.1, volatile and semi-volatile organic compounds - Methods SW846-8240 and SW846-8270, polychlorinated biphenyls (PCBs) - Method SW846-8080, the Target Compound List of 23 metals - Method SW846-7000 Series, total cyanide - Method SW846-9010, and total recoverable phenolics - Method SW846-9065.

A report prepared by R & R detailing the findings of the investigation was prepared upon receipt of the analytical results. (See Exhibit "A") The report describes the methodologies utilized

during the investigation, reports the results of the analytical testing, and provides any recommendations for additional work.

IV. LOCATION:

The property is located in the Northeast and Southeast Quarters of Section 13, Perry Township, Stark County, Ohio. It is also known as 4575 Southway Street, S.W., Canton, Ohio 44706.

V. DESCRIPTION OF THE PROPERTY:

The property is located in an industrial and manufacturing area west southwest of the Stark County Courthouse in downtown Canton about 3 miles away. The plant, built about 1945, currently supplies forged metal parts to various industries, e.g. aircraft, off-road and locomotive. The site includes about 30 acres north of Southway Street, S.W. Most buildings were constructed originally with a die shop being added in the 1950's.

VI. GEOGRAPHIC/GEOLOGICAL

The ground in the area of the facility is about 1070 feet above mean sea level. The ground elevation around the monitoring wells ranges from 1057.2 at B-5 to 1075.5 at B-8. The general high point of the property is just west of the forge shop and generally slopes in all directions from there. The east part of the property generally drains south towards Southway. However, very little storm water flows off the property or to Lagoon 3 due to Lagoons 1 & 2 being the receptor of the majority of the storm water from the buildings and yard drains.

The majority of the storm drainage in this area both on and off the side percolates into the ground with no clear drainage course for surface run-off. From the Stark County Official Highway Map, it appears that drainage south of the railroad drains south to Hurford Run to the Nimishillen Creek. The area north of the railroad probably drains to Sippo Lake.

According to the Stark County Soils survey the soils are defined as "Urban" . However, the adjacent soils are Canadice silt loam, Bogart silt loams, Chili gravelly loam, Chili silt loam and Conotton gravelly loam. These soils are generally classified as "deep, nearly level to steep, well-drained and somewhat poorly drained soils that have a loamy subsoil; formed mainly in glacial outwash."

The seasonal groundwater table as identified during this assessment had a high point at MW-3 west of the forge shop. The water table generally slopes to the north.

For further geological and groundwater information refer to Exhibit A.

VII. ENVIRONMENTAL ISSUES

Polychlorianted Biphenyls (PCBs): PCBs are associated with electrical transformers, capacitors, and substations. Main transformers are sometimes maintained by the utility company. Three surface locations were sampled for PCBs adjacent to existing outside transformer pads.

HB-1 indicated a concentration of 0.88 mg/kg of Aroclor #1260 PCBs. Also PCB's were identified at B-6 having a concentration of 0.31 mg/kg. The contamination was at about 1 foot and 5 foot,

respectfully. Under 40 CFR 302.4 the reportable quantity for PCBs is 10 pounds. The actual quantity can be determined after an investigation as to the content, if any, in the electrical transformers.

Friable Asbestos: Asbestos was not a part of this assessment. It was reported that Canton Drop Forge has an ongoing abatement program for the removal or encapsulating of the affected areas. Asbestos is regulated under 40 CFR Part 61 and 29 CFR 1910.

Underground Storage Tanks: There are two areas which have underground storage tanks. These tanks are located on Figure 4.1, "Site Plan" of the R & R Report marked Exhibit A. The description of the tank areas is described on page 4 of the R & R Report. Underground storage tanks are regulated by "BUSTR" under OAC 1301:7-9. USEPA regulations are found in 40 CFR Part 280. The existing UST's store quench oil and heating oil.

Hazardous Substances: Canton Drop Forge is on the "1991 Master Site List" published by the Division of Emergency and Remedial Response of Ohio EPA. During our soil and groundwater assessment the following contaminates were discovered:

Soil

Volatile and Semi-Volatile Organic Compounds

Name	Location	Concentration	Regulated Limits
Polychlorinated Biphenyls (PCB's)	B-6	0.31 mg/kg	
	HB-1	0.88 mg/kg	
Total Petroleum Hydrocarbons	B-5	4400 mg/kg	
	B-6	5100 mg/kg	
	B-8	6800 mg/kg	
2 - Butanone (Methyl Ethyl Ketone)	B-1	140 ug/kg	{"TC" Limit=20 mg/l
1, 1, 1 - Trichlorethane	B-3	22 ug/kg	
	B-4	11 ug/kg	
	B-6	110 ug/kg	
	B-8	18 ug/kg	
Tetrachlorethene	B-6	51 ug/kg	
	B-7	26 ug/kg	

	Water		
Name	Location	Concentration	Regulated Limits
Total Petroleum Hydrocarbons	MW-8	34 mg/l	No limit set*
Chloromethane	MW-8	21 ug/l	No limit set
Barium	MW-8	1.9 mg/l	2.0 mg/l (40 CFR 141.51)

*Note: Total Petroleum Hydrocarbons are not regulated under the SDWA, however, constituents of hydrocarbons are, i.e., BETX and were not detected.

It should be noted that all samples mentioned in Exhibit A designated by "S" were taken and analyzed by USEPA.

For other metal concentrations in the groundwater and soil samples refer to the R & R Report Tables 5.5 (pages 31 thru 33) and 5.10 (pages 41 thru 43). The metal concentrations in the soil are within normal background levels according to the US Geological Survey Professional Paper 1270 dated 1984 except for arsenic (170 mg/kg in B-7), Chormium (2000 mg/kg in B-6), and nickel (1800 mg/kg in B-6). The lead in MW-2 was retested and showed below the detection limit.

Industrial Waste Treatment: Presently all domestic waste goes to the Massillon Public Treatment Facility. The industrial waste consisting of oil and other contact water presently is treated in three lagoons. The oil and water (including storm water) is separated in Lagoon #1 and the water is pumped to Lagoon #2. Lagoon #2 receives storm water along with other contact water including boiler blow down. Oil and water are separated with the clean water being discharged to Lagoon #3. Lagoon #3 had no visible oil and the metal series test for Drinking Water yielded no metals above the SDWA Limits. There are no visible discharges pipes from any lagoon to the surface waters of Ohio.

Environmental Database: A database to investigate other environmental issues was implemented through Environmental Risk Information and Imaging Services Report (see Exhibit B). A summary of that information follows:

- Canton Drop Forge is on the 1991 Master List for Ohio (D001 - A solid waste exhibits the characteristic of ignitability)
- Canton Drop Forge is in the CERCLA database
- Canton Drop Forge - EPA ID #OHD004465142
- The report indicated a Court Docket #05-86-0111
- Canton Drop Forge reported a petroleum release on 4/2/90 — CHECK TO SEE IF THIS IS CORRECT

VIII. LIMITATION OF LIABILITY

It is expressly understood that the undersigned has not conducted any detailed engineering studies of the integrity of the facilities or properties. The statements set forth in this assessment are not to be construed as a guarantee or warranty.

IX. STANDARD OF CARE:

The services performed by Hammontree and Associates, Limited for this soil and groundwater Assessment was conducted in a manner consistent with the level of care and skill ordinarily exercised by firms similar to Hammontree and Associates, Limited which are currently providing similar services.

Canton Drop Forge recognizes that subsurface conditions or other field conditions may vary from those encountered at locations where samplings, surveys or other observations are made by Hammontree and Associates, Limited.

X. RECOMMENDATIONS:

The following recommendations are a result of the soil and groundwater assessment:

- Remediate the area in and around B-8 located south of Lagoon #3.
- Separate the industrial waste stream from the storm sewer system.
- Provide an industrial pretreatment system to be discharged to the City of Massillon Public Treatment works.
- Remediate Lagoons #1 & 2 according to OEPA and USEPA regulations (40CFR279.12).
- Consider conversion of Lagoons #1 and #2 to retention or detention basins for storm water.
- If Lagoon #3 overflows its banks, the discharge may require an NPDES Permit.
- Remove PCBs from the soil, if required.

XI. CONCLUSION:

Based on the above stated recommendations, we have concluded that proceeding to a remedial action Phase III is warranted. The tasks can be run concurrently or separately depending on your requirements.

PCB Remediation

- Determine PCB concentrations in transformers for regulatory purposes (40 CFR 761). This will effect the level of effort in any remediation.
- Delineation of Remediation area (Depth and Width)
- Prepare corrective action plan
- OEPA approval (negotiations)
- Implementation of plan (bidding, etc)
- Remediation activities
- Closure report to OEPA
- OEPA Approval

Soil Boring #8

- Delineation of Remediation Area
  (Depth and Width) (On-site only)
- Characterize Waste (Lab & Pilot Studies)
- Feasibility Study and Treatability Study - Remedial Options
- Corrective Action Plan
- OEPA Approval (negotiations)
- Implementation of Plan (bidding, etc.)
- Drain Lagoon #3 to permit remedial activities near the lagoon not to effect the water in Lagoon #3 or vice versa.
- Remedial Activities
  Physical Removal off site, or
  Bio-Remediation
- Evaluation and closures report to OEPA
- OEPA approval

Industrial Pretreatment - Phase I

- Feasibility Report (General Plan)
  Characterization of Waste (Flow)
  Pilot Study
- OEPA Approval (City of Massillon)
- Prepare Plans and Specifications
- OEPA Permit to Install
- Bidding and Construction
- No further action if discharged to Massillon

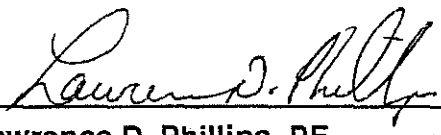
Industrial Pretreatment - Phase II (Lagoon Closure #1 of #2)

- Work plan development
- OEPA negotiation and approval
- Implement work plan - Closure Assessment Report
  Delineation of Remediation Area
  Assessment of problem
- OEPA negotiation and approval
- Feasibility Study and Treatability Study
  Remedial Options
- Corrective Action Plan
- OEPA Approval
- Implementation of Plan (bidding, etc.)
- Drain Lagoons
- Remedial Activities
  Physical removal off site, or
  Bio-Remediation
- Evaluation and closure report to OEPA
- Groundwater Monitoring and follow-up reports
- OEPA Approval

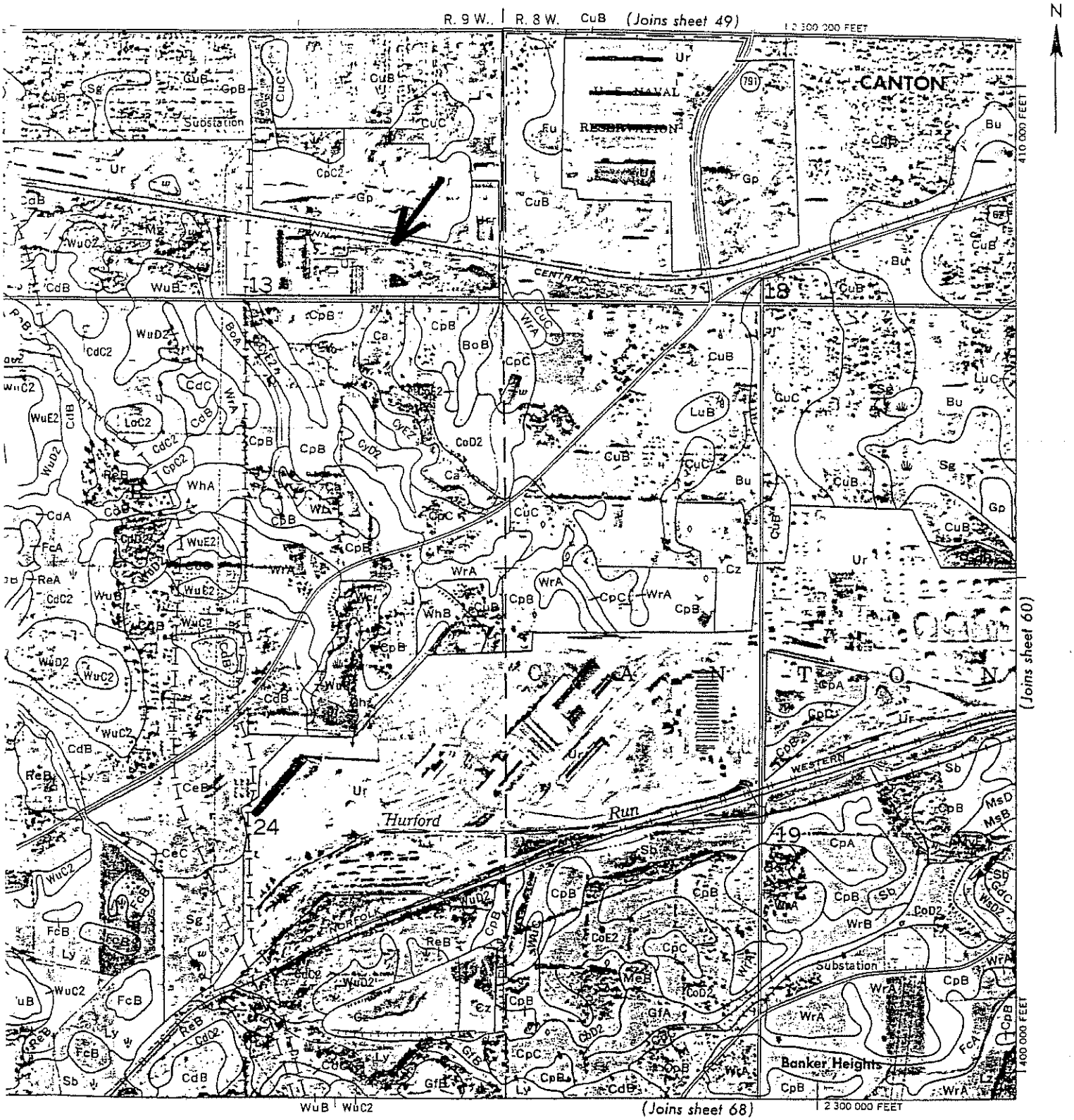
XII. CERTIFICATION:

We hereby certify that to the best of our knowledge and belief,...

- the statements of fact contained in this report are true and correct.
- the reported analyses, opinions, and conclusions are limited only by the reported assump- tions and limiting conditions and are Hammontree and Associates, Limited's unbiased professional analysis, opinion, and conclusions,
- Hammontree and Associates, Limited's compensation is not contingent on an action or event resulting from the analyses, opinions, and conclusions developed in this report,
- we have made an inspection of the property that is the subject of this report,
- this report, to the best of our knowledge, is forwarded as an accurate representation of the site condition at the time reported.



Lawrence D. Phillips, PE.
Partner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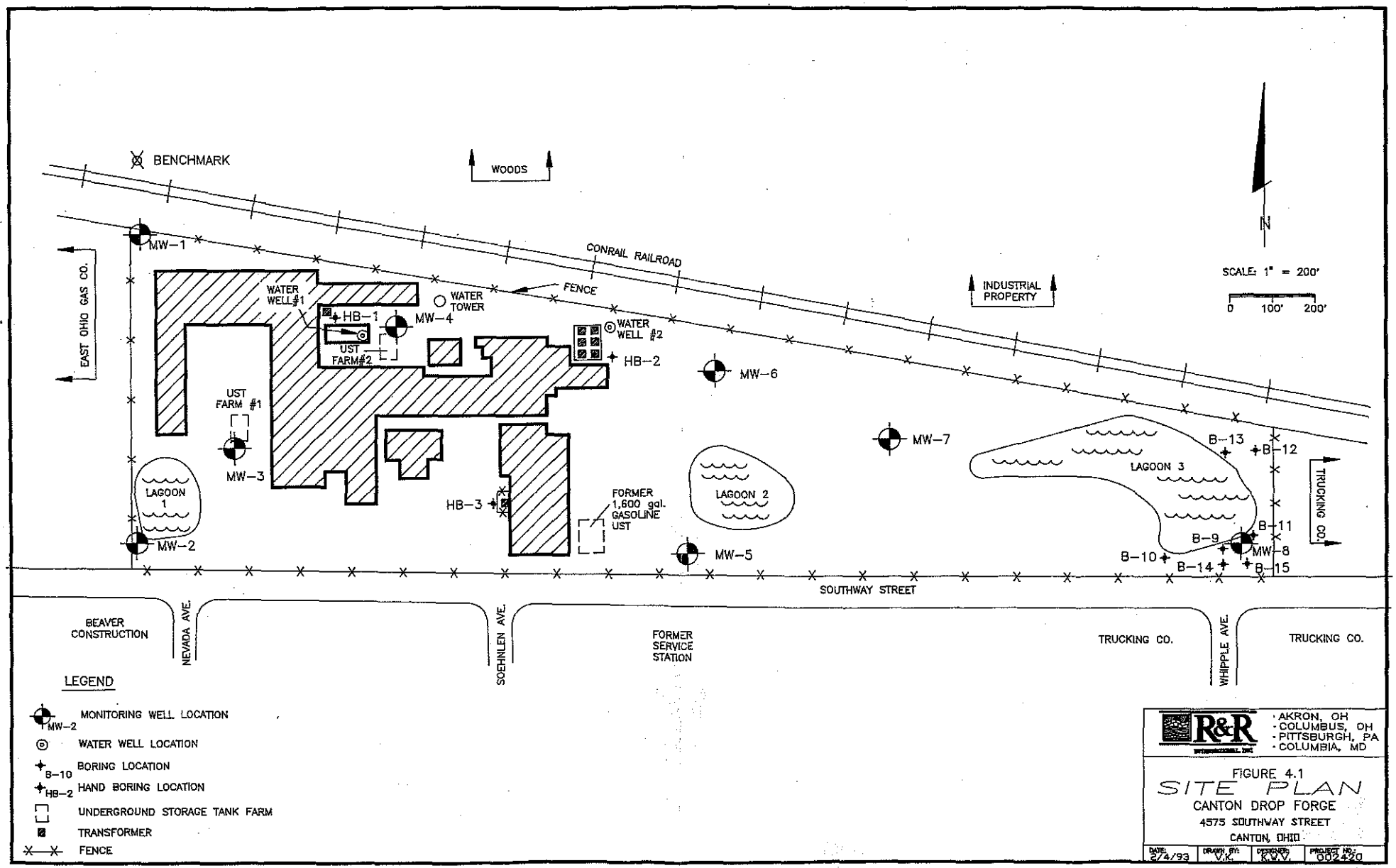

R&R · AKRON, OH · COLUMBUS, OH · PITTSBURGH, PA · COLUMBIA, MD

FIGURE 4.1

SITE PLAN

CANTON DROP FORGE

4575 SOUTHWAY STREET

CANTON, OHIO

DATE:	DRAWN BY:	DESIGNED:	PROJECT NO.:
2/4/93	V.K.	K.W.V.	002420

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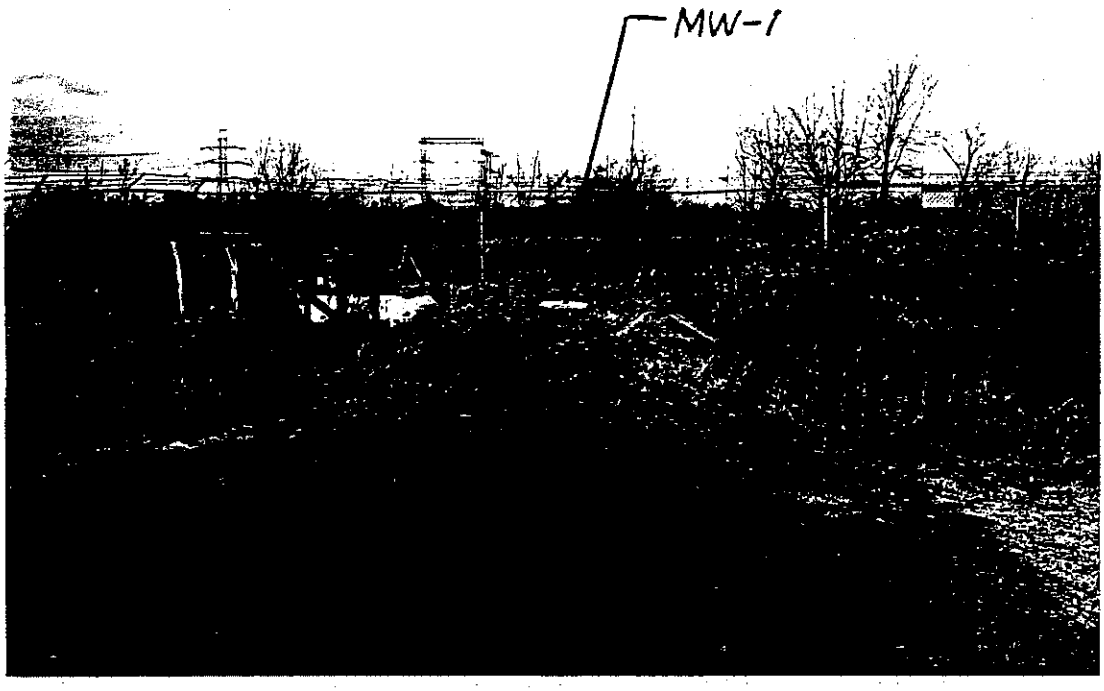

MW-1 LOOKING NORTH

B-2 LOOKING SOUTH

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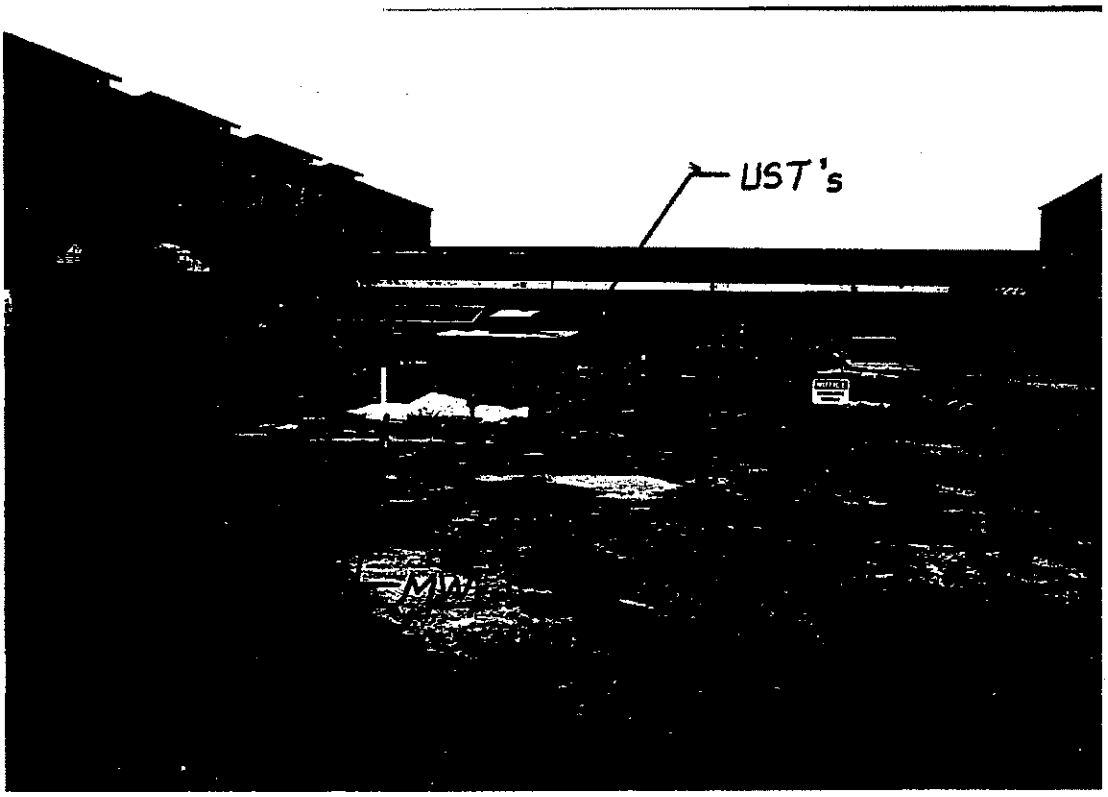
MW-2 LOOKING WEST



MW-3 LOOKING NORTH

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PRELIMINARY
SOIL AND GROUNDWATER ASSESSMENT
OF CANTON DROP FORGE, INC.
4575 SOUTHWAY STREET, SW
CANTON, OHIO

February, 1993

Prepared for:
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I. INTRODUCTION

Hammontree & Associates, Limited has been retained as a Consultant by Frederick Zollinger, Attorney at Law, to conduct a Phase II environmental assessment of the soil and groundwater on the 30 acre parcel located on the north side of Southway Street, S.W., Canton, Ohio. The purpose of this assessment was to determine the levels of contaminants, if any, on the property at locations at or near the most likely sources of contamination. Of special interest were the industrial lagoons, oily waste, and the area north of Lagoon #2. Wetlands, asbestos, vapor wastes, and other environmental compliance issues were not a part of this study.

II. EXECUTIVE SUMMARY

Hammontree & Associates, Limited after review of environmental information including soils and groundwater analysis has determined that certain environmental issues should be summarized. A list of our comments are as follows:

- The purpose of this summary of a Soil and Groundwater Assessment is to evaluate the environmental soundness of the soil and groundwater within the boundary lines of your facility north of Southway Street, SW, Canton, Ohio.

- Eight (8) monitoring wells were advanced on the site to depths up to 50 feet and found to contain insignificant soil or water contamination. Soil samples for B-5, B-6, and B-8 showed high hydrocarbons ranging from 4400 mg/kg to 6800 mg/kg. No groundwater remediation is indicated, because the total petroleum hydrocarbons are low and no related regulated constituents were found such as BETX.

- Very limited quantities of Polychlorinated Biphenyls (PCB's) were found in the soil at Test Hole B-6 @ 0.31 mg/kg. PCB #1260 was also found on the surface near one of the transformer locations, HB-1, at 0.88 mg/kg. The maximum concentration limit goals (MCLG) = zero (40 CFR 141.50).

- A moderate hydrocarbon odor and sheen was found on MW-8. This test well also indicated a small concentration of hydrocarbons at 34 mg/kg in the groundwater. USEPA and OEPA has no established limit at this time.

- Barium (1.9 mg/l) at MW-8 does not exceed the OEPA limit of 2.0 mg/l although 1.0 mg/l has been used. We believe that this material will be remediated along with the hydrocarbons. USEPA Barium limits are referenced below:

  40 CFR 141.11: MCL = 1.0 mg/l
  40 CFR 141.62: MCL = 2.0 mg/l
  40 CFR 141.51: MCLG = 2.0 mg/l
  40 CFR 264.94: MCL = 1.0 mg/l

- A water sample from Lagoon #3 was better than current safe drinking water regulations for the metals series, VOC's, and semi-VOC's.

- The area around B-8 should be remediated. Bio-remediation or disposal at a certified landfill are options that are currently available. Additional tests will be required to verify the most economical process to be used.

- The material on the bottom and around the embankments of Lagoons 1 and 2 should be remediated. Bio-remediation or disposal at a certified landfill are options. Additional tests will be required to verify the most economical best process to be used.

- Industrial pretreatment to treat process water is required by Federal Regulations. The closure of Lagoons 1 and 2 will be required as a result if the lagoons are abandoned. The effluent will be discharged to the City of Massillon sanitary sewer system.

III. SCOPE OF SERVICES

Objective

An additional objective of the soil/groundwater Phase II site assessment was to identify, if possible, an impermeable clay/rock layer between the groundwater and any possible contamination. In order to complete this objective and to determine the levels of contamination, if any, the following tasks were performed:

Task 1 - Drilling and Monitoring Well Installation

This work was performed by R & R International (R&R) of Copley, Ohio and coordinated by Hammontree & Associates, Limited (H&A). A total of eight (8) soil borings were advanced utilizing a truck mounted drilling rig at locations shown on the Location Map (see appendix). Soil samples were collected on a continuous basis utilizing a "split-spoon" soil sampling device in accordance with the ASTM D-1586 test method. All drilling and sampling equipment which encounters the soil materials was thoroughly decontaminated using high pressure steam cleaning between each boring location.

The borings were advanced to a depth of approximately seven (7) feet below the first saturated soil interval or rock refusal.

Subsequent to the completion of the drilling operations, monitoring wells were installed in each of the soil borings so that groundwater samples could be recovered for laboratory analysis. Each monitoring well was constructed of two (2) inch (outside diameter) PVC well screen and riser. The monitoring wells were installed as per the recommendations of the U.S. EPA's Technical Enforcement Guidance Document (TEGD). Each monitoring well was supplied with locking covers to prevent un-authorized access. Upon completion, the monitoring wells were properly developed by removing three (3) to five (5) times the calculated well volumes.

All monitoring wells were gauged using an interface probe capable of detecting phase separated hydrocarbons. Groundwater levels were obtained and are accurate to within 0.01 feet. The elevations and locations of all well casings were established by survey thus enabling the preparation of a groundwater surface map showing the local groundwater flow direction.

Soil cuttings and well development water generated during the course of the investigation were staged at the site for subsequent removal and disposal. The scope did not include soil analysis which may be necessary for acceptance of any contaminated soils into an approved sanitary landfill, or any groundwater analysis which may be necessary for acceptance of the development water at a treatment/recycling facility. A cost estimate for the removal and disposal of the soil and groundwater (if necessary) can be prepared at your request.

Task 2 - Soil and Groundwater Sampling

This task was completed by R & R and H & A analyzed sampling requirements for each location. Representative soil materials recovered from each split-spoon sample were promptly placed in laboratory supplied glass jars equipped with Teflon lined lids and tightly sealed. The headspace gas which collects in the sample jar above each soil sample was analyzed using a field calibrated photoionization detector (PID) capable of detecting volatile organic compounds (VOCs). The soil sample field screening was used as an aid in the determination of which of the collected soil samples will be submitted for laboratory analysis. One sample per core drilling was submitted to an outside laboratory service for testing.

Subsequent to monitoring well development activities and after a period of stabilization, groundwater samples were recovered from the installed monitoring wells using a clean teflon bailer. All samples were promptly labeled and placed in an ice-filled cooler for transport to the laboratory. A chain-of-custody form was prepared to document sampling handling from the field to the laboratory. All sampling equipment was properly decontaminated between sampling locations. One water sample per monitoring well was tested by an outside laboratory.

Task 3 - Soil Sample Analysis

H & A coordinated sampling and analyze of all test results. The soil sample from each boring which exhibits the highest concentration of VOCs as determined with the PID was submitted to an independent laboratory for analysis. Soil samples submitted to the laboratory were analyzed for total petroleum hydrocarbons (TPH) - EPA Method 418.1, volatile and semi-volatile organic compounds - Methods SW846-8240 and SW846-8270, polychlorinated biphenyls (PCBs) - Method SW846-8080, the Target Compound List (TCL)of 23 metals - Method SW846-7000 Series, total cyanide - Method SW846-9010, and total recoverable phenolics - Method SW846 -9065.

Task 4 - Groundwater Sample Analysis

H & A coordinated sampling and analyze of all test results. Groundwater samples obtained from the monitoring wells were submitted to an independent laboratory for analysis of total petroleum hydrocarbons (TPH) - EPA Method 418.1, volatile and semi-volatile organic compounds - Methods SW846-8240 and SW846-8270, polychlorinated biphenyls (PCBs) - Method SW846-8080, the Target Compound List of 23 metals - Method SW846-7000 Series, total cyanide - Method SW846-9010, and total recoverable phenolics - Method SW846-9065.

A report prepared by R & R detailing the findings of the investigation was prepared upon receipt of the analytical results. (See Exhibit "A") The report describes the methodologies utilized

during the investigation, reports the results of the analytical testing, and provides any recommendations for additional work.

IV. LOCATION:

The property is located in the Northeast and Southeast Quarters of Section 13, Perry Township, Stark County, Ohio. It is also known as 4575 Southway Street, S.W., Canton, Ohio 44706.

V. DESCRIPTION OF THE PROPERTY:

The property is located in an industrial and manufacturing area west southwest of the Stark County Courthouse in downtown Canton about 3 miles away. The plant, built about 1945, currently supplies forged metal parts to various industries, e.g. aircraft, off-road and locomotive. The site includes about 30 acres north of Southway Street, S.W. Most buildings were constructed originally with a die shop being added in the 1950's.

VI. GEOGRAPHIC/GEOLOGICAL

The ground in the area of the facility is about 1070 feet above mean sea level. The ground elevation around the monitoring wells ranges from 1057.2 at B-5 to 1075.5 at B-8. The general high point of the property is just west of the forge shop and generally slopes in all directions from there. The east part of the property generally drains south towards Southway. However, very little storm water flows off the property or to Lagoon 3 due to Lagoons 1 & 2 being the receptor of the majority of the storm water from the buildings and yard drains.

The majority of the storm drainage in this area both on and off the side percolates into the ground with no clear drainage course for surface run-off. From the Stark County Official Highway Map, it appears that drainage south of the railroad drains south to Hurford Run to the Nimishillen Creek. The area north of the railroad probably drains to Sippo Lake.

According to the Stark County Soils survey the soils are defined as "Urban" . However, the adjacent soils are Canadice silt loam, Bogart silt loams, Chili gravelly loam, Chili silt loam and Conotton gravelly loam. These soils are generally classified as "deep, nearly level to steep, well-drained and somewhat poorly drained soils that have a loamy subsoil; formed mainly in glacial outwash."

The seasonal groundwater table as identified during this assessment had a high point at MW-3 west of the forge shop. The water table generally slopes to the north.

For further geological and groundwater information refer to Exhibit A.

VII. ENVIRONMENTAL ISSUES

Polychlorianted Biphenyls (PCBs): PCBs are associated with electrical transformers, capacitors, and substations. Main transformers are sometimes maintained by the utility company. Three surface locations were sampled for PCBs adjacent to existing outside transformer pads.

HB-1 indicated a concentration of 0.88 mg/kg of Aroclor #1260 PCBs. Also PCB's were identified at B-6 having a concentration of 0.31 mg/kg. The contamination was at about 1 foot and 5 foot,

respectfully. Under 40 CFR 302.4 the reportable quantity for PCBs is 10 pounds. The actual quantity can be determined after an investigation as to the content, if any, in the electrical transformers.

Friable Asbestos: Asbestos was not a part of this assessment. It was reported that Canton Drop Forge has an ongoing abatement program for the removal or encapsulating of the affected areas. Asbestos is regulated under 40 CFR Part 61 and 29 CFR 1910.

Underground Storage Tanks: There are two areas which have underground storage tanks. These tanks are located on Figure 4.1, "Site Plan" of the R & R Report marked Exhibit A. The description of the tank areas is described on page 4 of the R & R Report. Underground storage tanks are regulated by "BUSTR" under OAC 1301:7-9. USEPA regulations are found in 40 CFR Part 280. The existing UST's store quench oil and heating oil.

Hazardous Substances: Canton Drop Forge is on the "1991 Master Site List" published by the Division of Emergency and Remedial Response of Ohio EPA. During our soil and groundwater assessment the following contaminates were discovered:

Soil

Volatile and Semi-Volatile Organic Compounds

Name	Location	Concentration	Regulated Limits
Polychlorinated Biphenyls (PCB's)	B-6	0.31 mg/kg	
	HB-1	0.88 mg/kg	
Total Petroleum Hydrocarbons	B-5	4400 mg/kg	
	B-6	5100 mg/kg	
	B-8	6800 mg/kg	
2 - Butanone (Methyl Ethyl Ketone)	B-1	140 ug/kg	{"TC" Limit=20 mg/l
1, 1, 1 - Trichlorethane	B-3	22 ug/kg	
	B-4	11 ug/kg	
	B-6	110 ug/kg	
	B-8	18 ug/kg	
Tetrachlorethene	B-6	51 ug/kg	
	B-7	26 ug/kg	

	Water		
Name	Location	Concentration	Regulated Limits
Total Petroleum Hydrocarbons	MW-8	34 mg/l	No limit set*
Chloromethane	MW-8	21 ug/l	No limit set
Barium	MW-8	1.9 mg/l	2.0 mg/l (40 CFR 141.51)

*Note: Total Petroleum Hydrocarbons are not regulated under the SDWA, however, constituents of hydrocarbons are, i.e., BETX and were not detected.

It should be noted that all samples mentioned in Exhibit A designated by "S" were taken and analyzed by USEPA.

For other metal concentrations in the groundwater and soil samples refer to the R & R Report Tables 5.5 (pages 31 thru 33) and 5.10 (pages 41 thru 43). The metal concentrations in the soil are within normal background levels according to the US Geological Survey Professional Paper 1270 dated 1984 except for arsenic (170 mg/kg in B-7), Chormium (2000 mg/kg in B-6), and nickel (1800 mg/kg in B-6). The lead in MW-2 was retested and showed below the detection limit.

Industrial Waste Treatment: Presently all domestic waste goes to the Massillon Public Treatment Facility. The industrial waste consisting of oil and other contact water presently is treated in three lagoons. The oil and water (including storm water) is separated in Lagoon #1 and the water is pumped to Lagoon #2. Lagoon #2 receives storm water along with other contact water including boiler blow down. Oil and water are separated with the clean water being discharged to Lagoon #3. Lagoon #3 had no visible oil and the metal series test for Drinking Water yielded no metals above the SDWA Limits. There are no visible discharges pipes from any lagoon to the surface waters of Ohio.

Environmental Database: A database to investigate other environmental issues was implemented through Environmental Risk Information and Imaging Services Report (see Exhibit B). A summary of that information follows:

- Canton Drop Forge is on the 1991 Master List for Ohio (D001 - A solid waste exhibits the characteristic of ignitability)
- Canton Drop Forge is in the CERCLA database
- Canton Drop Forge - EPA ID #OHD004465142
- The report indicated a Court Docket #05-86-0111
- Canton Drop Forge reported a petroleum release on 4/2/90 — CHECK TO SEE IF THIS IS CLOSED

VIII. LIMITATION OF LIABILITY

It is expressly understood that the undersigned has not conducted any detailed engineering studies of the integrity of the facilities or properties. The statements set forth in this assessment are not to be construed as a guarantee or warranty.

IX. STANDARD OF CARE:

The services performed by Hammontree and Associates, Limited for this soil and groundwater Assessment was conducted in a manner consistent with the level of care and skill ordinarily exercised by firms similar to Hammontree and Associates, Limited which are currently providing similar services.

Canton Drop Forge recognizes that subsurface conditions or other field conditions may vary from those encountered at locations where samplings, surveys or other observations are made by Hammontree and Associates, Limited.

X. RECOMMENDATIONS:

The following recommendations are a result of the soil and groundwater assessment:

- Remediate the area in and around B-8 located south of Lagoon #3.
- Separate the industrial waste stream from the storm sewer system.
- Provide an industrial pretreatment system to be discharged to the City of Massillon Public Treatment works.
- Remediate Lagoons #1 & 2 according to OEPA and USEPA regulations (40CFR279.12).
- Consider conversion of Lagoons #1 and #2 to retention or detention basins for storm water.
- If Lagoon #3 overflows its banks, the discharge may require an NPDES Permit.
- Remove PCBs from the soil, if required.

XI. CONCLUSION:

Based on the above stated recommendations, we have concluded that proceeding to a remedial action Phase III is warranted. The tasks can be run concurrently or separately depending on your requirements.

PCB Remediation

- Determine PCB concentrations in transformers for regulatory purposes (40 CFR 761). This will effect the level of effort in any remediation.
- Delineation of Remediation area (Depth and Width)
- Prepare corrective action plan
- OEPA approval (negotiations)
- Implementation of plan (bidding, etc)
- Remediation activities
- Closure report to OEPA
- OEPA Approval

Soil Boring #8

- Delineation of Remediation Area
  (Depth and Width) (On-site only)
- Characterize Waste (Lab & Pilot Studies)
- Feasibility Study and Treatability Study - Remedial Options
- Corrective Action Plan
- OEPA Approval (negotiations)
- Implementation of Plan (bidding, etc.)
- Drain Lagoon #3 to permit remedial activities near the lagoon not to effect the water in Lagoon #3 or vice versa.
- Remedial Activities
  Physical Removal off site, or
  Bio-Remediation
- Evaluation and closures report to OEPA
- OEPA approval

Industrial Pretreatment - Phase I

- Feasibility Report (General Plan)
  Characterization of Waste (Flow)
  Pilot Study
- OEPA Approval (City of Massillon)
- Prepare Plans and Specifications
- OEPA Permit to Install
- Bidding and Construction
- No further action if discharged to Massillon

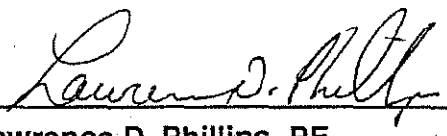
Industrial Pretreatment - Phase II (Lagoon Closure #1 of #2)

- Work plan development
- OEPA negotiation and approval
- Implement work plan - Closure Assessment Report
  Delineation of Remediation Area
  Assessment of problem
- OEPA negotiation and approval
- Feasibility Study and Treatability Study
  Remedial Options
- Corrective Action Plan
- OEPA Approval
- Implementation of Plan (bidding, etc.)
- Drain Lagoons
- Remedial Activities
  Physical removal off site, or
  Bio-Remediation
- Evaluation and closure report to OEPA
- Groundwater Monitoring and follow-up reports
- OEPA Approval

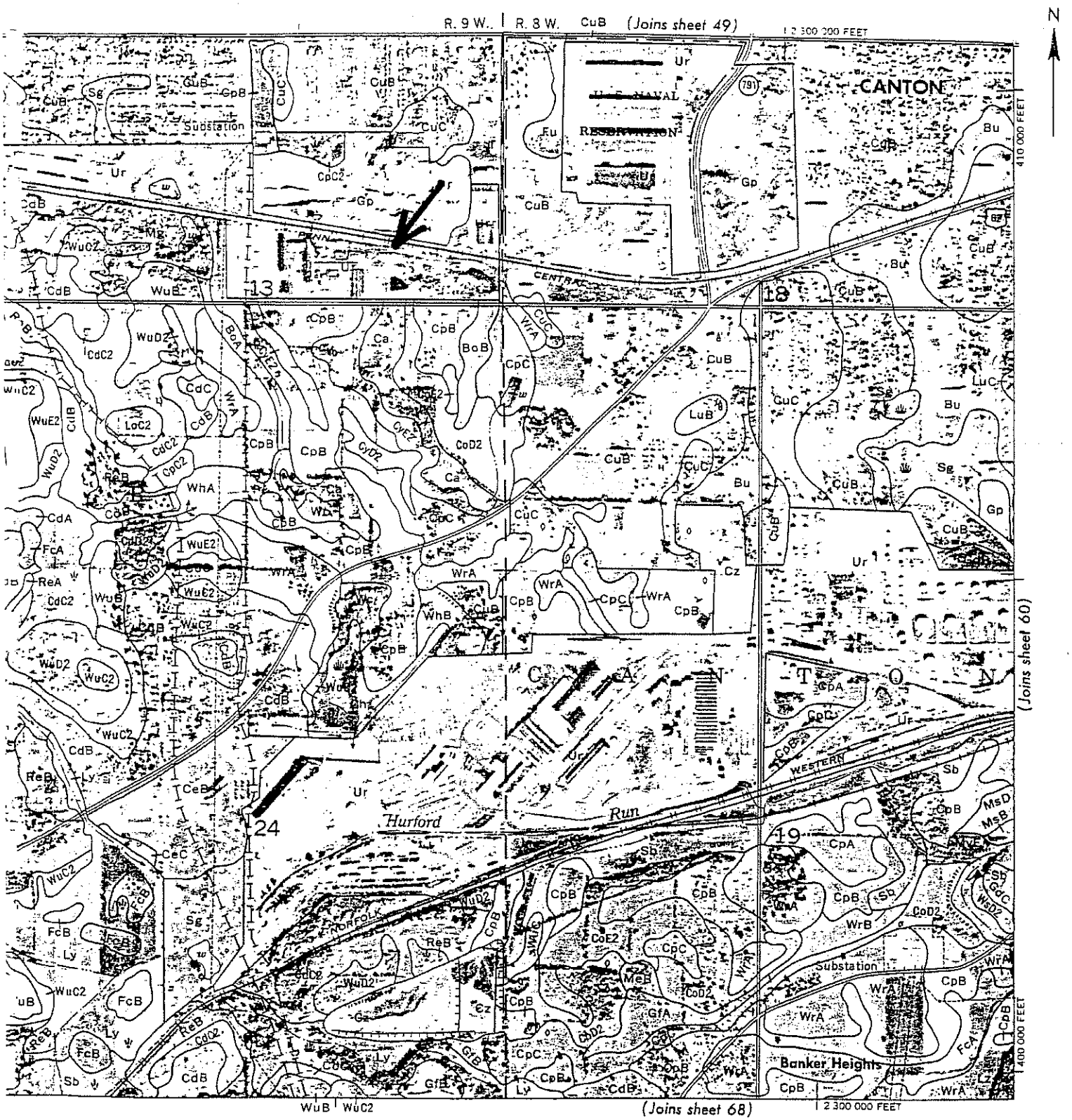
XII. CERTIFICATION:

We hereby certify that to the best of our knowledge and belief,...

- the statements of fact contained in this report are true and correct.
- the reported analyses, opinions, and conclusions are limited only by the reported assump- tions and limiting conditions and are Hammontree and Associates, Limited's unbiased professional analysis, opinion, and conclusions,
- Hammontree and Associates, Limited's compensation is not contingent on an action or event resulting from the analyses, opinions, and conclusions developed in this report,
- we have made an inspection of the property that is the subject of this report,
- this report, to the best of our knowledge, is forwarded as an accurate representation of the site condition at the time reported.



Lawrence D. Phillips, PE.
Partner



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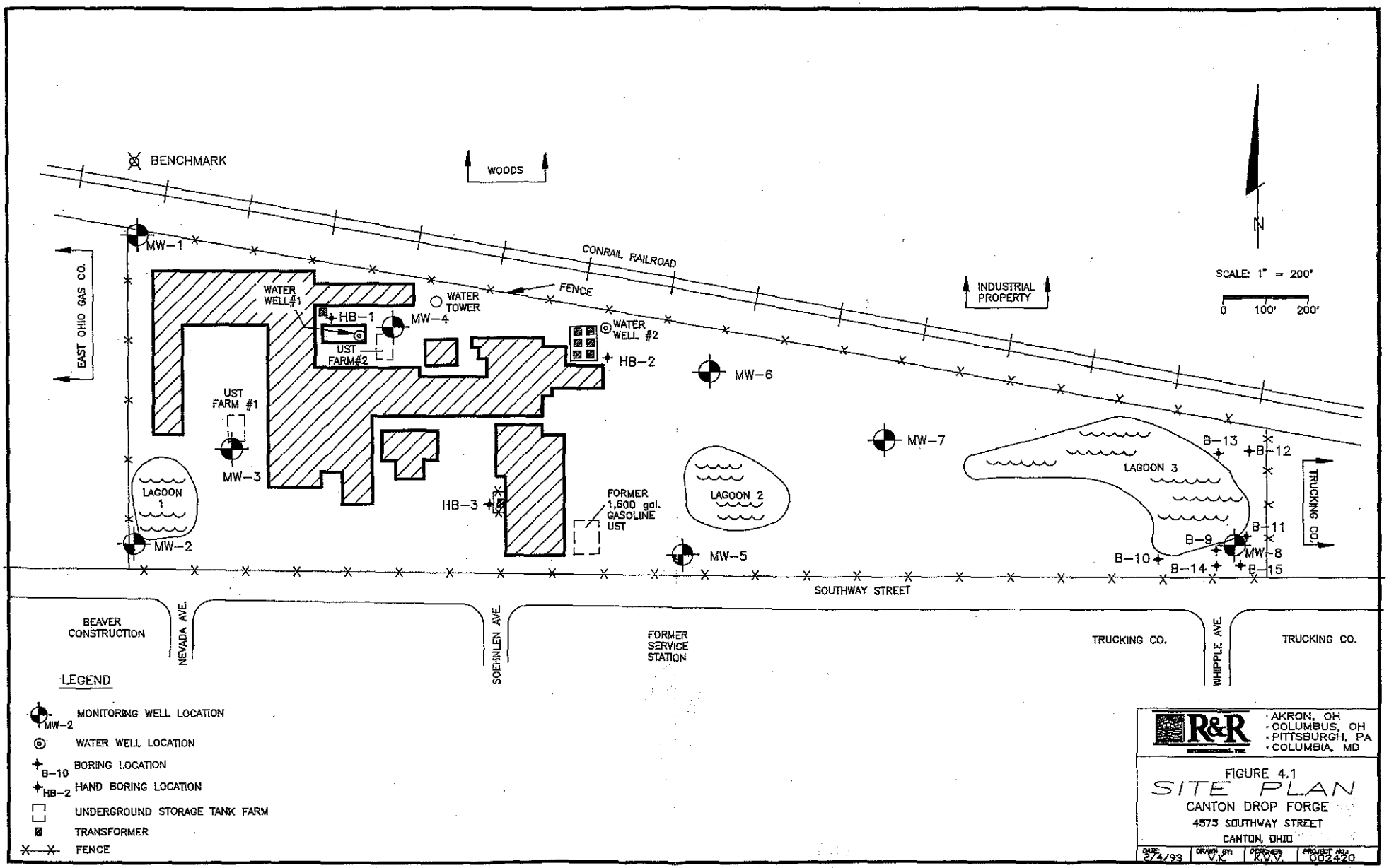

R&R · AKRON, OH · COLUMBUS, OH · PITTSBURGH, PA · COLUMBIA, MD

FIGURE 4.1

SITE PLAN

CANTON DROP FORGE

4575 SOUTHWAY STREET

CANTON, OHIO

DATE: 2/4/93	DRAWN BY: V.K.	DESIGNED: K.V.	PROJECT NO.: 002420

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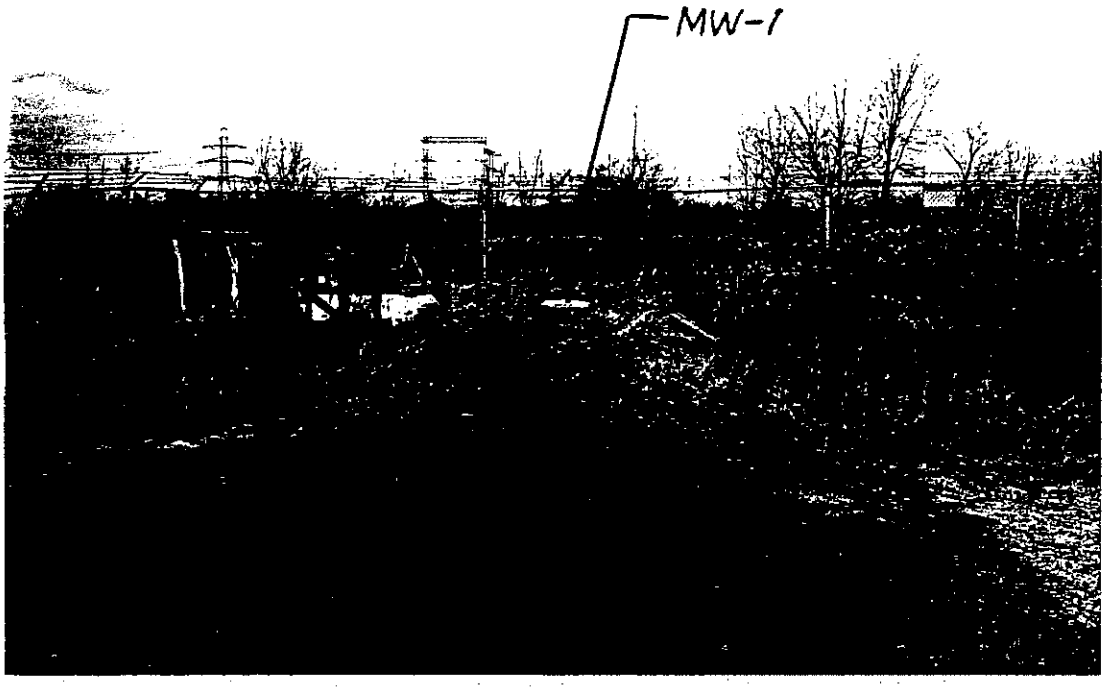

MW-1 LOOKING NORTH

B-2 LOOKING SOUTH

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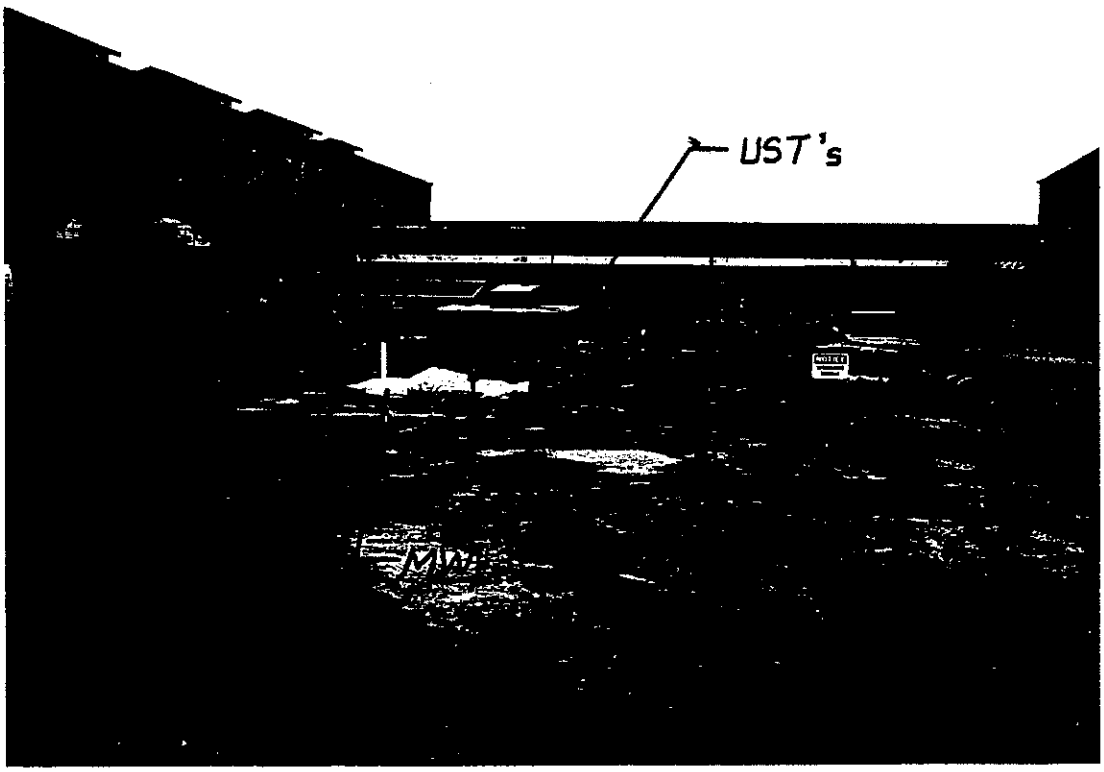
MW-2 LOOKING WEST



MW-3 LOOKING NORTH

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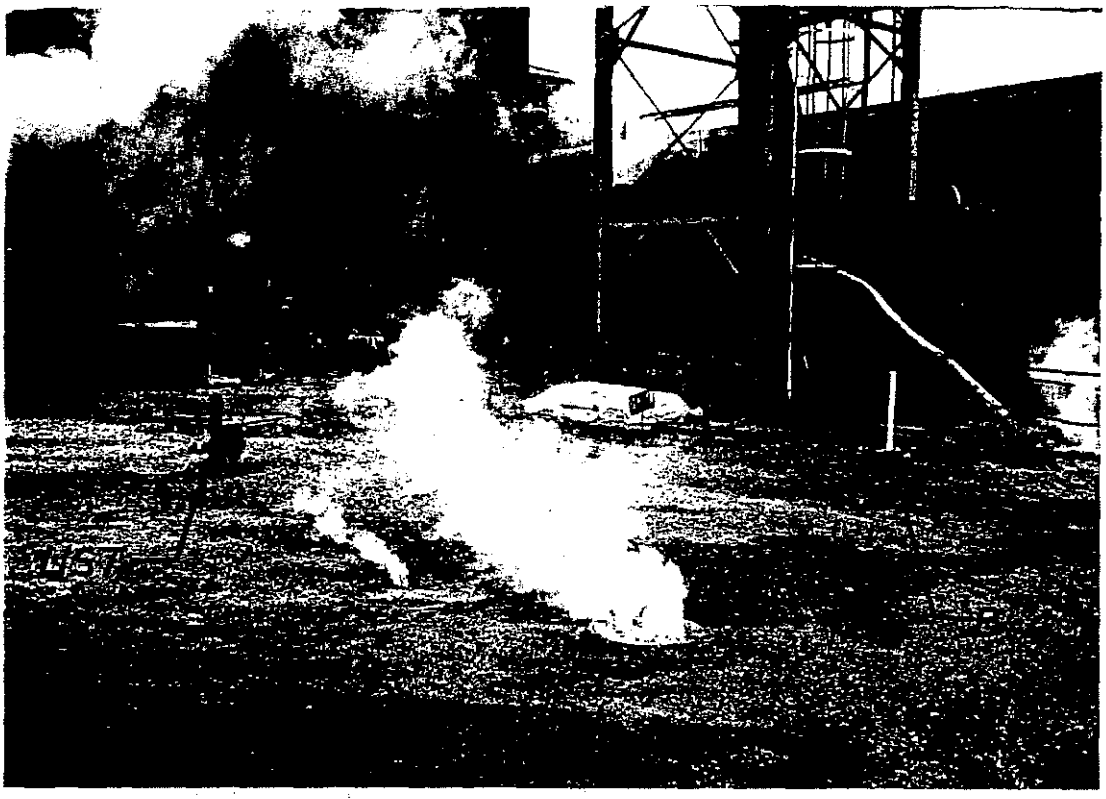

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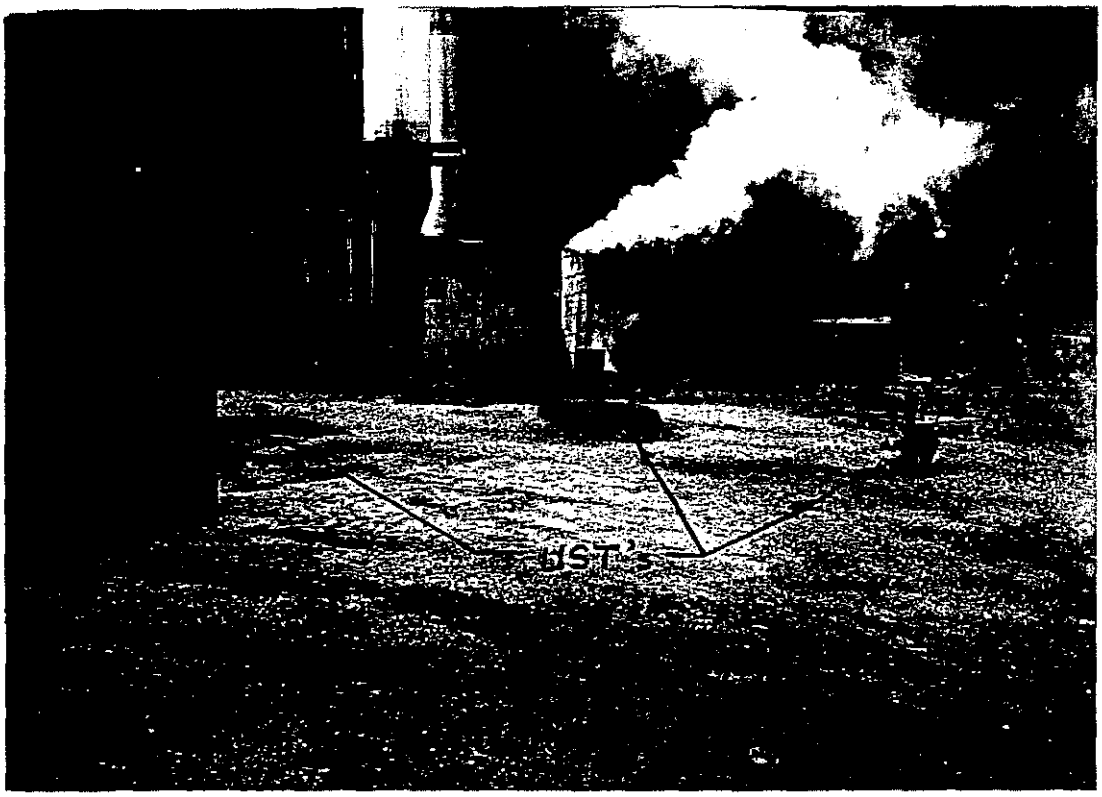

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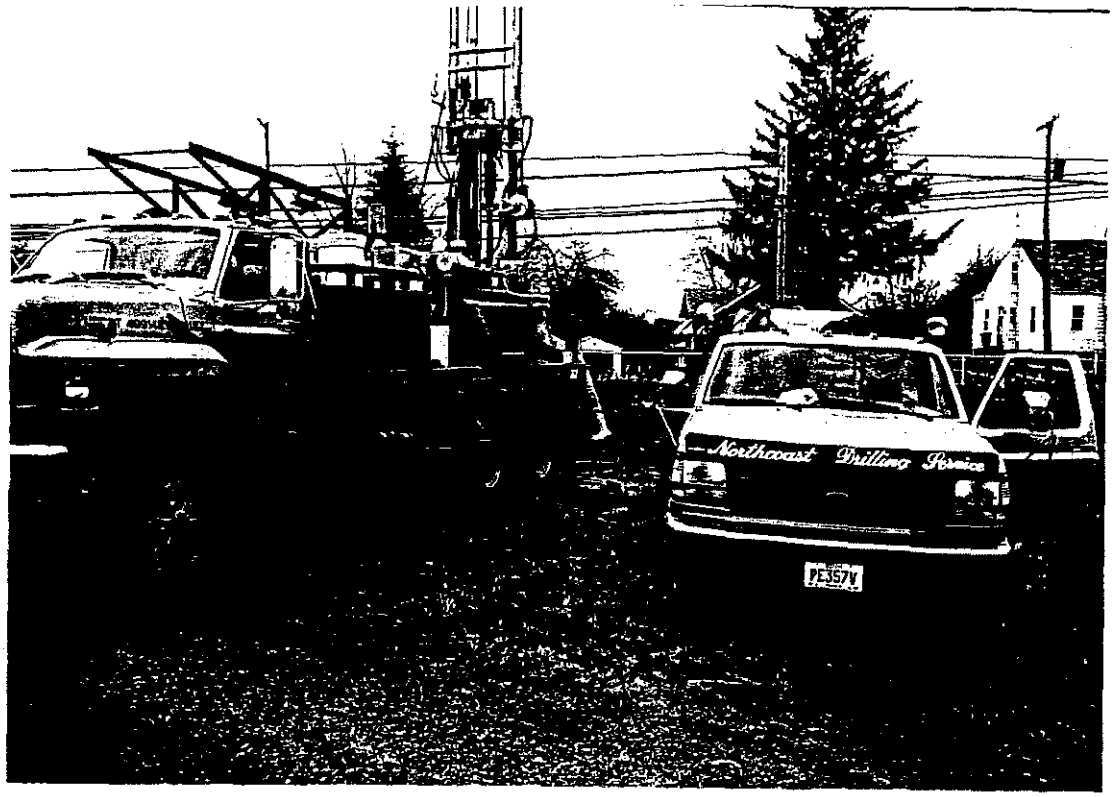
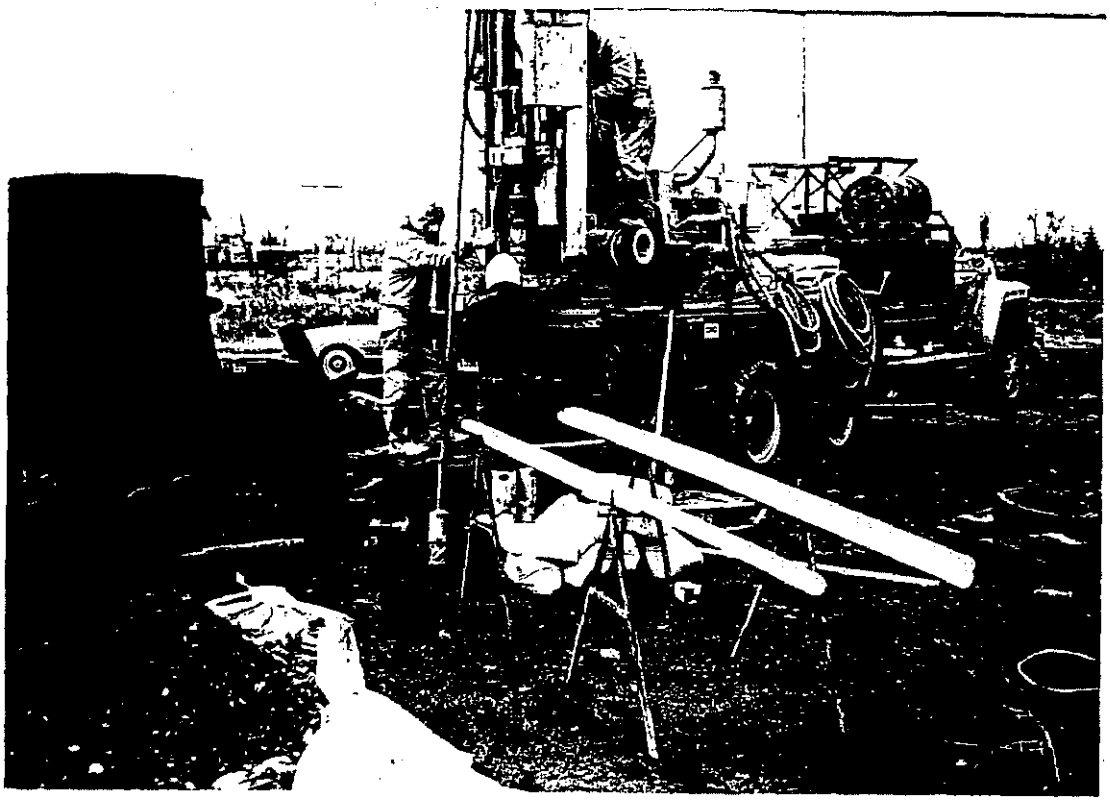


B-5 LOOKING SOUTH

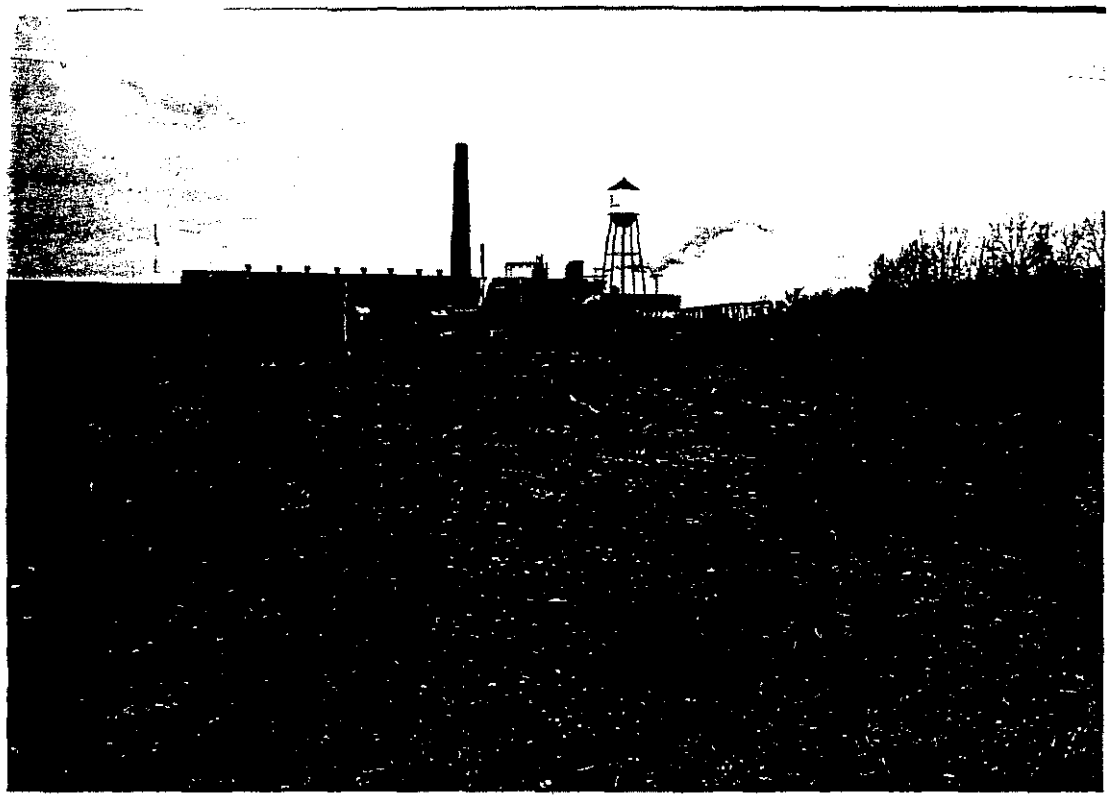
B-5 LOOKING EAST



B-6 LOOKING EAST

B-6 TAKING SOIL SAMPLE

B-6 LOOKING NORTH



B-7 LOOKING WEST

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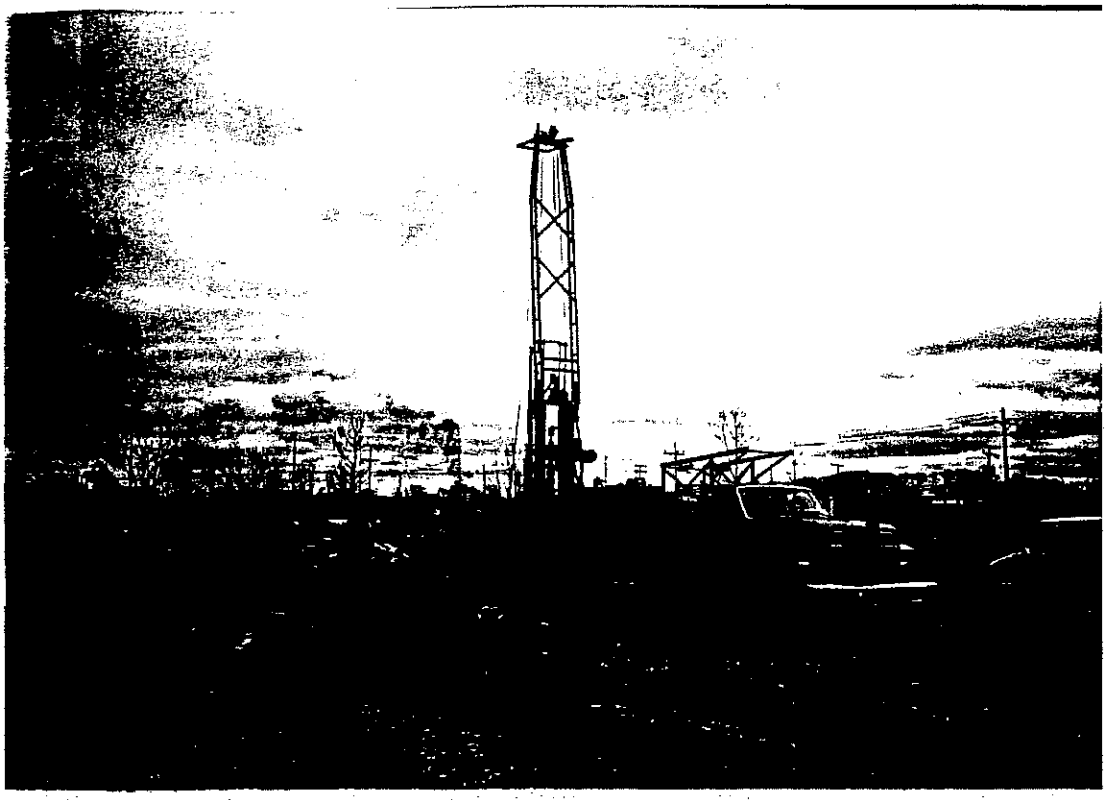

MW-7
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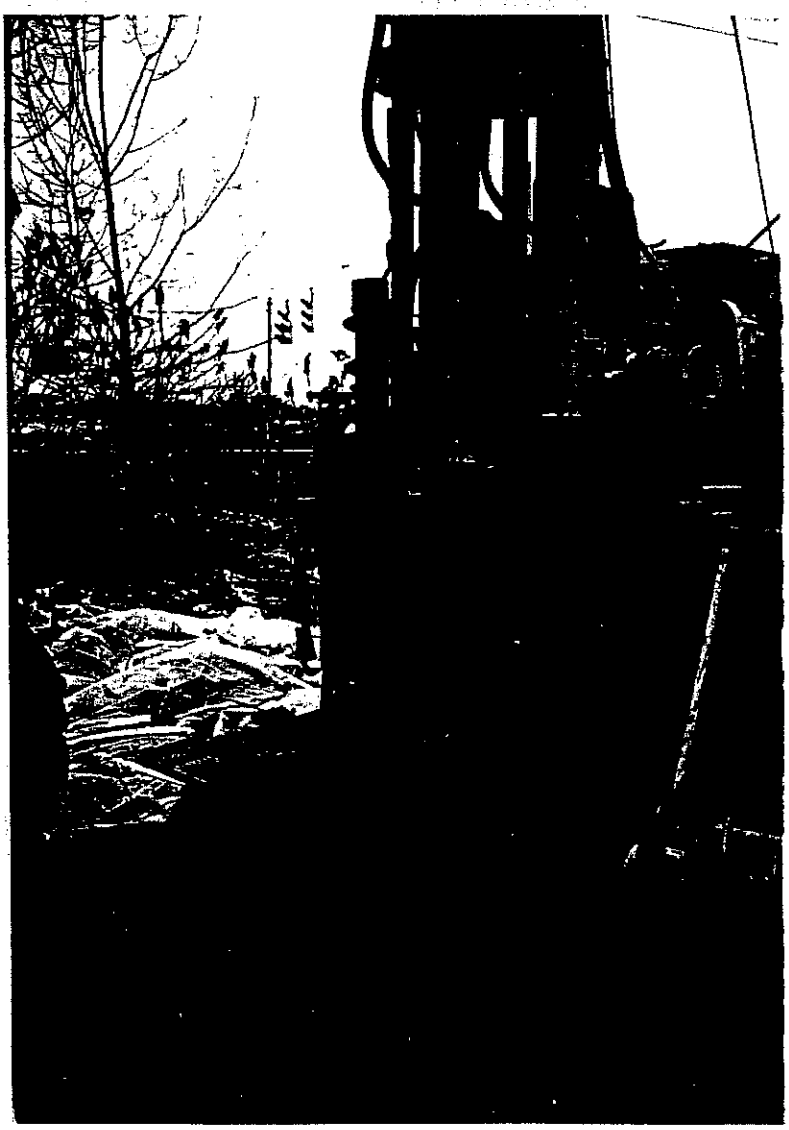

MW-8
LOOKING
SOUTHEAST

CDF012322

R&R
INTERNATIONAL,INC.

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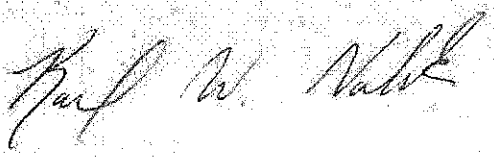
TEL. (216) 666-2200
FAX (216) 666-7874

PRELIMINARY
SOIL AND GROUNDWATER ASSESSMENT

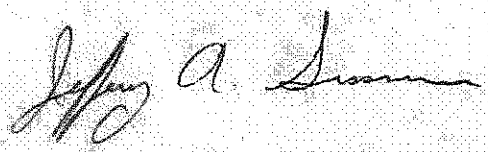
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

PREPARED FOR
HAMMONTREE & ASSOCIATES

R&R INTERNATIONAL, INCORPORATED



KARL W. VALEK
PROJECT MANAGER



JEFFERY A. SUSSMAN
MANAGER, ENVIRONMENTAL SERVICES

MARCH 24, 1993

R&R INTERNATIONAL INC.

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R&R INTERNATIONAL, INC.

APPENDICES

Appendix A	Drilling Logs and Monitoring Well Diagrams
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1.0 EXECUTIVE SUMMARY

A Preliminary Soil and Groundwater Assessment was conducted at Canton Drop Forge located at 4575 Southway Street in Canton, Ohio. This assessment included the advancement of eight (8) test borings, the installation of eight (8) monitoring wells within the borings, and shallow soil sampling.

Soil samples obtained during the drilling operations were screened in the field using PID headspace techniques which aided in selecting a single soil sample from each boring for laboratory analysis. Each sample was submitted to an independent laboratory for analysis of total petroleum hydrocarbons (TPH) per EPA Method 418.1, the Target Compound List (TCL) of volatile and semi-volatile organic compounds (SW846 8240 and 8270, respectively), polychlorinated biphenyls (PCBs, per SW846 8080), the TCL of metals (SW846 7000 series), total cyanide (SW846 9010), and total recoverable phenolics (SW846 9065). In addition, shallow soil samples obtained from three (3) exterior transformer locations were submitted for analysis of polychlorinated biphenyls (PCBs, per SW846 8080).

The boring program at the site revealed that the facility is underlain by predominantly brown sand and gravel which represents the shallow aquifer beneath the site. No laterally extensive clays or other impermeable intervals were identified that would provide a barrier to the vertical migration of potential contaminants at the site. Bedrock was not encountered by any of the borings advanced during this investigation.

Significantly elevated VOC concentrations were detected in soil samples obtained from one (1) of the eight (8) borings (B-8). The soil materials from B-8 were heavily stained by hydrocarbons, had a strong hydrocarbon odor, and a sheen was observed on the groundwater during sampling operations.

Relatively low concentrations of volatile organic compounds

were detected in several of the analyzed soil samples. Polychlorinated biphenyls (PCBs) were detected in one hand auger boring sample and in one (1) boring sample. The detected concentrations of these compounds do not appear to represent a serious environmental risk but this does not disallow the possibility of more significant areas of concentration at other locations at the site. The analytical results indicated that several metals were present in the soil samples. However, the lack of appreciable concentrations of dissolved metals in the groundwater samples collected during this investigation suggests that the detected metals in soil have not significantly impacted the shallow groundwater beneath at the site. The lack of groundwater impact by the metals detected in the soil may be due to the non-leachable character of metals bound within or on the soil materials. The detected concentrations of TPH detected during this investigation represents the main environmental concern with regard to the condition of the soil at the site. Depending on the intended use of the site, however, the TPH may not pose a serious environmental risk.

The groundwater in the shallow aquifer beneath the site appears to flow generally towards the north with an average calculated hydraulic gradient across the site of approximately 0.006 feet/foot. The groundwater elevation in the vicinity of MW-3 is relatively high and may represent a local groundwater recharge area or a perched groundwater zone. The two (2) water wells present at the site may be influencing the potentiometric surface of the shallow groundwater zone beneath the site based on the groundwater "low" located in the vicinity of MW-4 and the water wells which suggests that the deeper groundwater zone may be in communication with the shallow groundwater zone identified during this investigation. A perched groundwater zone was identified in the vicinity of MW-8 which appears to be in communication with the Lagoon No. 3.

Analytical results for the groundwater samples generally indicated low or non-detectable concentrations of the targeted compounds. Two (2) specific metals were identified which could indicate negative impact to the groundwater at the site. These metals involved the detected concentrations of dissolved lead in the groundwater sample from MW-2 and dissolved barium in the groundwater sample from MW-8. Upon re-sampling these two (2) monitoring wells, the detected lead concentration was below detection limits in the sample from MW-2, but the barium concentration in the sample from MW-8 still exceeded the USEPA Maximum Contaminant Level (1.0 ppm for barium) established for safe drinking water for barium. A water sample obtained from Lagoon No. 3, however, did not have a detectable concentration of barium which suggests the overall level of barium in the perched groundwater system (i.e. MW-8 vicinity and Lagoon No. 3) may not pose a serious health risk. The concentration of the other detectable constituents in the groundwater do not appear to pose a serious environmental risk.

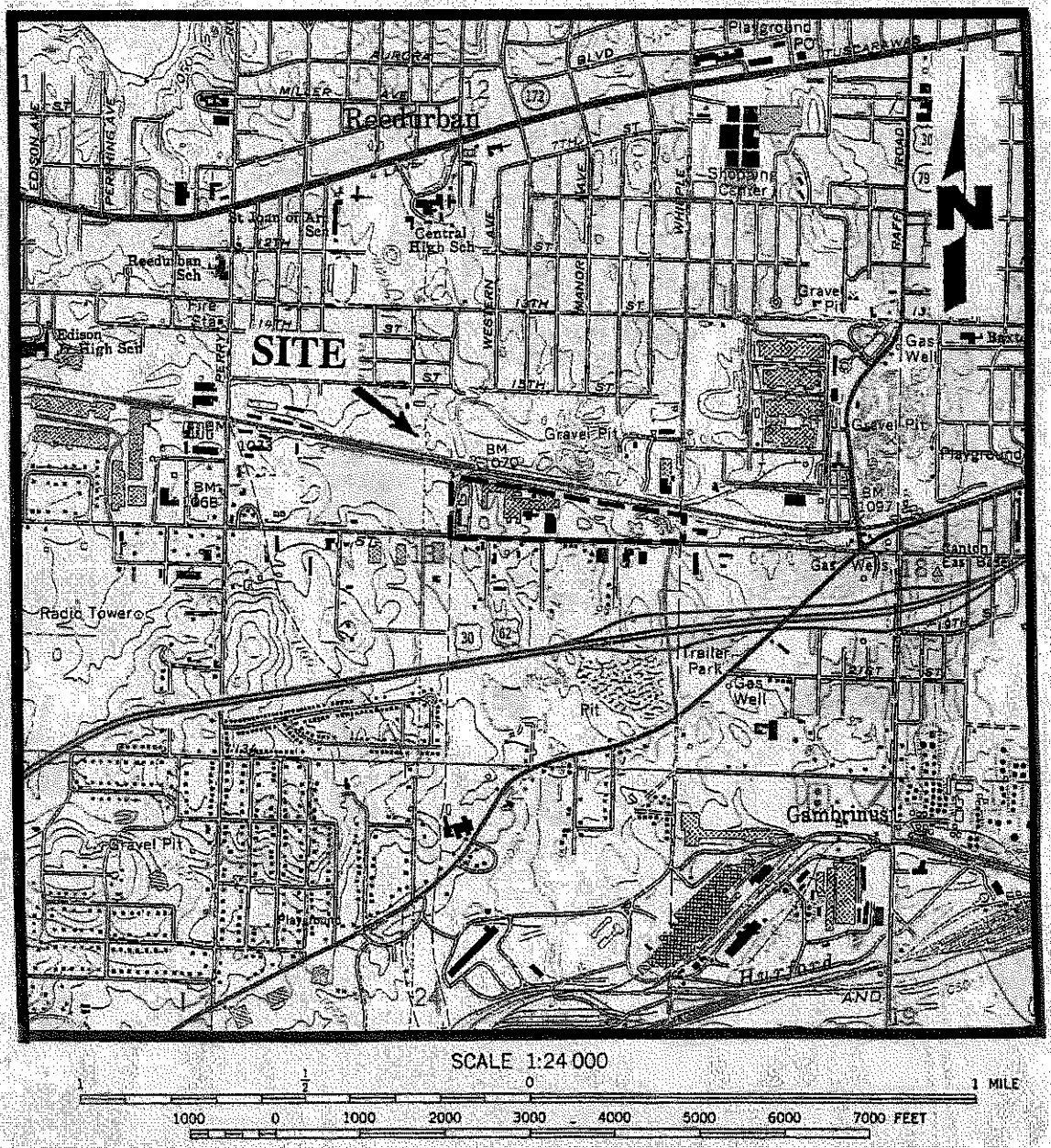
In conclusion, the main area of concern identified during this limited assessment at the site involves the petroleum hydrocarbon impacted soil and groundwater in the vicinity of MW-8. Based on the shallow borings advanced in the vicinity of MW-8 (i.e. borings B-9 through B-15), the hydrocarbon impacted area is limited to the west and north. The extent of the hydrocarbons to the east and south is unknown. The area's elevation relative to the surrounding properties would suggest that an off-site source for the hydrocarbon compounds is unlikely. An additional concern is the extent of the impermeable layer creating the perched groundwater zone in the area of MW-8. At the lateral edge of this layer, vertical migration of the residual hydrocarbons, if they persist, would not be restricted from impacting the deeper, primary shallow groundwater zone identified at the site during this investigation.

2.0 INTRODUCTION

R&R International, Incorporated, (R&R) was retained by Hammontree & Associates to conduct a Preliminary Soil and Groundwater Assessment at the Canton Drop Forge (CDF) located at 4575 Southway Street in Canton, Ohio. The approximate location of the site is indicated on Figure 2.1. Properties adjacent to the subject site include the East Ohio Gas Company to the west as well as light and heavy industrial facilities to the north, east and west. Undeveloped wooded land is also present north of the site which includes a gravel pit and small ponds. Several residential properties are also located south and southwest of the site. Sippo Lake and Lake Myers are located within two miles of the site.

Two (2) areas of underground storage tanks (USTs) are located at the site. Tank area 1, which is located west of the main forge, contains four (4) 25,000 gallon USTs that reportedly contain No. 2 fuel oil. Tank area 2, which is located east of the power house, contains four (4) 10,000 gallon USTs and one (1) 20,000 gallon UST. The USTs at tank area 2 reportedly contain No. 6 fuel oil except for one 10,000 gallon UST that contains "quench oil" (cooling oil). A 1,600 gallon gasoline UST was removed in 1990 and reportedly received a "no further action notification" from BUSTR following the closure activities.

A preliminary assessment report was submitted to the United States Environmental Protection Agency (USEPA) on June 6, 1985. A Screening Site Inspection (report dated April 8, 1991) was conducted by Ecology and Environment, Incorporated, Field Investigation Team for the USEPA. The site inspection included a concise review of the site's background which is presented below:



Source: USGS Topographic Map
West Canton Quadrangle

Figure 2.1
Site Location Map

2.2 Site Description

The CDF site is an active drop forge and manufacturing plant that currently manufactures parts for airplane, locomotive, and off-road transportation. The site is located at 4575 Southway SW, Stark County, Canton, Ohio (SW1/4NE1/4, sec. 13, T.10N., R.9W.). The CDF site is located in a manufacturing and urban area of Canton (see Figure 2-1[2.1] for site location). The CDF site is approximately 25 acres in size. The manufacturing plant occupies 6 of the site's 25 acres of land. An on-site landfill for manufacturing-derived wastes is located on 8 acres of the site. The remaining 11 acres of the site are used as parking and storage areas.

2.3 Site History

The Canton Drop Forge and Manufacturing plant began operation in 1945. The site was owned by the United States Army Air Corps (U.S. ACC). Canton Drop Forge and Manufacturing operated the site for U.S. ACC. The manufacturing plant forged airplane propeller hubs. It is not known what the land was used for, nor who owned the site prior to U.S. ACC (Bressanelli et al. 1990).

In 1950, Canton Drop Forge and Manufacturing bought the site from U.S. ACC and continued on-site operations. In 1981, the Corder Group bought the CDF site and is the current site owner and operator (Bressanelli et al. 1990).

From 1950 to the present, various drop-forged parts for airplane, locomotive, and off-road transportation have been manufactured on-site. The manufacturing process, called drop forging, begins with the selection of feedstock. The feedstocks are composed of different types of [metals, including iron and nickel base alloys as well as titanium]. The feedstock is then cut to size and heated to 1,700 to 2,400°F. A steam-driven hammer forges the piece into the desired shape as formed by a die. Lubricating oils are used to coat the dies. The drop-forged product may then be heat treated and cooled by quench oils or cleaned by shot blasting or grit cleaning. Prior to 1981, pickle liquor was used for scaling the steel [very limited usage]. A small amount of grinding may be done on the product, or the product may be quality tested. The tests performed on the product are magnaflux or zyglow, which are described as non-destructive [sic]. The product is then shipped to the customer. (Bressanelli et al. 1990).

The on-site plant currently has 40 air permits for various plant operations (Bressanelli et al. 1990). Appendix B [of USEPA report] includes the various permit numbers, descriptions, issuing dates, and expiration dates.

Various waste disposal practices were used at the CDF site, including on- and off-site landfilling, collection of process water and oils in lagoons, and the reclaiming of waste oils and sludge.

The on-site landfill was licensed by the Stark County Health Department (SCHD) in June 1976 (Bozerke 1977). The license number is not known. It is not known when the landfill began operating. Canton Drop Forge and Manufacturing closed the landfill in 1979 because it had reached its capacity. The on-site landfill was approximately 8 acres in size and was located in a natural depression east of the plant building. The landfill was divided into two zones, Zone A and Zone B. A scrap and salvage area was located in the middle of the landfill. Zone A was closed in October 1978, and Zone B in 1979 (Bressanelli et al. 1990). According to file information, a discrepancy exists regarding the closing date of Zone B. File information indicates that the landfill was still being used in late 1981. Canton Drop Forge and Manufacturing petitioned OEPA for an order of exemption under R.C. Section 3724.02(g) for the disposal of brickbats, concrete, and wood pallets on June 3, 1981 (EPA 1981). OEPA granted the company's petition in a Director's Final Findings and Orders on October 15, 1981 (OEPA 1981a).

The landfilling method used on-site was the dump and cover method. Cover material for the landfill included slag, ash, lime/soda softener sludge, and demolition wastes (Cavender 1978). According to Jerome P. Bressanelli, President of Canton Drop Forge and Manufacturing, the landfill was covered with a clay soil of unknown thickness. Zone A of the landfill was used for the disposal of all wastes generated at the site. These wastes included oil sludge (gypsum), floor sweepings, trash, and rags (Cavender 1978). Zone B of the landfill was used for the disposal of demolition wastes, concrete, and other exempt wastes. These wastes were piled around Lagoon #3, one of three on-site lagoons (Cavender 1978).

In 1981, wastes generated on-site were hauled from the site by the following waste transporters: Buckeye Sanitation of Canton, Ohio (general trash); Carl Pandoli of Canton, Ohio (scrubber sludges); and R. E. Slutz Trucking of Canton, Ohio (ashes). All three transporters dumped at Breitenstine Landfill in Waynesburg, Ohio. Reclaimable oil was picked up by Northway Environmental Services of Ashtubula, Ohio, and was transported to one of three different sites. The sites were located in Harpersfield, Cleveland, and Waynesburg (Breitenstine Landfill), all in Ohio. Pickle liquor was picked up by Industrial Wastes Corporation of New Brighton, Pennsylvania, and dumped at a location in Darlington Township, Pennsylvania (OEPA 1981b).

[No pickle liquor was picked up from plant according to Canton Drop Forge personnel]. In 1990, wastes generated on-site were hauled from the site by the following waste transporters: Browning Ferris Industries of Akron, Ohio (general trash and Advance Drain and Sewer of Wooster, Ohio (scrubber sludges) (Bressanelli et al. 1990).

A scrap and salvage area was located in the middle of the landfill area. This area was used to store scrap metal, old machinery, and other salvageable material. The scrap is sold whenever the market price is high (Cavender 1978; Bressanelli et al. 1990).

There are three man-made lagoons at the CDF site that are used to collect and treat plant process water. Used process water containing lubricating oil is dumped into Lagoon #1, where some of the oil is then skimmed off the water and collected in a 2,000-gallon tank. The lubricating oil is used to lubricate dies (Bressanelli et al. 1990). The water is then pumped via an underground pipe to Lagoon #2, where the rest of the oil is skimmed off the water. The waste oil is collected in two 2,000-gallon tanks. The water is then pumped through an underground pipe to Lagoon #3 for evaporation and infiltration. Lagon #1 is located in the southwest corner of the site. Lagoons #2 and #3 were excavated from and are located in the landfill area (Cavender 1978). It is not known from what material Lagoon #1 was excavated. None of the lagoons were lined (Bressanelli 1990). FIT did not observe any drums in the lagoons at the time of the SSI.

Beginning in 1976, Canton Drop Forge and Manufacturing was required by both SCHD and OEPA to file solid waste disposal operation reports for the on-site landfill and to apply for a landfill license (Bozerke 1977; Cavender 1978; Bressanelli et al. 1990). Canton Drop Forge and Manufacturing submitted a RCRA 3001 Notification as a Generator of Hazardous Waste for its F010 quench oil sludge on August 8, 1980. The F010 Quench oil sludge was later reclassified to include only those oils that contain cyanide. The quench oil used on-site in the manufacturing process does not contain cyanide.

The company filed a petition on June 3, 1981, with OEPA requesting an order of exemption under R.C. Section 3734.02(G) for the disposal of brickbats, concrete, and wood pallets in the on-site landfill. OEPA granted the exemption in a Director's Final Findings and Orders in June 15, 1978 (OEPA 1981a).

OEPA conducted a site inspection of the CDF site on June 30, 1983, in response to a complaint regarding buried drums and sludges. OEPA officials observed 15 to 20 partially exposed and leaking drums buried along the edges of Lagoon #2. The drums were buried in the late 1960s.

OEPA recommended that Canton Drop Forge and Manufacturing cover the sides of Lagoon #2 with 2 feet of compacted clay-type material (OEPA 1983). No drums were observed in the pit lagoons during the FIT SSI. The fate of these drums is not known. FIT did not collect any soil samples because the exact location of the exposed drums was not known.

No additional enforcement actions regarding the CDF site had taken place as of the date of the SSI.

The objective of this Soil and Groundwater Assessment was to obtain additional data concerning the distribution and concentration of potential contamination in the soil and groundwater at this site. This report summarizes the findings of the hydrogeological assessment work conducted.

3.0 SCOPE OF SERVICES

In order to accomplish the objectives of this preliminary soil and groundwater assessment, R&R International was limited to the execution of the following tasks:

Task I - Drilling Operations: Eight (8) borings were advanced to seven and one-half (7.5) feet below the water table or auger refusal, whichever occurred first. During the advancement of the borings, soil samples were collected on a continuous basis. Monitoring wells were installed within the borings after the presence of saturated conditions was confirmed within the drilled interval. The locations of the borings were determined by R&R and Hammontree Associates and discussed with CDF personnel to clear utilities and high traffic areas during an initial site visit. Borings were positioned to address specific environmental concerns identified at the site.

Task II - Analysis of the Samples: Split-spoon soil samples were field screened using PID headspace screening techniques. The headspace analysis results was used as an aid in the selection of a single soil sample from each boring for submission to an independent laboratory for analysis of the following parameters:

- Total Petroleum Hydrocarbons (TPH) - EPA Method 418.1
- Target Compound List of Volatile Organic Compounds - Method SW846 8240
- Target Compound List of Semi-Volatile Organic Compounds - Method SW846 8270
- Polychlorinated Biphenyls (PCBs) - Method SW846 8080
- Target Compound List of Metals - Method SW846 7000 Series
- Total Cyanide - Method SW846 9010

- Total Recoverable Phenolics - Method SW846 9065

Shallow soil samples were collected from locations near the three (3) transformer areas located outside of the plant buildings and were submitted to an independent laboratory for analysis of the following parameter:

- Polychlorinated Biphenyls (PCBs) - Method SW846 8080

Groundwater samples collected from the monitoring wells containing sufficient water were submitted to an independent laboratory for analysis of the following parameters:

- Total Petroleum Hydrocarbons (TPH) - EPA Method 418.1
- Target Compound List of Volatile Organic Compounds - Method SW846 8240
- Target Compound List of Semi-Volatile Organic Compounds - Method SW846 8270
- Polychlorinated Biphenyls (PCBs) - Method SW846 8080
- Target Compound List of Metals - Method SW846 7000 Series
- Total Cyanide - Method SW846 9010
- Total Recoverable Phenolics - Method SW846 9065

Task IV - Technical Report: A technical report (this document) was prepared which summarizes the findings of all tasks executed for this project.

4.0 FIELD ACTIVITIES

Field activities performed during this phase of work consisted of drilling operations, soil sampling, monitoring well installation, groundwater measurement and sampling, as well as shallow soil sampling. A description of these activities is presented in the following sections.

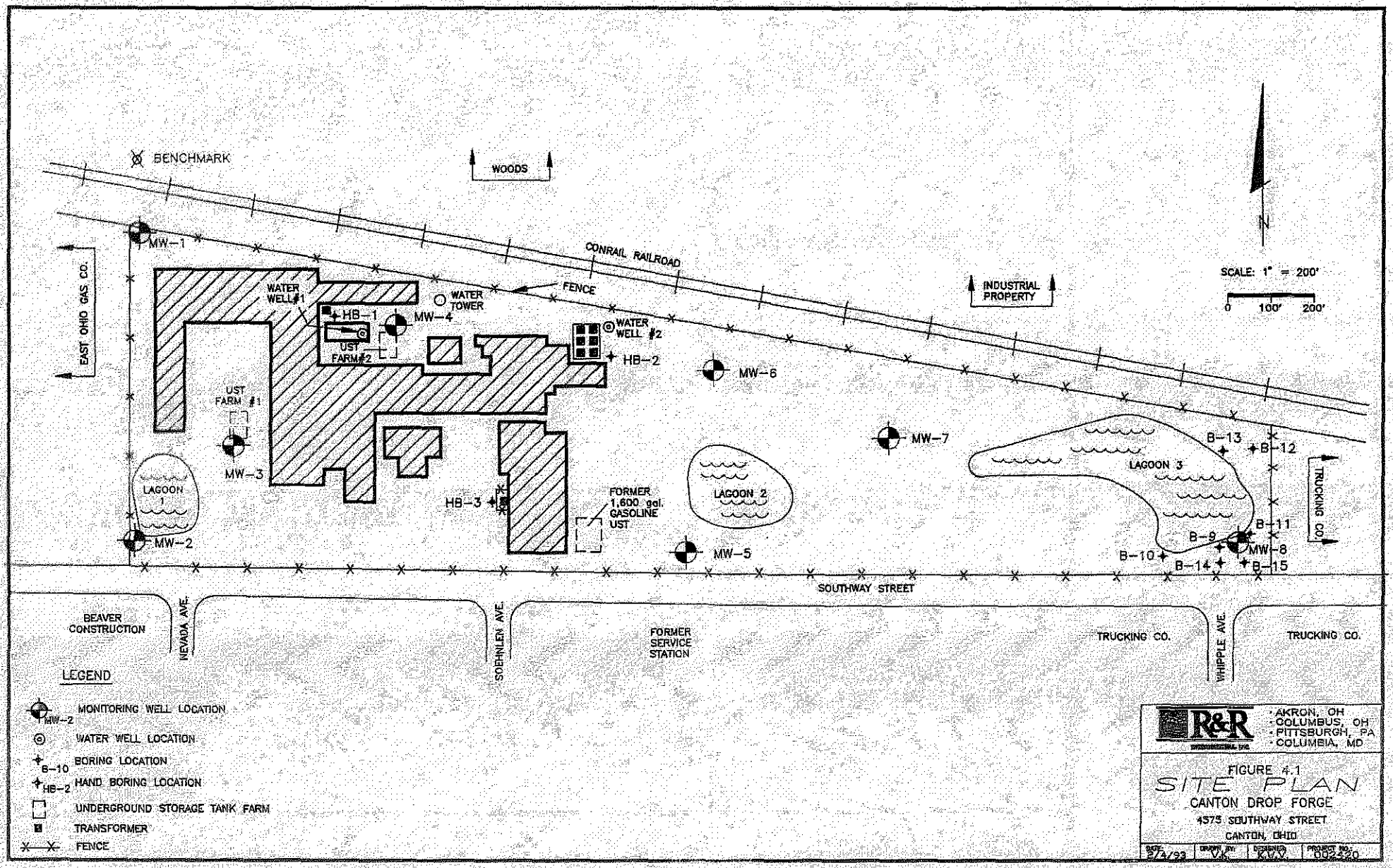
4.1 Drilling Operations

Drilling operations were conducted November 24 through December 4, 1992. An R&R environmental geologist supervised the drilling of eight (8) test borings using 4.25 inch inside diameter, continuous flight, hollow stem augers. The locations of the borings are identified on the Site Plan (Figure 4.1). Drilling logs for each boring are presented in Appendix A of this report. The locations of the borings were determined by R&R, Hammontree personnel, and discussed with CDF personnel to clear utilities during a pre-inspection visit to the site. An additional seven (7) shallow borings were advanced in the vicinity of B-8 after evidence of residual hydrocarbon compounds was encountered during field operations. The location of the additional borings were determined in the field by R&R and Hammontree, while CDF personnel were present, in an attempt to delineate the extent of the impacted shallow soils.

All sampling and drilling equipment that contacted the borings during drilling operations was decontaminated by high pressure steam cleaning between boring locations. Soil cuttings generated during the drilling operations were placed between plastic sheeting at each boring location and left at the site for subsequent disposal by Canton Drop Forge and Manufacturing.

4.2 Soil Sampling

Soil samples were collected on a continuous basis from borings B-1 through B-8 using a split-spoon sampling device (ASTM


BENCHMARK
WOODS
CONRAIL RAILROAD
FENCE
INDUSTRIAL PROPERTY
SCALE: 1" = 200'
0 100' 200'
N
EAST OHIO GAS CO.
MW-1
WATER WELL #1
HB-1
MW-4
WATER TOWER
UST FARM #2
WATER WELL #2
HB-2
MW-6
UST FARM #1
MW-3
MW-7
LAGOON 1
MW-2
HB-3
FORMER 1,600 gal. GASOLINE UST
LAGOON 2
MW-5
LAGOON 3
B-13
B-12
B-11
B-9
MW-8
B-10
B-14
B-15
TRUCKING CO.
SOUTHWAY STREET
BEAVER CONSTRUCTION
NEVADA AVE.
SOEHNLEN AVE.
FORMER SERVICE STATION
TRUCKING CO.
WHIPPLE AVE.
TRUCKING CO.
LEGEND
MW-2 MONITORING WELL LOCATION
WATER WELL LOCATION
B-10 BORING LOCATION
HB-2 HAND BORING LOCATION
UNDERGROUND STORAGE TANK FARM
TRANSFORMER
FENCE
R&R
· AKRON, OH
· COLUMBUS, OH
· PITTSBURGH, PA
· COLUMBIA, MD
FIGURE 4.1
SITE PLAN
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO
DATE: 2/4/93
DRAWN BY: V.K.
DESIGNED: K.V.V.
PROJECT NO.: 002420

CDF012338

D-1586). Each split-spoon sample was carefully examined and logged by the supervising R&R environmental geologist noting the recovery, soil type, moisture content and any evidence of contamination such as staining or odors.

Representative samples of the recovered soil materials were split and placed in one (1) four-ounce glass jar and one (1) eight-ounce glass jar (or three (3) four-ounce glass jars). Each jar was promptly sealed with a screw-on Teflon® lined lid and a label was placed on each sample jar indicating the sample identification number as well as the date and time of collection. One (1) of the jars was covered with aluminum foil prior to being sealed with the lid. The other soil sample(s) were promptly placed in an ice filled cooler (4°C). After a period of sample stabilization (not less than 15 minutes), the headspace gas in the foil covered sample jar was tested for the presence of volatile organic compounds (VOCs) using a photoionization detector (PID). This was accomplished by inserting the instrument probe into the jar through the aluminum foil seal and then observing the maximum VOC reading. These values were recorded for each soil sample and were used to aid in the selection of a soil sample for laboratory analysis. The selection of soil samples for laboratory analysis was approved by CDF personnel prior to submitting the samples to the laboratory.

The shallow soil samples were collected from locations near specific exterior electrical transformers with a hand-auger. The sample locations were determined by an R&R environmental geologist based on the local topography and proximity to the transformers. The soil samples were collected from depths ranging between 0.5 and 1.5 feet. The soil samples were promptly placed in eight-ounce glass jars and placed in an ice-filled cooler (4°C).

All sampling equipment that contacted the soils was carefully decontaminated between sampling events using a

laboratory grade soap and a fresh water rinse. The sampling equipment was permitted to air dry prior to re-use.

4.3 Monitoring Well Installation

Monitoring wells were installed in borings B-1 through B-8 after the presence of saturated conditions was confirmed within the drilled interval. The wells were constructed of 2-inch, schedule 40 PVC casing and 0.010-inch, slotted well screen. The annulus between the boring wall and the screen was filled with coarse sand, sufficient to cover the screened interval. A bentonite pellet seal was placed above the sand interval to prevent vertical fluid migration along the wellbore. A cement-bentonite grout was placed into the annulus of the well sufficient to bring the grout to within one (1) foot of grade. A lockable, expansion-type well cap was installed at the top of each casing string. The wells installed for this investigation were completed with a protective steel casing set in concrete. Well construction details are provided on the Monitoring Well Diagrams included in Appendix A of this report.

The monitoring wells installed during this investigation were properly developed by surging and then bailing to remove three (3) to five (5) times the calculated well volumes or bailing the wells dry, whichever occurred first. Well development and sampling data is included in Appendix B of this report. Development water generated during the field operations was contained in fifty-five (55) gallon drums which was labeled as to their contents and left at the site for subsequent disposal by Canton Drop Forge and Manufacturing.

4.4 Site Survey

The relative elevations of the well casing tops were established by surveying conducted by Hammontree & Associates. A United States Geological Survey (U.S.G.S.) benchmark was located

north of the northwest corner of the site with an elevation of 1069.15 feet. The elevation of each well casing top was referenced to this benchmark and is accurate to 0.01 feet. A site plan showing the location of the monitoring wells relative to the existing structures as well as the benchmark was also prepared (Figure 4.1).

4.5 Groundwater Measurement and Sampling

On December 7, 1992, groundwater depths in all the monitoring wells were measured prior to developing and sampling procedures while groundwater was in a static condition. Groundwater depths were measured using an electronic interface probe which can detect groundwater as well as phase-separated hydrocarbon layers and is accurate to within 0.01 feet. No phase separated hydrocarbons were detected in the monitoring wells during the this investigation.

After groundwater depths were recorded, the wells were properly developed and sampled following USEPA sampling protocols. The groundwater samples were inspected for separate phase compounds, color and odor. The samples were preserved with the appropriate acid supplied by the laboratory and were promptly placed in a ice-pack filled cooler (4°C). A label was placed on each sample jar indicating the sample identification number as well as the time and date of collection. A chain-of-custody form was prepared to document sample handling (see Appendix D).

On January 6, 1993, additional groundwater samples were collected from MW-2 and MW-8 to confirm the analytical results reported for the samples obtained on December 7, 1992. A water sample was obtained from Lagoon No. 3 for analysis of the Target Compound List of metals.

5.0 FINDINGS OF INVESTIGATION

Background research and the field activities conducted at this site yielded information regarding the geological and hydrological setting of the site. The laboratory analysis of the soil and groundwater samples submitted provided information concerning the presence or absence of the targeted compounds in the subsurface at this site. This information is summarized in the following sections.

5.1 Geology

According to the Glacial Map of Ohio (1967) published by the Ohio Department of Natural Resources (ODNR), the project site lies in an area of kames and eskers. These deposits are high, steep hummocks and long, sinuous ridges, respectively, composed almost entirely of interbedded sand and gravel. The thickness of these melt-water deposits range from 10 to 200 feet thick. These materials are generally considered to be highly susceptible to the infiltration and migration of contaminants due to their high permeability.

According to the soil survey map of Stark County (October, 1971) published by the U.S. Department of Agriculture, near surface soils at the site are comprised of the Chili-Wheeling-Shoals Association and Canfield-Wooster Association. In general, Chili-Wheeling-Shoals soils formed in glacial outwash and are deep, nearly level to steep, and well-drained. The Canfield-Wooster soils are deep, sloping to steep, moderately well drained to well drained, and formed in loamy glacial till. Overall, the soil at the site is classified as Urban which means that cut and fill operations may have altered the original soil profile to an unrecognizable extent.

Bedrock beneath the site is estimated to lie 70 feet beneath the existing grade. At this depth bedrock is expected to be

comprised of Pennsylvanian aged Pottsville and Allegheny formations. These formations consist of interbedded coal, sandstone, shale, and limestone.

The soil borings at the site encountered predominantly brown sand and gravel. Borings B-2, B-4, B-5, and B-6 encountered intervals of brown silt interbedded with the sand and gravel. Boring B-8 encountered brown silt and hydrocarbon stained silt to a termination depth of 11.0 feet. No laterally continuous impermeable layers (i.e. clay rich intervals) were encountered during this investigation that would represent a barrier to vertical migration in any of the borings. Bedrock was not encountered in any of the borings advanced during this investigation. For specific subsurface conditions at various depths, refer to the boring logs presented in Appendix A of this report.

5.2 Hydrogeology

Hydrogeological conditions at the site were researched by consulting the Groundwater Resources of Stark County Map published in 1988 by the Ohio Department of Natural Resources (ODNR) as well as reviewing located water well records for water wells located in the vicinity of the site. Three (3) water wells identified by ODNR are within one-half mile of the site. Two (2) additional water wells are present on the subject site. All five (5) wells penetrated soil materials similar to the soils encountered during this investigation. Four (4) of the five (5) wells were drilled to depths ranging from 215 to 425 feet and penetrated bedrock at depths ranging from 88 to 235 feet. Static groundwater levels ranged from 25 to 92 feet. The water well located southwest of the site was terminated at 84 feet in sand and gravel and is likely producing water from the shallow groundwater zone identified at the site during this investigation. Test rates for the wells set into bedrock ranged

from 34 to 300 gallons per minute (gpm). The well set in sand and gravel had a test rate of 10 gpm. From the water well report information it is not known whether the shales encountered in the water wells represent an impermeable layer between the shallow groundwater zone identified during this investigation and the groundwater zone from which four (4) of the five (5) local water wells are producing water. The shales are described with respect to color (dark to black) but do not provide any detail about weathering, fractures, or other indicators of permeability. Copies of the water well logs are included in Appendix C.

The groundwater resources map indicates that the site is located in the best groundwater area in Stark County. Yields of more than 500 gpm can be developed from the permeable sand and gravel deposits in deep buried valleys.

Groundwater was encountered in borings B-1 through B-8 during this investigation. Static water levels in the monitoring wells installed in the borings ranged between depths of 35.28 to 50.88 feet below the tops of the well casings during the well sampling activities which took place on December 7, 1992. The static water level in MW-8 was 6.47 feet below the top of the well casing and represents a perched groundwater zone. An apparent drop of the potentiometric surface of the shallow groundwater zone between well installation and groundwater sampling activities resulted in low water column heights in MW-1 and MW-5 which precluded the collection of sufficient samples for laboratory analyses. The groundwater level measurements obtained on December 7, 1992, are summarized in Table 5.1. This information has been used to construct a potentiometric surface map of the site which is presented in Figure 5.1. According to the potentiometric surface map, the shallow groundwater zone beneath the site generally flows towards the north. The average hydraulic gradient of the shallow aquifer intersected by the monitoring wells was calculated at approximately 0.006 feet/foot.

TABLE 5.1

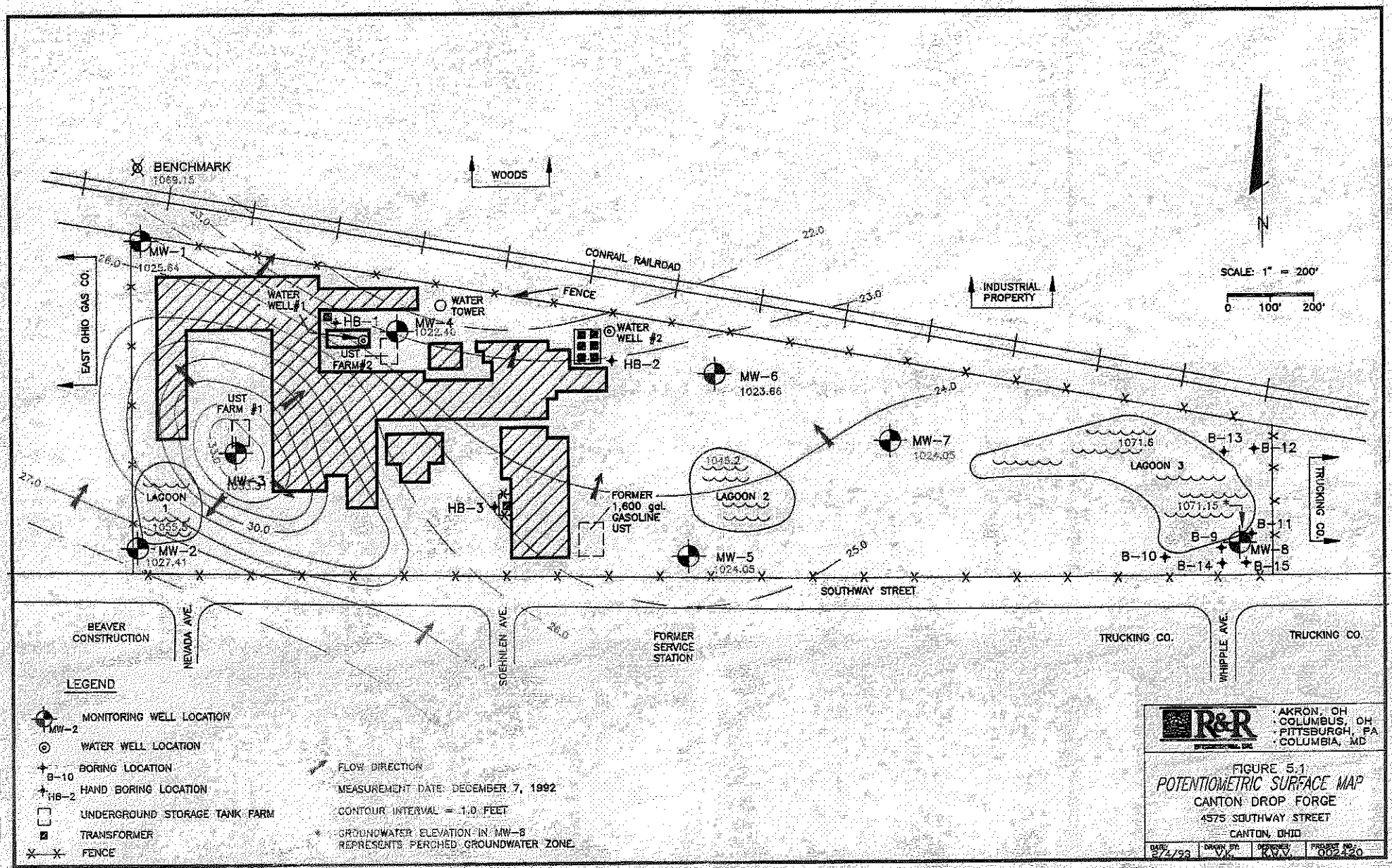
GROUNDWATER MEASUREMENTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATE: DECEMBER 7 AND 8, 1992

WELL NUMBER	DEPTH TO WATER (FT.) (1)	RELATIVE ELEVATION OF CASING (FT.) (2)	RELATIVE ELEVATION OF WATER (FT.) (2)
MW-1	49.87	1075.51	1025.64
MW-2	42.57	1069.98	1027.41
MW-3	37.70	1071.01	1033.31
MW-4	50.88	1073.28	1022.40
MW-5	35.28	1059.72	1024.44
MW-6	47.95	1071.61	1023.66
MW-7	50.15	1074.20	1024.05
MW-8	6.47	1077.62	1071.15

NOTES:
1. Depth to water measured from north side of casing.
2. Relative elevation of casing and water reference a U.S.C.G.S. benchmark located north of the northwest corner of the site with an elevation of 1069.15 feet above mean sea level. See Site Plan (Figure 4.1) for the location of the benchmark.
3. No phase separated hydrocarbons were detected in any of the monitoring wells during the investigation.


BENCHMARK
1069.15
WOODS
MW-1
1025.84
CONRAIL RAILROAD
FENCE
INDUSTRIAL PROPERTY
EAST OHIO GAS CO.
WATER WELL #1
WATER TOWER
HB-1
MW-4
1022.46
UST FARM #2
WATER WELL #2
HB-2
MW-6
1023.66
UST FARM #1
MW-3
1031.31
MW-7
1024.05
1045.2
LAGOON 1
1055.5
LAGOON 2
1071.6
LAGOON 3
1071.15
B-13
B-12
B-11
B-9
B-10
B-14
B-15
MW-8
HB-3
FORMER 1,600 gal. GASOLINE UST
MW-2
1027.41
MW-5
1024.05
SOUTHWAY STREET
TRUCKING CO.
BEAVER CONSTRUCTION
NEVADA AVE.
SOEHNLEN AVE.
FORMER SERVICE STATION
TRUCKING CO.
WHIPPLE AVE.
TRUCKING CO.
N
SCALE: 1" = 200'
0 100' 200'
LEGEND
MONITORING WELL LOCATION
WATER WELL LOCATION
BORING LOCATION
HAND BORING LOCATION
UNDERGROUND STORAGE TANK FARM
TRANSFORMER
FENCE
FLOW DIRECTION
MEASUREMENT DATE: DECEMBER 7, 1992
CONTOUR INTERVAL = 1.0 FEET
* GROUNDWATER ELEVATION IN MW-8 REPRESENTS PERCHED GROUNDWATER ZONE.
R&R
AKRON, OH
COLUMBUS, OH
PITTSBURGH, PA
COLUMBIA, MD
FIGURE 5.1
POTENTIOMETRIC SURFACE MAP
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO
DATE 5/4/93
DRAWN BY VK
DESIGNED RWV
PROJECT NO. 002420

CDF012346

A radial flow pattern located in the vicinity of MW-3 suggests a local recharge source. The permeable fill materials of the UST area 1 may be the cause of this local groundwater elevation "high". An alternate interpretation is that the groundwater "high" represents a perched groundwater zone caused by the clay and silty clay encountered at 38.0 to 39.0 feet and 40.0 to 41.0 feet, respectively. The on-site water wells appear that they may be influencing the potentiometric surface of the shallow groundwater zone at the site as indicated by the generally lower groundwater elevation in the area of the on-site water wells and MW-4. The groundwater encountered in MW-8 represents a perched groundwater zone and is likely in communication with Lagoon No. 3 based on the similar water elevations.

5.3 Target Compounds in the Subsurface

Results obtained from the laboratory analysis of the soil and groundwater samples indicate the presence of several of the targeted compounds in the soil and groundwater at the site. Details of the distribution and concentration of the compounds encountered at the site during this investigation are provided in the following sections.

5.3.1 Soil Analytical Results

All soil samples obtained during the advancement of each boring at the site were field screened for volatile organic compounds (VOCs) with a photoionization detector (PID) using headspace analysis techniques. Table 5.2 summarizes the data recorded from the headspace screening during this investigation.

The headspace analysis data indicates that significantly elevated VOC concentrations were detected in soil samples obtained from only one (1) of the eight (8) borings advanced at the site during this investigation (i.e. B-8). The maximum VOC concentration detected in the soils from B-8 was 141 ppm. The elevated concentrations

TABLE 5.2
SOIL SAMPLE HEADSPACE ANALYSIS
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE DATES: NOVEMBER 24 TO DECEMBER 4, 1992

SAMPLE DEPTH	HEADSPACE VOLATILE CONCENTRATION B-1 (ppm)	B-2 (ppm)	B-3 (ppm)	B-4 (ppm)	B-5 (ppm)	B-6 (ppm)	B-7 (ppm)	B-8 (ppm)
1.0-3.0	23.8	1.2	1.6	1.8	3.7	9.2	10.6	1.6
3.0-5.0	2.3	1.2	2.8	1.9	4.6*	12.6*	5.5	1.8
5.0-7.0	1.7	0.2	2.2	3.0	N.R.	9.9*	3.8	2.5
7.0-9.0	1.9	3.4	1.8	3.0	5.0*	7.7	1.2	141*
9.0-11.0	1.7	2.2	2.2	3.2	2.6	8.1	4.2	12.9*
11.0-13.0	1.7	1.9	1.6	3.5	2.6	10.5	3.7	
13.0-15.0	1.8	1.3	1.7	2.6	3.3	4.4	2.2	
15.0-17.0	2.4	1.3	N.R.	2.2	1.7	3.2	3.4	
17.0-19.0	2.2	2.0	1.7	1.8	2.6	N.R.	4.5	
19.0-21.0	N.R.	3.7	2.0	0.7	N.R.	5.8	3.0	
21.0-23.0	2.1	1.0	2.1	0.7	2.9	8.0	4.1	
23.0-25.0	2.1	1.2	2.4	0.9	2.1	9.7	6.1	
25.0-27.0	1.8	1.4	2.6	1.5	2.4	8.2	5.8	
27.0-29.0	1.6	1.1	2.3	1.1	4.3	2.8	6.2	
29.0-31.0	1.9	1.0	3.1	0.8	4.5	8.8	3.4	
31.0-33.0	1.8*	0.9*	3.3	1.4	2.9	6.5	11.1*	
33.0-35.0	1.5	1.7*	2.8	12.1*		7.0	9.7*	
35.0-37.0	1.6	1.1	2.7*	4.0*		8.0	7.7	
37.0-39.0	1.6	1.7	2.3*	2.9		8.8	10.8	
39.0-41.0	2.5	1.9	3.1	0.0		10.0	9.6	
41.0-43.0	2.1	1.1		0.0		7.2	7.5	
43.0-45.0	2.2	1.7		0.0		11.4	5.1	
45.0-47.0	4.2	2.7		2.2		8.0	4.5	
47.0-49.0	4.0			1.1		8.1	1.4	
49.0-51.0				0.0		4.6	1.8	
51.0-53.0				0.0		5.9	1.5	
53.0-55.0				0.0		4.6	1.8	
55.0-57.0				0.3				
57.0-59.0				0.0				

NOTES:
1. Photoionization detector utilized during this Investigation was a Photovac Microtip® Model HL-2000 fitted with a 10.6 eV lamp and calibrated to 100 ppm isobutylene.
2. * Sample which was submitted for laboratory analyses.
3. N.R. = No sample recovery.

were detected in samples obtained between the depths of 7.0 and 9.0 feet. The maximum concentrations in the soil samples obtained from the other seven (7) borings ranged from 3.3 ppm (B-3) to 23.8 ppm (B-1). The soil sample from B-8 also had significant hydrocarbon staining and odor. A sheen was also noted on the split-spoon during soil sampling. Subsequent to encountering the hydrocarbon impacted soils in B-8, a series of shallow borings designated B-9 through B-15, were advanced in the immediate area of B-8 (see Figure 4.1), as per the request of Canton Drop Forge personnel (Jerry Bressanelli, et al.). These shallow borings were an attempt to delineate the extent of the hydrocarbon compound impacted soil. All seven (7) borings encountered similar subsurface conditions comprised of silty soil materials. Borings B-9, B-11, B-14, and B-15 encountered evidence of hydrocarbon impacted soils. No soil samples were collected during the advancement of borings B-9 through B-15 and no well logs were generated.

The concentration of VOCs from borings B-1 through B-8 as determined by the PID headspace analyses, the presence of staining, and odor, as well as the depth of the sample with respect to the groundwater level were considered in the determination of a sample to submit to an independent laboratory for analysis. Final approval of all soil samples selected for laboratory analysis was obtained by CDF personnel (i.e. Keith Houseknecht). The soil samples were analyzed for total petroleum hydrocarbons (TPH) per EPA Method 418.1, the Target Compound List (TCL) of volatile and semi-volatile organic compounds (SW846 8240 and 8270, respectively), polychlorinated biphenyls (PCBs, per SW846 8080), the TCL of metals (SW846 7000 series), total cyanide (SW846 9010), and total recoverable phenolics (SW846 9065). In addition, the hand-augered soil samples obtained from

near the three (3) exterior transformer locations were submitted for analysis of polychlorinated biphenyls (PCBs, per SW846 8080). Transformers are often a source of PCBs. The results of the soil analyses obtained during this and the previous EPA investigation are presented in Tables 5.3, 5.4, 5.5, as well as 5.6. These tables were used to generate Figures 5.2 and 5.3, maps of detected targeted compounds in soil at the site. Complete laboratory analytical reports are included in Appendix D of this report.

The analytical results indicate that no detectable concentrations of total recoverable phenolics or total cyanide were detected in any of the submitted soil samples. PCBs were only detected in one (1) soil sample (B-6) with a concentration of 0.31 mg/Kg.

Total petroleum hydrocarbons (TPH) were detected in three (3) of the eight (8) soil samples. The reported concentrations ranged from 4400 mg/Kg (B-5) to 6800 mg/Kg (B-8). The three (3) samples were obtained from borings located in the landfill area on the eastern half of the site.

The analytical results indicate that at least one (1) volatile organic compound was detected in six (6) of the eight (8) soil samples obtained during this investigation. The detected compounds included 2-butanone (methyl ethyl ketone), tertrachloroethene, and 1,1,1-trichloroethane. These are not known residual petroleum hydrocarbons. The sample from B-1 had a reported concentration of 2-butanone 140 ug/Kg. Tetrachloroethene was detected in two (2) of the soil samples with reported concentrations of 26 ug/Kg(B-7) and 51 ug/Kg (B-6). The soil samples from B-3, B-4, and B-8 had detectable concentrations of 1,1,1-trichloroethane ranging from 11 (B-4) to 18 ug/Kg (B-8). The soil samples obtained from B-2 and B-5 had no detectable concentrations

TABLE 5.3

SUMMARY OF SOIL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	TOTAL CYANIDE (mg/Kg)	POLYCHLORINATED BIPHENYLS (PCBs) (mg/Kg)	TOTAL PETROLEUM HYDROCARBONS (EPA Method 418.1) (mg/Kg)	TOTAL RECOVERABLE PHENOLICS (mg/Kg)
Sample Dates: May 16, 1990				
S-1 (0.0-0.5)	BDL	BDL	N/A	N/A
S-2 (0.0-0.5)	BDL	BDL	N/A	N/A
S-3 (0.0-0.5)	1.3	BDL	N/A	N/A
S-4 (0.0-0.5)	BDL	BDL	N/A	N/A
S-5 (0.0-0.5)	BDL	BDL	N/A	N/A
S-6 (0.0-0.5)	BDL	BDL	N/A	N/A
S-7 (0.0-0.5)	BDL	BDL	N/A	N/A
S-8 (0.0-0.5)	BDL	BDL	N/A	N/A
S-9 (0.0-0.5)	BDL	BDL	N/A	N/A
Sample Date: November 24 to December 4, 1992				
B-1 (31.0-33.0)	BDL	BDL	BDL	BDL

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TABLE 5.3 (CONTINUED)

SUMMARY OF SOIL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	TOTAL CYANIDE (mg/Kg)	POLYCHLORINATED BIPHENYLS (PCBs) (mg/Kg)	TOTAL PETROLEUM HYDROCARBONS (EPA Method 418.1) (mg/Kg)	TOTAL RECOVERABLE PHENOLICS (mg/Kg)
Sample Date: November 24 to December 8, 1992				
B-2 (31.0-35.0)	BDL	BDL	BDL	BDL
B-3 (35.0-39.0)	BDL	BDL	BDL	BDL
B-4 (33.0-37.0)	BDL	BDL	BDL	BDL
B-5 (3.0-9.0)	BDL	BDL	4400	BDL
B-6 (3.0-7.0)	BDL	0.31	5100	BDL
B-7 (31.0-35.0)	BDL	BDL	BDL	BDL
B-8 (7.0-11.0)	BDL	BDL	6800	BDL

NOTES: 1. BDL = Below detection limits

2. N/A = Not analyzed

3. Detailed analytical results are reported in Appendix D of this report.

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TABLE 5.4

SUMMARY OF SOIL VOLATILE AND SEMI-VOLATILE ORGANIC COMPOUNDS
TARGET COMPOUND LIST RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	COMPOUND DETECTED	CONCENTRATION (ug/Kg)
Sample Date: May 16, 1990		
S-1 (0.0-0.5)	None	
S-2 (0.0-0.5)	1,1,1-Trichloroethane	20
	Toluene	38
	Ethylbenzene	17
	Xylene	140
	Naphthalene	830
	Fluorene	430
	Phenanthrene	1200
	Di-n-butylphthalate	680
	Pyrene	530
S-3 (0.0-0.5)	None	
S-4 (0.0-0.5)	Benzoic Acid	1100
	Chrysene	740
S-5 (0.0-0.5)	Methylene Chloride	45
	Bis (2-ethylhexyl) phthalate	840

TABLE 5.4 (CONTINUED)

SUMMARY OF SOIL VOLATILE AND SEMI-VOLATILE ORGANIC COMPOUNDS
TARGET COMPOUND LIST RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	COMPOUND DETECTED	CONCENTRATION (ug/Kg)
Sample Date: May 16, 1990		
S-6 (0.0-0.5)	Benzoic Acid	620
	Naphthalene	580
	2-Methylnaphthalene	990
	Phenanthrene	1000
	Fluoranthene	850
	Pyrene	1100
	Benzo[a]anthracene	460
	Chrysene	730
	Benzo[b]fluoranthene	450
S-7 (0.0-0.5)	Benzoic Acid	1400
	Phenanthrene	4000
	Chrysene	1500
S-8 (0.0-0.5)	None	
S-9 (0.0-0.5)	Fluoranthene	770
	Pyrene	690
	Benzo[a]anthracene	390
	Chrysene	530
	Benzo[b]fluoranthene	310
	Benzo[k]fluoranthene	280

TABLE 5.4 (CONTINUED)

SUMMARY OF SOIL VOLATILE AND SEMI-VOLATILE ORGANIC COMPOUNDS
TARGET COMPOUND LIST RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	COMPOUND DETECTED	CONCENTRATION (ug/Kg)
Sample Date: November 24 to December 4, 1992		
B-1 (31.0-33.0)	2-Butanone	140
B-2 (31.0-35.0)	None	
B-3 (35.0-39.0)	1,1,1-Trichloroethane	22
B-4 (33.0-37.0)	1,1,1-Trichloroethane	11
B-5 (3.0-9.0)	None	
B-6 (3.0-7.0)	Tetrachloroethene 1,1,1-Trichloroethane	51 110
B-7 (31.0-35.0)	Tetrachloroethene	26
B-8 (7.0-11.0)	1,1,1-Trichloroethane	18

Note: Detailed analytical results are reported in Appendix C of this report.

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TABLE 5.5

SUMMARY OF SOIL TOTAL METAL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (ft.)	ALUMINUM (mg/Kg)	ANTIMONY (mg/Kg)	ARSENIC (mg/Kg)	BARIUM (mg/Kg)	BERYLLIUM (mg/Kg)	CADMIUM (mg/Kg)	CALCIUM (mg/Kg)	CHROMIUM (mg/Kg)	COBALT (mg/Kg)
Sample Date: May 16, 1990									
S-1 (0.0 - 0.5)	2,180	14.2	32.7	48.7	0.26	BDL	8,210	247	25
S-2 (0.0 - 0.5)	2,730	16.8	19.9	11.3	BDL	BDL	625	251	40.2
S-3 (0.0 - 0.5)	11,100	8	27.3	413	1.5	1	4,360	2.9	23.4
S-4 (0.0 - 0.5)	12,400	BDL	28.4	252	0.59	BDL	11,200	32.7	16.9
S-5 (0.0 - 0.5)	9,860	8.7	37.6	415	0.92	BDL	4,460	40.6	12.7
S-6 (0.0 - 0.5)	2,500	6.5	29.5	1790	BDL	BDL	7,120	220	23.3
S-7 (0.0 - 0.5)	9,780	BDL	16.6	197	BDL	BDL	2,530	53.8	10.9
S-8 (0.0 - 0.5)	2,710	50.6	35.6	50.1	BDL	BDL	4,030	405	62.1
S-9 (0.0 - 0.5)	11,500	11.4	19.3	121	0.41	BDL	3,670	37.9	16
Sample Date: November 24 to December 4, 1992									
B-1 (31.0 - 33.0)	11,000	BDL	20	1100	BDL	0.23	2,800	24	17
B-2 (31.0 - 35.0)	14,000	BDL	44	93	BDL	0.39	2,500	25	BDL
B-3 (35.0 - 39.0)	30,000	1.0	20	200	BDL	BDL	29,000	45	BDL
B-4 (33.0 - 37.0)	9,300	BDL	19	77	BDL	0.068	35,000	21	BDL
B-5 (23.0 - 25.0)	13,000	BDL	17	99	BDL	0.58	2,100	26	BDL
B-6 (3.0 - 7.0)	6,000	0.58	7.6	1500	BDL	250	9,200	2000	33
B-7 (31.0 - 35.0)	11,000	BDL	170	130	BDL	200	40,000	16	12
B-8 (7.0 - 11.0)	15,000	BDL	0.71	530	BDL	180	2,200	110	BDL

CDF012356

TABLE 5.5 - Continued

SUMMARY OF SOIL TOTAL METAL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	COPPER (mg/Kg)	IRON (mg/Kg)	LEAD (mg/Kg)	MAGNESIUM (mg/Kg)	MANGANESE (mg/Kg)	MERCURY (mg/Kg)	NICKEL (mg/Kg)	POTASSIUM (mg/Kg)
Sample Date: May 16, 1990								
S-1 (0.0-0.5)	562	67,800	19.1	1,770	755	BDL	1200	259
S-2 (0.0-0.5)	1490	124,000	3	208	1,110	BDL	1320	BDL
S-3 (0.0-0.5)	79.3	45,300	57.2	1,640	3,060	BDL	149	804
S-4 (0.0-0.5)	39.2	31,800	31.5	3,320	612	0.21	67.2	1,450
S-5 (0.0-0.5)	106	26,200	65.4	2,210	242	0.27	110	915
S-6 (0.0-0.5)	125	73,600	76	399	337	0.16	219	628
S-7 (0.0-0.5)	87.7	26,300	71.6	1,680	409	BDL	208	987
S-8 (0.0-0.5)	572	114,000	1,130	758	1,050	BDL	1550	261
S-9 (0.0-0.5)	31.6	30,500	61.6	2,410	1,140	0.15	69.2	1,340
Sample Date: November 24 to December 4, 1992								
B-1 (31.0-33.0)	29	35,000	21	2,500	6,200	BDL	20	2,300
B-2 (31.0-35.0)	28	51,000	23	2,600	1,000	BDL	22	3,200
B-3 (35.0-39.0)	40	39,000	16	8,500	630	BDL	27	8,200
B-4 (33.0-37.0)	18	37,000	16	8,600	500	BDL	15	2,200
B-5 (23.0-25.0)	31	42,000	21	2,200	330	BDL	36	3,400
B-6 (3.0- 7.0)	360	2,800	24	1,400	260	BDL	1,800	1.7
B-7 (31.0-35.0)	17	390	46	15,000	1,400	BDL	33	6.0
B-8 (7.0-11.0)	38	870	20	1,800	420	BDL	68	3.2

CDF012357

TABLE 5.5 - Continued

SUMMARY OF SOIL TOTAL METAL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE NUMBER SAMPLE DEPTH (FT.)	SELENIUM (mg/Kg)	SODIUM (mg/Kg)	THALLIUM (mg/Kg)	VANADIUM (mg/Kg)	ZINC (mg/Kg)
Sample Date: May 16, 1990					
S-1 (0.0 - 0.5)	BDL	34.3	BDL	10.2	97.4
S-2 (0.0 - 0.5)	BDL	189	BDL	6	36.1
S-3 (0.0 - 0.5)	BDL	89.3	BDL	30.7	136
S-4 (0.0 - 0.5)	3.6	122	BDL	30.1	160
S-5 (0.0 - 0.5)	25.3	202	5.1	34.3	132
S-6 (0.0 - 0.5)	0.79	120	0.73	19.1	68
S-7 (0.0 - 0.5)	BDL	32.4	BDL	22.7	69.7
S-8 (0.0 - 0.5)	BDL	120	BDL	23.4	107
S-9 (0.0 - 0.5)	0.53	78.5	BDL	25.5	114
Sample Date: November 24 to December 4, 1992					
B-1 (31.0 - 33.0)	BDL	520	BDL	25	100
B-2 (31.0 - 35.0)	BDL	BDL	BDL	32	89
B-3 (35.0 - 39.0)	BDL	BDL	BDL	49	79
B-4 (33.0 - 37.0)	BDL	BDL	BDL	16	61
B-5 (23.0 - 25.0)	BDL	BDL	BDL	26	190
B-6 (3.0 - 7.0)	BDL	BDL	BDL	BDL	96
B-7 (31.0 - 35.0)	BDL	BDL	BDL	25	86
B-8 (7.0 - 11.0)	BDL	500	BDL	BDL	58

CDF012358

TABLE 5.6

SUMMARY OF HAND BORING SOIL ANALYTICAL RESULTS

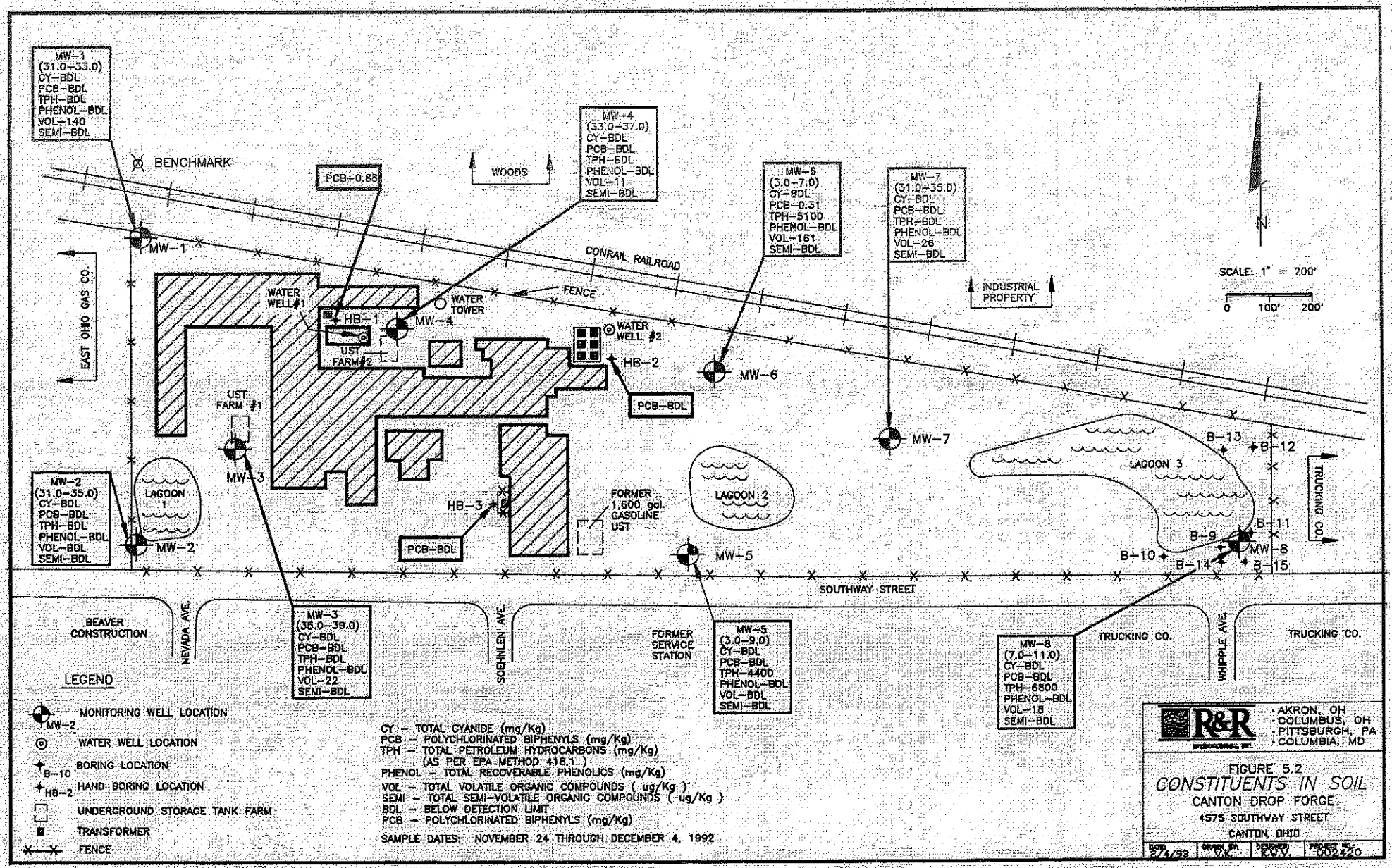
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATE: DECEMBER 8, 1992

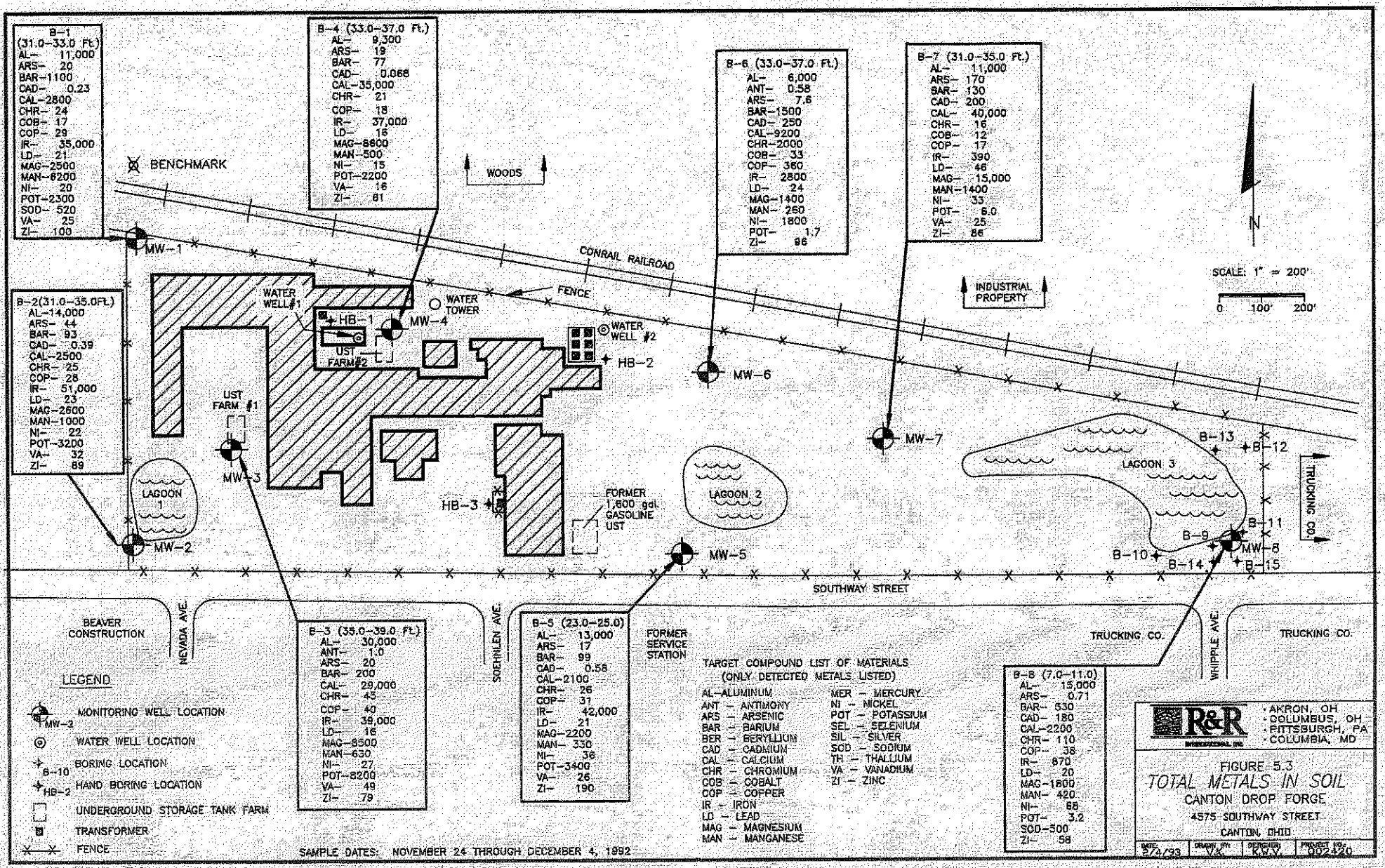
SAMPLE NUMBER	PCB 1016 (mg/Kg)	PCB 1221 (mg/Kg)	PCB 1232 (mg/Kg)	PCB 1242 (mg/Kg)	PCB 1248 (mg/Kg)	PCB 1254 (mg/Kg)	PCB 1260 (mg/Kg)
HB-1	BDL	BDL	BDL	BDL	BDL	BDL	0.88
HB-2	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HB-3	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: 1. BDL = Below detection limit

2. Sample locations indicated on Figure 4.1


MW-1
(31.0-33.0)
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-140
SEMI-BDL
BENCHMARK
PCB-0.88
WOODS
MW-4
(33.0-37.0)
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-11
SEMI-BDL
MW-6
(3.0-7.0)
CY-BDL
PCB-0.31
TPH-5100
PHENOL-BDL
VOL-161
SEMI-BDL
MW-7
(31.0-33.0)
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-26
SEMI-BDL
CONRAIL RAILROAD
FENCE
INDUSTRIAL PROPERTY
SCALE: 1" = 200'
0 100' 200'
N
EAST OHIO GAS CO.
WATER WELL #1
WATER TOWER
HB-1
MW-4
WATER WELL #2
HB-2
MW-6
PCB-BDL
UST FARM #2
UST FARM #1
MW-3
MW-7
B-13
B-12
LAGOON 3
TRUCKING CO.
MW-2
(31.0-35.0)
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-BDL
SEMI-BDL
LAGOON 1
MW-2
HB-3
PCB-BDL
FORMER 1,600 gal. GASOLINE UST
LAGOON 2
MW-5
B-11
B-9
MW-8
B-10
B-14
B-15
SOUTHWAY STREET
BEAVER CONSTRUCTION
NEVADA AVE.
MW-3
(35.0-39.0)
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-22
SEMI-BDL
SOEHNLEN AVE.
FORMER SERVICE STATION
MW-5
(3.0-9.0)
CY-BDL
PCB-BDL
TPH-4400
PHENOL-BDL
VOL-BDL
SEMI-BDL
MW-8
(7.0-11.0)
CY-BDL
PCB-BDL
TPH-6500
PHENOL-BDL
VOL-18
SEMI-BDL
TRUCKING CO.
WHIPPLE AVE.
TRUCKING CO.
LEGEND
MONITORING WELL LOCATION
MW-2
WATER WELL LOCATION
B-10 BORING LOCATION
HB-2 HAND BORING LOCATION
UNDERGROUND STORAGE TANK FARM
TRANSFORMER
FENCE
CY - TOTAL CYANIDE (mg/Kg)
PCB - POLYCHLORINATED BIPHENYLS (mg/Kg)
TPH - TOTAL PETROLEUM HYDROCARBONS (mg/Kg)
(AS PER EPA METHOD 418.1)
PHENOL - TOTAL RECOVERABLE PHENOLICS (mg/Kg)
VOL - TOTAL VOLATILE ORGANIC COMPOUNDS (ug/Kg)
SEMI - TOTAL SEMI-VOLATILE ORGANIC COMPOUNDS (ug/Kg)
BDL - BELOW DETECTION LIMIT
PCB - POLYCHLORINATED BIPHENYLS (mg/Kg)
SAMPLE DATES: NOVEMBER 24 THROUGH DECEMBER 4, 1992
R&R
• AKRON, OH
• COLUMBUS, OH
• PITTSBURGH, PA
• COLUMBIA, MD
FIGURE 5.2
CONSTITUENTS IN SOIL
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO
DATE 5/4/93
DRAWN BY VK
DESIGNED RVV
PROJECT NO. 002420

CDF012360


B-1 (31.0-33.0 Ft.)
AL- 11,000
ARS- 20
BAR-1100
CAD- 0.23
CAL-2800
CHR- 24
COB- 17
COP- 29
IR- 35,000
LD- 21
MAG-2500
MAN-6200
NI- 20
POT-2300
SOD- 520
VA- 25
ZI- 100
B-4 (33.0-37.0 Ft.)
AL- 9,300
ARS- 19
BAR- 77
CAD- 0.068
CAL-35,000
CHR- 21
COP- 18
IR- 37,000
LD- 16
MAG-8600
MAN-500
NI- 15
POT-2200
VA- 16
ZI- 81
B-6 (33.0-37.0 Ft.)
AL- 6,000
ANT- 0.58
ARS- 7.6
BAR-1500
CAD- 250
CAL-9200
CHR-2000
COB- 33
COP- 360
IR- 2800
LD- 24
MAG-1400
MAN- 260
NI- 1800
POT- 1.7
ZI- 96
B-7 (31.0-35.0 Ft.)
AL- 11,000
ARS- 170
BAR- 130
CAD- 200
CAL- 40,000
CHR- 16
COB- 12
COP- 17
IR- 390
LD- 46
MAG- 15,000
MAN-1400
NI- 33
POT- 6.0
VA- 25
ZI- 86
B-2(31.0-35.0Ft.)
AL-14,000
ARS- 44
BAR- 93
CAD- 0.39
CAL-2500
CHR- 25
COP- 28
IR- 51,000
LD- 23
MAG-2500
MAN-1000
NI- 22
POT-3200
VA- 32
ZI- 89
B-3 (35.0-39.0 Ft.)
AL- 30,000
ANT- 1.0
ARS- 20
BAR- 200
CAL- 29,000
CHR- 45
COP- 40
IR- 39,000
LD- 16
MAG-8500
MAN-630
NI- 27
POT-8200
VA- 49
ZI- 79
B-5 (23.0-25.0)
AL- 13,000
ARS- 17
BAR- 99
CAD- 0.55
CAL-2100
CHR- 26
COP- 31
IR- 42,000
LD- 21
MAG-2200
MAN- 330
NI- 36
POT-3400
VA- 26
ZI- 190
B-8 (7.0-11.0)
AL- 15,000
ARS- 0.71
BAR- 530
CAD- 180
CAL-2200
CHR- 110
COP- 38
IR- 870
LD- 20
MAG-1800
MAN- 420
NI- 68
POT- 3.2
SOD-500
ZI- 58
BENCHMARK
WOODS
CONRAIL RAILROAD
FENCE
INDUSTRIAL PROPERTY
WATER WELL #1
WATER TOWER
WATER WELL #2
UST FARM #2
UST FARM #1
FORMER 1,600 gal. GASOLINE UST
LAGOON 1
LAGOON 2
LAGOON 3
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
HB-1
HB-2
HB-3
B-9
B-10
B-11
B-12
B-13
B-14
B-15
SOUTHWAY STREET
BEAVER CONSTRUCTION
NEVADA AVE.
SOEHNLEN AVE.
FORMER SERVICE STATION
TRUCKING CO.
TRUCKING CO.
WHIPPLE AVE.
TRUCKING CO.
N
SCALE: 1" = 200'
0 100' 200'
LEGEND
MONITORING WELL LOCATION
WATER WELL LOCATION
BORING LOCATION
HAND BORING LOCATION
UNDERGROUND STORAGE TANK FARM
TRANSFORMER
FENCE
SAMPLE DATES: NOVEMBER 24 THROUGH DECEMBER 4, 1992
TARGET COMPOUND LIST OF MATERIALS
(ONLY DETECTED METALS LISTED)
AL-ALUMINUM
ANT - ANTIMONY
ARS - ARSENIC
BAR - BARIUM
BER - BERYLLIUM
CAD - CADMIUM
CAL - CALCIUM
CHR - CHROMIUM
COB - COBALT
COP - COPPER
IR - IRON
LD - LEAD
MAG - MAGNESIUM
MAN - MANGANESE
MER - MERCURY
NI - NICKEL
POT - POTASSIUM
SEL - SELENIUM
SIL - SILVER
SOD - SODIUM
TH - THALLIUM
VA - VANADIUM
ZI - ZINC
R&R
- AKRON, OH
- COLUMBUS, OH
- PITTSBURGH, PA
- COLUMBIA, MD
FIGURE 5.3
TOTAL METALS IN SOIL
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO
DATE 2/24/93
DRAWN BY VK
DESIGNED K.V.V.
PROJECT NO. 002420

CDF012361

of volatile organic compounds. No detectable concentration of any of the BTEX compounds or semi-volatile organic compounds were detected in the soil samples obtained during this investigation.

Concentrations of 18 of the 23 Target Compound List (TCL) metals were detected in the soil samples obtained during this investigation. Detectable concentrations of aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, and zinc were detected in all eight (8) soil samples. Other detected metals included antimony, cadmium, cobalt, sodium, and vanadium. According to the U. S. Geological Survey Professional Paper 1270 (1984), the detected concentration of the metals are within the range of normal concentrations detectable in soils from the conterminous United States except for three (3) samples: arsenic (170 mg/Kg in B-7), chromium (2000 mg/Kg in B-6), and nickel (1800 mg/Kg in B-6). The concentrations of beryllium, mercury, selenium, silver, and thallium were below detectable limits for all the submitted soil samples.

5.3.2 Groundwater Analytical Results

The groundwater samples collected on December 7, 8, and 17, 1992, from the eight (8) monitoring wells installed during this investigation were submitted to an independent laboratory for analysis of total petroleum hydrocarbons (TPH) per EPA Method 418.1, the Target Compound List (TCL) of volatile and semi-volatile organic compounds (SW846 8240 and 8270, respectively), polychlorinated biphenyls (PCBs, per SW846 8080), the TCL of metals (SW846 7000 series), total cyanide (SW846 9010), and total recoverable phenolics (SW846 9065). A summary of the groundwater sample characteristics is presented in Table 5.7. The analytical results reported for the groundwater samples collected during this investigation are summarized in Tables

TABLE 5.7

GROUNDWATER SAMPLE CHARACTERISTICS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

SAMPLE DATES: DECEMBER 7 AND 8, 1992

WELL NUMBER	SAMPLE APPEARANCE	ODOR
MW-1	Clear	None
MW-2	Brown	None
MW-3	Brown	None
MW-4	Brown	None
MW-5	I.S.	---
MW-6	Brown (muddy)	None
MW-7	Clear	None
MW-8	Clear with a sheen	Moderate hydrocarbon

NOTE: I.S. = Monitoring well had a water column height which was insufficient to allow water sampling activities.

5.8, 5.9, and 5.10. This information has been used to generate maps of constituents in groundwater and dissolved metals in
groundwater (Figures 5.4 and 5.5, respectively). Complete laboratory analytical reports are included in Appendix D of this report.

The results of the groundwater analysis indicated that no detectable concentrations of total cyanide, total recoverable phenolics and polychlorinated biphenyls (PCBs) were reported in the samples. The only detection of total petroleum hydrocarbons (TPH) was in the groundwater sample collected from MW-8 with a concentration of 34 mg/L.

The laboratory analysis of the groundwater samples only detected one (1) sample with a detectable concentration of any of the targeted volatile organic compounds. Chloromethane was detected in the sample from MW-8 with a concentration of 21 ug/L. No BTEX compounds or semi-volatile organic compounds were detected in the groundwater samples collected during this investigation.

Detectable concentrations of 14 of 23 Target Compound List (TCL) metals were reported in the groundwater samples. Calcium, magnesium, manganese, potassium, and sodium were detected in all six (6) samples. Other detected metals included aluminum, barium, cadmium, chromium, cobalt, iron, lead, vanadium, and zinc. The detected concentrations of barium in MW-8 (1.9 mg/L) and lead in MW-2 (0.040 mg/L) exceed the USEPA Maximum Contaminant Level (MCL) and Ohio EPA Action Level, for safe drinking water for those compounds, (i.e. 1.0 and 0.015 mg/L,respectively). The concentrations of manganese detected in all the samples exceed the Secondary Maximum Contaminant Level for that compound (0.05 mg/L).

Lead was not detected above detection limits for the groundwater collected from MW-2 during the re-sampling of

TABLE 5.8

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATES: DECEMBER 7 AND 8, 1992

SAMPLE NUMBER	TOTAL CYANIDE (mg/L)	POLYCHLORINATED BIPHENYLS (PCBs) (ug/L)	TOTAL PETROLEUM HYDROCARBONS (EPA Method 418.1) (mg/L)	TOTAL RECOVERABLE PHENOLICS (ug/L)
MW-1	I.S.	I.S.	I.S.	I.S.
MW-2	BDL	BDL	BDL	BDL
MW-3	BDL	BDL	BDL	BDL
MW-4	BDL	BDL	BDL	BDL
MW-5	I.S.	I.S.	I.S.	I.S.
MW-6	BDL	BDL	BDL	BDL
MW-7	BDL	BDL	BDL	BDL
MW-8	BDL	BDL	34	BDL

NOTES:
1. BDL = Below detection limits
2. I.S. = Monitoring well had a water column height which was insufficient for the collection of a water sample for this analysis.
3. Detailed analytical results are reported in Appendix D of this report.

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TABLE 5.9

SUMMARY OF GROUNDWATER VOLATILE AND SEMI-VOLATILE ORGANICS
TARGET COMPOUND LIST RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATES: DECEMBER 7 AND 8, 1992

SAMPLE NUMBER	COMPOUND DETECTED	CONCENTRATION (ug/L)
MW-1	None	-
MW-2	None	-
MW-3	None	-
MW-4	None	-
MW-5	I.S.	-
MW-6	None	-
MW-7	None	-
MW-8	Chloromethane	21

NOTES:
1. I.S. = Monitoring well had a water column height which was insufficient for the collection of a water sample for this analysis.
2. Detailed analytical results are reported in Appendix D of this report.

R&R INTERNATIONAL, INC.

TABLE 5.10

SUMMARY OF GROUNDWATER DISSOLVED METAL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATES: DECEMBER 7, 8, AND 17, 1992

SAMPLE NUMBER	ALUMINUM (mg/L)	ANTIMONY (mg/L)	ARSENIC (mg/L)	BARIUM (mg/L)	BERYLLIUM (mg/L)	CADMIUM (mg/L)	CALCIUM (mg/L)	CHROMIUM (mg/L)	COBALT (mg/L)
MW-1	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.
MW-2	BDL	BDL	BDL	0.14	BDL	0.0014	920	0.030	BDL
MW-3	BDL	BDL	BDL	BDL	BDL	BDL	640	BDL	BDL
MW-4	BDL	BDL	BDL	BDL	BDL	BDL	330	0.026	BDL
MW-5	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.
MW-6	0.38	BDL	BDL	BDL	BDL	BDL	540	BDL	BDL
MW-7	BDL	BDL	BDL	BDL	BDL	0.00084	320	BDL	BDL
MW-8	0.13	BDL	BDL	1.9 (3.4)[5]	BDL	BDL	140	BDL	BDL
Lagoon No. 3	0.083	BDL	BDL	BDL	BDL	BDL	48	BDL	BDL

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TABLE 5.10 (CONTINUED)

SUMMARY OF GROUNDWATER DISSOLVED METAL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATES: DECEMBER 7, 8, AND 17, 1992

SAMPLE NUMBER	COPPER (mg/L)	IRON (mg/L)	LEAD (mg/L)	MAGNESIUM (mg/L)	MANGANESE (mg/L)	MERCURY (mg/L)	NICKEL (mg/L)	POTASSIUM (mg/L)	SELENIUM (mg/L)	SILVER (mg/L)
MW-1	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.
MW-2	BDL	0.014	0.04 (BDL)[5]	110	2.1	BDL	BDL	9.6	BDL	BDL
MW-3	BDL	BDL	BDL	340	1.6	BDL	BDL	15	BDL	BDL
MW-4	BDL	BDL	BDL	120	1.8	BDL	BDL	9.8	BDL	BDL
MW-5	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.	I.S.
MW-6	BDL	BDL	BDL	140	1.3	BDL	BDL	7.3	BDL	BDL
MW-7	BDL	BDL	BDL	98	1.1	BDL	BDL	5.7	BDL	BDL
MW-8	BDL	0.18	BDL	60	1.7	BDL	BDL	7.2	BDL	BDL
Lagoon No. 3	BDL	0.20	BDL	33	0.064	BDL	BDL	2.4	BDL	BDL

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TABLE 5.10 (CONTINUED)

SUMMARY OF SOIL DISSOLVED METAL ANALYTICAL RESULTS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

MEASUREMENT DATES: DECEMBER 7, 8, AND 17, 1992

SAMPLE NUMBER SAMPLE DEPTH (FT.)	SODIUM (mg/L)	THALLIUM (mg/L)	VANADIUM (mg/L)	ZINC (mg/L)
MW-1	I.S.	I.S.	I.S.	I.S.
MW-2	550	BDL	BDL	0.066
MW-3	29	BDL	BDL	BDL
MW-4	55	BDL	BDL	BDL
MW-5	I.S.	I.S.	I.S.	I.S.
MW-6	66	BDL	0.057	BDL
MW-7	55	BDL	BDL	BDL
MW-8	62	BDL	BDL	BDL
Lagoon No. 3	39	BDL	BDL	BDL

Note: 1. I.S. = Monitoring well had a water column height which was insufficient to allow water sampling activities.
2. BDL = Below detection limits
3. Detailed analytical results are reported in Appendix D of this report.
4. Analytical results for antimony, calcium, magnesium, potassium, selenium, sodium, and thallium represent total sample concentration, not a dissolved concentration.
5. MW-2 lead re-sampled, MW-8 barium re-sampled, Lagoon 3 sampled on January 6, 1993.

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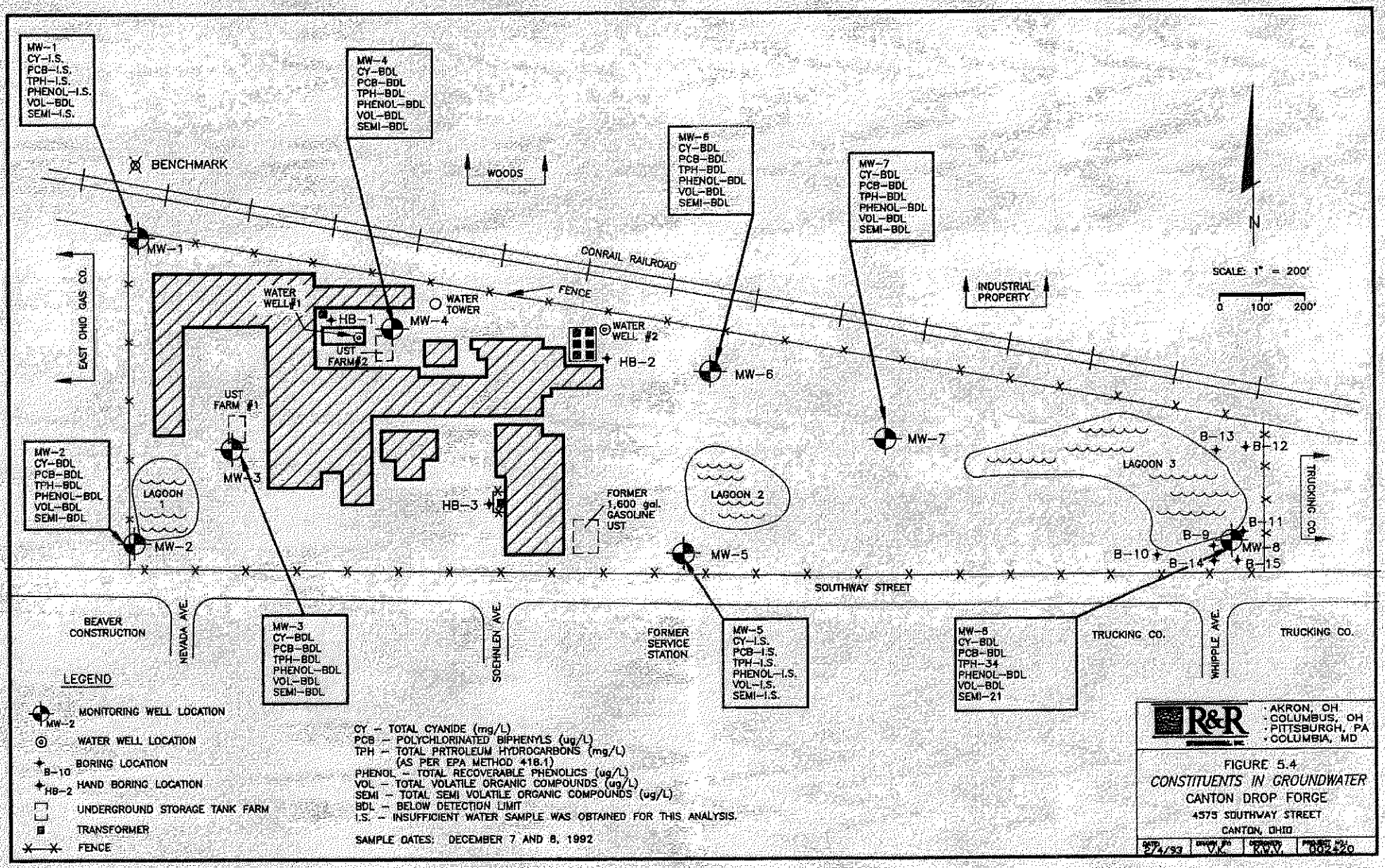
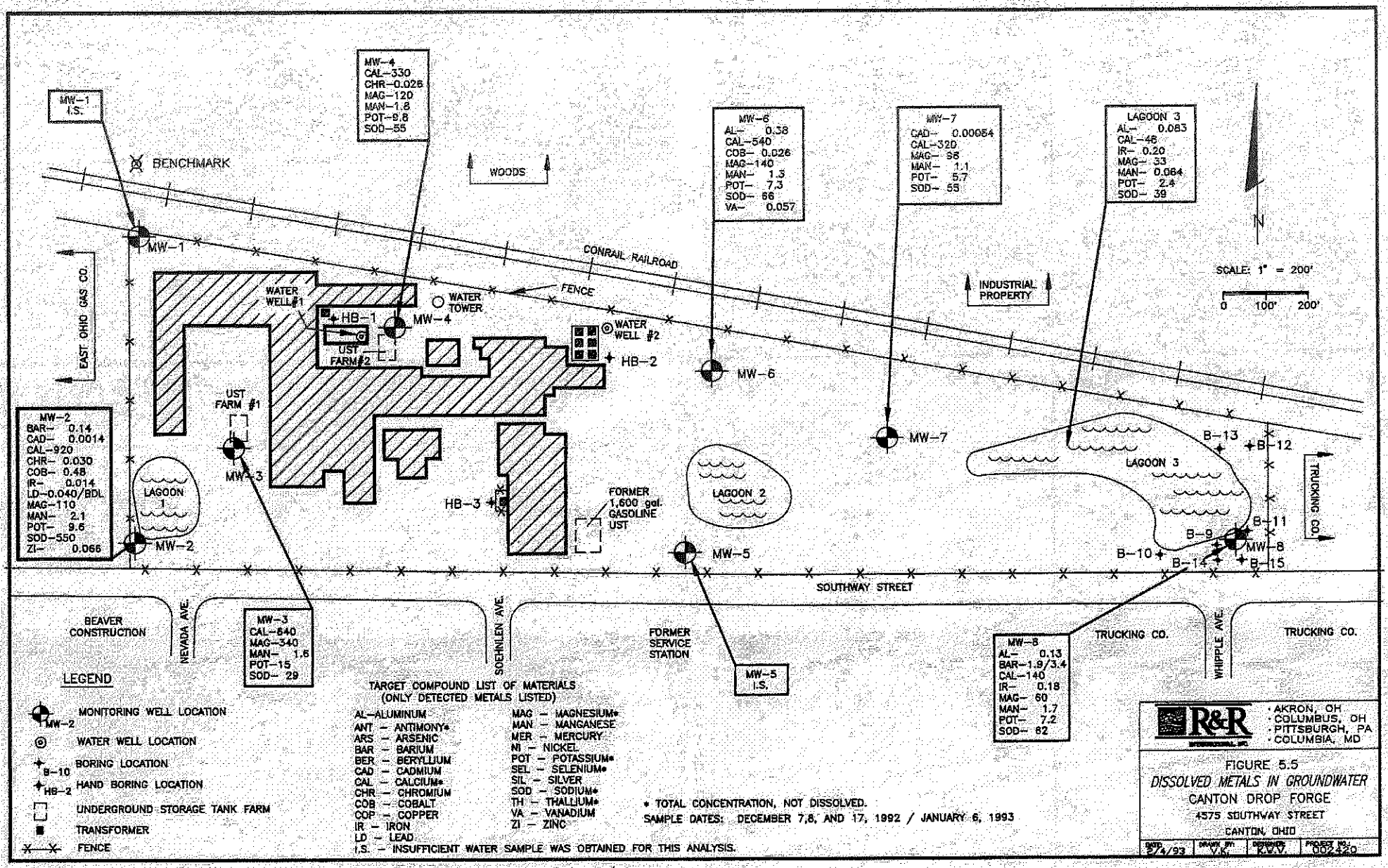

MW-1
CY-I.S.
PCB-I.S.
TPH-I.S.
PHENOL-I.S.
VOL-BDL
SEMI-I.S.
MW-4
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-BDL
SEMI-BDL
MW-6
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-BDL
SEMI-BDL
MW-7
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-BDL
SEMI-BDL
BENCHMARK
WOODS
CONRAIL RAILROAD
FENCE
INDUSTRIAL PROPERTY
N
SCALE: 1" = 200'
0 100' 200'
EAST OHIO GAS CO.
WATER WELL #1
WATER TOWER
HB-1
MW-4
WATER WELL #2
HB-2
MW-6
UST FARM #2
UST FARM #1
MW-7
MW-2
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-BDL
SEMI-BDL
LAGOON 1
MW-3
HB-3
FORMER 1,600 gal. GASOLINE UST
LAGOON 2
LAGOON 3
B-13
B-12
B-11
B-9
B-10
B-14
B-15
MW-8
MW-5
MW-2
TRUCKING CO.
SOUTHWAY STREET
BEAVER CONSTRUCTION
NEVADA AVE.
SOEHNLEN AVE.
MW-3
CY-BDL
PCB-BDL
TPH-BDL
PHENOL-BDL
VOL-BDL
SEMI-BDL
FORMER SERVICE STATION
MW-5
CY-I.S.
PCB-I.S.
TPH-I.S.
PHENOL-I.S.
VOL-I.S.
SEMI-I.S.
MW-8
CY-BDL
PCB-BDL
TPH-34
PHENOL-BDL
VOL-BDL
SEMI-21
TRUCKING CO.
WHIPPLE AVE.
TRUCKING CO.
LEGEND
MW-2 MONITORING WELL LOCATION
WATER WELL LOCATION
B-10 BORING LOCATION
HB-2 HAND BORING LOCATION
UNDERGROUND STORAGE TANK FARM
TRANSFORMER
FENCE
CY - TOTAL CYANIDE (mg/L)
PCB - POLYCHLORINATED BIPHENYLS (ug/L)
TPH - TOTAL PRTROLEUM HYDROCARBONS (mg/L) (AS PER EPA METHOD 418.1)
PHENOL - TOTAL RECOVERABLE PHENOLICS (ug/L)
VOL - TOTAL VOLATILE ORGANIC COMPOUNDS (ug/L)
SEMI - TOTAL SEMI VOLATILE ORGANIC COMPOUNDS (ug/L)
BDL - BELOW DETECTION LIMIT
I.S. - INSUFFICIENT WATER SAMPLE WAS OBTAINED FOR THIS ANALYSIS.
SAMPLE DATES: DECEMBER 7 AND 8, 1992
R&R
· AKRON, OH
· COLUMBUS, OH
· PITTSBURGH, PA
· COLUMBIA, MD
FIGURE 5.4
CONSTITUENTS IN GROUNDWATER
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO
DATE 5/4/93
DRAWN BY V.K.
CHECKED BY R.W.W.
PROJECT NO. 002420

CDF012370


MW-1
I.S.
BENCHMARK
MW-4
CAL-330
CHR-0.026
MAG-120
MAN-1.8
POT-9.8
SOD-55
WOODS
MW-6
AL- 0.38
CAL-540
COB- 0.026
MAG-140
MAN- 1.3
POT- 7.3
SOD- 66
VA- 0.057
MW-7
CAD- 0.00054
CAL-320
MAG- 98
MAN- 1.1
POT- 5.7
SOD- 55
LAGOON 3
AL- 0.083
CAL-46
IR- 0.20
MAG- 33
MAN- 0.064
POT- 2.4
SOD- 39
N
SCALE: 1" = 200'
0 100' 200'
CONRAIL RAILROAD
FENCE
INDUSTRIAL PROPERTY
EAST OHIO GAS CO.
WATER WELL #1
WATER TOWER
HB-1
MW-4
UST FARM #2
WATER WELL #2
HB-2
MW-6
MW-7
UST FARM #1
MW-3
MW-2
BAR- 0.14
CAD- 0.0014
CAL-920
CHR- 0.030
COB- 0.48
IR- 0.014
LD-0.040/BDL
MAG-110
MAN- 2.1
POT- 9.6
SOD-550
ZI- 0.066
LAGOON 1
HB-3
FORMER 1,600 gal. GASOLINE UST
LAGOON 2
MW-5
B-13
B-12
LAGOON 3
TRUCKING CO.
B-11
B-9
MW-8
B-10
B-14
B-15
SOUTHWAY STREET
BEAVER CONSTRUCTION
NEVADA AVE.
MW-3
CAL-640
MAG-340
MAN- 1.6
POT-15
SOD- 29
SOHNLEN AVE.
FORMER SERVICE STATION
MW-5
I.S.
MW-8
AL- 0.13
BAR-1.9/3.4
CAL-140
IR- 0.18
MAG- 60
MAN- 1.7
POT- 7.2
SOD- 62
TRUCKING CO.
TRUCKING CO.
WHIPPLE AVE.
LEGEND
MONITORING WELL LOCATION
MW-2
WATER WELL LOCATION
BORING LOCATION
B-10
HAND BORING LOCATION
HB-2
UNDERGROUND STORAGE TANK FARM
TRANSFORMER
FENCE
TARGET COMPOUND LIST OF MATERIALS
(ONLY DETECTED METALS LISTED)
AL-ALUMINUM
ANT - ANTIMONY*
ARS - ARSENIC
BAR - BARIUM
BER - BERYLLIUM
CAD - CADMIUM
CAL - CALCIUM*
CHR - CHROMIUM
COB - COBALT
COP - COPPER
IR - IRON
LD - LEAD
MAG - MAGNESIUM*
MAN - MANGANESE
MER - MERCURY
NI - NICKEL
POT - POTASSIUM*
SEL - SELENIUM*
SIL - SILVER
SOD - SODIUM*
TH - THALLIUM*
VA - VANADIUM
ZI - ZINC
* TOTAL CONCENTRATION, NOT DISSOLVED.
SAMPLE DATES: DECEMBER 7,8, AND 17, 1992 / JANUARY 6, 1993
I.S. - INSUFFICIENT WATER SAMPLE WAS OBTAINED FOR THIS ANALYSIS.
R&R
ENVIRONMENTAL, INC.
• AKRON, OH
• COLUMBUS, OH
• PITTSBURGH, PA
• COLUMBIA, MD
FIGURE 5.5
DISSOLVED METALS IN GROUNDWATER
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO
DATE 2/4/93
DRAWN BY V.K.
DESIGNED K.V.V.
PROJECT NO. 002420

CDF012371

that well on January 6, 1993. Barium was detected in the re-sampled groundwater collected from MW-8 with a concentration of 3.4 mg/Kg. The analytical results for the TCL of metals in the water sample collected from Lagoon No. 3 on January 6, 1993, reported detectable concentrations of aluminum, calcium, iron, magnesium, manganese, potassium, and sodium.

6.0 TECHNICAL SUMMARY

The findings of this investigation indicate that the site is underlain by predominantly brown sand and gravel with some interbedded brown silts. No laterally extensive clays or clayey intervals were identified that would provide a barrier to the vertical migration of potential contaminants at the site. Bedrock was not encountered by any of the borings advanced during this investigation.

Significantly elevated VOC concentrations were detected in soil samples obtained from one (1) of the eight (8) borings (B-8). The maximum VOC concentration measured in the soil samples from B-8 was 141 ppm at a depth of 7.0 to 11.0 feet. The soil materials from B-8 were heavily stained by hydrocarbons, had a strong hydrocarbon odor, and a sheen was observed on the groundwater during sampling operations.

Relatively low concentrations of volatile organic compounds and were detected in several of the analyzed soil samples. One (1) boring soil sample (B-6) and one (1) shallow soil sample (HB-1) had detectable concentrations of PCBs. The detected concentrations of these compounds do not appear to represent a serious environmental risk, but this does not disallow the possibility of more significant areas of concentration at other locations at the site. The analytical results indicated that several metals were present in the soil samples. However, the lack of appreciable concentrations of dissolved metals in the groundwater samples collected during this investigation suggests that the detected metals in soil have not significantly impacted the groundwater at the site. The detected concentrations of TPH detected during this investigation represents the main environmental concern with regard to the condition of the soil at the site. The TPH detected in the sample from B-8 is associated with the hydrocarbon impacted soils identified in the area.

Reported TPH concentrations in sample B-5 may be related to the landfill material or the black slag material exposed in the area of Lagoon No. 2. The concentration of TPH in soil sample B-6 may be related to the landfill material located in the vicinity of B-6. Depending on the intended use of the site, however, the TPH may not pose a serious environmental risk (i.e. no change in site use and no penetration/excavation/exposure of TPH impacted soils).

The groundwater in the shallow aquifer beneath the site appears to flow generally towards the north. The average calculated hydraulic gradient across the site is approximately 0.006 feet/foot. The groundwater elevation in the vicinity of MW-3 is relatively high and creates a radial flow pattern on the western third of the site. This local groundwater high may be the result of groundwater recharge due to the permeable backfill materials that may be present in the tank farm adjacent to MW-3. An alternative interpretation suggests the groundwater "high" represents a perched groundwater zone. The two (2) water wells present at the site may be influencing the potentiometric surface of the shallow groundwater zone beneath the site based on the groundwater "low" located in the vicinity of MW-4 and the water wells. Assuming that the water wells were pumping during the monitoring well groundwater measurements and did influence the groundwater measurements, it suggests that the deeper groundwater zone may be in communication with the shallow groundwater zone identified during this investigation. Canton Drop Forge personnel, however, report that on-site water well testing does not indicate any contamination which suggests that the deeper groundwater zone has not been impacted.

A perched groundwater zone was identified in the vicinity of MW-8. The elevation of the water in Lagoon No. 3 strongly suggests that the perched groundwater zone is in communication with the Lagoon No. 3. The maximum lateral extent of the perched

groundwater zone is limited to the west by MW-7 which lacks a shallow impermeable layer.

Analytical results for the groundwater samples generally indicated low or non-detectable concentrations of the targeted compounds. Two (2) specific metals were identified which could indicate negative impact to the groundwater at the site. These metals involved the detected concentrations of dissolved lead in the groundwater sample from MW-2 and dissolved barium in the groundwater sample from MW-8. The detected concentration of lead in the MW-2 sample exceeds the Ohio EPA Action Level (15 ppb for lead) established for Public Water Supplies. The concentration of barium in sample MW-8 exceeds the USEPA Maximum Contaminant Level (1.0 ppm for barium) established for safe drinking water for barium. Upon re-sampling these two (2) monitoring wells, the detected lead concentration was below detection limits in the sample from MW-2, but the barium concentration in the sample from MW-8 still exceeded the MCL established for barium. The groundwater zone being sampled is an open, flowing, and dynamic system and slight fluctuations in sample results is not unusual. A water sample obtained from Lagoon No. 3, however, did not have a detectable concentration of barium. Assuming the lagoon is in communication with the groundwater sampled in MW-8, the overall level of barium in the perched groundwater system may not pose a serious health risk. The concentration of the other detectable constituents in the groundwater do not appear to pose a serious environmental risk.

In conclusion, the main area of concern identified during this limited (see section 7.0 Limitations) assessment at the site involves the petroleum hydrocarbon impacted soil and groundwater in the vicinity of
MW-8. Based on the shallow borings advanced in the vicinity of MW-8 (i.e. borings B-9 through B-15), the hydrocarbon impacted area is limited to the west and north. The extent of the

unlikely. An additional concern is the extent of the impermeable layer creating the perched groundwater zone in the area of MW-8. At the lateral edge of this layer, vertical migration of the residual hydrocarbons, may impact the deeper, primary shallow groundwater zone identified at the site during this investigation.

7.0 LIMITATIONS

This Preliminary Soil and Groundwater Assessment was limited to the client approved Scope of Work. This investigation involved the testing of soil and groundwater at a limited and specific number of locations at the site. The number of test locations as well as the actual placement of the test borings was at least partially determined by site personnel based upon known and suspected areas where contamination may be present. The locations of buried utilities and other subsurface obstructions were also considered in placement of borings at the site. This investigation should be considered to represent an initial site characterization and is not, nor was it intended to represent, a complete site evaluation. It must be understood that the conclusions in this report are based upon a limited number of test locations and samples as well as and selected analyses. Because of the size of the site and the diverse uses of various areas of the facility, actual subsurface conditions may vary considerably at the site. This evaluation was undertaken without the benefit of a Phase I Property Evaluation or a Compliance Audit which may have revealed additional areas representing environmental concerns at the facility. The client approved Scope of Work and this report do not address any interior areas at the site. This investigation also specifically does not address any issues regarding the compliance of the subject site with environmental laws, permits or other applicable ordinances.

Investigations of this type generally proceed in phases with each additional phase being based upon information obtained during prior investigations. This investigation, which provides a good basis for general conclusions to be drawn regarding the environmental condition of the site, should be viewed as an initial assessment and not as a complete or final evaluation of the site. The use of this report for purposes other than those for which it was intended is done so at the sole risk of the

client. It must be understood that regardless of the number of borings and analyses performed, it is not possible to state with total certainty that all possible environmental concerns at a property have been identified.

R&R INTERNATIONAL INC

APPENDIX A
DRILLING LOGS AND MONITORING WELL DIAGRAMS

R&R INTERNATIONAL INC

BORING NO. B-1
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 11-24-92 — Completed 11-24-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
		TOPSOIL	1	1.0	2-2-45/0	0.3	23.8
1.5		Loose, red, brown, SILT, some clay, trace brick, moist	2	3.0	2-2-2-2	1.0	2.3
4.5		Loose, red-brown, SAND AND GRAVEL, trace cobble, moist	3	5.0	2-3-3-2	0.5	1.7
6.0		Very loose, mottled brown, red-brown, light gray, SAND AND GRAVEL, little silt and cobble, damp	4	7.0	2-1-1-3	0.5	1.9
		Note: Light gray, dry gravel and cobbles					
		Note: Soil becomes medium dense to dense at 9.0 feet	5	9.0	3-7-11-12	0.8	1.7
		Note: Gray shale cobble					
		Note: Light gray cobble	6	11.0	11-13-22-22	1.8	1.7
		Note: Odor detected 12.0-12.5 feet; not hydrocarbon					
		Note: Faint non-hydrocarbon odor 13.0-15.0 feet	7	13.0	13-16-16-19	1.8	1.8
			8	15.0	15-14-30-50/5	1.2	2.4
		Note: Cobbles encountered with no recovery 17.0-21.0 feet	9	17.0	22-39-18-21	0.2	2.2
		Note: Very dense at 17.0-19.0 feet					
			10	19.0	19-12-9-6	0.0	-
		Note: Non-hydrocarbon odor 21.0-23.0	11	21.0	1-3-4-7	0.8	2.1
		Note: Soil becomes moist					
			12	23.0	4-4-5-5	0.1	2.1

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WATER DEPTH: During Drilling 42.0 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-1 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment — Project No. 002420

Depth (ft)	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
	Note: Trace coal	13	25.0	3-3-4-4	0.8	1.8
		14	27.0	3-5-4-4	1.0	1.6
28.0	Loose, brown, SILT, moist	15	29.0	7-6-5-5	0.8	1.9
30.0	Medium dense, SAND AND GRAVEL, as above, moist	16	31.0	3-3-4-5	1.0	1.8
32.2	Medium dense, stained black, SAND AND GRAVEL, moist, no odor	17	33.0	4-4-10-11	1.0	1.5
34.5	Note: Very moist at 34.0 feet	18	35.0	4-6-9-9	2.0	1.6
35.0	Medium dense, brown, SILT, trace sand and gravel, moist					
	Note: Cobble at 35.0 feet	19	37.0	9-10-11-12	1.2	1.6
	Very stiff, gray, CLAY, trace sand and gravel, moist					
38.5	Note: Little gravel at 38.0 feet	20	39.0	5-5-5-8	0.8	2.5
40.0	Loose, light brown, SILT, damp	21	41.0	1-4-7-8	1.0	2.1
	Medium dense, mottled brown and red-brown, SAND AND GRAVEL, some silt, moist					
	Note: Wet at 42.0 feet	22	43.0	4-3-4-9	1.2	2.2
43.8						
44.5	Loose, brown, SAND, trace gravel, very moist to wet	23	45.0	3-4-4-5	1.2	4.2
	Loose, brown, SAND AND GRAVEL, moist to very moist	24	47.0	3-2-3-3	1.0	4.0
	Note: Soil saturated					
49.0	TERMINATION DEPTH = 49.0 FEET					

CDF012381

WATER DEPTH: During Drilling 42.0 ft. Upon Compl. Dry Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-2
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 11-24-92 — Completed 11-25-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
0.0		TOPSOIL	1	1.0	6-13-11-12	1.0	1.2
1.2 / 1.5		Medium dense, black, SILT, moist, faint hydrocarbon odor	2	3.0	4-6-8-13	0.3	1.2
		Medium dense, mottled brwon and red-brown, SAND AND GRAVEL, little silt, moist, hydrocarbon odor	3	5.0	5-10-13-12	2.0	0.2
5.0 / 6.0		Very stiff, gray, CLAYEY SILT, some sand and gravel, moist	4	7.0	10-14-12-11	1.7	3.4
7.5		Very stiff, mottled gray and red-brown, CLAYEY SILT, some gravel, little sand, trace cobble, moist, trace black stain	5	9.0	1-2-2-2	1.8	2.2
9.3		Very stiff, gray, brown in part, SILTY CLAY, trace sand, moist	6	11.0	3-4-6-6	2.0	1.9
11.5		Very loose, gray, SILT, trace sand, moist Note: Little clay 9.5-10.0 feet	7	13.0	1-4-6-6	1.5	1.3
		Stiff, tan, CLAYEY SILT, trace sand, moist	8	15.0	3-4-4-6	2.0	1.3
			9	17.0	2-4-7-8	1.5	2.0
		Note: Little sand and gravel	10	19.0	8-6-5-5	0.3	3.7
		Note: Minor black stain at 20.8 feet	11	21.0	4-5-3-3	0.8	1.0
22.0		Loose-medium dense, brown, SAND AND GRAVEL, some silt, trace cobble, moist	12	23.0	4-4-4-5	1.2	1.2

CDF012382

WATER DEPTH: During Drilling 40.5 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC.

BORING NO. B-2 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment — Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
		~~Note: Soil is wet at 24.0~~	13	25.0	3-5-8-7	0.5	1.4
			14	27.0	6-7-5-5	1.0	1.1
28.2		Loose, brown, SAND, little gravel, wet	15	29.0	3-4-6-6	1.3	1.0
		Note: Minor black stain at 28.5 feet	16	31.0	7-9-10-11	0.2	0.9
32.8		Medium dense, brown, SAND AND GRAVEL, trace cobble, moist	17	33.0	10-9-9-8	0.4	1.7
		Note: No groundwater produced overnight at TD of 33.0 feet	18	35.0	6-8-7-6	1.2	1.1
		Note: Black stain, 2 inches thick at 28.5					
		Note: Little cobble, little silt	19	37.0	7-6-5-7	0.1	1.7
			20	39.0	5-3-2-5	0.8	1.9
40.5		Note: Black stained material at 40.3 (or coal?)	21	41.0	10-11-12-5	2.0	1.1
41.0		Loose, brown, SAND, little gravel, wet					
41.5		Loose, brown, SAND AND GRAVEL, saturated	22	43.0	4-10-32-27	1.5	1.7
44.0		Medium dense, brown, SAND, little to no silt (silt laminations), wet	23	45.0	21-18-21-17	0.5	2.7
		Note: Heaving sands					
46.5		Very stiff, gray, SILTY CLAY, some cobble, trace gravel, saturated					
47.0		Dense, mottled brown and tan, SAND AND GRAVEL, little cobble, wet					
		TERMINATION DEPTH = 47.0 FEET					

CDF012383

WATER DEPTH: During Drilling 40.5 ft. Upon Compl. Dry _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-3
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 11-25-92 — Completed 11-30-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
0.3		Dark gray, CINDERS, some asphalt gravel	1	1.0	3-3-3-3	1.5	1.6
		Soft-medium stiff, red-brown, CLAYEY SILT, some sand and gravel, little clay and asphalt, trace brick, moist, hydrocarbon odor, fill	2	3.0	3-4-4-3	0.8	2.8
			3	5.0	3-1-2-3	0.8	2.2
6.5		Very loose-loose, brown, SAND, trace silt, moist, fill	4	7.0	1-1-1-1	0.8	1.8
			5	9.0	1/12-1-1	1.0	2.2
			6	11.0	1-2-4-4	0.8	1.6
			7	13.0	1-1-4-19	0.8	1.7
14.3							
14.8		Loose, brown, CLAYEY SILT AND GRAVEL, little sand, moist	8	15.0	40-50/2	0.0	-
		Dense, red-brown to brown, SAND AND GRAVEL, little cobble, moist	9	17.0	7-11-19-16	1.0	1.7
		Note: Granite cobble	10	19.0	14-17-13-11	1.0	2.0
			11	21.0	14-18-20-22	1.0	2.1
		Note: Soil becomes loose-medium dense	12	23.0	14-9-10-8	1.0	2.4

CDF012384

WATER DEPTH: During Drilling 34.0 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-3 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
			13	25.0	4-3-2-3	0.8	2.6
			14	27.0	5-5-6-7	0.8	2.3
			15	29.0	4-6-8-8	1.2	3.1
			16	31.0	11-7-5-5	0.6	3.3
			17	33.0	4-5-4-3	0.5	2.8
		Note: Wet at 34.0 feet	18	35.0	2-4-8-19	0.5	2.7
		Note: Little silt	19	37.0	7-7-7-10	1.0	2.3
38.0		Stiff, gray, CLAY, trace sand and gravel, moist	20	39.0	4-6-6-11	2.0	3.1
39.0		Medium dense, red-brown, SAND AND GRAVEL, little cobble, saturated					
40.0		Stiff, gray, SILTY CLAY, trace sand and gravel, moist					
41.0		TERMINATION DEPTH = 41.0 FEET					

CDF012385

WATER DEPTH: During Drilling 34.0 ft. Upon Compl. Dry ____Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL INC.

BORING NO. B-4
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 11-30-92 — Completed 12-1-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
0.3		GRAVEL, asphaltic	1	1.0	9-8-5-4	1.2	1.8
		Very loose, brown, SAND AND GRAVEL, trace cobble, moist					
		Note: Black stain at 1.0 feet	2	3.0	1-1-1-1	0.3	1.9
		Note: Orange sand, 2 inch thick at 1.8 feet					
			3	5.0	1-1-1-3	0.8	3.0
		Note: Black stain at 6.0 feet					
			4	7.0	1-1-2-2	0.8	3.0
8.0		Very loose, brown, SAND, trace gravel, moist	5	9.0	2-1-2-3	0.6	3.2
		Note: Black stain at 8.0-8.5 and 9.0 feet					
10.5		Loose-medium dense, brown to red-brown, SAND AND GRAVEL, little cobble, moist	6	11.0	5-4-3-2	0.5	3.5
			7	13.0	3-5-6-7	1.0	2.6
			8	15.0	3-4-6-7	1.0	2.2
		Note: Minor black stain 16.0-16.5 feet, trace black solid					
			9	17.0	4-6-6-6	1.0	1.8
18.2		Very stiff, brown, CLAYEY SILT, little gravel, trace sand, moist	10	19.0	10-8-10-16	2.0	0.7
20.0		Very stiff, gray, SILT, some clay, little gravel, trace sand, moist	11	21.0	8-14-13-12	2.0	0.7
21.5							
22.5		Very stiff, brown, SILT, trace gravel, moist	12	23.0	14-10-18-14	1.8	0.9
24.0		Medium dense, brown, SAND, trace gravel, moist					

CDF012386

WATER DEPTH: During Drilling 54.5 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-4 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
24.0		Very stiff, brown, SILT, moist	13	25.0	8-16-17-30	2.0	1.5
25.5							
26.0		Hard, mottled gray and brown, SILT, little gravel, moist					
		Dense, brown to red-brown, GRAVEL AND SAND, some silt, little cobble, moist	14	27.0	50-32-13-18	1.6	1.1
		Note: Black material in part and very moist at 29.0 feet	15	29.0	8-16-19-21	2.0	0.8
29.5							
		Hard, brown, SILT, little sand and gravel, trace cobble, moist	16	31.0	20-15-21-18	1.8	1.4
31.8		Note: Minor black stain at 30.0 feet					
32.2		Dense, brown, SAND, moist	17	33.0	9-13-17-12	1.8	12.1
34.5		Dense, brown, SILTY SAND, little gravel, moist	18	35.0	7-9-8-6	1.0	4.0
		Medium dense, brown, SAND AND GRAVEL, some silt, little cobble, moist	19	37.0	4-4-7-9	1.5	2.9
37.5		Note: Pervasive/dry black stained material, 1 inch thick faint hydrocarbon odor at 37.0					
		Medium dense, brown, SAND, fine grained, moist	20	39.0	7-9-9-10	1.5	0.0
		Note: minor black stain at 37.5 feet	21	41.0	10-10-10-12	1.5	0.0
41.5		Dense-very dense, brown, SANDAND GRAVEL, moist					
		Note: Coal (?), 3 inches thick at 42.0 feet	22	43.0	14-16-16-17	1.2	0.0
		Note: Coal (?), 1 inch thick at 42.5 feet					
		Note: Non-layered black material (coal?) at 44.0 (2") and 44.3 (2")	23	45.0	15-17-18-20	1.8	2.2
		Note: Dark gray stain with odor, 4 inches thick at 45.2 feet	24	47.0	15-17-19-19	1.5	1.1
			25	49.0	39-32-22-18	1.8	0.0
			26	51.0	7-14-17-20	1.8	0.0
51.5		Very stiff, gray, SILTY CLAY, little gravel, trace sand, moist					

CDF012387

WATER DEPTH: During Drilling 54.5 ft. Upon Compl. Dry Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC.

BORING NO. B-4 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
			27	53.0	7-9-17-14	2.0	8.9
		Note: Wet at 54.5					
55.0			28	55.0	4-8-11-17	2.0	0.3
		Medium dense, gray, SAND, little silt, trace gravel, wet					
		Note: Heaving sands	29	57.0	5-10-11-15	2.0	0.0
60.0		TERMINATION DEPTH = 60.0 FEET					

CDF012388

WATER DEPTH: During Drilling 54.5 ft. Upon Compl. Dry ____Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL INC

BORING NO. B-5
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 12-1-92 — Completed 12-1-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
0.3		TOPSOIL	1	1.0	5-6-9-12	1.3	3.7
2.5		Medium dense, tan, SILT, trace gravel, sand, black organic material, moist	2	3.0	19-21-24-11	1.5	4.6
3.5		Medium dense, light gray, SAND AND GRAVEL, damp					
4.0		Dense, brown, SILT, trace sand, moist	3	5.0	9-17-7-6	0.0	-
		Medium dense-loose, mottled brown and black, SAND, little gravel and silt, black staining, moist, strong hydrocarbon odor	4	7.0	3-4-5-5	0.2	5.0
		Note: Black stain, strong hydrocarbon odor at 8.8 feet	5	9.0	2-2-2-3	0.8	2.6
10.0		Medium stiff, brown, SILT, little clay, gravel, and sand, moist	6	11.0	3-6-4-3	0.4	2.6
		Note: Black organic material with organic odor at 10.9 feet	7	13.0	2-4-5-6	1.5	3.3
		Note: Cobble at 12.8 feet					
13.8		Note: Black staining at 13.0 feet	8	15.0	3-5-5-7	1.5	1.7
		Medium stiff-stiff, gray, SILTY CLAY, trace organics, trace rootlets, moist, mottled with brown in part	9	17.0	2-4-3-6	0.3	2.6
		Note: Trace gravel and cobble at 15.5	10	19.0	5-8-6-6	0.0	-
			11	21.0	2-4-3-4	1.0	2.9
22.0		Loose, mottled gray and brown, SAND AND GRAVEL, little cobble and silt, moist	12	23.0	3-3-4-4	1.3	2.1
24.0		Note: Very moist					

CDF012389

WATER DEPTH: During Drilling 27.5 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-5 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
24.0		Dense-very dense, light gray, SANDY SILT, little gravel, moist	13	25.0	5-6-11-14	1.5	2.4
		Note: Very orange sand, appears wet on outside in spoon,m interior sand is moist; submitted for metals	14	27.0	13-16-17-21	1.5	4.3
		Note: Very moist	15	29.0	13-15-17-18	1.8	4.5
		Note: Soil saturated	16	31.0	17-18-21-29	1.5	2.9
33.5		TERMINATION DEPTH = 33.5 FEET					

CDF012390

WATER DEPTH: During Drilling 27.5 ft. Upon Compl. Dry ____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-6
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 12-2-92 — Completed 12-2-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
0.3		Black, SAND AND GRAVEL	1	1.0	3-5-7-9	1.0	9.2
		Medium dense, brown, SAND, GRAVEL AND SILT, trace wood, trace cobble, moist, faint organic odor	2	3.0	8-9-12-12	1.0	12.6
3.5		Note: Orange sand 1 inch thick at 4.0 feet	3	5.0	8-9-9-34	1.0	9.9
7.0		Loose-medium dense, light brown, SILT, trace sand, gravel, black organic material, moist	4	7.0	4-4-4-6	2.0	7.7
			5	9.0	5-6-7-8	2.0	8.1
			6	11.0	4-7-7-5	2.5	10.5
		Note: Some gravel, little sand	7	13.0	3-4-5-6	1.0	4.4
14.0		Medium dense, brown, red-brown in part, SAND AND GRAVEL, little silt and cobble, moist	8	15.0	4-5-4-8	0.2	3.2
			9	17.0	9-13-13-17	0.0	-
			10	19.0	10-12-14-16	0.5	5.8
			11	21.0	10-11-13-13	1.5	8.0
			12	23.0	9-11-12-13	1.2	9.7

CDF012391

WATER DEPTH: During Drilling 46.0 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL INC

BORING NO. B-6 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
			13	25.0	10-12-11-14	1.0	8.2
			14	27.0	15-10-12-12	1.0	2.8
			15	29.0	8-8-9-9	0.8	8.8
31.0			16	31.0	7-12-10-12	1.6	6.5
		Medium dense, brown, dark gray in part, SAND, trace gravel and cobble, moist	17	33.0	5-6-7-15	1.0	7.0
34.0		Medium dense-dense, brown, SAND AND GRAVEL, little silt and cobbles, moist	18	35.0	10-16-8-12	1.5	8.0
			19	37.0	12-20-17-10	1.5	8.8
38.7			20	39.0	32-21-15-50/.25	1.0	10.0
		Dense, brown, SAND, little gravel, moist					
40.2		Very dense, brown, SAND ANSD GRAVEL, little cobble, moist	21	41.0	18-40-43-29	1.5	7.2
42.2							
42.6		Very dense, tan, SAND, trace coal, moist	22	43.0	43-50/.45	0.4	11.4
		Very dense, brown, gray in part, SAND AND GRAVEL, some cobbles, moist	23	45.0	15-13-22-23	1.2	8.0
46.0		Dense, brown, GRAVEL, some sand, little cobbles, saturated	24	47.0	23-17-23-24	2.0	8.1
48.0		Dense, brown, SAND, trace gravel, wet	25	49.0	17-15-16-22	2.0	4.6
			26	51.0	12-12-17-21	2.0	5.9

CDF012392

WATER DEPTH: During Drilling 46.0 ft. Upon Compl. Dry Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC.

BORING NO. B-6 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
53.0		TERMINATION DEPTH = 53.0 FEET					

CDF012393

WATER DEPTH: During Drilling 46.0 ft. Upon Compl. Dry ____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC.

BORING NO. B-7
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 12-3-92 — Completed 12-3-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
		Medium dense, brown, SILT, trace sand and gravel, moist	1	1.0	10-10-12-20	1.5	10.6
1.5		Dense, black (stain?), SILT, trace wood, little coal?, hydrocarbon (?) odor, moist	2	3.0	26-26-16-17	1.8	5.5
4.0		Dense, brown, SILT, little sand, trace gravel, moist	3	5.0	5-6-8-7	1.8	3.8
5.0		Loose-medium dense, brown, trace of dark gray and red-brown, SANDY SILT, some gravel, moist	4	7.0	5-6-4-5	1.3	1.2
			5	9.0	3-2-2-3	1.0	4.2
			6	11.0	2-2-3-2	0.5	3.7
12.5		Loose-medium dense, brown, SAND AND GRAVEL, trace cobbles, moist	7	13.0	2-1-2-3	0.5	2.2
			8	15.0	4-5-5-5	0.5	3.4
		Note: Mottled brown, red-brown with trace dark gray	9	17.0	2-2-5-9	0.7	4.5
			10	19.0	7-9-10-20	1.5	3.0
		Note: Little cobbles, soil dense-very dense	11	21.0	26-45-50/.5	0.2	4.1
			12	23.0	20-25-20-26	1.2	6.1

CDF012394

WATER DEPTH: During Drilling 48.4 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-7 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
			13	25.0	32-32-26-31	1.5	5.8
			14	27.0	18-29-32-50/.2	1.2	6.2
			15	29.0	40-35-31-27	1.5	3.4
			16	31.0	40-30-25-15	1.5	11.1
			17	33.0	7-9-10-10	1.2	9.7
		Note: Mottled brown and dark gray 34.5-35.0 feet	18	35.0	6-11-18-16	1.0	7.7
			19	37.0	13-17-13-13	1.5	10.8
			20	39.0	17-29-26-17	1.3	9.6
			21	41.0	19-15-14-21	1.8	7.5
42.5							
42.9		Medium dense, brown, SAND, moist	22	43.0	19-22-20-25	2.0	5.1
43.5		Medium dense, brown, SAND AND GRAVEL, little cobbles, moist	23	45.0	18-43-32-26	1.5	4.5
46.0		Very dense, brown, SAND, some gravel, trace cobble, moist	24	47.0	7-9-8-10	1.5	1.4
		Dense, brown, SAND AND GRAVEL, little cobbles, moist cobbles light gray in part					
48.4		Medium dense-dense, brown, SAND, trace gravel, wet	25	49.0	5-7-11-18	2.0	1.8
		Note: Soil saturated; heaving sands	26	51.0	6-14-26-28	2.0	1.5
		Note: Sand light gray					

CDF012395

WATER DEPTH: During Drilling 48.4 ft. Upon Compl. Dry _____Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-7 (cont.)
ELEV. _____

DRILLING LOG

Project Hydrogeological Site Assessment Project No. 002420

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
55.0		TERMINATION DEPTH = 55.0 FEET					

CDF012396

WATER DEPTH: During Drilling 48.4 ft. Upon Compl. Dry ____Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL, INC

BORING NO. B-8
ELEV. _____

DRILLING LOG

Client Hammontree & Associates, Limited
Project Hydrogeological Site Assessment — Project No. 002420
Location Canton Drop Forge & Manufacturing Co.
Date: Started 12-4-92 — Completed 12-4-92 — Driller Northcoast
Sampler: Dia 2 ins — Type s/s — Hammer Wt 140 lbs — Fall 30 ins
Casing: Dia 4.25 ins — Type HSA — Hammer Wt _____ — Fall _____
Water/Mud used in drilling: Yes _____ No * — Geologist/Engineer K Valek

Depth (ft)	Graphic Log	Material Description	Sample No	Sample Depth	Blows/0.5'	REC (ft.)	PID (ppm)
0.2		TOPSOIL	1	1.0	3-2-4-3	1.5	1.66
		Very loose-loose, brown, SILT, trace gravel, trace dark brown organics, moist	2	3.0	1-1-2-2	0.8	1.8
		Note: Black stain is pervasive, hydrocarbon odor at 4.5 feet	3	5.0	WOH-5-5-15	1.2	2.5
		Note: Wet at 6.5 feet	4	7.0	1-2-5-36	0.5	141.0
		Note: Saturated at 8.5 feet; broken sheen on water in spoon, little wood, strong hydrocarbon odor (diesel?)	5	9.0	1-2-4-5	1.5	12.9
10.0		Note: Complete sheen on spoon water at 9.0 feet					
11.0		Medium stiff, brown, CLAYEY SILT, trace organcis, moist hydrocarbon odor					
		TERMINATION DEPTH = 11.0 FEET					

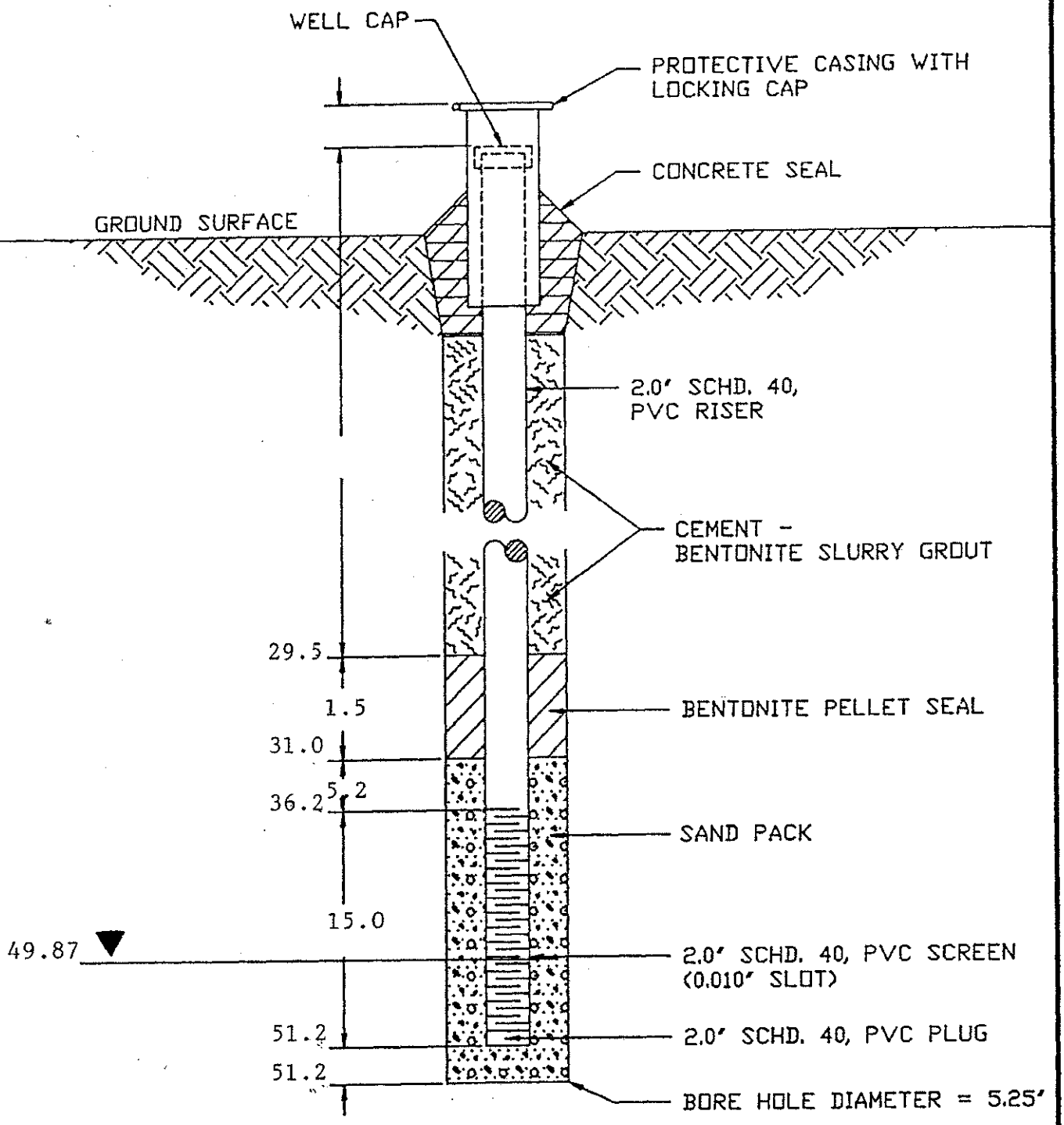
CDF012397

WATER DEPTH: During Drilling 6.5 ft. — Upon Compl. Dry — _____ Hrs. after Compl. N.R.
Weather: _____ Remarks: _____

R&R INTERNATIONAL INC.

MONITORING WELL

NO: MW-1



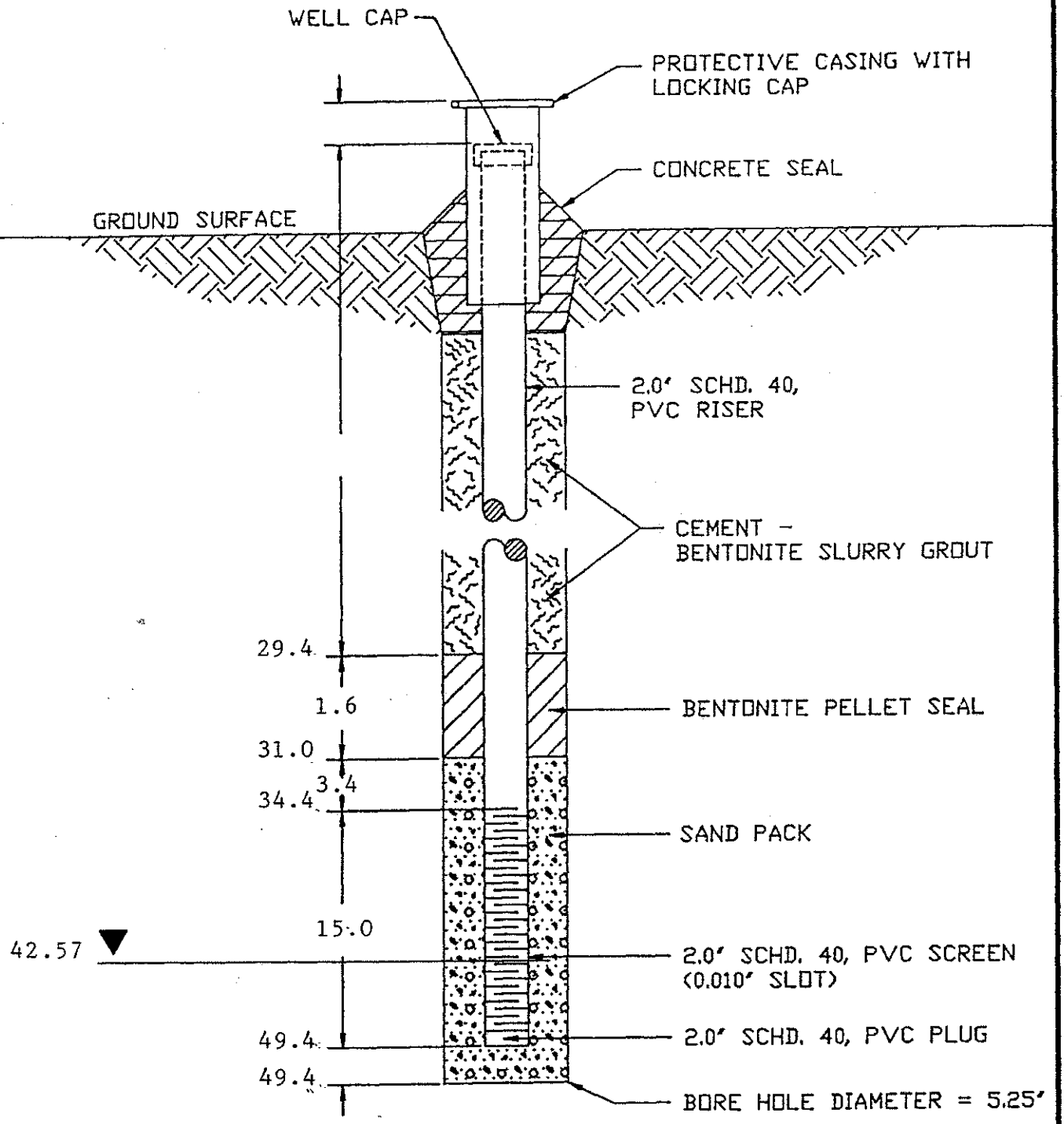
NOT TO SCALE

CDF012398

R&R INTERNATIONAL INC.

MONITORING WELL

NO: MW-2



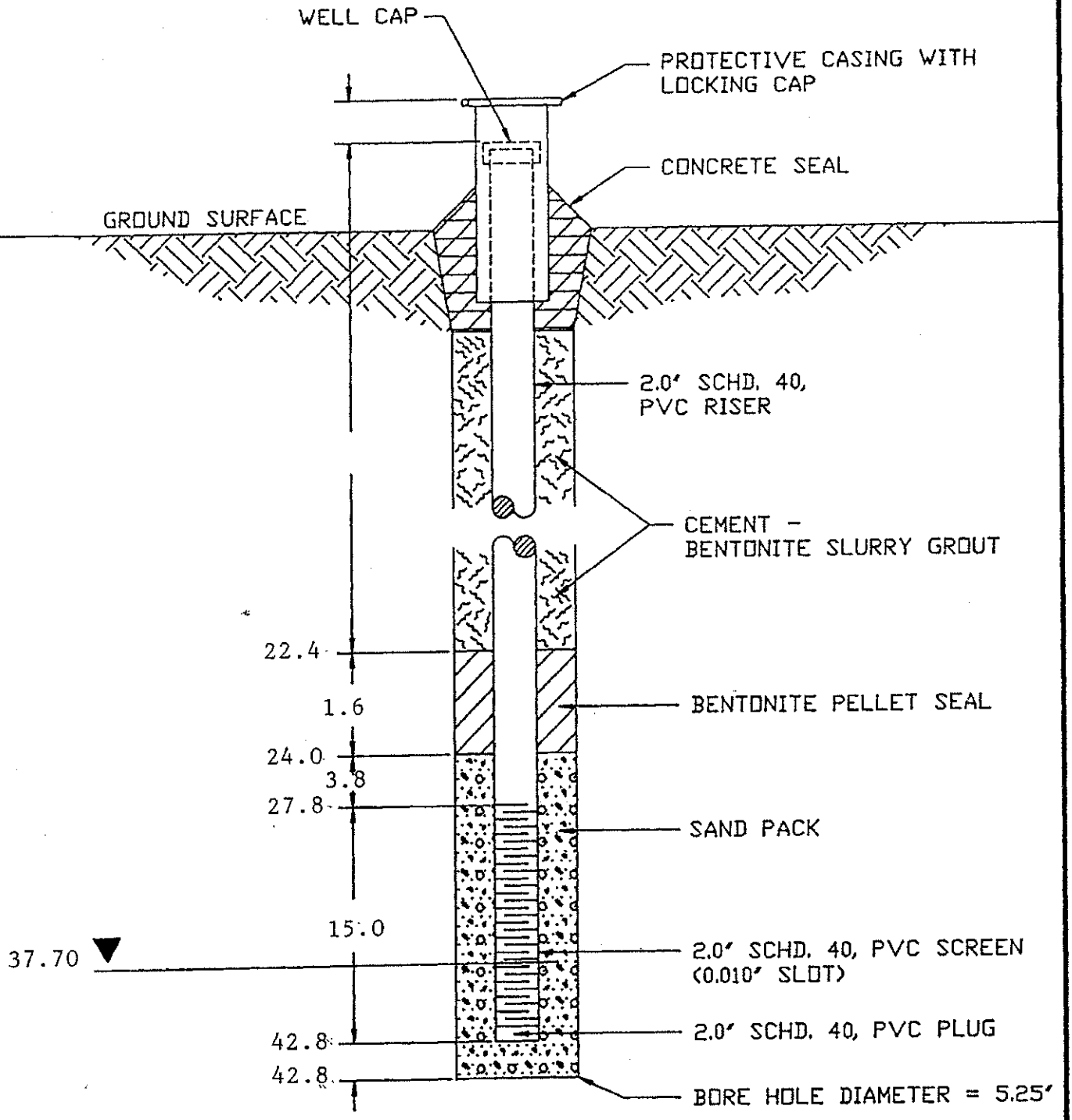
NOT TO SCALE

CDF012399

R&R

MONITORING WELL

NO: MW-3



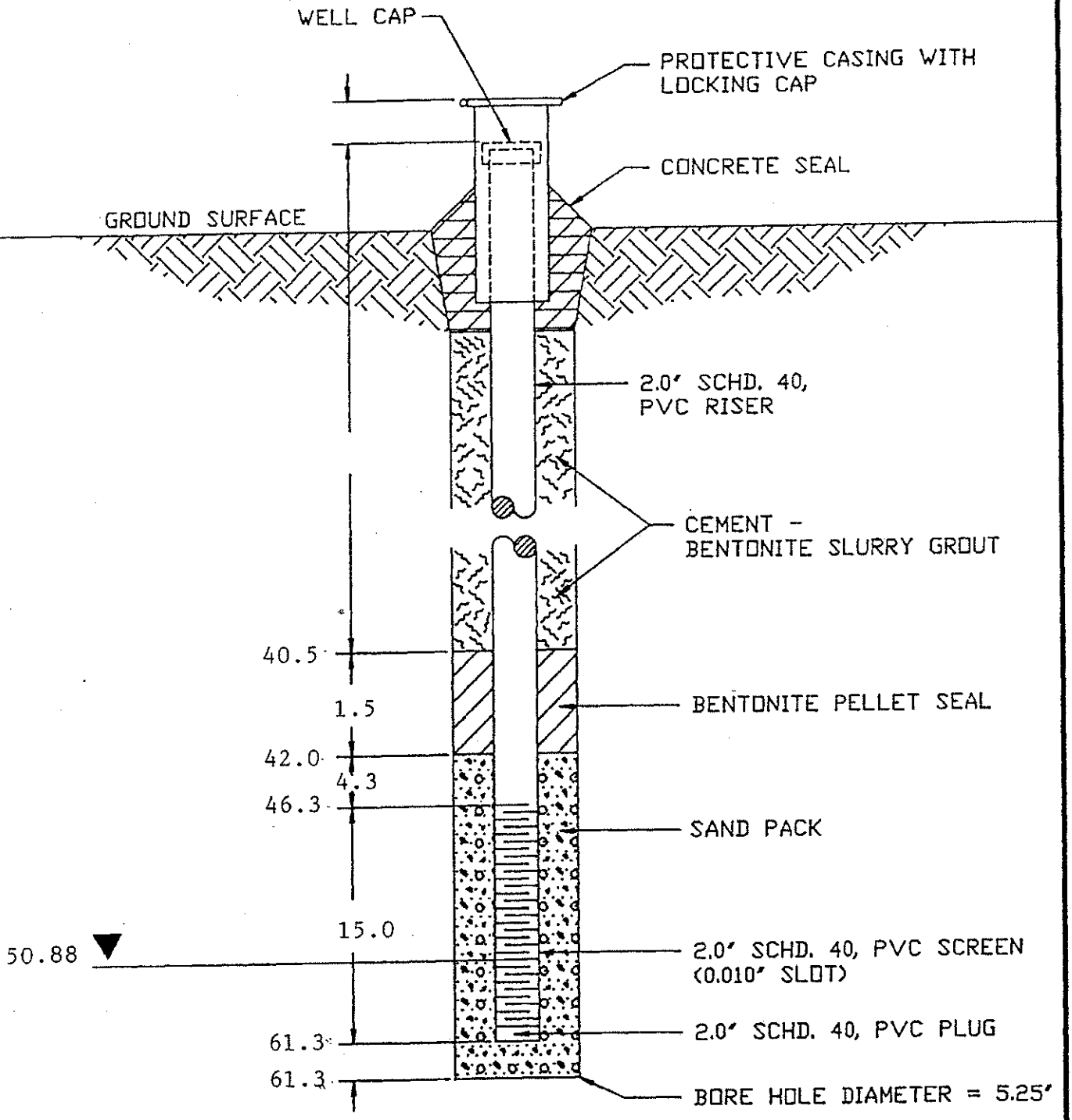
NOT TO SCALE

CDF012400

R&R INTERNATIONAL, INC.

MONITORING WELL

NO: MW-4



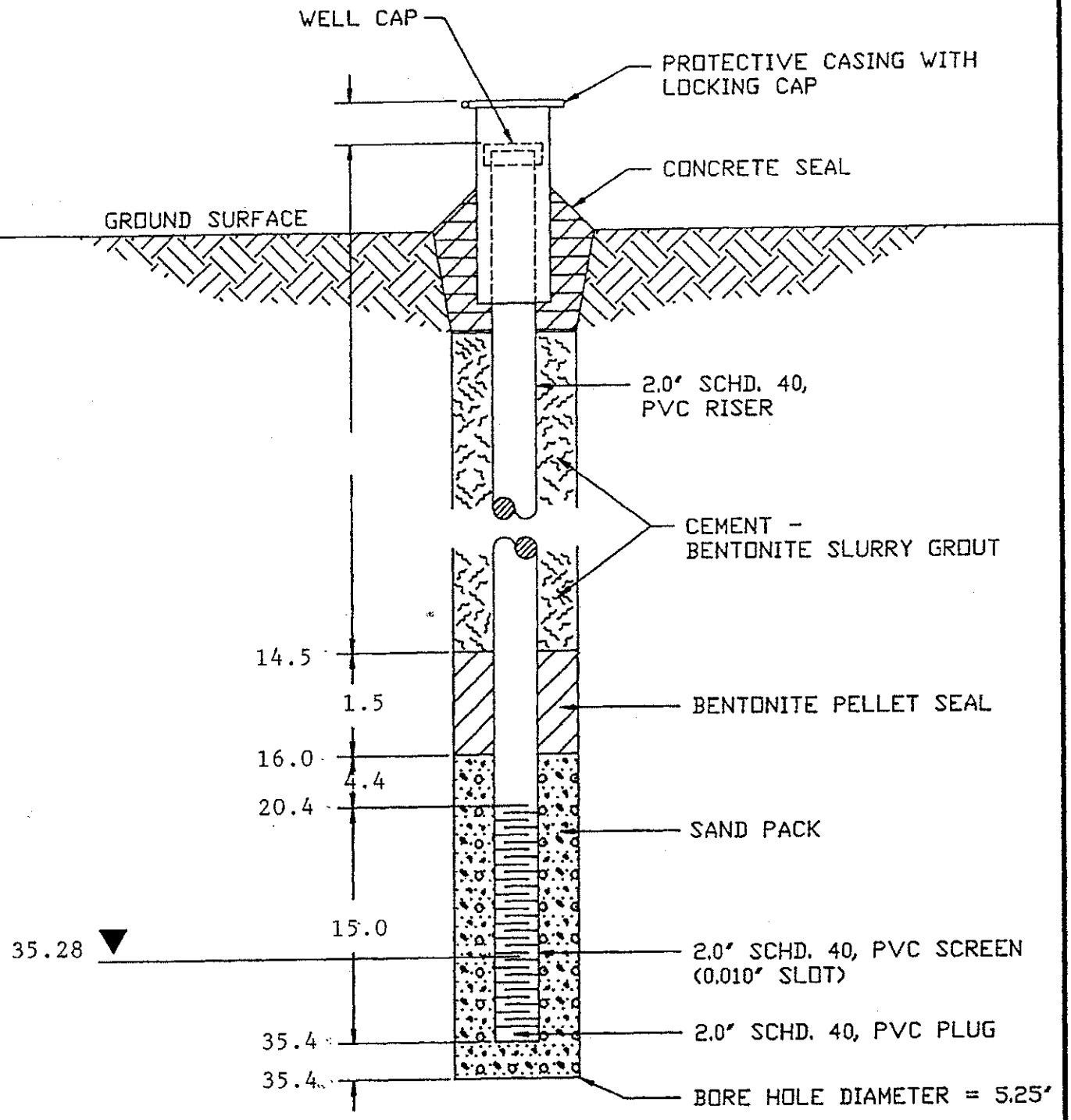
NOT TO SCALE

CDF012401

R&R INTERNATIONAL INC.

MONITORING WELL

NO: MW-5



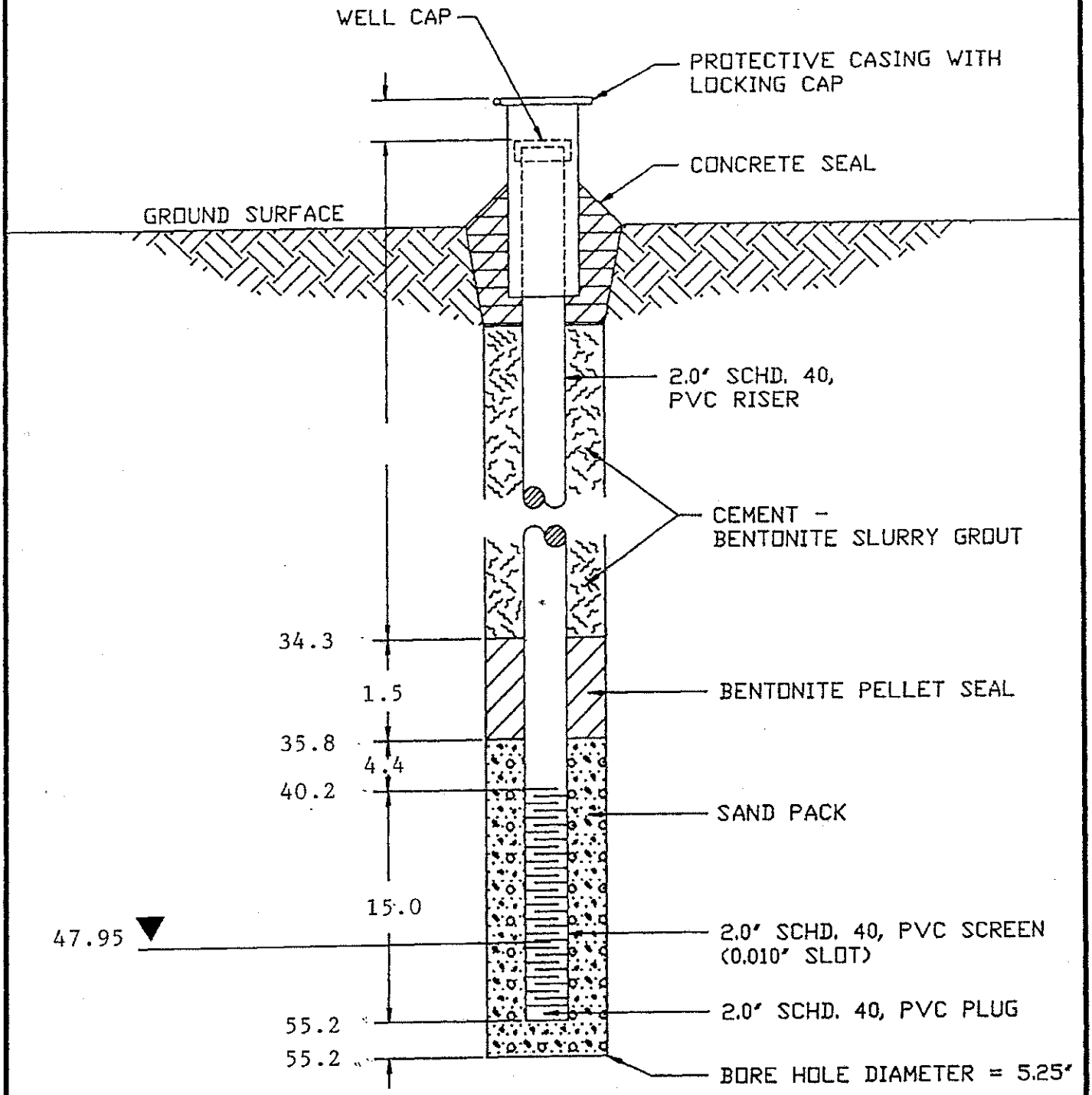
NOT TO SCALE

CDF012402

R&R

MONITORING WELL

NO: MW-6



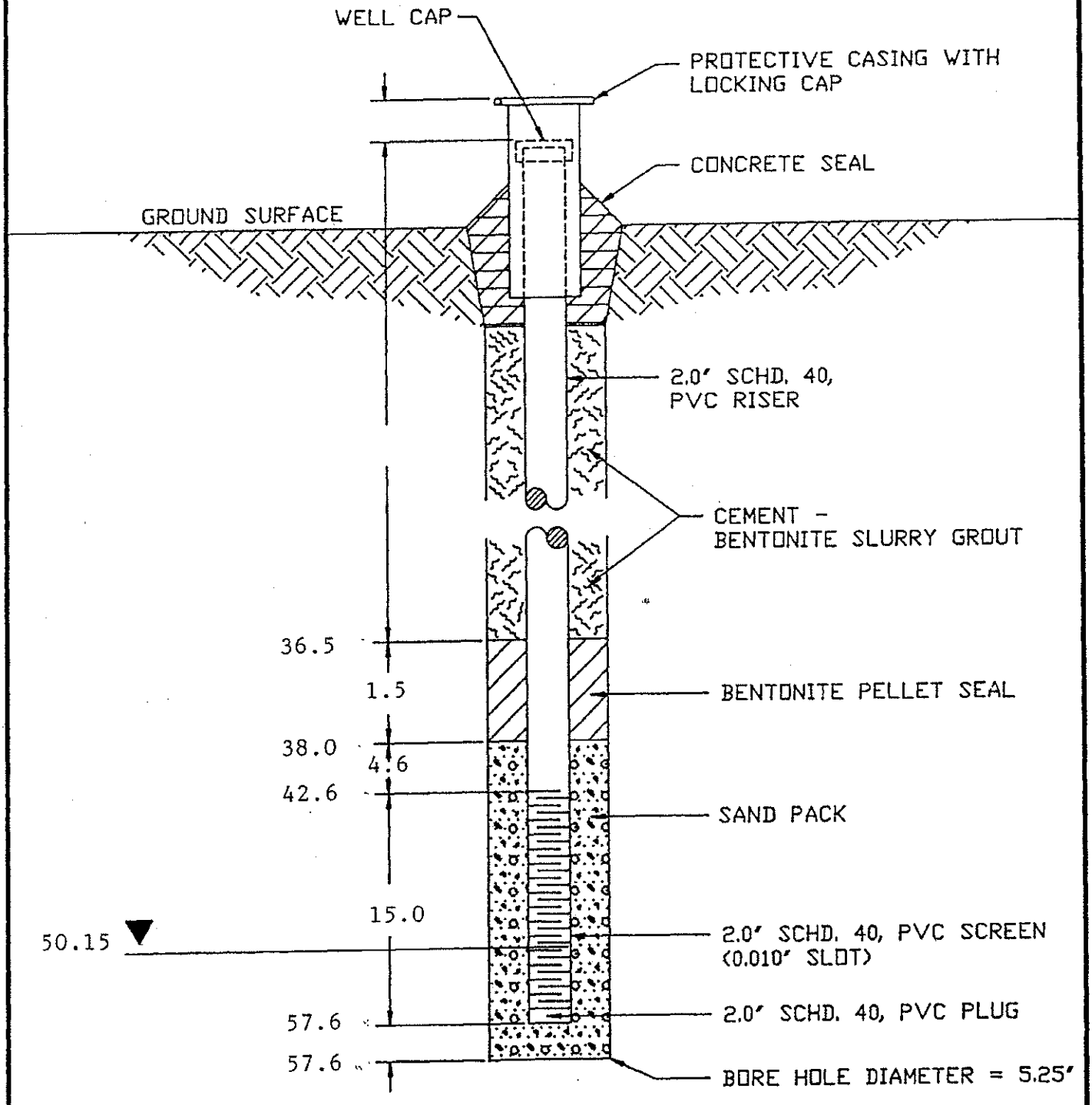
NOT TO SCALE

CDF012403

R&R
ENVIRONMENTAL INC.

MONITORING WELL

NO: MW-7



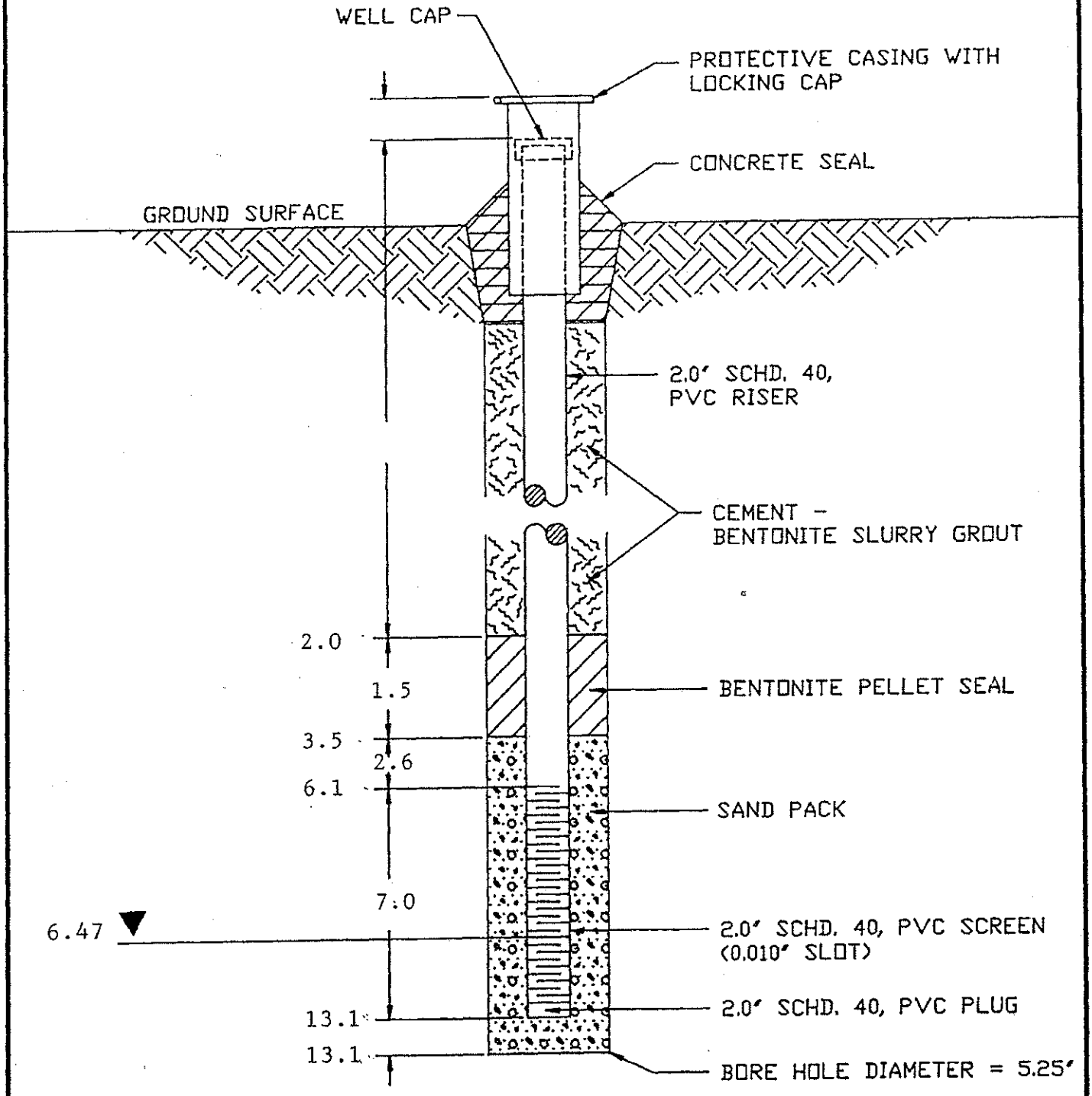
NOT TO SCALE

CDF012404

R&R

MONITORING WELL

NO: MW-8



NOT TO SCALE

CDF012405

R&R INTERNATIONAL INC.

APPENDIX B
MONITORING WELL DEVELOPMENT AND SAMPLING FORMS

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-1 DATE DRILLED 11/24/92

PRE-DEVELOPMENT DATA

WELL DEPTH 51.17 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 49.87 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 1.30 ft.

CASING ELEV. ____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: ____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 1.3 ft. x 0.16 gals/ft. = .21 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = ____ gallons FIVE WELL VOLUMES = 1.1 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP ____

VOLUME REMOVED: .9 gallons
RECHARGE INFO: Slow
ODOR: None
SHEEN: None

COMMENTS: Bailed Dry

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-1 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/08 19 92 TIME COLLECTED: 10:00 am

PURGE VOLUME: - gallons

SAMPLE COLOR: Clear

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs	X	OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: Sampled dry after approximately 500 ml

CDF012408

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-2 DATE DRILLED 11/25/92

PRE-DEVELOPMENT DATA

WELL DEPTH 49.35 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 42.57 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 6.78 ft.

CASING ELEV. ____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: ____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 6.78 ft. x 0.16 gals/ft. = 1.1 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = ____ gallons FIVE WELL VOLUMES = 5.5 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP ____

VOLUME REMOVED: 6.0 gallons
RECHARGE INFO: Fast
ODOR: None
SHEEN: Slight

COMMENTS: ____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-2 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/07 19 92 TIME COLLECTED: 2:40 pm

PURGE VOLUME: _____ gallons

SAMPLE COLOR: Brown

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs	X	OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-3 DATE DRILLED 11/30/92

PRE-DEVELOPMENT DATA

WELL DEPTH 42.83 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 37.70 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 5.13 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 5.13 ft. x 0.16 gals/ft. = .82 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = 4.10 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP _____

VOLUME REMOVED: 3.1 gallons
RECHARGE INFO: Slow
ODOR: None
SHEEN: None

COMMENTS: Bailed Dry

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-3 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/07 19 92 TIME COLLECTED: 3:15 pm

PURGE VOLUME: _____ gallons

SAMPLE COLOR: Brown

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs	X	OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-4 DATE DRILLED 12/01/92

PRE-DEVELOPMENT DATA

WELL DEPTH 61.32 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 50.88 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 10.44 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 10.44 ft. x 0.16 gals/ft. = 1.67 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = 8.4 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP _____

VOLUME REMOVED: 8.5 gallons
RECHARGE INFO: Fast
ODOR: None
SHEEN: None

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-4 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/08 19 92 TIME COLLECTED: 1:00 pm

PURGE VOLUME: _____ gallons

SAMPLE COLOR: Brown

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs	X	OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:	ALCONOX WASH	X
	DISTILLED WATER RINSE	X
	METHANOL RINSE	X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-5 DATE DRILLED 12/01/92

PRE-DEVELOPMENT DATA

WELL DEPTH 35.37 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 35.28 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT .09 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = WATER COLUMN HEIGHT x GALS/FOOT

= .09 ft. x 0.16 gals/ft. = .0135 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP _____

VOLUME REMOVED: Trace gallons
RECHARGE INFO: -
ODOR: -
SHEEN: -

COMMENTS: Too little water

R&R INTERNATIONAL, INC.

Project No. 002420 Well No. MW-5 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER_____ gals.			
AFTER_____ gals.			
AFTER_____ gals.			
AFTER_____ gals.			
LAST BAILER: _____ gals.			

COMMENTS: _____

_____

SAMPLES COLLECTED

DATE SAMPLED: _____ 19 _____ TIME COLLECTED: _____

PURGE VOLUME: _____ gallons

SAMPLE COLOR: _____

ODOR: _____

SAMPLES TO BE ANALYZED FOR:

VOCs _____	METALS* _____	BTEX _____	OTHER _____
SEMI-VOCs _____	PESTICIDES _____	OTHER _____	OTHER _____
TPH _____	PCBs _____	OTHER _____	OTHER _____
DUPLICATE _____	DECON BLANK _____	OTHER _____	OTHER _____

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER: ALCONOX WASH _____

DISTILLED WATER RINSE _____

METHANOL RINSE _____

NEW ROPE: _____ YES _____ NO

COMMENTS: _____

_____

_____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-6 DATE DRILLED 12/02/92

PRE-DEVELOPMENT DATA

WELL DEPTH 55.23 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 47.95 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 7.28 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = WATER COLUMN HEIGHT x GALS/FOOT

= 7.28 ft. x 0.16 gals/ft. = 1.17 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = 5.85 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP _____

VOLUME REMOVED: 6.0 gallons
RECHARGE INFO: Rapid
ODOR: No
SHEEN: No

COMMENTS: Muddy

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-6 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/07/92 19 ____ TIME COLLECTED: 4:00 pm

PURGE VOLUME: - gallons

SAMPLE COLOR: Brown (Muddy)

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs	X	OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH: X
- DISTILLED WATER RINSE: X
- METHANOL RINSE: X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-7 DATE DRILLED 12/03/92

PRE-DEVELOPMENT DATA

WELL DEPTH 57.62 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 50.15 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 7.47 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 7.47 ft. x 0.16 gals/ft. = 1.19 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = 5.95 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP _____

VOLUME REMOVED: 6.0 gallons
RECHARGE INFO: No
ODOR: No
SHEEN: _____

COMMENTS: Muddy

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-7 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/07/92 19 ____ TIME COLLECTED: 3:20 pm

PURGE VOLUME: - gallons

SAMPLE COLOR: Clear

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs	X	OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates DATE 12/07/92

PROJECT Canton Drop Forge PROJECT NO. 002420

SAMPLER(s) Karl Valek and Bob Dornbush

WELL NUMBER MW-8 DATE DRILLED 12/04/92

PRE-DEVELOPMENT DATA

WELL DEPTH 13.10 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 6.47 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 6.63 ft.

CASING ELEV. ____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: ____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 6.63 ft. x 0.16 gals/ft. = 1.06 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = ____ gallons FIVE WELL VOLUMES = 5.30 gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER X PUMP ____

VOLUME REMOVED: 5.8 gallons
RECHARGE INFO: Rapid
ODOR: Faint HC
SHEEN: Yes, slightly broken

COMMENTS: Muddy

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-8 Date 12/07/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/07 19 92 TIME COLLECTED: 3:00 pm

PURGE VOLUME: - gallons

SAMPLE COLOR: Clear, Sheen

ODOR: Moderate HC

SAMPLES TO BE ANALYZED FOR:

VOCs	X	METALS*	X	BTEX		OTHER	Cyanide
SEMI-VOCs	X	PESTICIDES		OTHER		OTHER	Phenolics
TPH	X	PCBs		OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/17/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) J. Hess/B. Dornbush

WELL NUMBER MW-2 DATE DRILLED 11/25/92

PRE-DEVELOPMENT DATA

WELL DEPTH 49.35 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 43.58 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 5.77 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 5.77 ft. x 0.16 gals/ft. = 0.92 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-2 Date 12/17/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/17 19 92 TIME COLLECTED: 10:25

PURGE VOLUME: 1.0 gallons

SAMPLE COLOR: Clear to cloudy

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* X	BTEX ____	OTHER ____
SEMI-VOCs ____	PESTICIDES ____	OTHER Base/Neutral	OTHER ____
TPH ____	PCBs ____	OTHER ____	OTHER ____
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/17/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) J. Hess/B. Dornbush

WELL NUMBER MW-3 DATE DRILLED 11/30/92

PRE-DEVELOPMENT DATA

WELL DEPTH 42.83 ft.
HEADSPACE VOC CONCENTRATION _____ ppm*
DEPTH TO PRODUCT _____ ft.
DEPTH TO WATER 37.74 ft.
PRODUCT THICKNESS _____ ft.
WATER COLUMN HEIGHT 5.09 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 5.09 ft. x 0.16 gals/ft. = .81 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-3 Date 12/17/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/17 19 92 TIME COLLECTED: 10:55

PURGE VOLUME: 0.80 gallons

SAMPLE COLOR: Cloudy

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* X	BTEX ____	OTHER ____
SEMI-VOCs ____	PESTICIDES ____	OTHER ____	OTHER ____
TPH ____	PCBs ____	OTHER ____	OTHER ____
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/17/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) J. Hess/B. Dornbush

WELL NUMBER MW-4 DATE DRILLED 12/01/92

PRE-DEVELOPMENT DATA

WELL DEPTH 61.32 ft.
HEADSPACE VOC CONCENTRATION _____ ppm*
DEPTH TO PRODUCT _____ ft.
DEPTH TO WATER 50.96 ft.
PRODUCT THICKNESS _____ ft.
WATER COLUMN HEIGHT 10.36 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 10.36 ft. x 0.16 gals/ft. = 1.66 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-4 Date 12/17/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/17 19 92 TIME COLLECTED: 11:45

PURGE VOLUME: 1.8 gallons

SAMPLE COLOR: Brown to cloudy

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* X	BTEX ____	OTHER ____
SEMI-VOCs ____	PESTICIDES ____	OTHER ____	OTHER ____
TPH ____	PCBs ____	OTHER ____	OTHER ____
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/17/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) J. Hess/B. Dornbush

WELL NUMBER MW-6 DATE DRILLED 12/02/92

PRE-DEVELOPMENT DATA

WELL DEPTH 55.23 ft.
HEADSPACE VOC CONCENTRATION _____ ppm*
DEPTH TO PRODUCT _____ ft.
DEPTH TO WATER 47.97 ft.
PRODUCT THICKNESS _____ ft.
WATER COLUMN HEIGHT 7.26 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 7.26 ft. x 0.16 gals/ft. = 1.16 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-6 Date 12/17/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/17 19 92 TIME COLLECTED: _____

PURGE VOLUME: 1.1 gallons

SAMPLE COLOR: Brown to cloudy

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* X	BTEX ____	OTHER ____	
SEMI-VOCs ____	PESTICIDES ____	OTHER ____	OTHER ____	
TPH ____	PCBs ____	OTHER ____	OTHER ____	
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/17/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) J. Hess/B. Dornbush

WELL NUMBER MW-7 DATE DRILLED 12/03/92

PRE-DEVELOPMENT DATA

WELL DEPTH 57.62 ft.
HEADSPACE VOC CONCENTRATION _____ ppm*
DEPTH TO PRODUCT _____ ft.
DEPTH TO WATER 50.16 ft.
PRODUCT THICKNESS _____ ft.
WATER COLUMN HEIGHT 7.46 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 7.46 ft. x 0.16 gals/ft. = 1.19 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for DATE 12/17/92

PROJECT Canton Drop Forge Manufacturing Company
Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) J. Hess/B. Dornbush

WELL NUMBER MW-8 DATE DRILLED 12/04/92

PRE-DEVELOPMENT DATA

WELL DEPTH 13.10 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 6.32 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 6.78 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 6.78 ft. x 0.16 gals/ft. = 1.08 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

Project No. 002420 Well No. MW-8 Date 12/17/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/17 19 92 TIME COLLECTED: 11:30 am

PURGE VOLUME: 1.2 gallons

SAMPLE COLOR: Black

ODOR: "Grease-like" odor

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* X	BTEX ____	OTHER ____
SEMI-VOCs ____	PESTICIDES ____	OTHER Base/Neutral	OTHER ____
TPH ____	PCBs ____	OTHER ____	OTHER ____
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/30/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) B. Dornbush

WELL NUMBER Lagoon 3 DATE DRILLED N/A

PRE-DEVELOPMENT DATA

WELL DEPTH _____ ft.
HEADSPACE VOC CONCENTRATION _____ ppm*
DEPTH TO PRODUCT _____ ft.
DEPTH TO WATER _____ ft.
PRODUCT THICKNESS _____ ft.
WATER COLUMN HEIGHT _____ ft.

CASING ELEV. _____
CASING SIZE _____ in.
CASING TYPE _____
SCREEN TYPE _____

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: =" WATER COLUMN HEIGHT x GALS/FOOT

= _____ ft. x _____ gals/ft. = _____ gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. Lagoon 3 Date 12/30/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/30 19 92 TIME COLLECTED: 10:37 am

PURGE VOLUME: _____ gallons

SAMPLE COLOR: Clear

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs		METALS*	Barium	BTEX		OTHER	
SEMI-VOCs		PESTICIDES		OTHER		OTHER	
TPH		PCBs		OTHER		OTHER	
DUPLICATE		DECON BLANK		OTHER		OTHER	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/30/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) B. Dornbush

WELL NUMBER MW-2 DATE DRILLED 11/25/92

PRE-DEVELOPMENT DATA

WELL DEPTH 49.35 ft.
HEADSPACE VOC CONCENTRATION _____ ppm*
DEPTH TO PRODUCT _____ ft.
DEPTH TO WATER 43.69 ft.
PRODUCT THICKNESS _____ ft.
WATER COLUMN HEIGHT 5.66 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 5.66 ft. x 0.16 gals/ft. = 0.9 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

Project No. 002420 Well No. MW-2 Date 12/30/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/30 19 92 TIME COLLECTED: 9:52 am

PURGE VOLUME: 1.0 gallons

SAMPLE COLOR: Clear to brown tint

ODOR: None

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* Lead	BTEX ____	OTHER ____	
SEMI-VOCs ____	PESTICIDES ____	OTHER ____	OTHER ____	
TPH ____	PCBs ____	OTHER ____	OTHER ____	
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____	

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT AND SAMPLING FORM

CLIENT Hammontree & Associates for Canton Drop Forge Manufacturing Company DATE 12/30/92

PROJECT Hydrogeological Site Assessment PROJECT NO. 002420

SAMPLER(s) B. Dornbush

WELL NUMBER MW-8 DATE DRILLED 12/04/92

PRE-DEVELOPMENT DATA

WELL DEPTH 13.10 ft.
HEADSPACE VOC CONCENTRATION - ppm*
DEPTH TO PRODUCT - ft.
DEPTH TO WATER 6.63 ft.
PRODUCT THICKNESS - ft.
WATER COLUMN HEIGHT 6.47 ft.

CASING ELEV. _____
CASING SIZE 2 in.
CASING TYPE PVC
SCREEN TYPE PVC 0.010"

* As determined by Photoionization Detector

COMMENTS: _____

CALCULATION OF DEVELOPMENT VOLUME

ONE WELL VOLUME: = [WATER COLUMN HEIGHT x GALS/FOOT]

= 6.47 ft. x 0.16 gals/ft. = 1.0 gallons

(FOR 2" WELLS, USE 0.16 gal/ft. - FOR 4" WELLS, USE 0.65 gal/ft.)

DEVELOPMENT SHALL CONSIST OF THE REMOVAL OF A MINIMUM OF THREE (3) WELL VOLUMES

THREE WELL VOLUMES = _____ gallons FIVE WELL VOLUMES = _____ gallons

DEVELOPMENT DATA

DEVELOPED BY: BAILER _____ PUMP _____

VOLUME REMOVED: _____ gallons

RECHARGE INFO: _____

ODOR: _____

SHEEN: _____

COMMENTS: _____

R&R INTERNATIONAL, INC.

WELL DEVELOPMENT & SAMPLING FORM

Project No. 002420 Well No. MW-8 Date 12/30/92

GROUNDWATER DATA

	pH	TEMP.	COND.
1ST BAILER:			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
AFTER ____ gals.			
LAST BAILER: ____ gals.			

COMMENTS: _____

SAMPLES COLLECTED

DATE SAMPLED: 12/30 19 92 TIME COLLECTED: 10:21 am

PURGE VOLUME: 1.0 gallons

SAMPLE COLOR: Clear to black tint

ODOR: Yes

SAMPLES TO BE ANALYZED FOR:

VOCs ____	METALS* Barium	BTEX ____	OTHER ____
SEMI-VOCs ____	PESTICIDES ____	OTHER ____	OTHER ____
TPH ____	PCBs ____	OTHER ____	OTHER ____
DUPLICATE ____	DECON BLANK ____	OTHER ____	OTHER ____

* Metal analyses for water must be field-filtered.

DECONTAMINATION PROCEDURES

SAMPLE BAILER:
- ALCONOX WASH X
- DISTILLED WATER RINSE X
- METHANOL RINSE X

NEW ROPE: X YES ____ NO

COMMENTS: _____

R&R
INTERNATIONAL, INC.

APPENDIX C
ODNR WATER WELL LOGS

CANTON DROP FORGE

TELECOPIER COVER SHEET

PLEASE DELIVER THE FOLLOWING PAGES TO:

NAME: KARL VALEK
FIRM: R&R
CITY:
PHONE:

FROM:

NAME: KEITH HAUSERMEYER
FIRM: Canton Drop Forge
CITY: Canton, OH

TOTAL NUMBER OF PAGES 6 INCLUDING COVER SHEET.

WE ARE TRANSMITTING ON THE FOLLOWING:

DATE: 12/17/92
TIME: 3100

IF YOU DO NOT RECEIVE ALL PAGES - PLEASE CALL BACK AS SOON AS POSSIBLE.

TELEPHONE: (216) 477-4511, EXT. _____

4575 Southway Street S.W. • P.O. Box 6902 • Canton, Ohio 44706-0902 • (216) 477-4511 • FAX (216) 477-9046

WATER WELLS and PUMPS

WELL SCREENS and TEST HOLES

M. J. ENGEL DRILLING CO.

MASSILLON, OHIO, R. D. 2

PHONE: MASSILLON 2-1650

DRILLED FOR The Canton Drop Forge and Manufacturing Co.

ADDRESS Canton, Ohio

DATE August 27, 1942

LOCATION 500 feet east of #1 well and 50 feet south of Pennsylvania Railroad tracks.

Well #2

Thickness	Strata	Total	Water Level
20 feet	gravel, sand, and clay		
40 feet	sand and gravel	60 feet	
30 feet	sand and clay	90 feet	
10 feet	gravel	100 feet	
15 feet	sand, gravel, and clay	115 feet	
10 feet	sand(fine)	125 feet	
15 feet	sand(fine)	140 feet	
50 feet	sand and clay	190 feet	
35 feet	clay and sand	225 feet	
10 feet	black shale	235 feet	
23 feet	black shale	258 feet	
2 feet	sand rock	260 feet	
10 feet	sand rock and shale	270 feet	
10 feet	sand rock and	280 feet	92 feet
22 feet	sand rock	302 feet	
20 feet	sand rock	322 feet	
5 feet	sand rock(pebles)	327 feet	
27 feet	sand rock(some pebles)	354 feet	86 feet
23 feet	sand rock(" ")	377 feet	84 feet
8 feet	sand rock(" ")	385 feet	
15 feet	sand rock(fine)	400 feet	

265'-9'' of 12'' 51# drive pipe in well. Also, one 12 '' drive shoe.
Shot well from 345' to 385'.

CDF012442

WATER WELLS and PUMPS

WELL SCREENS and TEST HOLES

M. J. ENGEL DRILLING CO.

MASSILLON, OHIO, R. D. 2

PHONE: MASSILLON 2-1629

DRILLED FOR The Canton Drop Forge and Manufacturing Co.

ADDRESS Canton, Ohio

DATE April 8, 1942

LOCATION 450 feet North of house on back Canton-Massillon Rd.

250 feet from Pennsylvania Railroad.

Well #1

Thickness	Strata	Total	Water Level
30 feet	gravel, sand, and clay	30 feet	
50 feet	sand and clay	80 feet	
10 feet	sand, clay and gravel	90 feet	
15 feet	gravel	105 feet	
19 feet	sand	124 feet	
15 feet	clay and sand	139 feet	
7 feet	sand rock	146 feet	71 feet

Set 30 feet of 10'' perforated pipe for screen.

CDF012443

WATER WELLS and PUMPS

WELL SCREENS and TEST HOLES

M. J. ENGEL DRILLING CO.

MASSILLON, OHIO, R. D. 2

PHONE: MASSILLON 2-1620

DRILLED FOR The Canton Drop Forge and Manufacturing Co.

ADDRESS Canton, Ohio

DATE June 7, 1943

LOCATION

Well #1

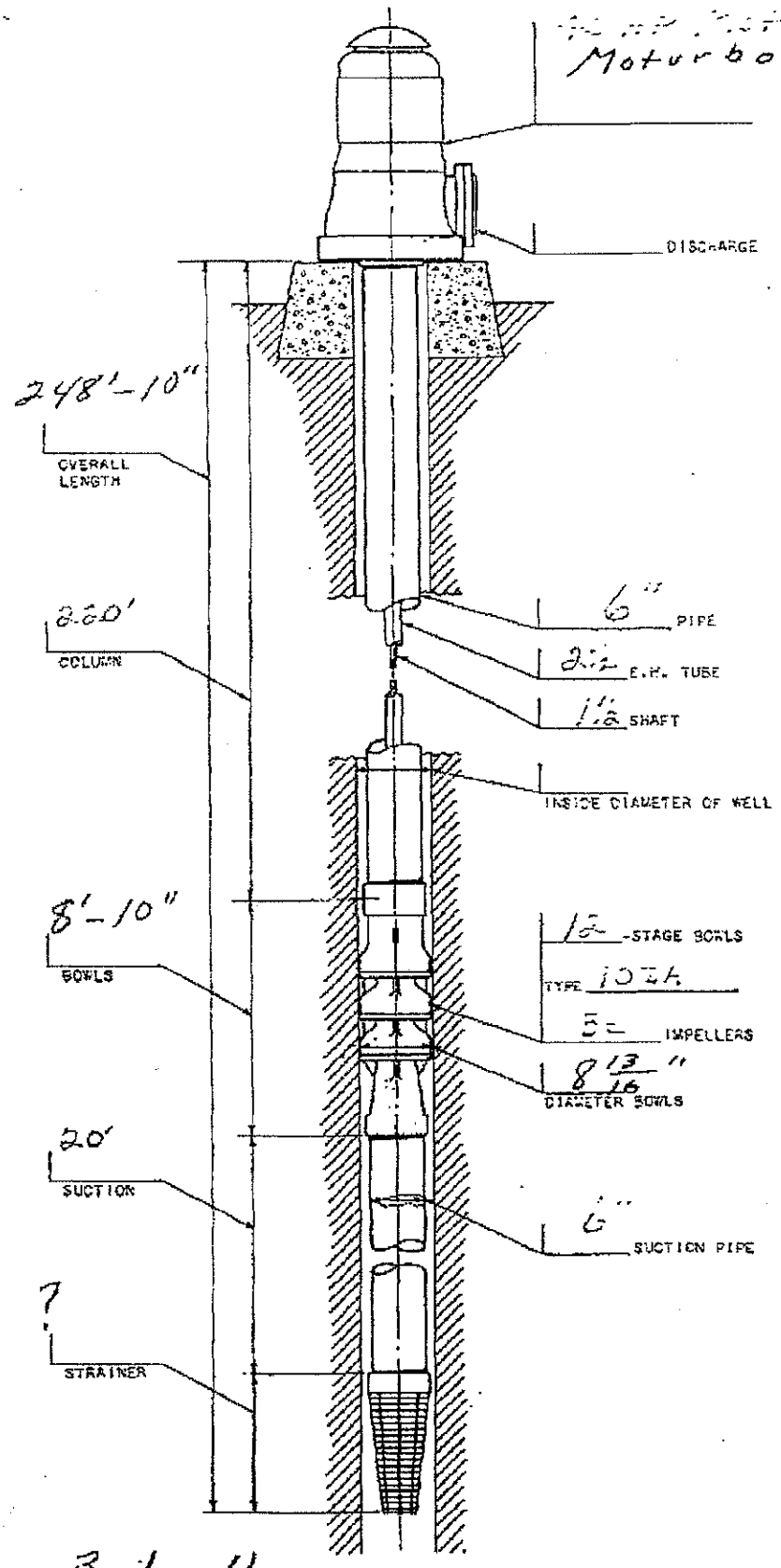
Thickness	Strata	Total	Water Level
	Moved back, pulled screen, and drove 12" pipe to rock. Depth at start - 146 feet.		
2 feet	sand rock	148 feet	
4 feet	clay and sand	152 feet	
8 feet	shale and sand rock	160 feet	
20 feet	sand rock and shale	180 feet	
42 feet	soft black shale	222 feet	
2 feet	sand rock	224 feet	
10 feet	soft black shale	234 feet	
3 feet	sand rock	237 feet	
21 feet	soft black shale	265 feet	
17 feet	sand rock and shale	282 feet	
8 feet	sand rock	290 feet	
2 feet	shale	292 feet	
133 feet	sand rock	425 feet	75 feet

160 feet 12" drive pipe
Well was shot with 60 quarts of Nitro.

Measurements- ground level

CDF012444

PEERLESS PUMP



366 G.P.M.
366' TOTAL HEAD
1760 R.P.M.
39 H.P. REQUIRED
60+ 96 lbs
84 WATER LE

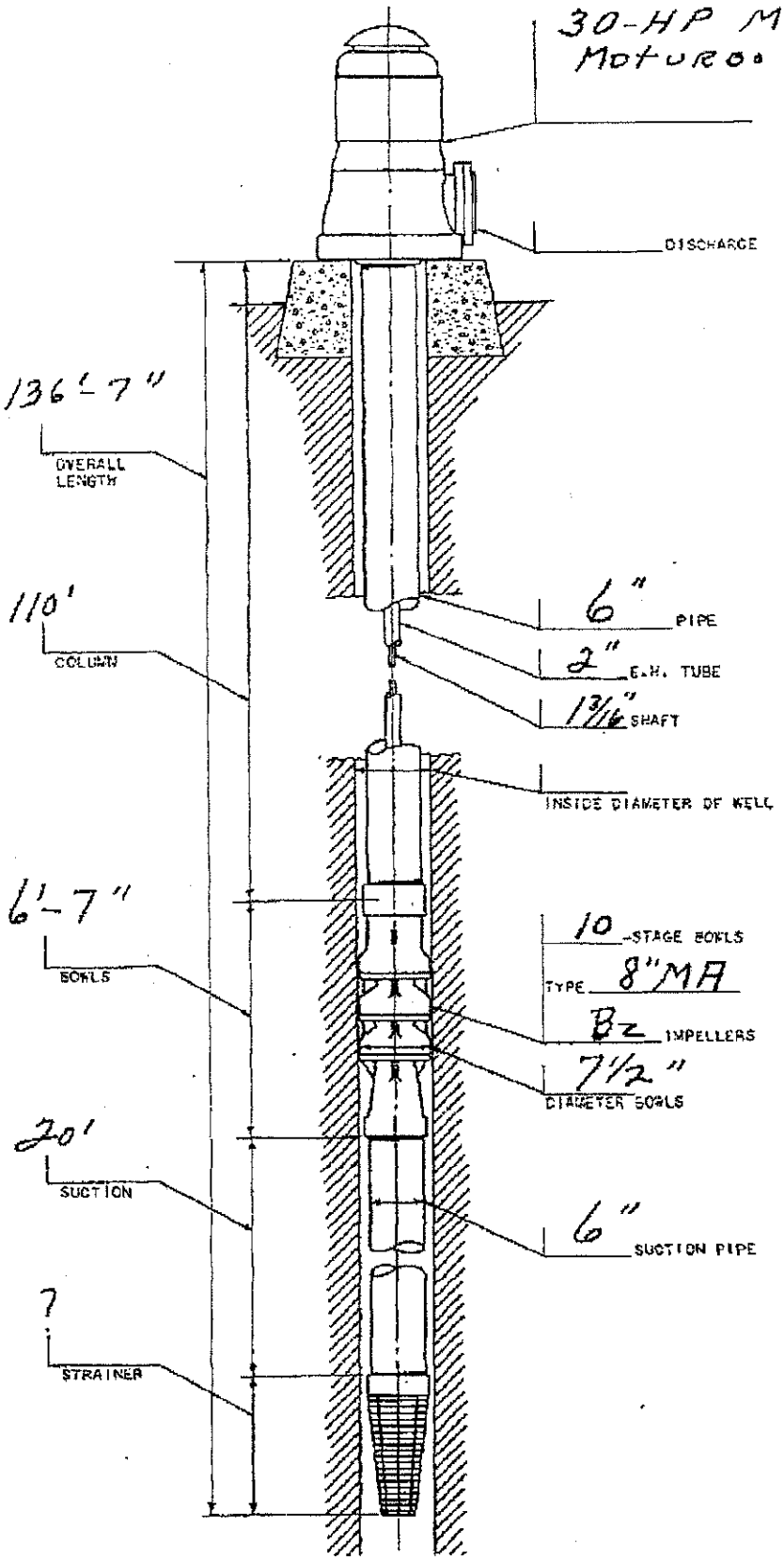
PUMP-17446

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
MASSILLON OHIO

R-1 CO Boiler House

MS-998

PEERLESS PUMP



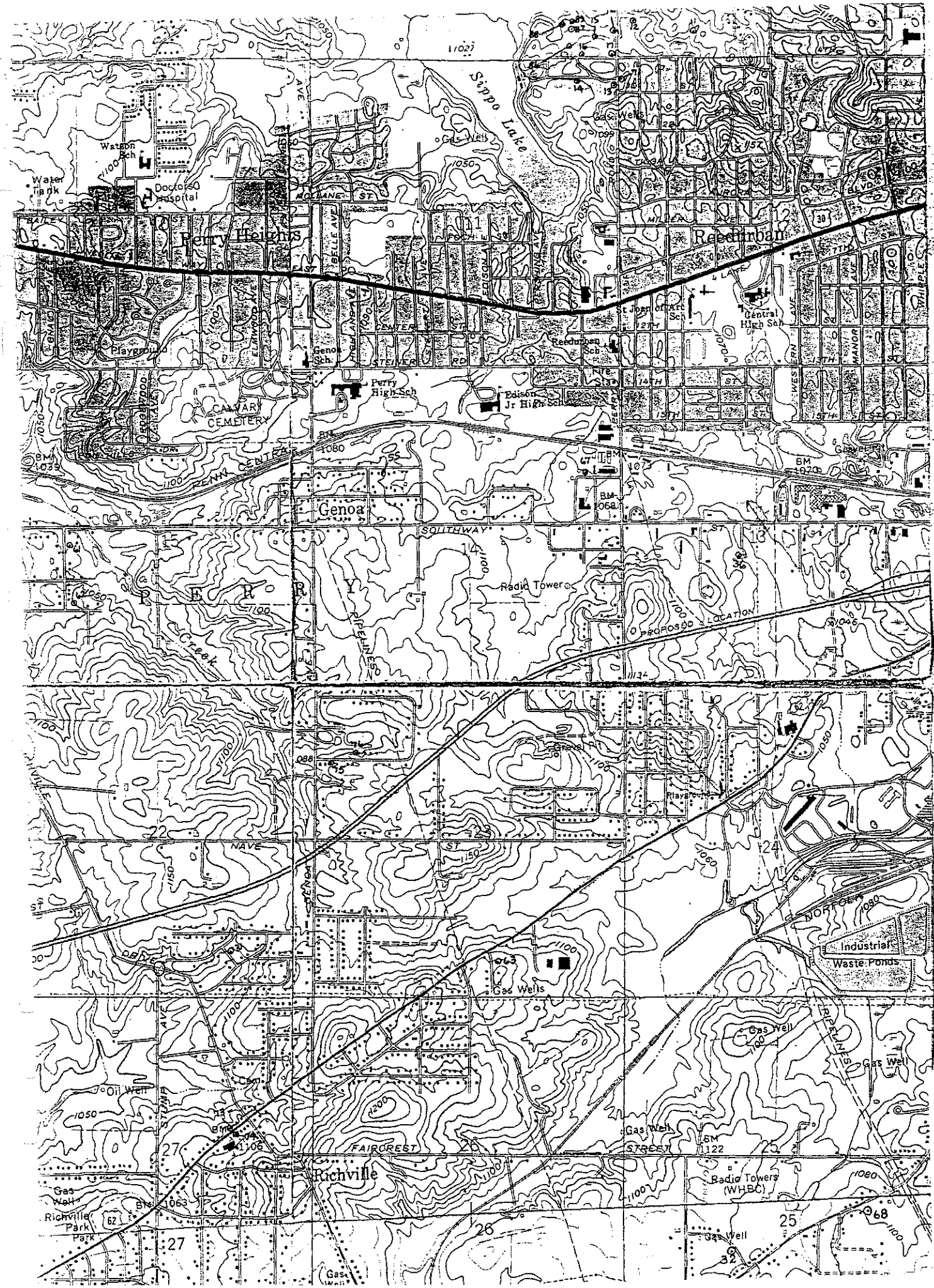
300 G.P.M.
270' TOTAL HEAD
1760 R.P.M.
28 H.P. REQUIRED
67+

Pump # 16141

PEERLESS PUMP DIVISION
FOOD MACHINERY CORPORATION
MASSILLON OHIO

R-L CO

MS-998


Sippo Lake
Gas Well
Watson Sch
Water Tank
Doctors Hospital
Perry Heights
Reedurban
Playground
Genoa Sch
Perry High Sch
Edison Jr High Sch
Reedurban Sch
St Joan of Arc Sch
Central High Sch
CALVARY CEMETERY
PENN CENTRAL
Genoa
SOUTHWAY
Radio Tower
PROPOSED LOCATION
Creek
Gravel Pit
Playground
NAVE
NORFOLK
Industrial Waste Ponds
Gas Wells
Oil Well
FAIRCREST
STREET
Richville
Radio Towers (WHBC)
Richville Park
Gas Well

CDF012447

36

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

permit #18480

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
H.B. Columbus, Ohio 43215

No. 414453

County Stark Township Perry Section of Township 13

Owner Olliver Potete Address 1322 11th St. SE rear, Canton Ohio

Location of property 1840 Navada SW, Canton,O

CONSTRUCTION DETAILS

Casing diameter 5" Length of casing 84'

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 10 G.P.M. Duration of test 2 hrs.

Drawdown none ft. Date 10/21/70

Static level-depth to water 42' ft.

Quality (clear, cloudy, taste, odor) clear

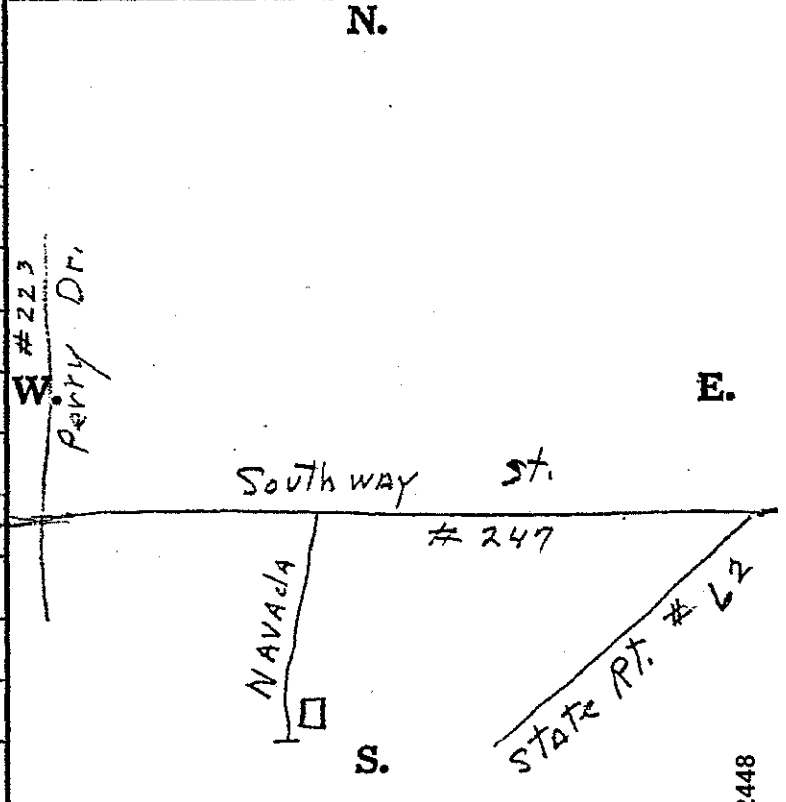
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
sand, gravel	0 Feet	84' Ft.
perforated point		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm ADAMS & WILLIAMS WELL DRILLING 4310 - 38th St. N.W. CANTON, OHIO

Address

Date 10/23/70

Signed John Adams

LOCAT 36

CDF012448

*If additional space is needed to complete well log, use next consecutive numbered form.

3

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER

DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

No. 331396

County Stark Township Canton Section of Township 18

Owner Commercial Freight Inc. Address 315 East Long St, Columbus, O.

Location of property S.E. corner of Southway and W. Tipple

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 193'8"

Type of screen — Length of screen

Type of pump submersible

Capacity of pump 70 gpm

Depth of pump setting 147'

Date of completion 12-17-65

BAILING ~~OR PUMPING~~ TEST

Pumping Rate 34 G.P.M. Duration of test hrs.

Drawdown -0 ft. Date 9-9-65

Static level-depth to water 64 ft.

Quality (clear, cloudy, taste, odor)

9 grain - little iron

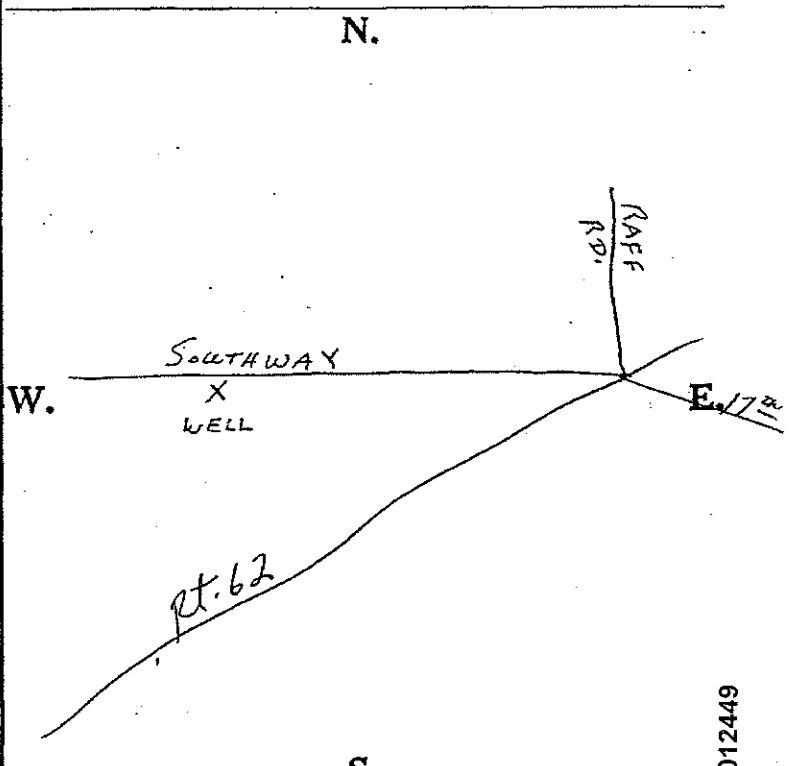
Pump installed by Everett Waltz & Co. Inc.

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
Brown Muddy Gravel	0 Feet	65 Ft.
Gray Mud + Gravel	65	90
Gray Gravel (Clean)	90	110
Gray Mud	110	160
Brown Mud	160	172
Dark Shale	172	176
Coal	176	176'6"
Clay	176'6	182
Sandy Shale & Sandrock	182	207
Dark Shale	207	221
Limestone	221	222
Dark Shale	222	275
Gray Shale	275	278
Sandrock	278	317

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

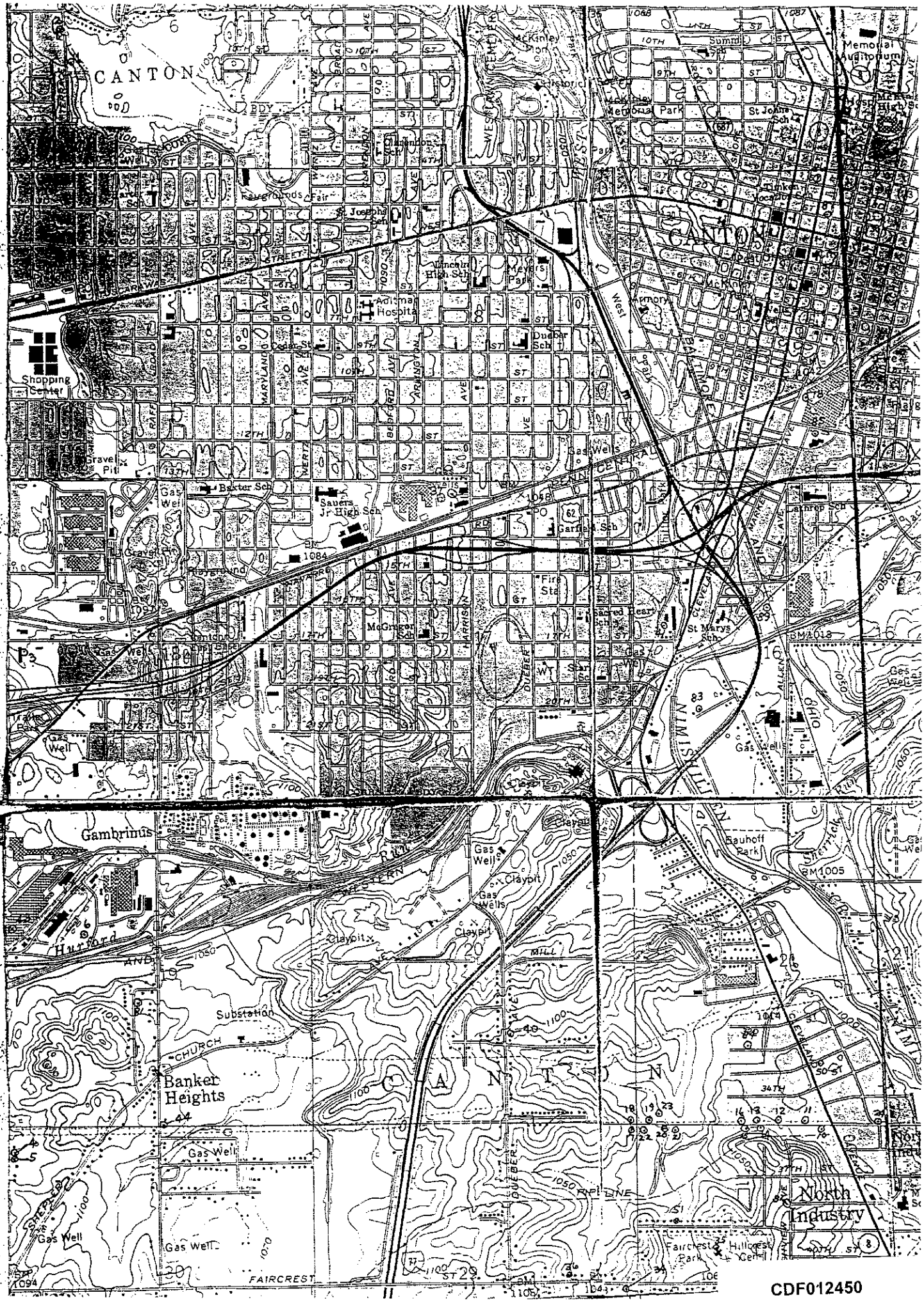
CDF012449

Drilling Firm EVERETT WALTZ & CO. Inc. DRILLING CONTRACTORS Date 12-18-65

Address STRASBURG, OHIO Signed A. H. Carr

LOCATED 3

*If additional space is needed to complete well log, use next consecutive numbered form.


CANTON
Memorial Auditorium
McKinley Memorial Park
St Johns Sch
Fairgrounds Fair
St Josephs Sch
Lincoln High Sch
Meyers Park
Aultman Hospital
Dueber Sch
Shopping Center
Gravel Pit
Baxter Sch
Sauers Jr High Sch
Garfield Sch
Fire Sta
McGregor Sch
Sacred Heart Sch
St Marys Sch
Lathrop Sch
Gas Wells
Gambrinus
Hurford
Claypit
Substation
Banker Heights
Bauhoff Park
North Industry
Faircrest Park
Hillcrest Cem
FAIRCREST
PENN CENTRAL
WESTERN
CHURCH
MILL
PIPE LINE

CDF012450

7

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

428762
Well No. 2

County Stark Township Perry Section of Township 2

Owner Massilon Plastics Inc Address Southway ave Canton

Location of property off Southway behind Southway Warehouses

CONSTRUCTION DETAILS

Casing diameter 10" Length of casing 50'

Type of screen — Length of screen —

Type of pump 15 hp sub.

Capacity of pump 150 gpm

Depth of pump setting 150'

Date of completion 10/28/71

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 100 G.P.M. Duration of test 2 hr

Drawdown 10 ft. Date 10/28/71

Static level-depth to water 25' f

Quality (clear, cloudy, taste, odor) clear

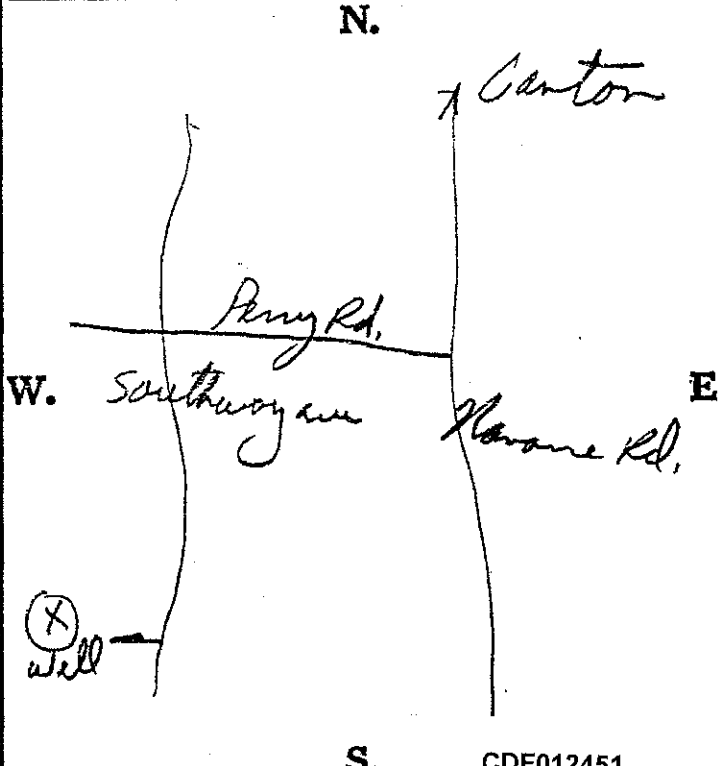
Pump installed by Fearon & Feller

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	Ft.
mud	0	30
gray shale	30	50
limestone	50	52
gray shale	52	77
Clay	77	88
gray shale	88	100
gray sandy sh	100	105
dark shale	105	115
sandrock	115	135
dark shale	135	150
sandy shale	150	215

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



CDF012451

Drilling Firm Fearon & Feller Date 11/15/71

Address Rt 1, Beach City, O Signed Bill Feller

LOCATED 67

*If additional space is needed to complete well log, use next consecutive numbered form

R&R
INTERNATIONAL INC

APPENDIX D
ANALYTICAL RESULTS AND CHAIN-OF-CUSTODY FORMS

AMERICAN ANALYTICAL LABORATORIES, INC.
INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

American Analytical
Laboratories, Inc.
840 S. Main Street
Akron, Ohio 44311
Attn: Tim Lavey
Phone: (216) 535-1300

R & R International
1234 S. Cleveland-Mass Rd.
P.O. Box 4383
Akron, Ohio 44321
Attn: Jeffery A. Sussman
Invoice Number: 12281

Order #: 92-11-379
Date: 12/10/92
Work ID: Project #002420
Date Received: 11/25/92
Date Completed: 12/10/92
Client Code: RRINTERNATNL

Soil results are reported on a dry weight basis.
Facility: Canton Drop Forge

SAMPLE IDENTIFICATION

Sample Number	Sample Description
01	B-1/S-16
02	B-1/S-16
03	B-1/S-16

BDL - Below Detection Limit

Certified By
T. J. Lavey

CDF012453

Sample Description: B-1/S-16 Lab No: 01A
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 11/24/92 10:00

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	240
Benzene	BDL	12
Bromodichloromethane	BDL	12
Bromoform	BDL	12
Bromomethane	BDL	24
2-Butanone	140	120
Carbon Disulfide	BDL	24
Carbon Tetrachloride	BDL	12
Chlorobenzene	BDL	12
Chlorodibromomethane	BDL	12
Chloroethane	BDL	24
Chloroform	BDL	12
Chloromethane	BDL	24
1,1-Dichloroethane	BDL	12
1,1-Dichloroethene	BDL	12
trans-1,2-Dichloroethene	BDL	12
1,2-Dichloropropane	BDL	12
cis-1,3-Dichloropropene	BDL	12
trans-1,3-Dichloropropene	BDL	12
Ethylbenzene	BDL	12
2-Hexanone	BDL	120
Methylene Chloride	BDL	47
4-Methyl-2-pentanone	BDL	120
Styrene	BDL	12
1,1,2,2-Tetrachloroethane	BDL	12
Tetrachloroethene	BDL	12
Toluene	BDL	12
1,1,1-Trichloroethane	BDL	12
1,1,2-Trichloroethane	BDL	12
Trichloroethene	BDL	12
Vinyl Chloride	BDL	24
Xylene	BDL	12

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	97	70 - 121
Toluene-d8	102	81 - 117
4-Bromofluorobenzene	95	74 - 121

Notes and Definitions for this Report:

EXTRACTED 11/25/92
DATE RUN 11/25/92
ANALYST MWO
UNITS ug/Kg

Sample Description: B-1/S-16 Lab No: 03A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 11/24/92 10:00

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	380	
2-Chlorophenol	BDL	380	
2-Methylphenol	BDL	380	
3&4-Methylphenol	BDL	380	
2-Nitrophenol	BDL	380	
2,4-Dimethylphenol	BDL	380	
2,4-Dichlorophenol	BDL	380	
4-Chloro-3-methylphenol	BDL	380	
2,4,6-Trichlorophenol	BDL	380	
2,4,5-Trichlorophenol	BDL	380	
2,4-Dinitrophenol	BDL	1900	
4-Nitrophenol	BDL	1900	
2-Methyl-4,6-dinitrophenol	BDL	1900	
Pentachlorophenol	BDL	1900	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	58	25 - 121
Phenol d-5	58	24 - 113
2,4,6-Tribromophenol	44	19 - 122

Notes and Definitions for this Report:

EXTRACTED 11/27/92
DATE RUN 11/27/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-1/S-16 Lab No: 03A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/24/92 10:00

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	380	
1,3-Dichlorobenzene	BDL	380	
1,4-Dichlorobenzene	BDL	380	
1,2-Dichlorobenzene	BDL	380	
bis(2-Chloroisopropyl) ether	BDL	380	
N-Nitroso-di-n-propylamine	BDL	380	
Hexachloroethane	BDL	380	
Nitrobenzene	BDL	380	
Isophorone	BDL	380	
bis(2-Chloroethoxy)methane	BDL	380	
1,2,4-Trichlorobenzene	BDL	380	
Naphthalene	BDL	380	
4-Chloroaniline	BDL	380	
Hexachlorobutadiene	BDL	380	
2-Methylnaphthalene	BDL	380	
Hexachlorocyclopentadiene	BDL	380	
2-Chloronaphthalene	BDL	380	
2-Nitroaniline	BDL	1900	
Dimethylphthalate	BDL	380	
Acenaphthylene	BDL	380	
2,6-Dinitrotoluene	BDL	380	
3-Nitroaniline	BDL	1900	
Acenaphthene	BDL	380	
Dibenzofuran	BDL	380	
2,4-Dinitrotoluene	BDL	380	
Diethylphthalate	BDL	380	
4-Chlorophenyl-phenylether	BDL	380	
Fluorene	BDL	380	
4-Nitroaniline	BDL	1900	
N-Nitrosodiphenylamine	BDL	380	
4-Bromophenyl-phenylether	BDL	380	
Hexachlorobenzene	BDL	380	
Phenanthrene	BDL	380	
Anthracene	BDL	380	
Carbazole	BDL	380	
Di-n-butylphthalate	BDL	380	
Fluoranthene	BDL	380	
Pyrene	BDL	380	
Butylbenzylphthalate	BDL	380	
3,3'-Dichlorobenzidine	BDL	760	
Benzo(a)anthracene	BDL	380	
Chrysene	BDL	380	
bis(2-Ethylhexyl)phthalate	BDL	380	

Sample Description: B-1/S-16 Lab No: 03A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/24/92 10:00

Di-n-octylphthalate	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(a)pyrene	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Dibenz(a,h)anthracene	BDL	380
Benzo(g,h,i)perylene	BDL	380

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	77	23 - 120
2-Fluorobiphenyl	44	30 - 115
p-Terphenyl d14	64	18 - 137

Notes and Definitions for this Report:

EXTRACTED 11/27/92
DATE RUN 11/27/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-1/S-16 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/24/92 10:00

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.11
PCB-1221	BDL	0.11
PCB-1232	BDL	0.11
PCB-1242	BDL	0.11
PCB-1248	BDL	0.11
PCB-1254	BDL	0.11
PCB-1260	BDL	0.11

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	85	24 - 154

Notes and Definitions for this Report:

EXTRACTED 11/27/92
DATE RUN 11/27/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-1/S-16 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/24/92 10:00

Sample Description: B-1/S-16 Lab No: 03A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 11/24/92 10:00

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	29

Notes and Definitions for this Report:

EXTRACTED 11/30/92
DATE RUN 11/30/92
ANALYST ROZ
UNITS mg/Kg

% Moisture
Method: ASTM D2216

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	B-1/S-16	12.6	%		11/27/92	AMM

Aluminum
Method: EPA 7020

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	11000	mg/Kg	2300	11/30/92	CAZ

Antimony
Method: EPA 7041

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	< 0.58	mg/Kg	0.58	12/01/92	JSC

Arsenic
Method: EPA 7060

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	20	mg/Kg	0.58	12/02/92	JSC

Barium
Method: EPA 7080

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	1100	mg/Kg	58	11/30/92	CAZ

Beryllium
Method: EPA 7090

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	< 5.8	mg/Kg	5.8	12/03/92	JSC

Cadmium
Method: EPA 7131

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	0.23	mg/Kg	0.06	11/30/92	JSC

Calcium
Method: EPA 7140

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	2800	mg/Kg	1200	11/30/92	CAZ

Chromium
Method: EPA 7190

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	24	mg/Kg	12	11/27/92	JSC

Cobalt
Method: EPA 7200

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	17	mg/Kg	12	12/03/92	JSC

Copper
Method: EPA 7210

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	29	mg/Kg	5.8	11/30/92	CAZ

Cyanide (Total)
Method: SW846 9010

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	B-1/S-16	<0.3	mg/Kg	0.3	11/30/92	LAK

Iron
Method: EPA 7380

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	35000	mg/Kg	580	11/30/92	CAZ

Lead
Method: EPA 7421

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	21	mg/Kg	0.58	12/01/92	JSC

Magnesium
Method: EPA 7450

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	2500	mg/Kg	120	11/30/92	CAZ

Manganese
Method: EPA 7460

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	6200	mg/Kg	5.8	12/03/92	DRB

Mercury
Method: EPA 7471

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	< 0.12	mg/Kg	0.12	12/07/92	DRB

Nickel
Method: EPA 7520

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	20	mg/Kg	5.8	12/02/92	JSC

Phenolics (Solid)
Method: EPA 420.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	B-1/S-16	<0.5	mg/Kg	0.5	12/02/92	WBB

Potassium
Method: SW846 7610

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	2300	mg/Kg	1200	12/03/92	JSC

Selenium
Method: EPA 7740

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	< 0.58	mg/Kg	0.58	12/03/92	JSC

Silver
Method: EPA 7760

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	< 5.8	mg/Kg	5.8	12/01/92	DRB

Sodium
Method: EPA 7770

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	520	mg/Kg	29	11/30/92	CAZ

Thallium
Method: EPA 7841

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	< 1.2	mg/Kg	1.2	11/30/92	JSC

Vanadium
Method: EPA 7911

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	25	mg/Kg	9.2	12/04/92	JSC

Zinc
Method: EPA 7950

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02A	B-1/S-16	100	mg/Kg	2.3	11/30/92	CAZ

92-11-379
BR

R&R INTERNATIONAL, INC. (RRINTERNATNL)

CHAIN OF CUSTODY RECORD

PROJECT NO.: 002420

SITE NAME: CANTON DROP FORGE

SAMPLERS (SIGNATURE): Karl W. Valek

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH 418.1	VOL 8240 (TCL)	SEMI-VOL 8270 (TCL)	BIPHENYLS (PCB) 8080	Metals (TCL) 7000 series	Tot. Cyanide 9010	Tot Rec. Phenolic 9065	REMARKS
	11/24	10:00		x	B-1/S-16	2	x	x	x	x	x	x	x	Forward Results to Karl Valek (216) 666-2200
							THCSIR SP 3550	V8240S-4	AC 8270 BS PSV-A PSV-B	PCB-S PP	TCL MTS	UN TOT	HHNL-S	
														Use 8 oz. jar for volatiles analysis. 4 oz. jar has been used for headspace gas field analysis.

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
Karl W. Valek	7:19 11/25/92	[signature]	[signature]	11/25/92 1:10pm	
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY (SIGNATURE): Beth Redhead	DATE/TIME 11/25/92 1:10pm	REMARKS:	

FORM 577

CDF012463

AMERICAN ANALYTICAL LABORATORIES, INC.
INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

American Analytical
Laboratories, Inc.
840 S. Main Street
Akron, Ohio 44311
Attn: Tim Lavey
Phone: (216) 535-1300

DEC 15 1992

R & R International
1234 S. Cleveland-Mass Rd.
P.O. Box 4383
Akron, Ohio 44321
Attn: Karl Valek
Invoice Number:

Order #: 92-12-020
Date: 12/15/92
Work ID: Project No. 002420
Date Received: 12/01/92
Date Completed: 12/15/92
Client Code: RRINTERNATNL

Facility: Canton Drop Forge
Soil results are reported on a dry weight basis.

SAMPLE IDENTIFICATION

Sample Number	Sample Description
01	B-2/S-17 - B-2/S-18
02	B-3/S-18 - B-3/S-19
03	B-4/S-17 - B-4/S-18
04	B-5/S-2 - B-5/S-4
05	B-5/S-12

BDL - Below Detection Limit

Certified By
T. J. Lavey

CDF012464

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 11/25/92 09:15 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	380	
2-Chlorophenol	BDL	380	
2-Methylphenol	BDL	380	
3&4-Methylphenol	BDL	380	
2-Nitrophenol	BDL	380	
2,4-Dimethylphenol	BDL	380	
2,4-Dichlorophenol	BDL	380	
4-Chloro-3-methylphenol	BDL	380	
2,4,6-Trichlorophenol	BDL	380	
2,4,5-Trichlorophenol	BDL	380	
2,4-Dinitrophenol	BDL	1900	
4-Nitrophenol	BDL	1900	
2-Methyl-4,6-dinitrophenol	BDL	1900	
Pentachlorophenol	BDL	1900	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	45	25 - 121
Phenol d-5	42	24 - 113
2,4,6-Tribromophenol	29	19 - 122

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/02/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/25/92 09:15 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	380	
1,3-Dichlorobenzene	BDL	380	
1,4-Dichlorobenzene	BDL	380	
1,2-Dichlorobenzene	BDL	380	
bis(2-Chloroisopropyl) ether	BDL	380	
N-Nitroso-di-n-propylamine	BDL	380	
Hexachloroethane	BDL	380	
Nitrobenzene	BDL	380	
Isophorone	BDL	380	
bis(2-Chloroethoxy)methane	BDL	380	
1,2,4-Trichlorobenzene	BDL	380	
Naphthalene	BDL	380	
4-Chloroaniline	BDL	380	
Hexachlorobutadiene	BDL	380	
2-Methylnaphthalene	BDL	380	
Hexachlorocyclopentadiene	BDL	380	
2-Chloronaphthalene	BDL	380	
2-Nitroaniline	BDL	1900	
Dimethylphthalate	BDL	380	
Acenaphthylene	BDL	380	
2,6-Dinitrotoluene	BDL	380	
3-Nitroaniline	BDL	1900	
Acenaphthene	BDL	380	
Dibenzofuran	BDL	380	
2,4-Dinitrotoluene	BDL	380	
Diethylphthalate	BDL	380	
4-Chlorophenyl-phenylether	BDL	380	
Fluorene	BDL	380	
4-Nitroaniline	BDL	1900	
N-Nitrosodiphenylamine	BDL	380	
4-Bromophenyl-phenylether	BDL	380	
Hexachlorobenzene	BDL	380	
Phenanthrene	BDL	380	
Anthracene	BDL	380	
Carbazole	BDL	380	
Di-n-butylphthalate	BDL	380	
Fluoranthene	BDL	380	
Pyrene	BDL	380	
Butylbenzylphthalate	BDL	380	
3,3'-Dichlorobenzidine	BDL	760	
Benzo(a)anthracene	BDL	380	
Chrysene	BDL	380	
bis(2-Ethylhexyl)phthalate	BDL	380	

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/25/92 09:15 Category: COMPOSITE

Di-n-octylphthalate	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(a)pyrene	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Dibenz(a,h)anthracene	BDL	380
Benzo(g,h,i)perylene	BDL	380

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	58	23 - 120
2-Fluorobiphenyl	29 Q	30 - 115
p-Terphenyl d14	41	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/02/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/25/92 09:15 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.12
PCB-1221	BDL	0.12
PCB-1232	BDL	0.12
PCB-1242	BDL	0.12
PCB-1248	BDL	0.12
PCB-1254	BDL	0.12
PCB-1260	BDL	0.12

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	38	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/03/92
DATE RUN 12/03/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/25/92 09:15 Category: COMPOSITE

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 11/25/92 09:15 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	29

Notes and Definitions for this Report:

EXTRACTED 12/04/92
DATE RUN 12/04/92
ANALYST ROZ
UNITS mg/Kg

Sample Description: B-2/S-17 - B-2/S-18 Lab No: 01C
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 11/25/92 09:15 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	120
Benzene	BDL	5.8
Bromodichloromethane	BDL	5.8
Bromoform	BDL	5.8
Bromomethane	BDL	12
2-Butanone	BDL	58
Carbon Disulfide	BDL	12
Carbon Tetrachloride	BDL	5.8
Chlorobenzene	BDL	5.8
Chlorodibromomethane	BDL	5.8
Chloroethane	BDL	12
Chloroform	BDL	5.8
Chloromethane	BDL	12
1,1-Dichloroethane	BDL	5.8
1,1-Dichloroethene	BDL	5.8
trans-1,2-Dichloroethene	BDL	5.8
1,2-Dichloropropane	BDL	5.8
cis-1,3-Dichloropropene	BDL	5.8
trans-1,3-Dichloropropene	BDL	5.8
Ethylbenzene	BDL	5.8
2-Hexanone	BDL	58
Methylene Chloride	BDL	23
4-Methyl-2-pentanone	BDL	58
Styrene	BDL	5.8
1,1,2,2-Tetrachloroethane	BDL	5.8
Tetrachloroethene	BDL	5.8
Toluene	BDL	5.8
1,1,1-Trichloroethane	BDL	5.8
1,1,2-Trichloroethane	BDL	5.8
Trichloroethene	BDL	5.8
Vinyl Chloride	BDL	12
Xylene	BDL	5.8

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	90	70 - 121
Toluene-d8	107	81 - 117
4-Bromofluorobenzene	89	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	380	
2-Chlorophenol	BDL	380	
2-Methylphenol	BDL	380	
3&4-Methylphenol	BDL	380	
2-Nitrophenol	BDL	380	
2,4-Dimethylphenol	BDL	380	
2,4-Dichlorophenol	BDL	380	
4-Chloro-3-methylphenol	BDL	380	
2,4,6-Trichlorophenol	BDL	380	
2,4,5-Trichlorophenol	BDL	380	
2,4-Dinitrophenol	BDL	1900	
4-Nitrophenol	BDL	1900	
2-Methyl-4,6-dinitrophenol	BDL	1900	
Pentachlorophenol	BDL	1900	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	54	25 - 121
Phenol d-5	50	24 - 113
2,4,6-Tribromophenol	39	19 - 122

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/02/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	380	
1,3-Dichlorobenzene	BDL	380	
1,4-Dichlorobenzene	BDL	380	
1,2-Dichlorobenzene	BDL	380	
bis(2-Chloroisopropyl) ether	BDL	380	
N-Nitroso-di-n-propylamine	BDL	380	
Hexachloroethane	BDL	380	
Nitrobenzene	BDL	380	
Isophorone	BDL	380	
bis(2-Chloroethoxy)methane	BDL	380	
1,2,4-Trichlorobenzene	BDL	380	
Naphthalene	BDL	380	
4-Chloroaniline	BDL	380	
Hexachlorobutadiene	BDL	380	
2-Methylnaphthalene	BDL	380	
Hexachlorocyclopentadiene	BDL	380	
2-Chloronaphthalene	BDL	380	
2-Nitroaniline	BDL	1900	
Dimethylphthalate	BDL	380	
Acenaphthylene	BDL	380	
2,6-Dinitrotoluene	BDL	380	
3-Nitroaniline	BDL	1900	
Acenaphthene	BDL	380	
Dibenzofuran	BDL	380	
2,4-Dinitrotoluene	BDL	380	
Diethylphthalate	BDL	380	
4-Chlorophenyl-phenylether	BDL	380	
Fluorene	BDL	380	
4-Nitroaniline	BDL	1900	
N-Nitrosodiphenylamine	BDL	380	
4-Bromophenyl-phenylether	BDL	380	
Hexachlorobenzene	BDL	380	
Phenanthrene	BDL	380	
Anthracene	BDL	380	
Carbazole	BDL	380	
Di-n-butylphthalate	BDL	380	
Fluoranthene	BDL	380	
Pyrene	BDL	380	
Butylbenzylphthalate	BDL	380	
3,3'-Dichlorobenzidine	BDL	760	
Benzo(a)anthracene	BDL	380	
Chrysene	BDL	380	
bis(2-Ethylhexyl)phthalate	BDL	380	

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/30/92 Category: COMPOSITE

Di-n-octylphthalate	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(a)pyrene	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Dibenz(a,h)anthracene	BDL	380
Benzo(g,h,i)perylene	BDL	380

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	75	23 - 120
2-Fluorobiphenyl	42	30 - 115
p-Terphenyl d14	67	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/02/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.12
PCB-1221	BDL	0.12
PCB-1232	BDL	0.12
PCB-1242	BDL	0.12
PCB-1248	BDL	0.12
PCB-1254	BDL	0.12
PCB-1260	BDL	0.12

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	41	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/03/92
DATE RUN 12/03/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/30/92 Category: COMPOSITE

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	29

Notes and Definitions for this Report:

EXTRACTED 12/04/92
DATE RUN 12/04/92
ANALYST ROZ
UNITS mg/Kg

Sample Description: B-3/S-18 - B-3/S-19 Lab No: 02C
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	120
Benzene	BDL	5.8
Bromodichloromethane	BDL	5.8
Bromoform	BDL	5.8
Bromomethane	BDL	12
2-Butanone	BDL	58
Carbon Disulfide	BDL	12
Carbon Tetrachloride	BDL	5.8
Chlorobenzene	BDL	5.8
Chlorodibromomethane	BDL	5.8
Chloroethane	BDL	12
Chloroform	BDL	5.8
Chloromethane	BDL	12
1,1-Dichloroethane	BDL	5.8
1,1-Dichloroethene	BDL	5.8
trans-1,2-Dichloroethene	BDL	5.8
1,2-Dichloropropane	BDL	5.8
cis-1,3-Dichloropropene	BDL	5.8
trans-1,3-Dichloropropene	BDL	5.8
Ethylbenzene	BDL	5.8
2-Hexanone	BDL	58
Methylene Chloride	BDL	23
4-Methyl-2-pentanone	BDL	58
Styrene	BDL	5.8
1,1,2,2-Tetrachloroethane	BDL	5.8
Tetrachloroethene	BDL	5.8
Toluene	BDL	5.8
1,1,1-Trichloroethane	22	5.8
1,1,2-Trichloroethane	BDL	5.8
Trichloroethene	BDL	5.8
Vinyl Chloride	BDL	12
Xylene	BDL	5.8

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	91	70 - 121
Toluene-d8	117	81 - 117
4-Bromofluorobenzene	87	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	350	
2-Chlorophenol	BDL	350	
2-Methylphenol	BDL	350	
3&4-Methylphenol	BDL	350	
2-Nitrophenol	BDL	350	
2,4-Dimethylphenol	BDL	350	
2,4-Dichlorophenol	BDL	350	
4-Chloro-3-methylphenol	BDL	350	
2,4,6-Trichlorophenol	BDL	350	
2,4,5-Trichlorophenol	BDL	350	
2,4-Dinitrophenol	BDL	1800	
4-Nitrophenol	BDL	1800	
2-Methyl-4,6-dinitrophenol	BDL	1800	
Pentachlorophenol	BDL	1800	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	54	25 - 121
Phenol d-5	50	24 - 113
2,4,6-Tribromophenol	32	19 - 122

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/02/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	350	
1,3-Dichlorobenzene	BDL	350	
1,4-Dichlorobenzene	BDL	350	
1,2-Dichlorobenzene	BDL	350	
bis(2-Chloroisopropyl) ether	BDL	350	
N-Nitroso-di-n-propylamine	BDL	350	
Hexachloroethane	BDL	350	
Nitrobenzene	BDL	350	
Isophorone	BDL	350	
bis(2-Chloroethoxy)methane	BDL	350	
1,2,4-Trichlorobenzene	BDL	350	
Naphthalene	BDL	350	
4-Chloroaniline	BDL	350	
Hexachlorobutadiene	BDL	350	
2-Methylnaphthalene	BDL	350	
Hexachlorocyclopentadiene	BDL	350	
2-Chloronaphthalene	BDL	350	
2-Nitroaniline	BDL	1800	
Dimethylphthalate	BDL	350	
Acenaphthylene	BDL	350	
2,6-Dinitrotoluene	BDL	350	
3-Nitroaniline	BDL	1800	
Acenaphthene	BDL	350	
Dibenzofuran	BDL	350	
2,4-Dinitrotoluene	BDL	350	
Diethylphthalate	BDL	350	
4-Chlorophenyl-phenylether	BDL	350	
Fluorene	BDL	350	
4-Nitroaniline	BDL	1800	
N-Nitrosodiphenylamine	BDL	350	
4-Bromophenyl-phenylether	BDL	350	
Hexachlorobenzene	BDL	350	
Phenanthrene	BDL	350	
Anthracene	BDL	350	
Carbazole	BDL	350	
Di-n-butylphthalate	BDL	350	
Fluoranthene	BDL	350	
Pyrene	BDL	350	
Butylbenzylphthalate	BDL	350	
3,3'-Dichlorobenzidine	BDL	700	
Benzo(a)anthracene	BDL	350	
Chrysene	BDL	350	
bis(2-Ethylhexyl)phthalate	BDL	350	

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 11/30/92 Category: COMPOSITE

Di-n-octylphthalate	BDL	350
Benzo(b)fluoranthene	BDL	350
Benzo(k)fluoranthene	BDL	350
Benzo(a)pyrene	BDL	350
Indeno(1,2,3-cd)pyrene	BDL	350
Dibenz(a,h)anthracene	BDL	350
Benzo(g,h,i)perylene	BDL	350

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	66	23 - 120
2-Fluorobiphenyl	36	30 - 115
p-Terphenyl d14	41	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/02/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.11
PCB-1221	BDL	0.11
PCB-1232	BDL	0.11
PCB-1242	BDL	0.11
PCB-1248	BDL	0.11
PCB-1254	BDL	0.11
PCB-1260	BDL	0.11

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	38	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/03/92
DATE RUN 12/03/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 11/30/92 Category: COMPOSITE

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	27

Notes and Definitions for this Report:

EXTRACTED 12/04/92
DATE RUN 12/04/92
ANALYST ROZ
UNITS mg/Kg

Sample Description: B-4/S-17 - B-4/S-18 Lab No: 03C
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 11/30/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	110
Benzene	BDL	5.3
Bromodichloromethane	BDL	5.3
Bromoform	BDL	5.3
Bromomethane	BDL	11
2-Butanone	BDL	53
Carbon Disulfide	BDL	11
Carbon Tetrachloride	BDL	5.3
Chlorobenzene	BDL	5.3
Chlorodibromomethane	BDL	5.3
Chloroethane	BDL	11
Chloroform	BDL	5.3
Chloromethane	BDL	11
1,1-Dichloroethane	BDL	5.3
1,1-Dichloroethene	BDL	5.3
trans-1,2-Dichloroethene	BDL	5.3
1,2-Dichloropropane	BDL	5.3
cis-1,3-Dichloropropene	BDL	5.3
trans-1,3-Dichloropropene	BDL	5.3
Ethylbenzene	BDL	5.3
2-Hexanone	BDL	53
Methylene Chloride	BDL	22
4-Methyl-2-pentanone	BDL	53
Styrene	BDL	5.3
1,1,2,2-Tetrachloroethane	BDL	5.3
Tetrachloroethene	BDL	5.3
Toluene	BDL	5.3
1,1,1-Trichloroethane	11	5.3
1,1,2-Trichloroethane	BDL	5.3
Trichloroethene	BDL	5.3
Vinyl Chloride	BDL	11
Xylene	BDL	5.3

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	100	70 - 121
Toluene-d8	117	81 - 117
4-Bromofluorobenzene	87	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 12/01/92 01:00 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	380	
2-Chlorophenol	BDL	380	
2-Methylphenol	BDL	380	
3&4-Methylphenol	BDL	380	
2-Nitrophenol	BDL	380	
2,4-Dimethylphenol	BDL	380	
2,4-Dichlorophenol	BDL	380	
4-Chloro-3-methylphenol	BDL	380	
2,4,6-Trichlorophenol	BDL	380	
2,4,5-Trichlorophenol	BDL	380	
2,4-Dinitrophenol	BDL	1900	
4-Nitrophenol	BDL	1900	
2-Methyl-4,6-dinitrophenol	BDL	1900	
Pentachlorophenol	BDL	1900	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	35	25 - 121
Phenol d-5	35	24 - 113
2,4,6-Tribromophenol	20	19 - 122

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/03/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/01/92 01:00 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	380	
1,3-Dichlorobenzene	BDL	380	
1,4-Dichlorobenzene	BDL	380	
1,2-Dichlorobenzene	BDL	380	
bis(2-Chloroisopropyl) ether	BDL	380	
N-Nitroso-di-n-propylamine	BDL	380	
Hexachloroethane	BDL	380	
Nitrobenzene	BDL	380	
Isophorone	BDL	380	
bis(2-Chloroethoxy)methane	BDL	380	
1,2,4-Trichlorobenzene	BDL	380	
Naphthalene	BDL	380	
4-Chloroaniline	BDL	380	
Hexachlorobutadiene	BDL	380	
2-Methylnaphthalene	BDL	380	
Hexachlorocyclopentadiene	BDL	380	
2-Chloronaphthalene	BDL	380	
2-Nitroaniline	BDL	1900	
Dimethylphthalate	BDL	380	
Acenaphthylene	BDL	380	
2,6-Dinitrotoluene	BDL	380	
3-Nitroaniline	BDL	1900	
Acenaphthene	BDL	380	
Dibenzofuran	BDL	380	
2,4-Dinitrotoluene	BDL	380	
Diethylphthalate	BDL	380	
4-Chlorophenyl-phenylether	BDL	380	
Fluorene	BDL	380	
4-Nitroaniline	BDL	1900	
N-Nitrosodiphenylamine	BDL	380	
4-Bromophenyl-phenylether	BDL	380	
Hexachlorobenzene	BDL	380	
Phenanthrene	BDL	380	
Anthracene	BDL	380	
Carbazole	BDL	380	
Di-n-butylphthalate	BDL	380	
Fluoranthene	BDL	380	
Pyrene	BDL	380	
Butylbenzylphthalate	BDL	380	
3,3'-Dichlorobenzidine	BDL	760	
Benzo(a)anthracene	BDL	380	
Chrysene	BDL	380	
bis(2-Ethylhexyl)phthalate	BDL	380	

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/01/92 01:00 Category: COMPOSITE

Di-n-octylphthalate	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(a)pyrene	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Dibenz(a,h)anthracene	BDL	380
Benzo(g,h,i)perylene	BDL	380

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	57	23 - 120
2-Fluorobiphenyl	34	30 - 115
p-Terphenyl d14	52	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/02/92
DATE RUN 12/03/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/01/92 01:00 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	2.4
PCB-1221	BDL	2.4
PCB-1232	BDL	2.4
PCB-1242	BDL	2.4
PCB-1248	BDL	2.4
PCB-1254	BDL	2.4
PCB-1260	BDL	2.4

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	Q	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/03/92
DATE RUN 12/04/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/01/92 01:00 Category: COMPOSITE

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 12/01/92 01:00 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	4400	290

Notes and Definitions for this Report:

EXTRACTED 12/04/92
DATE RUN 12/04/92
ANALYST ROZ
UNITS mg/Kg

Sample Description: B-5/S-2 - B-5/S-4 Lab No: 04B
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 12/01/92 01:00 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	120
Benzene	BDL	5.8
Bromodichloromethane	BDL	5.8
Bromoform	BDL	5.8
Bromomethane	BDL	12
2-Butanone	BDL	58
Carbon Disulfide	BDL	12
Carbon Tetrachloride	BDL	5.8
Chlorobenzene	BDL	5.8
Chlorodibromomethane	BDL	5.8
Chloroethane	BDL	12
Chloroform	BDL	5.8
Chloromethane	BDL	12
1,1-Dichloroethane	BDL	5.8
1,1-Dichloroethene	BDL	5.8
trans-1,2-Dichloroethene	BDL	5.8
1,2-Dichloropropane	BDL	5.8
cis-1,3-Dichloropropene	BDL	5.8
trans-1,3-Dichloropropene	BDL	5.8
Ethylbenzene	BDL	5.8
2-Hexanone	BDL	58
Methylene Chloride	BDL	23
4-Methyl-2-pentanone	BDL	58
Styrene	BDL	5.8
1,1,2,2-Tetrachloroethane	BDL	5.8
Tetrachloroethene	BDL	5.8
Toluene	BDL	5.8
1,1,1-Trichloroethane	BDL	5.8
1,1,2-Trichloroethane	BDL	5.8
Trichloroethene	BDL	5.8
Vinyl Chloride	BDL	12
Xylene	BDL	5.8

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	97	70 - 121
Toluene-d8	107	81 - 117
4-Bromofluorobenzene	93	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

% Moisture
Method: ASTM D2216

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	B-2/S-17 - B-2/S-18	13.8	%		12/02/92	AMM
02A	B-3/S-18 - B-3/S-19	13.8	%		12/02/92	AMM
03A	B-4/S-17 - B-4/S-18	6.0	%		12/02/92	AMM
04A	B-5/S-2 - B-5/S-4	13.0	%		12/02/92	AMM

Aluminum
Method: EPA 7020

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	14000	mg/Kg	2900	12/09/92	CAZ
02B	B-3/S-18 - B-3/S-19	30000	mg/Kg	2900	12/09/92	CAZ
03B	B-4/S-17 - B-4/S-18	9300	mg/Kg	2700	12/09/92	CAZ
05A	B-5/S-12	13000	mg/Kg	3000	12/09/92	CAZ

Antimony
Method: EPA 7041

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 0.58	mg/Kg	0.58	12/10/92	JSC
02B	B-3/S-18 - B-3/S-19	1.0	mg/Kg	0.58	12/10/92	JSC
03B	B-4/S-17 - B-4/S-18	< 0.53	mg/Kg	0.53	12/10/92	JSC
05A	B-5/S-12	< 0.60	mg/Kg	0.60	12/10/92	JSC

Arsenic
Method: EPA 7060

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	44	mg/Kg	5.8	12/07/92	JSC
02B	B-3/S-18 - B-3/S-19	20	mg/Kg	2.3	12/07/92	JSC
03B	B-4/S-17 - B-4/S-18	19	mg/Kg	5.3	12/07/92	JSC
05A	B-5/S-12	17	mg/Kg	2.4	12/07/92	JSC

Barium
Method: EPA 7080

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	93	mg/Kg	58	12/03/92	DRB
02B	B-3/S-18 - B-3/S-19	200	mg/Kg	58	12/03/92	DRB
03B	B-4/S-17 - B-4/S-18	77	mg/Kg	53	12/03/92	DRB
05A	B-5/S-12	99	mg/Kg	60	12/03/92	DRB

Beryllium
Method: EPA 7090

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 5.8	mg/Kg	5.8	12/03/92	JSC
02B	B-3/S-18 - B-3/S-19	< 5.8	mg/Kg	5.8	12/03/92	JSC
03B	B-4/S-17 - B-4/S-18	< 5.3	mg/Kg	5.3	12/03/92	JSC
05A	B-5/S-12	< 6.0	mg/Kg	6.0	12/03/92	JSC

Cadmium
Method: EPA 7131

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	0.39	mg/Kg	0.058	12/03/92	DRB
02B	B-3/S-18 - B-3/S-19	< 0.058	mg/Kg	0.058	12/03/92	DRB
03B	B-4/S-17 - B-4/S-18	0.068	mg/Kg	0.053	12/03/92	DRB
05A	B-5/S-12	0.58	mg/Kg	0.060	12/04/92	DRB

Calcium
Method: EPA 7140

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	2500	mg/Kg	1200	12/09/92	DRB
02B	B-3/S-18 - B-3/S-19	29000	mg/Kg	12000	12/10/92	DRB
03B	B-4/S-17 - B-4/S-18	35000	mg/Kg	11000	12/10/92	DRB
05A	B-5/S-12	2100	mg/Kg	1200	12/10/92	DRB

Chromium
Method: EPA 7190

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	25	mg/Kg	12	12/07/92	JSC
02B	B-3/S-18 - B-3/S-19	45	mg/Kg	12	12/07/92	JSC
03B	B-4/S-17 - B-4/S-18	21	mg/Kg	11	12/07/92	JSC
05A	B-5/S-12	26	mg/Kg	12	12/07/92	JSC

Cobalt
Method: EPA 7200

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 12	mg/Kg	12	12/09/92	DRB
02B	B-3/S-18 - B-3/S-19	< 12	mg/Kg	12	12/09/92	DRB
03B	B-4/S-17 - B-4/S-18	< 11	mg/Kg	11	12/09/92	DRB
05A	B-5/S-12	< 12	mg/Kg	12	12/09/92	DRB

Copper
Method: EPA 7210

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	28	mg/Kg	5.8	12/04/92	DRB
02B	B-3/S-18 - B-3/S-19	40	mg/Kg	5.8	12/04/92	DRB
03B	B-4/S-17 - B-4/S-18	18	mg/Kg	5.3	12/04/92	DRB
05A	B-5/S-12	31	mg/Kg	6.0	12/04/92	DRB

Cyanide (Total)
Method: SW846 9010

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	B-2/S-17 - B-2/S-18	<0.3	mg/Kg	0.3	12/02/92	LAK
02A	B-3/S-18 - B-3/S-19	<0.3	mg/Kg	0.3	12/02/92	LAK
03A	B-4/S-17 - B-4/S-18	<0.3	mg/Kg	0.3	12/02/92	LAK
04A	B-5/S-2 - B-5/S-4	<0.3	mg/Kg	0.3	12/02/92	LAK

Iron
Method: EPA 7380

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	51000	mg/Kg	580	12/07/92	DRB
02B	B-3/S-18 - B-3/S-19	39000	mg/Kg	580	12/07/92	DRB
03B	B-4/S-17 - B-4/S-18	37000	mg/Kg	530	12/07/92	DRB
05A	B-5/S-12	42000	mg/Kg	600	12/07/92	DRB

Lead
Method: EPA 7421

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	23	mg/Kg	0.58	12/08/92	JSC
02B	B-3/S-18 - B-3/S-19	16	mg/Kg	0.58	12/08/92	JSC
03B	B-4/S-17 - B-4/S-18	16	mg/Kg	0.53	12/08/92	JSC
05A	B-5/S-12	21	mg/Kg	0.60	12/08/92	JSC

Magnesium
Method: EPA 7450

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	2600	mg/Kg	120	12/09/92	DRB
02B	B-3/S-18 - B-3/S-19	8500	mg/Kg	120	12/09/92	DRB
03B	B-4/S-17 - B-4/S-18	8600	mg/Kg	110	12/09/92	DRB
05A	B-5/S-12	2200	mg/Kg	120	12/09/92	DRB

Manganese
Method: EPA 7460

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	1000	mg/Kg	5.8	12/03/92	DRB
02B	B-3/S-18 - B-3/S-19	630	mg/Kg	0.58	12/03/92	DRB
03B	B-4/S-17 - B-4/S-18	500	mg/Kg	0.53	12/03/92	DRB
05A	B-5/S-12	330	mg/Kg	0.60	12/03/92	DRB

Mercury
Method: EPA 7471

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 23	mg/Kg	23	12/07/92	DRB
02B	B-3/S-18 - B-3/S-19	< 23	mg/Kg	23	12/07/92	DRB
03B	B-4/S-17 - B-4/S-18	< 21	mg/Kg	21	12/07/92	DRB
05A	B-5/S-12	< 24	mg/Kg	24	12/07/92	DRB

Nickel
Method: EPA 7520

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	22	mg/Kg	5.8	12/04/92	DRB
02B	B-3/S-18 - B-3/S-19	27	mg/Kg	5.8	12/04/92	DRB
03B	B-4/S-17 - B-4/S-18	15	mg/Kg	5.3	12/04/92	DRB
05A	B-5/S-12	36	mg/Kg	6.0	12/04/92	DRB

Phenolics (Solid)
Method: EPA 420.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	B-2/S-17 - B-2/S-18	<0.5	mg/Kg	0.5	12/03/92	WBB
02A	B-3/S-18 - B-3/S-19	<0.5	mg/Kg	0.5	12/03/92	WBB
03A	B-4/S-17 - B-4/S-18	<0.5	mg/Kg	0.5	12/03/92	WBB
04A	B-5/S-2 - B-5/S-4	<0.5	mg/Kg	0.5	12/03/92	WBB

Potassium
Method: SW846 7610

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	3200	mg/Kg	1200	12/08/92	DRB
02B	B-3/S-18 - B-3/S-19	8200	mg/Kg	1200	12/08/92	DRB
03B	B-4/S-17 - B-4/S-18	2200	mg/Kg	1100	12/08/92	DRB
05A	B-5/S-12	3400	mg/Kg	1200	12/08/92	DRB

Selenium
Method: EPA 7740

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 0.58	mg/Kg	0.58	12/07/92	CAZ
02B	B-3/S-18 - B-3/S-19	< 0.58	mg/Kg	0.58	12/07/92	CAZ
03B	B-4/S-17 - B-4/S-18	< 0.53	mg/Kg	0.53	12/07/92	CAZ
05A	B-5/S-12	< 0.60	mg/Kg	0.60	12/07/92	CAZ

Silver
Method: EPA 7760

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 5.8	mg/Kg	5.8	12/07/92	DRB
02B	B-3/S-18 - B-3/S-19	< 5.8	mg/Kg	5.8	12/07/92	DRB
03B	B-4/S-17 - B-4/S-18	< 5.3	mg/Kg	5.3	12/07/92	DRB
05A	B-5/S-12	< 6.0	mg/Kg	6.0	12/07/92	DRB

Sodium
Method: EPA 7770

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 580	mg/Kg	580	12/08/92	DRB
02B	B-3/S-18 - B-3/S-19	< 580	mg/Kg	580	12/08/92	DRB
03B	B-4/S-17 - B-4/S-18	< 530	mg/Kg	530	12/08/92	DRB
05A	B-5/S-12	< 600	mg/Kg	600	12/08/92	DRB

Thallium
Method: EPA 7841

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	< 1.2	mg/Kg	1.2	12/09/92	CAZ
02B	B-3/S-18 - B-3/S-19	< 1.2	mg/Kg	1.2	12/09/92	CAZ
03B	B-4/S-17 - B-4/S-18	< 1.1	mg/Kg	1.1	12/09/92	CAZ
05A	B-5/S-12	< 1.2	mg/Kg	1.2	12/09/92	CAZ

Vanadium
Method: EPA 7911

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	32	mg/Kg	2.3	12/07/92	JSC
02B	B-3/S-18 - B-3/S-19	49	mg/Kg	2.3	12/07/92	JSC
03B	B-4/S-17 - B-4/S-18	16	mg/Kg	2.1	12/07/92	JSC
05A	B-5/S-12	26	mg/Kg	2.4	12/07/92	JSC

Zinc
Method: EPA 7950

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-2/S-17 - B-2/S-18	89	mg/Kg	2.3	12/03/92	JSC
02B	B-3/S-18 - B-3/S-19	79	mg/Kg	2.3	12/03/92	JSC
03B	B-4/S-17 - B-4/S-18	61	mg/Kg	2.1	12/03/92	JSC
05A	B-5/S-12	190	mg/Kg	2.4	12/03/92	JSC

R&R INTERNATIONAL, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.: 002420

SITE NAME: Canton Drop Forge

SAMPLERS (SIGNATURE): Karl W. Valek

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH 418.1	TCL Volatiles 8240	TCL Semi-Vol. 8270	Poly/Chl. Bi Phenyl (PCB) 8080	Metals (TCL) 7000 series	Tot. Cyanide 9010	Tot Rec. Phenolics 9065	REMARKS
	11/25	9:10		x	B-2/S-17 } Run as composite	2	X	X	X	X	X	X	X	Combine + Run B-2/S-17 and B-2/S-18 as a composite
	11/25	9:15		x	B-2/S-18	2	X	X	X	X	X	X	X	
	11/30			x	B-3/S-18 } Run as composite	2	X	X	X	X	X	X	X	
	11/30			x	B-3/S-19	2	X	X	X	X	X	X	X	
	11/30			x	B-4/S-17 } Run as composite	2	X	X	X	X	X	X	X	Do not use 4.0 oz jar sample for volatiles since they have been used for headspace gas field analysis.
	11/30			x	B-4/S-18	2	X	X	X	X	X	X	X	
	12/1	1:00		x	B-5/S-2 } Run as composite	2	X	X	X	X		X	X	
	12/1	1:20		x	B-5/S-4	2	X	X	X	X		X	X	
	12/1	2:00		x	B-5/S-12	2					X			

Also combine B-5/S-2, B-5/S-4

Also combine B-3/18, B-3/19

Also combine B-4/S-17, B-4/S-18

Run ~~both~~ each in composite

Forward results to Karl Valek (216) 666-2200

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE): Karl W. Valek	DATE/TIME 12-1-92 5:00	RECEIVED FOR LABORATORY BY (SIGNATURE): [signature]	DATE/TIME 12-1-92 5:00	REMARKS:	

FORM 577

CDF012491

AMERICAN ANALYTICAL LABORATORIES, INC.

INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

American Analytical
Laboratories, Inc.
840 S. Main Street
Akron, Ohio 44311
Attn: Tim Lavey
Phone: (216) 535-1300

DEC 17 1992

R & R International
1234 S. Cleveland-Mass Rd.
P.O. Box 4383
Akron, Ohio 44321
Attn: Karl W. Valek
Invoice Number:

Order #: 92-12-072
Date: 12/16/92
Work ID: Project #002420
Date Received: 12/04/92
Date Completed: 12/16/92
Client Code: RRINTERNATNL

Facility: Canton Drop Forge
Soil results are reported on a dry weight basis.

SAMPLE IDENTIFICATION

Sample Number	Sample Description
01	B-6/S-2 - B-6/S-3
02	B-7/S-16 - B-7/S-17
03	B-8/S-3 - B-8/S-4

BDL - Below Detection Limit

Certified By
T.J. Lavey

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 12/02/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	3700	
2-Chlorophenol	BDL	3700	
2-Methylphenol	BDL	3700	
3&4-Methylphenol	BDL	3700	
2-Nitrophenol	BDL	3700	
2,4-Dimethylphenol	BDL	3700	
2,4-Dichlorophenol	BDL	3700	
4-Chloro-3-methylphenol	BDL	3700	
2,4,6-Trichlorophenol	BDL	3700	
2,4,5-Trichlorophenol	BDL	3700	
2,4-Dinitrophenol	BDL	18000	
4-Nitrophenol	BDL	18000	
2-Methyl-4,6-dinitrophenol	BDL	18000	
Pentachlorophenol	BDL	18000	

SURROGATE	%RECOVERY	LIMITS	
2-Fluorophenol	Q	25	121
Phenol d-5	Q	24	113
2,4,6-Tribromophenol	Q	19	122

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/09/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/02/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	3700	
1,3-Dichlorobenzene	BDL	3700	
1,4-Dichlorobenzene	BDL	3700	
1,2-Dichlorobenzene	BDL	3700	
bis(2-Chloroisopropyl) ether	BDL	3700	
N-Nitroso-di-n-propylamine	BDL	3700	
Hexachloroethane	BDL	3700	
Nitrobenzene	BDL	3700	
Isophorone	BDL	3700	
bis(2-Chloroethoxy)methane	BDL	3700	
1,2,4-Trichlorobenzene	BDL	3700	
Naphthalene	BDL	3700	
4-Chloroaniline	BDL	3700	
Hexachlorobutadiene	BDL	3700	
2-Methylnaphthalene	BDL	3700	
Hexachlorocyclopentadiene	BDL	3700	
2-Chloronaphthalene	BDL	3700	
2-Nitroaniline	BDL	18000	
Dimethylphthalate	BDL	3700	
Acenaphthylene	BDL	3700	
2,6-Dinitrotoluene	BDL	3700	
3-Nitroaniline	BDL	18000	
Acenaphthene	BDL	3700	
Dibenzofuran	BDL	3700	
2,4-Dinitrotoluene	BDL	3700	
Diethylphthalate	BDL	3700	
4-Chlorophenyl-phenylether	BDL	3700	
Fluorene	BDL	3700	
4-Nitroaniline	BDL	18000	
N-Nitrosodiphenylamine	BDL	3700	
4-Bromophenyl-phenylether	BDL	3700	
Hexachlorobenzene	BDL	3700	
Phenanthrene	BDL	3700	
Anthracene	BDL	3700	
Carbazole	BDL	3700	
Di-n-butylphthalate	BDL	3700	
Fluoranthene	BDL	3700	
Pyrene	BDL	3700	
Butylbenzylphthalate	BDL	3700	
3,3'-Dichlorobenzidine	BDL	7400	
Benzo(a)anthracene	BDL	3700	
Chrysene	BDL	3700	
bis(2-Ethylhexyl)phthalate	BDL	3700	

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/02/92 Category: COMPOSITE

Di-n-octylphthalate	BDL	3700
Benzo(b)fluoranthene	BDL	3700
Benzo(k)fluoranthene	BDL	3700
Benzo(a)pyrene	BDL	3700
Indeno(1,2,3-cd)pyrene	BDL	3700
Dibenz(a,h)anthracene	BDL	3700
Benzo(g,h,i)perylene	BDL	3700

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	Q	23 - 120
2-Fluorobiphenyl	Q	30 - 115
p-Terphenyl d14	Q	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/09/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/02/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.11
PCB-1221	BDL	0.11
PCB-1232	BDL	0.11
PCB-1242	BDL	0.11
PCB-1248	0.25	0.11
PCB-1254	0.06	0.11
PCB-1260	BDL	0.11

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	30	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/11/92
DATE RUN 12/11/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/02/92 Category: COMPOSITE

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 12/02/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	5100	690

Notes and Definitions for this Report:

EXTRACTED 12/08/92
DATE RUN 12/08/92
ANALYST ROZ
UNITS mg/Kg

Sample Description: B-6/S-2 - B-6/S-3 Lab No: 01C
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 12/02/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	110
Benzene	BDL	5.6
Bromodichloromethane	BDL	5.6
Bromoform	BDL	5.6
Bromomethane	BDL	12
2-Butanone	BDL	56
Carbon Disulfide	BDL	12
Carbon Tetrachloride	BDL	5.6
Chlorobenzene	BDL	5.6
Chlorodibromomethane	BDL	5.6
Chloroethane	BDL	12
Chloroform	BDL	5.6
Chloromethane	BDL	12
1,1-Dichloroethane	BDL	5.6
1,1-Dichloroethene	BDL	5.6
trans-1,2-Dichloroethene	BDL	5.6
1,2-Dichloropropane	BDL	5.6
cis-1,3-Dichloropropene	BDL	5.6
trans-1,3-Dichloropropene	BDL	5.6
Ethylbenzene	BDL	5.6
2-Hexanone	BDL	56
Methylene Chloride	BDL	23
4-Methyl-2-pentanone	BDL	56
Styrene	BDL	5.6
1,1,2,2-Tetrachloroethane	BDL	5.6
Tetrachloroethene	51	5.6
Toluene	BDL	5.6
1,1,1-Trichloroethane	110	5.6
1,1,2-Trichloroethane	BDL	5.6
Trichloroethene	BDL	5.6
Vinyl Chloride	BDL	12
Xylene	BDL	5.6

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	99	70 - 121
Toluene-d8	125 Q	81 - 117
4-Bromofluorobenzene	81	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 12/03/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	360	
2-Chlorophenol	BDL	360	
2-Methylphenol	BDL	360	
3&4-Methylphenol	BDL	360	
2-Nitrophenol	BDL	360	
2,4-Dimethylphenol	BDL	360	
2,4-Dichlorophenol	BDL	360	
4-Chloro-3-methylphenol	BDL	360	
2,4,6-Trichlorophenol	BDL	360	
2,4,5-Trichlorophenol	BDL	360	
2,4-Dinitrophenol	BDL	1800	
4-Nitrophenol	BDL	1800	
2-Methyl-4,6-dinitrophenol	BDL	1800	
Pentachlorophenol	BDL	1800	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	48	25 - 121
Phenol d-5	51	24 - 113
2,4,6-Tribromophenol	41	19 - 122

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/09/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/03/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	360	
1,3-Dichlorobenzene	BDL	360	
1,4-Dichlorobenzene	BDL	360	
1,2-Dichlorobenzene	BDL	360	
bis(2-Chloroisopropyl) ether	BDL	360	
N-Nitroso-di-n-propylamine	BDL	360	
Hexachloroethane	BDL	360	
Nitrobenzene	BDL	360	
Isophorone	BDL	360	
bis(2-Chloroethoxy)methane	BDL	360	
1,2,4-Trichlorobenzene	BDL	360	
Naphthalene	BDL	360	
4-Chloroaniline	BDL	360	
Hexachlorobutadiene	BDL	360	
2-Methylnaphthalene	BDL	360	
Hexachlorocyclopentadiene	BDL	360	
2-Chloronaphthalene	BDL	360	
2-Nitroaniline	BDL	1800	
Dimethylphthalate	BDL	360	
Acenaphthylene	BDL	360	
2,6-Dinitrotoluene	BDL	360	
3-Nitroaniline	BDL	1800	
Acenaphthene	BDL	360	
Dibenzofuran	BDL	360	
2,4-Dinitrotoluene	BDL	360	
Diethylphthalate	BDL	360	
4-Chlorophenyl-phenylether	BDL	360	
Fluorene	BDL	360	
4-Nitroaniline	BDL	1800	
N-Nitrosodiphenylamine	BDL	360	
4-Bromophenyl-phenylether	BDL	360	
Hexachlorobenzene	BDL	360	
Phenanthrene	BDL	360	
Anthracene	BDL	360	
Carbazole	BDL	360	
Di-n-butylphthalate	BDL	360	
Fluoranthene	BDL	360	
Pyrene	BDL	360	
Butylbenzylphthalate	BDL	360	
3,3'-Dichlorobenzidine	BDL	720	
Benzo(a)anthracene	BDL	360	
Chrysene	BDL	360	
bis(2-Ethylhexyl)phthalate	BDL	360	

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/03/92 Category: COMPOSITE

Di-n-octylphthalate	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(a)pyrene	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Dibenz(a,h)anthracene	BDL	360
Benzo(g,h,i)perylene	BDL	360

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	69	23 - 120
2-Fluorobiphenyl	45	30 - 115
p-Terphenyl d14	66	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/09/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/03/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.11
PCB-1221	BDL	0.11
PCB-1232	BDL	0.11
PCB-1242	BDL	0.11
PCB-1248	BDL	0.11
PCB-1254	BDL	0.11
PCB-1260	BDL	0.11

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	40	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/09/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/03/92 Category: COMPOSITE

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCSIR
Collected: 12/03/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	27

Notes and Definitions for this Report:

EXTRACTED 12/08/92
DATE RUN 12/08/92
ANALYST ROZ
UNITS mg/Kg

Sample Description: B-7/S-16 - B-7/S-17 Lab No: 02C
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 12/03/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	110
Benzene	BDL	5.5
Bromodichloromethane	BDL	5.5
Bromoform	BDL	5.5
Bromomethane	BDL	11
2-Butanone	BDL	55
Carbon Disulfide	BDL	11
Carbon Tetrachloride	BDL	5.5
Chlorobenzene	BDL	5.5
Chlorodibromomethane	BDL	5.5
Chloroethane	BDL	11
Chloroform	BDL	5.5
Chloromethane	BDL	11
1,1-Dichloroethane	BDL	5.5
1,1-Dichloroethene	BDL	5.5
trans-1,2-Dichloroethene	BDL	5.5
1,2-Dichloropropane	BDL	5.5
cis-1,3-Dichloropropene	BDL	5.5
trans-1,3-Dichloropropene	BDL	5.5
Ethylbenzene	BDL	5.5
2-Hexanone	BDL	55
Methylene Chloride	BDL	22
4-Methyl-2-pentanone	BDL	55
Styrene	BDL	5.5
1,1,2,2-Tetrachloroethane	BDL	5.5
Tetrachloroethene	26	5.5
Toluene	BDL	5.5
1,1,1-Trichloroethane	BDL	5.5
1,1,2-Trichloroethane	BDL	5.5
Trichloroethene	BDL	5.5
Vinyl Chloride	BDL	11
Xylene	BDL	5.5

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	97	70 - 121
Toluene-d8	103	81 - 117
4-Bromofluorobenzene	99	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03A
Test Description: Acid Fraction Method: SW846 8270 Test Code: AC8270
Collected: 12/04/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	430	
2-Chlorophenol	BDL	430	
2-Methylphenol	BDL	430	
3&4-Methylphenol	BDL	430	
2-Nitrophenol	BDL	430	
2,4-Dimethylphenol	BDL	430	
2,4-Dichlorophenol	BDL	430	
4-Chloro-3-methylphenol	BDL	430	
2,4,6-Trichlorophenol	BDL	430	
2,4,5-Trichlorophenol	BDL	430	
2,4-Dinitrophenol	BDL	2200	
4-Nitrophenol	BDL	2200	
2-Methyl-4,6-dinitrophenol	BDL	2200	
Pentachlorophenol	BDL	2200	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	42	25 - 121
Phenol d-5	45	24 - 113
2,4,6-Tribromophenol	40	19 - 122

Notes and Definitions for this Report:

EXTRACTED 12/10/92
DATE RUN 12/10/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/04/92 Category: COMPOSITE

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	430	
1,3-Dichlorobenzene	BDL	430	
1,4-Dichlorobenzene	BDL	430	
1,2-Dichlorobenzene	BDL	430	
bis(2-Chloroisopropyl) ether	BDL	430	
N-Nitroso-di-n-propylamine	BDL	430	
Hexachloroethane	BDL	430	
Nitrobenzene	BDL	430	
Isophorone	BDL	430	
bis(2-Chloroethoxy)methane	BDL	430	
1,2,4-Trichlorobenzene	BDL	430	
Naphthalene	BDL	430	
4-Chloroaniline	BDL	430	
Hexachlorobutadiene	BDL	430	
2-Methylnaphthalene	BDL	430	
Hexachlorocyclopentadiene	BDL	430	
2-Chloronaphthalene	BDL	430	
2-Nitroaniline	BDL	2200	
Dimethylphthalate	BDL	430	
Acenaphthylene	BDL	430	
2,6-Dinitrotoluene	BDL	430	
3-Nitroaniline	BDL	2200	
Acenaphthene	BDL	430	
Dibenzofuran	BDL	430	
2,4-Dinitrotoluene	BDL	430	
Diethylphthalate	BDL	430	
4-Chlorophenyl-phenylether	BDL	430	
Fluorene	BDL	430	
4-Nitroaniline	BDL	2200	
N-Nitrosodiphenylamine	BDL	430	
4-Bromophenyl-phenylether	BDL	430	
Hexachlorobenzene	BDL	430	
Phenanthrene	BDL	430	
Anthracene	BDL	430	
Carbazole	BDL	430	
Di-n-butylphthalate	BDL	430	
Fluoranthene	BDL	430	
Pyrene	BDL	430	
Butylbenzylphthalate	BDL	430	
3,3'-Dichlorobenzidine	BDL	860	
Benzo(a)anthracene	BDL	430	
Chrysene	BDL	430	
bis(2-Ethylhexyl)phthalate	BDL	430	

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03A
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BS
Collected: 12/04/92 Category: COMPOSITE

Di-n-octylphthalate	BDL	430
Benzo(b)fluoranthene	BDL	430
Benzo(k)fluoranthene	BDL	430
Benzo(a)pyrene	BDL	430
Indeno(1,2,3-cd)pyrene	BDL	430
Dibenz(a,h)anthracene	BDL	430
Benzo(g,h,i)perylene	BDL	430

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	33	23 - 120
2-Fluorobiphenyl	19 Q	30 - 115
p-Terphenyl d14	28	18 - 137

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/09/92
ANALYST IYE
UNITS ug/Kg

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/04/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	2.6
PCB-1221	BDL	2.6
PCB-1232	BDL	2.6
PCB-1242	BDL	2.6
PCB-1248	BDL	2.6
PCB-1254	BDL	2.6
PCB-1260	BDL	2.6

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	Q	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/07/92
DATE RUN 12/10/92
ANALYST IYE
UNITS mg/Kg

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/04/92 Category: COMPOSITE

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCS1R
Collected: 12/04/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	6800	810

Notes and Definitions for this Report:

EXTRACTED 12/08/92
DATE RUN 12/08/92
ANALYST ROZ
UNITS mg/kg

Sample Description: B-8/S-3 - B-8/S-4 Lab No: 03C
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240S
Collected: 12/04/92 Category: COMPOSITE

PARAMETER	RESULT	DETECTION LIMIT
Acetone	BDL	130
Benzene	BDL	6.5
Bromodichloromethane	BDL	6.5
Bromoform	BDL	6.5
Bromomethane	BDL	13
2-Butanone	BDL	65
Carbon Disulfide	[illegible]	13
Carbon Tetrachlor[illegible]	BDL	6.5
Chlorobenzene	BDL	6.5
Chlorodibromomethane	BDL	6.5
Chloroethane	BDL	13
Chloroform	BDL	6.5
Chloromethane	BDL	13
1,1-Dichloroethane	BDL	6.5
1,1-Dichloroethene	BDL	6.5
trans-1,2-Dichloroethene	BDL	6.5
1,2-Dichloropropane	BDL	6.5
cis-1,3-Dichloropropene	BDL	6.5
trans-1,3-Dichloropropene	BDL	6.5
Ethylbenzene	BDL	6.5
2-Hexanone	BDL	65
Methylene Chloride	BDL	26
4-Methyl-2-pentanone	BDL	65
Styrene	BDL	6.5
1,1,2,2-Tetrachloroethane	BDL	6.5
Tetrachloroethene	BDL	6.5
Toluene	BDL	6.5
1,1,1-Trichloroethane	18	6.5
1,1,2-Trichloroethane	BDL	6.5
Trichloroethene	BDL	6.5
Vinyl Chloride	BDL	13
Xylene	BDL	6.5

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	98	70 - 121
Toluene-d8	107	81 - 117
4-Bromofluorobenzene	92	74 - 121

Notes and Definitions for this Report:

EXTRACTED 12/14/92
DATE RUN 12/14/92
ANALYST MWO
UNITS ug/Kg

% Moisture
Method: ASTM D2216

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	B-6/S-2 - B-6/S-3	9.5	%		12/07/92	SKB
02A	B-7/S-16 - B-7/S-17	7.9	%		12/07/92	SKB
03A	B-8/S-3 - B-8/S-4	22.9	%		12/07/92	SKB

Aluminum
Method: EPA 7020

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	6000	mg/Kg	2800	12/09/92	CAZ
02B	B-7/S-16 - B-7/S-17	11000	mg/Kg	2700	12/09/92	CAZ
03B	B-8/S-3 - B-8/S-4	15000	mg/Kg	3200	12/09/92	CAZ

Antimony
Method: EPA 7041

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	0.58	mg/Kg	0.55	12/10/92	JSC
02B	B-7/S-16 - B-7/S-17	< 0.54	mg/Kg	0.54	12/10/92	JSC
03B	B-8/S-3 - B-8/S-4	< 0.65	mg/Kg	0.65	12/10/92	JSC

Arsenic
Method: EPA 7060

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	7.6	mg/Kg	1.1	12/09/92	DRB
02B	B-7/S-16 - B-7/S-17	170	mg/Kg	22	12/09/92	DRB
03B	B-8/S-3 - B-8/S-4	0.71	mg/Kg	0.65	12/09/92	DRB

Barium
Method: EPA 7080

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	1500	mg/Kg	55	12/09/92	CAZ
02B	B-7/S-16 - B-7/S-17	130	mg/Kg	54	12/09/92	CAZ
03B	B-8/S-3 - B-8/S-4	530	mg/Kg	65	12/09/92	CAZ

Beryllium
Method: EPA 7090

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 5.5	mg/Kg	5.5	12/15/92	JSC
02B	B-7/S-16 - B-7/S-17	< 5.4	mg/Kg	5.4	12/15/92	JSC
03B	B-8/S-3 - B-8/S-4	< 6.5	mg/Kg	6.5	12/15/92	JSC

Cadmium
Method: EPA 7131

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	250	mg/Kg	55	12/11/92	JSC
02B	B-7/S-16 - B-7/S-17	200	mg/Kg	54	12/11/92	JSC
03B	B-8/S-3 - B-8/S-4	180	mg/Kg	65	12/11/92	JSC

Calcium
Method: EPA 7140

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	9200	mg/Kg	1100	12/09/92	DRB
02B	B-7/S-16 - B-7/S-17	40000	mg/Kg	11000	12/09/92	DRB
03B	B-8/S-3 - B-8/S-4	2200	mg/Kg	1300	12/09/92	DRB

Chromium
Method: EPA 7190

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	2000	mg/Kg	110	12/11/92	JSC
02B	B-7/S-16 - B-7/S-17	16	mg/Kg	11	12/11/92	JSC
03B	B-8/S-3 - B-8/S-4	110	mg/Kg	13	12/11/92	JSC

Cobalt
Method: EPA 7200

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	33	mg/Kg	11	12/09/92	DRB
02B	B-7/S-16 - B-7/S-17	12	mg/Kg	11	12/09/92	DRB
03B	B-8/S-3 - B-8/S-4	< 13	mg/Kg	13	12/09/92	DRB

Copper
Method: EPA 7210

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	360	mg/Kg	5.5	12/08/92	AMN
02B	B-7/S-16 - B-7/S-17	17	mg/Kg	5.4	12/08/92	AMN
03B	B-8/S-3 - B-8/S-4	38	mg/Kg	6.5	12/14/92	DRB

Cyanide (Total)
Method: SW846 9010

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	B-6/S-2 - B-6/S-3	<0.3	mg/Kg	0.3	12/07/92	LAK
02A	B-7/S-16 - B-7/S-17	<0.3	mg/Kg	0.3	12/07/92	LAK
03A	B-8/S-3 - B-8/S-4	<0.3	mg/Kg	0.3	12/07/92	LAK

Iron
Method: EPA 7380

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	2800	mg/Kg	100	12/11/92	JSC
02B	B-7/S-16 - B-7/S-17	390	mg/Kg	100	12/11/92	JSC
03B	B-8/S-3 - B-8/S-4	870	mg/Kg	100	12/11/92	JSC

Lead
Method: EPA 7421

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	24	mg/Kg	0.55	12/08/92	JSC
02B	B-7/S-16 - B-7/S-17	46	mg/Kg	0.54	12/08/92	JSC
03B	B-8/S-3 - B-8/S-4	20	mg/Kg	2.6	12/15/92	DRB

Magnesium
Method: EPA 7450

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	1400	mg/Kg	110	12/09/92	DRB
02B	B-7/S-16 - B-7/S-17	15000	mg/Kg	1100	12/09/92	DRB
03B	B-8/S-3 - B-8/S-4	1800	mg/Kg	130	12/15/92	JSC

Manganese
Method: EPA 7460

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	260	mg/Kg	55	12/11/92	DRB
02B	B-7/S-16 - B-7/S-17	1400	mg/Kg	54	12/11/92	DRB
03B	B-8/S-3 - B-8/S-4	420	mg/Kg	65	12/11/92	DRB

Mercury
Method: EPA 7471

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 0.11	mg/Kg	0.11	12/10/92	DRB
02B	B-7/S-16 - B-7/S-17	< 0.11	mg/Kg	0.11	12/10/92	DRB
03B	B-8/S-3 - B-8/S-4	< 0.13	mg/Kg	0.13	12/10/92	DRB

Nickel
Method: EPA 7520

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	1800	mg/Kg	55	12/08/92	JSC
02B	B-7/S-16 - B-7/S-17	33	mg/Kg	5.4	12/08/92	JSC
03B	B-8/S-3 - B-8/S-4	68	mg/Kg	6.5	12/08/92	JSC

Phenolics (Solid)
Method: EPA 420.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	B-6/S-2 - B-6/S-3	<0.5	mg/Kg	0.5	12/07/92	WBB
02A	B-7/S-16 - B-7/S-17	<0.5	mg/Kg	0.5	12/07/92	WBB
03A	B-8/S-3 - B-8/S-4	<0.5	mg/Kg	0.5	12/07/92	WBB

Potassium
Method: SW846 7610

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	1.7	mg/Kg	0.25	12/15/92	DRB
02B	B-7/S-16 - B-7/S-17	6.0	mg/Kg	2.5	12/15/92	DRB
03B	B-8/S-3 - B-8/S-4	3.2	mg/Kg	2.5	12/15/92	DRB

Selenium
Method: EPA 7740

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 0.55	mg/Kg	0.55	12/07/92	CAZ
02B	B-7/S-16 - B-7/S-17	< 0.54	mg/Kg	0.54	12/07/92	CAZ
03B	B-8/S-3 - B-8/S-4	< 0.65	mg/Kg	0.65	12/15/92	JSC

Silver
Method: EPA 7760

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 5.5	mg/Kg	5.5	12/11/92	DRB
02B	B-7/S-16 - B-7/S-17	< 5.4	mg/Kg	5.4	12/11/92	DRB
03B	B-8/S-3 - B-8/S-4	< 6.5	mg/Kg	6.5	12/11/92	DRB

Sodium
Method: EPA 7770

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 550	mg/Kg	550	12/08/92	DRB
02B	B-7/S-16 - B-7/S-17	< 540	mg/Kg	540	12/08/92	DRB
03B	B-8/S-3 - B-8/S-4	500	mg/Kg	260	12/14/92	JSC

Thallium
Method: EPA 7841

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 1.1	mg/Kg	1.1	12/09/92	CAZ
02B	B-7/S-16 - B-7/S-17	< 1.1	mg/Kg	1.1	12/09/92	CAZ
03B	B-8/S-3 - B-8/S-4	< 1.3	mg/Kg	1.3	12/09/92	CAZ

Vanadium
Method: EPA 7911

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	< 2.2	mg/Kg	2.2	12/15/92	JSC
02B	B-7/S-16 - B-7/S-17	25	mg/Kg	2.2	12/15/92	JSC
03B	B-8/S-3 - B-8/S-4	< 2.6	mg/Kg	2.6	12/15/92	JSC

Zinc
Method: EPA 7950

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01B	B-6/S-2 - B-6/S-3	96	mg/Kg	2.2	12/10/92	DRB
02B	B-7/S-16 - B-7/S-17	86	mg/Kg	2.2	12/10/92	DRB
03B	B-8/S-3 - B-8/S-4	58	mg/Kg	2.6	12/10/92	DRB

R&R INTERNATIONAL INC.

CHAIN OF CUSTODY RECORD

92/12/07 BR

PROJECT NO.:	SITE NAME:
002420	Canton Drop Forge

SAMPLERS (SIGNATURE): Karl W. Valek

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH 418.1	Vols (TCL) 8240	Semi Vol/TCL 8270	Polychl Biphenyls (PCB) 8080	Metals (TCL) 7000 series	Tot. Cyanide 9010	Tot Rec. Phenols 9065	REMARKS
	12/2			X	B-6/5-2 } Run as	2	X	X	X	X	X	X	X	
	12/2			X	B-6/5-3 } Composite	2	X	X	X	X	X	X	X	For Samples B-8 notify if Fe high looking for Fe_3O_4 Fe_2O_3
	12/3			X	B-7/5-16 } Run as	3	X	X	X	X	X	X	X	
	12/3			X	B-7/5-17 } Composite	3	X	X	X	X	X	X	X	
	12/4			X	B-8/5-3 } Run As	3	X	X	X	X	X	X	X	
	12/4			X	B-8/5-4 } A Composite	2	X	X	X	X	X	X	X	
														One jar from each sample has been labeled as "Do Not Use for Volatiles" (Previous Headspace Analysis)
														Forward Results to Karl Valek 666-2200

RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE): Karl W. Valek	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE): Beth Redhead	DATE / TIME 12/07 4:40	REMARKS:	

CDF012513

FORM 577

AMERICAN ANALYTICAL LABORATORIES, INC.
INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

American Analytical
Laboratories, Inc.
840 S. Main Street
Akron, Ohio 44311
Attn: Tim Lavey
Phone: (216) 535-1300

DEC 29 1992

R & R International
1234 S. Cleveland-Mass Rd.
P.O. Box 4383
Akron, Ohio 44321
Attn: Karl Valek
Invoice Number: 12390

Order #: 92-12-105
Date: 12/28/92
Work ID: Project No. 002420
Date Received: 12/08/92
Date Completed: 12/18/92
Client Code: RRINTERNATNL

Facility: Canton Drop Forge
Soil results are reported on a dry weight basis.
Metal results are reported as a total concentration.
* Amended Report - Originally issued 12/17/92

SAMPLE IDENTIFICATION

Sample Number	Sample Description	Sample Number	Sample Description
01	MW-1	06	MW-7
02	MW-2	07	MW-8
03	MW-3	08	HB-1
04	MW-4	09	HB-2
05	MW-6	10	HB-3

BDL - Below Detection Limit

Certified By
T. J. Lavey

Sample Description: MW-1 Lab No: 01A
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/08/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	BDL	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	99	76 - 114
Toluene-d8	102	88 - 110
4-Bromofluorobenzene	103	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/18/92
DATE RUN 12/18/92
ANALYST MWO

Sample Description: MW-1 Lab No: 01A
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/08/92

UNITS ug/L

Sample Description: MW-2 Lab No: 02A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_W
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	1.0
PCB-1221	BDL	1.0
PCB-1232	BDL	1.0
PCB-1242	BDL	1.0
PCB-1248	BDL	1.0
PCB-1254	BDL	1.0
PCB-1260	BDL	1.0

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/10/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-2 Lab No: 02A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCWIR
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	1

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST ROZ
UNITS mg/L

Sample Description: MW-2 Lab No: 02D
Test Description: Acid Fraction Method: SW846 8270 Test Code: A8270W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	12	
2-Chlorophenol	BDL	12	
2-Methylphenol	BDL	12	
3&4-Methylphenol	BDL	12	
2-Nitrophenol	BDL	12	
2,4-Dimethylphenol	BDL	12	
2,4-Dichlorophenol	BDL	12	
4-Chloro-3-methylphenol	BDL	12	
2,4,6-Trichlorophenol	BDL	12	
2,4,5-Trichlorophenol	BDL	12	
2,4-Dinitrophenol	BDL	60	
4-Nitrophenol	BDL	60	
2-Methyl-4,6-dinitrophenol	BDL	60	
Pentachlorophenol	BDL	60	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	35	21 - 100
Phenol d-5	36	10 - 94
2,4,6-Tribromophenol	29	10 - 123

Notes and Definitions for this Report:

EXTRACTED 12/11/92
DATE RUN 12/14/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-2 Lab No: 02D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	10	
1,3-Dichlorobenzene	BDL	10	
1,4-Dichlorobenzene	BDL	10	
1,2-Dichlorobenzene	BDL	10	
bis(2-Chloroisopropyl) ether	BDL	10	
N-Nitroso-di-n-propylamine	BDL	10	
Hexachloroethane	BDL	10	
Nitrobenzene	BDL	10	
Isophorone	BDL	10	
bis(2-Chloroethoxy)methane	BDL	10	
1,2,4-Trichlorobenzene	BDL	10	
Naphthalene	BDL	10	
4-Chloroaniline	BDL	10	
Hexachlorobutadiene	BDL	10	
2-Methylnaphthalene	BDL	10	
Hexachlorocyclopentadiene	BDL	10	
2-Chloronaphthalene	BDL	10	
2-Nitroaniline	BDL	50	
Dimethylphthalate	BDL	10	
Acenaphthylene	BDL	10	
2,6-Dinitrotoluene	BDL	10	
3-Nitroaniline	BDL	50	
Acenaphthene	BDL	10	
Dibenzofuran	BDL	10	
2,4-Dinitrotoluene	BDL	10	
Diethylphthalate	BDL	10	
4-Chlorophenyl-phenylether	BDL	10	
Fluorene	BDL	10	
4-Nitroaniline	BDL	50	
N-Nitrosodiphenylamine	BDL	10	
4-Bromophenyl-phenylether	BDL	10	
Hexachlorobenzene	BDL	10	
Phenanthrene	BDL	10	
Anthracene	BDL	10	
Carbazole	BDL	10	
Di-n-butylphthalate	BDL	10	
Fluoranthene	BDL	10	
Pyrene	BDL	10	
Butylbenzylphthalate	BDL	10	
3,3'-Dichlorobenzidine	BDL	20	
Benzo(a)anthracene	BDL	10	
Chrysene	BDL	10	
bis(2-Ethylhexyl)phthalate	BDL	20	

Sample Description: MW-2 Lab No: 02D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

Di-n-octylphthalate	BDL	10
Benzo(b)fluoranthene	BDL	10
Benzo(k)fluoranthene	BDL	10
Benzo(a)pyrene	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Dibenz(a,h)anthracene	BDL	10
Benzo(g,h,i)perylene	BDL	10

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	64	35 - 114
2-Fluorobiphenyl	40 Q	43 - 116
p-Terphenyl d14	18 Q	33 - 141

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-2 Lab No: 02E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	BDL	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	98	76 - 114
Toluene-d8	98	88 - 110
4-Bromofluorobenzene	104	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/15/92
DATE RUN 12/15/92
ANALYST MWO

Sample Description: MW-2 Lab No: 02E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

UNITS ug/L

Sample Description: MW-3 Lab No: 03A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_W
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	1.0
PCB-1221	BDL	2.0
PCB-1232	BDL	1.0
PCB-1242	BDL	1.0
PCB-1248	BDL	1.0
PCB-1254	BDL	1.0
PCB-1260	BDL	1.0

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/10/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-3 Lab No: 03A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCWIR
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	1

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST ROZ
UNITS mg/L

Sample Description: MW-3 Lab No: 03D
Test Description: Acid Fraction Method: SW846 8270 Test Code: A8270W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	10	
2-Chlorophenol	BDL	10	
2-Methylphenol	BDL	10	
3&4-Methylphenol	BDL	10	
2-Nitrophenol	BDL	10	
2,4-Dimethylphenol	BDL	10	
2,4-Dichlorophenol	BDL	10	
4-Chloro-3-methylphenol	BDL	10	
2,4,6-Trichlorophenol	BDL	10	
2,4,5-Trichlorophenol	BDL	10	
2,4-Dinitrophenol	BDL	50	
4-Nitrophenol	BDL	50	
2-Methyl-4,6-dinitrophenol	BDL	50	
Pentachlorophenol	BDL	50	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	15 Q	21 - 100
Phenol d-5	23	10 - 94
2,4,6-Tribromophenol	12	10 - 123

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-3 Lab No: 03D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	10	
1,3-Dichlorobenzene	BDL	10	
1,4-Dichlorobenzene	BDL	10	
1,2-Dichlorobenzene	BDL	10	
bis(2-Chloroisopropyl) ether	BDL	10	
N-Nitroso-di-n-propylamine	BDL	10	
Hexachloroethane	BDL	10	
Nitrobenzene	BDL	10	
Isophorone	BDL	10	
bis(2-Chloroethoxy)methane	BDL	10	
1,2,4-Trichlorobenzene	BDL	10	
Naphthalene	BDL	10	
4-Chloroaniline	BDL	10	
Hexachlorobutadiene	BDL	10	
2-Methylnaphthalene	BDL	10	
Hexachlorocyclopentadiene	BDL	10	
2-Chloronaphthalene	BDL	10	
2-Nitroaniline	BDL	50	
Dimethylphthalate	BDL	10	
Acenaphthylene	BDL	10	
2,6-Dinitrotoluene	BDL	10	
3-Nitroaniline	BDL	50	
Acenaphthene	BDL	10	
Dibenzofuran	BDL	10	
2,4-Dinitrotoluene	BDL	10	
Diethylphthalate	BDL	10	
4-Chlorophenyl-phenylether	BDL	10	
Fluorene	BDL	10	
4-Nitroaniline	BDL	50	
N-Nitrosodiphenylamine	BDL	10	
4-Bromophenyl-phenylether	BDL	10	
Hexachlorobenzene	BDL	10	
Phenanthrene	BDL	10	
Anthracene	BDL	10	
Carbazole	BDL	10	
Di-n-butylphthalate	BDL	10	
Fluoranthene	BDL	10	
Pyrene	BDL	10	
Butylbenzylphthalate	BDL	10	
3,3'-Dichlorobenzidine	BDL	20	
Benzo(a)anthracene	BDL	10	
Chrysene	BDL	10	
bis(2-Ethylhexyl)phthalate	BDL	20	

Sample Description: MW-3 Lab No: 03D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

Di-n-octylphthalate	BDL	10
Benzo(b)fluoranthene	BDL	10
Benzo(k)fluoranthene	BDL	10
Benzo(a)pyrene	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Dibenz(a,h)anthracene	BDL	10
Benzo(g,h,i)perylene	BDL	10

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	76	35 - 114
2-Fluorobiphenyl	50	43 - 116
p-Terphenyl d14	27 Q	33 - 141

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-3 Lab No: 03E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	BDL	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	99	76 - 114
Toluene-d8	99	88 - 110
4-Bromofluorobenzene	107	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/15/92
DATE RUN 12/15/92
ANALYST MWO

Sample Description: MW-3 Lab No: 03E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

UNITS ug/L

Sample Description: MW-4 Lab No: 04A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_W
Collected: 12/08/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	1.0
PCB-1221	BDL	1.0
PCB-1232	BDL	1.0
PCB-1242	BDL	1.0
PCB-1248	BDL	1.0
PCB-1254	BDL	1.0
PCB-1260	BDL	1.0

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/10/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-4 Lab No: 04A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCWIR
Collected: 12/08/92

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	1

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST ROZ
UNITS mg/L

Sample Description: MW-4 Lab No: 04D
Test Description: Acid Fraction Method: SW846 8270 Test Code: A8270W
Collected: 12/08/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	10	
2-Chlorophenol	BDL	10	
2-Methylphenol	BDL	10	
3&4-Methylphenol	BDL	10	
2-Nitrophenol	BDL	10	
2,4-Dimethylphenol	BDL	10	
2,4-Dichlorophenol	BDL	10	
4-Chloro-3-methylphenol	BDL	10	
2,4,6-Trichlorophenol	BDL	10	
2,4,5-Trichlorophenol	BDL	10	
2,4-Dinitrophenol	BDL	50	
4-Nitrophenol	BDL	50	
2-Methyl-4,6-dinitrophenol	BDL	50	
Pentachlorophenol	BDL	50	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	56	21 - 100
Phenol d-5	50	10 - 94
2,4,6-Tribromophenol	34	10 - 123

Notes and Definitions for this Report:

EXTRACTED 12/11/92
DATE RUN 12/14/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-4 Lab No: 04D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/08/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	10	
1,3-Dichlorobenzene	BDL	10	
1,4-Dichlorobenzene	BDL	10	
1,2-Dichlorobenzene	BDL	10	
bis(2-Chloroisopropyl) ether	BDL	10	
N-Nitroso-di-n-propylamine	BDL	10	
Hexachloroethane	BDL	10	
Nitrobenzene	BDL	10	
Isophorone	BDL	10	
bis(2-Chloroethoxy)methane	BDL	10	
1,2,4-Trichlorobenzene	BDL	10	
Naphthalene	BDL	10	
4-Chloroaniline	BDL	10	
Hexachlorobutadiene	BDL	10	
2-Methylnaphthalene	BDL	10	
Hexachlorocyclopentadiene	BDL	10	
2-Chloronaphthalene	BDL	10	
2-Nitroaniline	BDL	50	
Dimethylphthalate	BDL	10	
Acenaphthylene	BDL	10	
2,6-Dinitrotoluene	BDL	10	
3-Nitroaniline	BDL	50	
Acenaphthene	BDL	10	
Dibenzofuran	BDL	10	
2,4-Dinitrotoluene	BDL	10	
Diethylphthalate	BDL	10	
4-Chlorophenyl-phenylether	BDL	10	
Fluorene	BDL	10	
4-Nitroaniline	BDL	50	
N-Nitrosodiphenylamine	BDL	10	
4-Bromophenyl-phenylether	BDL	10	
Hexachlorobenzene	BDL	10	
Phenanthrene	BDL	10	
Anthracene	BDL	10	
Carbazole	BDL	10	
Di-n-butylphthalate	BDL	10	
Fluoranthene	BDL	10	
Pyrene	BDL	10	
Butylbenzylphthalate	BDL	10	
3,3'-Dichlorobenzidine	BDL	20	
Benzo(a)anthracene	BDL	10	
Chrysene	BDL	10	
bis(2-Ethylhexyl)phthalate	BDL	20	

Sample Description: MW-4 Lab No: 04D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/08/92

Di-n-octylphthalate	BDL	10
Benzo(b)fluoranthene	BDL	10
Benzo(k)fluoranthene	BDL	10
Benzo(a)pyrene	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Dibenz(a,h)anthracene	BDL	10
Benzo(g,h,i)perylene	BDL	10

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	74	35 - 114
2-Fluorobiphenyl	43	43 - 116
p-Terphenyl d14	26 Q	33 - 141

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-4 Lab No: 04E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/08/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	BDL	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	94	76 - 114
Toluene-d8	95	88 - 110
4-Bromofluorobenzene	102	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/15/92
DATE RUN 12/15/92
ANALYST MWO

Sample Description: MW-6 Lab No: 05D
Test Description: Acid Fraction Method: SW846 8270 Test Code: A8270W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	10	
2-Chlorophenol	BDL	10	
2-Methylphenol	BDL	10	
3&4-Methylphenol	BDL	10	
2-Nitrophenol	BDL	10	
2,4-Dimethylphenol	BDL	10	
2,4-Dichlorophenol	BDL	10	
4-Chloro-3-methylphenol	BDL	10	
2,4,6-Trichlorophenol	BDL	10	
2,4,5-Trichlorophenol	BDL	10	
2,4-Dinitrophenol	BDL	50	
4-Nitrophenol	BDL	50	
2-Methyl-4,6-dinitrophenol	BDL	50	
Pentachlorophenol	BDL	50	

SURROGATE	%RECOVERY	LIMITS	
2-Fluorophenol	53	21	100
Phenol d-5	52	10	94
2,4,6-Tribromophenol	22	10	123

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-6 Lab No: 05D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	10	
1,3-Dichlorobenzene	BDL	10	
1,4-Dichlorobenzene	BDL	10	
1,2-Dichlorobenzene	BDL	10	
bis(2-Chloroisopropyl) ether	BDL	10	
N-Nitroso-di-n-propylamine	BDL	10	
Hexachloroethane	BDL	10	
Nitrobenzene	BDL	10	
Isophorone	BDL	10	
bis(2-Chloroethoxy)methane	BDL	10	
1,2,4-Trichlorobenzene	BDL	10	
Naphthalene	BDL	10	
4-Chloroaniline	BDL	10	
Hexachlorobutadiene	BDL	10	
2-Methylnaphthalene	BDL	10	
Hexachlorocyclopentadiene	BDL	10	
2-Chloronaphthalene	BDL	10	
2-Nitroaniline	BDL	50	
Dimethylphthalate	BDL	10	
Acenaphthylene	BDL	10	
2,6-Dinitrotoluene	BDL	10	
3-Nitroaniline	BDL	50	
Acenaphthene	BDL	10	
Dibenzofuran	BDL	10	
2,4-Dinitrotoluene	BDL	10	
Diethylphthalate	BDL	10	
4-Chlorophenyl-phenylether	BDL	10	
Fluorene	BDL	10	
4-Nitroaniline	BDL	50	
N-Nitrosodiphenylamine	BDL	10	
4-Bromophenyl-phenylether	BDL	10	
Hexachlorobenzene	BDL	10	
Phenanthrene	BDL	10	
Anthracene	BDL	10	
Carbazole	BDL	10	
Di-n-butylphthalate	BDL	10	
Fluoranthene	BDL	10	
Pyrene	BDL	10	
Butylbenzylphthalate	BDL	10	
3,3'-Dichlorobenzidine	BDL	20	
Benzo(a)anthracene	BDL	10	
Chrysene	BDL	10	
bis(2-Ethylhexyl)phthalate	BDL	20	

Sample Description: MW-6 Lab No: 05D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

Di-n-octylphthalate	BDL	10
Benzo(b)fluoranthene	BDL	10
Benzo(k)fluoranthene	BDL	10
Benzo(a)pyrene	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Dibenz(a,h)anthracene	BDL	10
Benzo(g,h,i)perylene	BDL	10

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	99	35 - 114
2-Fluorobiphenyl	51	43 - 116
p-Terphenyl d14	21 Q	33 - 141

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-6 Lab No: 05E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	BDL	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	97	76 - 114
Toluene-d8	96	88 - 110
4-Bromofluorobenzene	107	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/15/92
DATE RUN 12/15/92
ANALYST MWO

Sample Description: MW-6 Lab No: 05E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

UNITS ug/L

Sample Description: MW-7 Lab No: 06A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_W
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	1.0
PCB-1221	BDL	2.0
PCB-1232	BDL	1.0
PCB-1242	BDL	1.0
PCB-1248	BDL	1.0
PCB-1254	BDL	1.0
PCB-1260	BDL	1.0

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/10/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-7 Lab No: 06A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCWIR
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	BDL	1

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST ROZ
UNITS mg/L

Sample Description: MW-7 Lab No: 06D
Test Description: Acid Fraction Method: SW846 8270 Test Code: A8270W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	10	
2-Chlorophenol	BDL	10	
2-Methylphenol	BDL	10	
3&4-Methylphenol	BDL	10	
2-Nitrophenol	BDL	10	
2,4-Dimethylphenol	BDL	10	
2,4-Dichlorophenol	BDL	10	
4-Chloro-3-methylphenol	BDL	10	
2,4,6-Trichlorophenol	BDL	10	
2,4,5-Trichlorophenol	BDL	10	
2,4-Dinitrophenol	BDL	50	
4-Nitrophenol	BDL	50	
2-Methyl-4,6-dinitrophenol	BDL	50	
Pentachlorophenol	BDL	50	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	50	21 - 100
Phenol d-5	48	10 - 94
2,4,6-Tribromophenol	23	10 - 123

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-7 Lab No: 06D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	10	
1,3-Dichlorobenzene	BDL	10	
1,4-Dichlorobenzene	BDL	10	
1,2-Dichlorobenzene	BDL	10	
bis(2-Chloroisopropyl) ether	BDL	10	
N-Nitroso-di-n-propylamine	BDL	10	
Hexachloroethane	BDL	10	
Nitrobenzene	BDL	10	
Isophorone	BDL	10	
bis(2-Chloroethoxy)methane	BDL	10	
1,2,4-Trichlorobenzene	BDL	10	
Naphthalene	BDL	10	
4-Chloroaniline	BDL	10	
Hexachlorobutadiene	BDL	10	
2-Methylnaphthalene	BDL	10	
Hexachlorocyclopentadiene	BDL	10	
2-Chloronaphthalene	BDL	10	
2-Nitroaniline	BDL	50	
Dimethylphthalate	BDL	10	
Acenaphthylene	BDL	10	
2,6-Dinitrotoluene	BDL	10	
3-Nitroaniline	BDL	50	
Acenaphthene	BDL	10	
Dibenzofuran	BDL	10	
2,4-Dinitrotoluene	BDL	10	
Diethylphthalate	BDL	10	
4-Chlorophenyl-phenylether	BDL	10	
Fluorene	BDL	10	
4-Nitroaniline	BDL	50	
N-Nitrosodiphenylamine	BDL	10	
4-Bromophenyl-phenylether	BDL	10	
Hexachlorobenzene	BDL	10	
Phenanthrene	BDL	10	
Anthracene	BDL	10	
Carbazole	BDL	10	
Di-n-butylphthalate	BDL	10	
Fluoranthene	BDL	10	
Pyrene	BDL	10	
Butylbenzylphthalate	BDL	10	
3,3'-Dichlorobenzidine	BDL	20	
Benzo(a)anthracene	BDL	10	
Chrysene	BDL	10	
bis(2-Ethylhexyl)phthalate	BDL	20	

Sample Description: MW-7 Lab No: 060
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

Di-n-octylphthalate	BDL	10
Benzo(b)fluoranthene	BDL	10
Benzo(k)fluoranthene	BDL	10
Benzo(a)pyrene	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Dibenz(a,h)anthracene	BDL	10
Benzo(g,h,i)perylene	BDL	10

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	92	35 - 114
2-Fluorobiphenyl	51	43 - 116
p-Terphenyl d14	23 Q	33 - 141

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-7 Lab No: 06E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	BDL	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	99	76 - 114
Toluene-d8	97	88 - 110
4-Bromofluorobenzene	105	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/15/92
DATE RUN 12/15/92
ANALYST MWO

Sample Description: MW-7 Lab No: 06E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

UNITS ug/L

Sample Description: MW-8 Lab No: 07A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_W
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	10
PCB-1221	BDL	10
PCB-1232	BDL	10
PCB-1242	BDL	10
PCB-1248	BDL	10
PCB-1254	BDL	10
PCB-1260	BDL	10

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/10/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-8 Lab No: 07A
Test Description: TRPH (IR) Method: EPA 418.1 Test Code: THCWIR
Collected: 12/07/92

PARAMETER	RESULT	DETECTION LIMIT
TRPH (IR)	34	10

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST ROZ
UNITS mg/L

Sample Description: MW-8 Lab No: 07D
Test Description: Acid Fraction Method: SW846 8270 Test Code: A8270W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
Phenol	BDL	10	
2-Chlorophenol	BDL	10	
2-Methylphenol	BDL	10	
3&4-Methylphenol	BDL	10	
2-Nitrophenol	BDL	10	
2,4-Dimethylphenol	BDL	10	
2,4-Dichlorophenol	BDL	10	
4-Chloro-3-methylphenol	BDL	10	
2,4,6-Trichlorophenol	BDL	10	
2,4,5-Trichlorophenol	BDL	10	
2,4-Dinitrophenol	BDL	50	
4-Nitrophenol	BDL	50	
2-Methyl-4,6-dinitrophenol	BDL	50	
Pentachlorophenol	BDL	50	

SURROGATE	%RECOVERY	LIMITS
2-Fluorophenol	50	21 - 100
Phenol d-5	45	10 - 94
2,4,6-Tribromophenol	30	10 - 123

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-8 Lab No: 07D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8270
bis(2-Chloroethyl) ether	BDL	10	
1,3-Dichlorobenzene	BDL	10	
1,4-Dichlorobenzene	BDL	10	
1,2-Dichlorobenzene	BDL	10	
bis(2-Chloroisopropyl) ether	BDL	10	
N-Nitroso-di-n-propylamine	BDL	10	
Hexachloroethane	BDL	10	
Nitrobenzene	BDL	10	
Isophorone	BDL	10	
bis(2-Chloroethoxy)methane	BDL	10	
1,2,4-Trichlorobenzene	BDL	10	
Naphthalene	BDL	10	
4-Chloroaniline	BDL	10	
Hexachlorobutadiene	BDL	10	
2-Methylnaphthalene	BDL	10	
Hexachlorocyclopentadiene	BDL	10	
2-Chloronaphthalene	BDL	10	
2-Nitroaniline	BDL	50	
Dimethylphthalate	BDL	10	
Acenaphthylene	BDL	10	
2,6-Dinitrotoluene	BDL	10	
3-Nitroaniline	BDL	50	
Acenaphthene	BDL	10	
Dibenzofuran	BDL	10	
2,4-Dinitrotoluene	BDL	10	
Diethylphthalate	BDL	10	
4-Chlorophenyl-phenylether	BDL	10	
Fluorene	BDL	10	
4-Nitroaniline	BDL	50	
N-Nitrosodiphenylamine	BDL	10	
4-Bromophenyl-phenylether	BDL	10	
Hexachlorobenzene	BDL	10	
Phenanthrene	BDL	10	
Anthracene	BDL	10	
Carbazole	BDL	10	
Di-n-butylphthalate	BDL	10	
Fluoranthene	BDL	10	
Pyrene	BDL	10	
Butylbenzylphthalate	BDL	10	
3,3'-Dichlorobenzidine	BDL	20	
Benzo(a)anthracene	BDL	10	
Chrysene	BDL	10	
bis(2-Ethylhexyl)phthalate	BDL	20	

Sample Description: MW-8 Lab No: 07D
Test Description: Base/Neutral Semivolatiles Method: SW846 8270 Test Code: 8270BW
Collected: 12/07/92

Di-n-octylphthalate	BDL	10
Benzo(b)fluoranthene	BDL	10
Benzo(k)fluoranthene	BDL	10
Benzo(a)pyrene	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Dibenz(a,h)anthracene	BDL	10
Benzo(g,h,i)perylene	BDL	10

SURROGATE	%RECOVERY	LIMITS
Nitrobenzene d5	40	35 - 114
2-Fluorobiphenyl	25 Q	43 - 116
p-Terphenyl d14	16 Q	33 - 141

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/11/92
ANALYST IYE
UNITS ug/L

Sample Description: MW-8 Lab No: 07E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

PARAMETER	RESULT	LIMIT	METHOD: SW846 8240
Acetone	BDL	50	
Benzene	BDL	5.0	
Bromodichloromethane	BDL	5.0	
Bromoform	BDL	5.0	
Bromomethane	BDL	10	
2-Butanone	BDL	50	
Carbon Disulfide	BDL	10	
Carbon Tetrachloride	BDL	5.0	
Chlorobenzene	BDL	5.0	
Chlorodibromomethane	BDL	5.0	
Chloroethane	BDL	10	
Chloroform	BDL	5.0	
Chloromethane	21	10	
1,1-Dichloroethane	BDL	5.0	
1,1-Dichloroethene	BDL	5.0	
trans-1,2-Dichloroethene	BDL	5.0	
1,2-Dichloropropane	BDL	5.0	
cis-1,3-Dichloropropene	BDL	5.0	
trans-1,3-Dichloropropene	BDL	5.0	
Ethylbenzene	BDL	5.0	
2-Hexanone	BDL	50	
Methylene Chloride	BDL	20	
4-Methyl-2-pentanone	BDL	50	
Styrene	BDL	5.0	
1,1,2,2-Tetrachloroethane	BDL	5.0	
Tetrachloroethene	BDL	5.0	
Toluene	BDL	5.0	
1,1,1-Trichloroethane	BDL	5.0	
1,1,2-Trichloroethane	BDL	5.0	
Trichloroethene	BDL	5.0	
Vinyl Chloride	BDL	10	
Xylene	BDL	5.0	

SURROGATE	%RECOVERY	LIMITS
1,2-Dichloroethane-d4	99	76 - 114
Toluene-d8	97	88 - 110
4-Bromofluorobenzene	106	86 - 115

Notes and Definitions for this Report:

EXTRACTED 12/15/92
DATE RUN 12/15/92
ANALYST MWO

Sample Description: MW-8 Lab No: 07E
Test Description: Method 8240 Volatiles Method: SW846 8240 Test Code: V8240W
Collected: 12/07/92

UNITS ug/L

Sample Description: HB-1 Lab No: 08A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/08/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.12
PCB-1221	BDL	0.12
PCB-1232	BDL	0.12
PCB-1242	BDL	0.12
PCB-1248	BDL	0.12
PCB-1254	BDL	0.12
PCB-1260	0.88	0.12

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	29	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/10/92
ANALYST IYE
UNITS mg/Kg

Sample Description: HB-2 Lab No: 09A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/08/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.12
PCB-1221	BDL	0.12
PCB-1232	BDL	0.12
PCB-1242	BDL	0.12
PCB-1248	BDL	0.12
PCB-1254	BDL	0.12
PCB-1260	BDL	0.12

Sample Description: HB-2 Lab No: 09A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/08/92

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	42	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST IYE
UNITS mg/Kg

Sample Description: HB-3 Lab No: 10A
Test Description: Polychlorinated Biphenyls Method: SW846 8080 Test Code: PCB_S
Collected: 12/08/92

PARAMETER	RESULT	DETECTION LIMIT
PCB-1016	BDL	0.11
PCB-1221	BDL	0.11
PCB-1232	BDL	0.11
PCB-1242	BDL	0.11
PCB-1248	BDL	0.11
PCB-1254	BDL	0.11
PCB-1260	BDL	0.11

SURROGATE	%RECOVERY	LIMITS
Tetrachloro-m-xylene	35	24 - 154

Notes and Definitions for this Report:

EXTRACTED 12/09/92
DATE RUN 12/09/92
ANALYST IYE
UNITS mg/Kg

% Moisture
Method: ASTM D2216

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
08A	HB-1	13.2	%		12/09/92	SKB
09A	HB-2	15.1	%		12/09/92	SKB
10A	HB-3	12.9	%		12/09/92	SKB

Aluminum
Method: EPA 202.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	250	mg/L	25	12/16/92	JSC
03C	MW-3	350	mg/L	25	12/16/92	JSC
04C	MW-4	99	mg/L	25	12/16/92	JSC
05C	MW-6	120	mg/L	25	12/16/92	JSC
06C	MW-7	88	mg/L	25	12/16/92	JSC
07C	MW-8	65	mg/L	25	12/16/92	JSC

Antimony
Method: EPA 204.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	< 0.005	mg/L	0.005	12/10/92	JSC
03C	MW-3	< 0.005	mg/L	0.005	12/10/92	JSC
04C	MW-4	< 0.005	mg/L	0.005	12/10/92	JSC
05C	MW-6	< 0.005	mg/L	0.005	12/10/92	JSC
06C	MW-7	< 0.005	mg/L	0.005	12/10/92	JSC
07C	MW-8	< 0.005	mg/L	0.005	12/10/92	JSC

Arsenic
Method: EPA 206.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.17	mg/L	0.020	12/11/92	JSC
03C	MW-3	0.15	mg/L	0.020	12/11/92	JSC
04C	MW-4	0.062	mg/L	0.010	12/11/92	JSC
05C	MW-6	0.29	mg/L	0.050	12/11/92	JSC
06C	MW-7	0.21	mg/L	0.050	12/11/92	JSC
07C	MW-8	0.055	mg/L	0.010	12/11/92	JSC

Barium
Method: EPA 208.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	3.5	mg/L	0.50	12/16/92	JSC
03C	MW-3	2.9	mg/L	0.50	12/16/92	JSC
04C	MW-4	1.2	mg/L	0.50	12/16/92	JSC

Samp	Sample Description	Result	Units	Limit	Prepared	Analyzed	By
05C	MW-6	5.4	mg/L	0.50		12/16/92	JSC
06C	MW-7	1.3	mg/L	0.50		12/16/92	JSC
07C	MW-8	4.1	mg/L	0.50		12/16/92	JSC

Beryllium
Method: EPA 210.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.016	mg/L	0.013	12/15/92	JSC
03C	MW-3	0.022	mg/L	0.013	12/15/92	JSC
04C	MW-4	< 0.013	mg/L	0.013	12/15/92	JSC
05C	MW-6	0.014	mg/L	0.013	12/15/92	JSC
06C	MW-7	< 0.013	mg/L	0.013	12/15/92	JSC
07C	MW-8	< 0.013	mg/L	0.013	12/15/92	JSC

Cadmium
Method: EPA 213.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.011	mg/L	0.0005	12/11/92	JSC
03C	MW-3	0.096	mg/L	0.0005	12/11/92	JSC
04C	MW-4	0.082	mg/L	0.0005	12/11/92	JSC
05C	MW-6	0.085	mg/L	0.0005	12/11/92	JSC
06C	MW-7	0.038	mg/L	0.0005	12/11/92	JSC
07C	MW-8	0.051	mg/L	0.0005	12/11/92	JSC

Calcium
Method: EPA 215.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	920	mg/L	400	12/16/92	JSC
03C	MW-3	640	mg/L	400	12/16/92	JSC
04C	MW-4	330	mg/L	100	12/16/92	JSC
05C	MW-6	540	mg/L	100	12/16/92	JSC
06C	MW-7	320	mg/L	100	12/16/92	JSC
07C	MW-8	140	mg/L	100	12/16/92	JSC

Chromium
Method: EPA 218.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.64	mg/L	0.025	12/11/92	JSC
03C	MW-3	0.71	mg/L	0.025	12/11/92	JSC
04C	MW-4	0.39	mg/L	0.025	12/11/92	JSC
05C	MW-6	0.41	mg/L	0.025	12/11/92	JSC
06C	MW-7	0.25	mg/L	0.025	12/11/92	JSC
07C	MW-8	0.30	mg/L	0.025	12/11/92	JSC

Cobalt
Method: EPA 219.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.53	mg/L	0.10	12/16/92	JSC
03C	MW-3	0.55	mg/L	0.25	12/16/92	JSC
04C	MW-4	0.19	mg/L	0.025	12/16/92	JSC
05C	MW-6	0.36	mg/L	0.025	12/16/92	JSC
06C	MW-7	0.19	mg/L	0.025	12/16/92	JSC
07C	MW-8	0.10	mg/L	0.10	12/16/92	JSC

Copper
Method: EPA 220.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	1.3	mg/L	0.025	12/14/92	DRB
03C	MW-3	1.6	mg/L	0.063	12/14/92	DRB
04C	MW-4	0.43	mg/L	0.013	12/14/92	DRB
05C	MW-6	2.8	mg/L	0.063	12/14/92	DRB
06C	MW-7	0.50	mg/L	0.013	12/14/92	DRB
07C	MW-8	0.33	mg/L	0.013	12/14/92	DRB

Cyanide (Total)
Method: EPA 335.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02B	MW-2	<0.010	mg/L	0.010	12/09/92	LAK
03B	MW-3	<0.010	mg/L	0.010	12/09/92	LAK
04B	MW-4	<0.010	mg/L	0.010	12/09/92	LAK
05B	MW-6	<0.010	mg/L	0.010	12/09/92	LAK
06B	MW-7	<0.010	mg/L	0.010	12/09/92	LAK
07B	MW-8	<0.010	mg/L	0.010	12/09/92	LAK

Iron
Method: EPA 236.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	3900	mg/L	100	12/11/92	JSC
03C	MW-3	6000	mg/L	100	12/11/92	JSC
04C	MW-4	1400	mg/L	100	12/11/92	JSC
05C	MW-6	4000	mg/L	100	12/11/92	JSC
06C	MW-7	1400	mg/L	100	12/11/92	JSC
07C	MW-8	860	mg/L	100	12/11/92	JSC

Lead
Method: EPA 239.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.52	mg/L	0.05	12/16/92	DRB
03C	MW-3	0.72	mg/L	0.05	12/16/92	DRB
04C	MW-4	0.21	mg/L	0.05	12/16/92	DRB
05C	MW-6	0.81	mg/L	0.05	12/16/92	DRB
06C	MW-7	0.45	mg/L	0.05	12/16/92	DRB
07C	MW-8	0.22	mg/L	0.05	12/16/92	DRB

Magnesium
Method: EPA 242.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	110	mg/L	100	12/15/92	JSC
03C	MW-3	340	mg/L	25	12/15/92	JSC
04C	MW-4	120	mg/L	25	12/15/92	JSC
05C	MW-6	140	mg/L	25	12/15/92	JSC
06C	MW-7	98	mg/L	25	12/15/92	JSC
07C	MW-8	60	mg/L	25	12/15/92	JSC

Manganese
Method: EPA 243.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	43	mg/L	1.3	12/16/92	JSC
03C	MW-3	47	mg/L	1.3	12/16/92	JSC
04C	MW-4	10	mg/L	1.3	12/16/92	JSC
05C	MW-6	18	mg/L	1.3	12/16/92	JSC
06C	MW-7	10	mg/L	1.3	12/16/92	JSC
07C	MW-8	1.7	mg/L	0.5	12/16/92	JSC

Mercury
Method: EPA 245.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.0008	mg/L	0.0002	12/16/92	DRB
03C	MW-3	0.001	mg/L	0.0002	12/16/92	JSC
04C	MW-4	0.00035	mg/L	0.0002	12/16/92	JSC
05C	MW-6	0.00067	mg/L	0.0002	12/16/92	JSC
06C	MW-7	0.00028	mg/L	0.0002	12/16/92	JSC
07C	MW-8	< 0.0002	mg/L	0.0002	12/16/92	JSC

Nickel
Method: EPA 249.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.78	mg/L	0.013	12/15/92	DRB
03C	MW-3	1.1	mg/L	0.013	12/15/92	DRB
04C	MW-4	0.30	mg/L	0.013	12/15/92	DRB
05C	MW-6	0.61	mg/L	0.013	12/15/92	DRB
06C	MW-7	0.29	mg/L	0.013	12/15/92	DRB
07C	MW-8	0.36	mg/L	0.013	12/15/92	DRB

Phenolics
Method: EPA 420.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02F	MW-2	<5	ug/L	5	12/09/92	WBB
03F	MW-3	<5	ug/L	5	12/09/92	WBB
04F	MW-4	<5	ug/L	5	12/09/92	WBB
05F	MW-6	<5	ug/L	5	12/09/92	WBB
06F	MW-7	<5	ug/L	5	12/09/92	WBB
07F	MW-8	<5	ug/L	5	12/09/92	WBB

Potassium
Method: EPA 258.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	9.6	mg/L	2.5	12/15/92	DRB
03C	MW-3	15	mg/L	2.5	12/15/92	DRB
04C	MW-4	9.8	mg/L	2.5	12/15/92	DRB
05C	MW-6	7.3	mg/L	2.5	12/15/92	DRB
06C	MW-7	5.7	mg/L	2.5	12/15/92	DRB
07C	MW-8	7.2	mg/L	2.5	12/15/92	DRB

Selenium
Method: EPA 270.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	< 0.005	mg/L	0.005	12/15/92	JSC
03C	MW-3	< 0.005	mg/L	0.005	12/15/92	JSC
04C	MW-4	< 0.005	mg/L	0.005	12/15/92	JSC
05C	MW-6	< 0.005	mg/L	0.005	12/15/92	JSC
06C	MW-7	< 0.005	mg/L	0.005	12/15/92	JSC
07C	MW-8	< 0.005	mg/L	0.005	12/15/92	JSC

Silver
Method: EPA 272.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.0013	mg/L	0.0005	12/16/92	DRB
03C	MW-3	0.0014	mg/L	0.0005	12/16/92	DRB
04C	MW-4	< 0.0005	mg/L	0.0005	12/16/92	DRB
05C	MW-6	0.0021	mg/L	0.0005	12/16/92	DRB
06C	MW-7	0.0006	mg/L	0.0005	12/16/92	DRB
07C	MW-8	< 0.0005	mg/L	0.0005	12/16/92	DRB

Sodium
Method: EPA 273.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	550	mg/L	50	12/16/92	JSC
03C	MW-3	29	mg/L	5.0	12/16/92	JSC
04C	MW-4	55	mg/L	5.0	12/16/92	JSC
05C	MW-6	66	mg/L	5.0	12/16/92	JSC
06C	MW-7	55	mg/L	5.0	12/16/92	JSC
07C	MW-8	62	mg/L	5.0	12/16/92	JSC

Thallium / Furnace
Method: EPA 279.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	< 0.010	mg/L	0.010	12/09/92	CAZ
03C	MW-3	< 0.010	mg/L	0.010	12/09/92	CAZ
04C	MW-4	< 0.010	mg/L	0.010	12/09/92	CAZ
05C	MW-6	< 0.010	mg/L	0.010	12/09/92	CAZ
06C	MW-7	< 0.010	mg/L	0.010	12/09/92	CAZ
07C	MW-8	< 0.010	mg/L	0.010	12/15/92	JSC

Vanadium
Method: EPA 279.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	0.80	mg/L	0.2	12/15/92	JSC
03C	MW-3	0.90	mg/L	0.2	12/15/92	JSC
04C	MW-4	0.22	mg/L	0.08	12/15/92	JSC
05C	MW-6	0.36	mg/L	0.08	12/15/92	JSC
06C	MW-7	0.22	mg/L	0.08	12/15/92	JSC
07C	MW-8	0.14	mg/L	0.04	12/15/92	JSC

Zinc
Method: EPA 289.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
02C	MW-2	3.9	mg/L	0.1	12/15/92	DRB
03C	MW-3	5.1	mg/L	0.1	12/15/92	DRB
04C	MW-4	1.3	mg/L	0.05	12/15/92	DRB
05C	MW-6	3.4	mg/L	0.1	12/15/92	DRB
06C	MW-7	1.2	mg/L	0.05	12/15/92	DRB
07C	MW-8	0.93	mg/L	0.05	12/15/92	DRB

The base-neutral surrogate recoveries for samples 92-12-105-02D and -07D were out of control and re-extractions of these samples also had out of control surrogate recoveries. Therefore the samples matrices may interfere with the base-neutral analysis.

CHAIN OF CUSTODY RECORD

R&R INTERNATIONAL INC.

PROJECT NO.:	SITE NAME:
002420	Canton Drop Forge

SAMPLERS (SIGNATURE): Karl W. Valek

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Polyn. Biphenyls 8080 PCBs	TPH 418.1	TCL Volatiles 8240	TCL Semi VOCs 8270	TCL Metals 7000 Series	Tot. Cyanide 9010	Tot Rec. Phenolics 9065	REMARKS
	12/8			~	MW-1	3	X	X	X	X	X	X	X	
	12/7			~	MW-2	6	X	X	X	X	X	X	X	For all water samples
	12/7			~	MW-3	6	X	X	X	X	X	X	X	(except MW-1) a 1 jar
	12/8			~	MW-4	6	X	X	X	X	X	X	X	is labeled and preserved
	12/7			~	MW-6	6	X	X	X	X	X	X	X	for TPH with HCl.
	12/7			~	MW-7	6	X	X	X	X	X	X	X	
	12/7			~	MW-8	6	X	X	X	X	X	X	X	Run sample MW-1
	12/8			~	HB-1	1	X							first - Due to low
	12/8			~	HB-2	1	X							volume obtained,
	12/8			~	HB-3	1	X							run sample for
														those analyses with
														highest concentrations
														Call Karl Valek
														w/ Questions
														Forward results
														to Karl Valek
														666-2200

RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE): Karl W. Valek	DATE / TIME 12/8	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME 12-8-92 7:00	REMARKS:	

CDF012555

FORM 577

AMERICAN ANALYTICAL LABORATORIES, INC.
INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

American Analytical
Laboratories, Inc.
840 S. Main Street
Akron, Ohio 44311
Attn: Tim Lavey
Phone: (216) 535-1300

DEC 29 1992

R & R International
1234 S. Cleveland-Mass Rd.
P.O. Box 4383
Akron, Ohio 44321
Attn: Karl Valek
Invoice Number:

Order #: 92-12-269
Date: 12/28/92
Work ID: Project #002420
Date Received: 12/18/92
Date Completed: 12/28/92
Client Code: RRINTERNATNL

Facility: Canton Drop Forge
The samples reported herein were analyzed for dissolved metals

SAMPLE IDENTIFICATION

Sample Number	Sample Description	Sample Number	Sample Description
01	MW-2	04	MW-6
02	MW-3	05	MW-7
03	MW-4	06	MW-8

BDL - Below Detection Limit

Certified By
T. J. Lavey

CDF012556

Aluminum
Method: EPA 202.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.13	mg/L	0.13	12/23/92	DRB
02A	MW-3	< 0.13	mg/L	0.13	12/23/92	DRB
03A	MW-4	< 0.13	mg/L	0.13	12/23/92	DRB
04A	MW-6	0.38	mg/L	0.13	12/23/92	DRB
05A	MW-7	< 0.13	mg/L	0.13	12/23/92	DRB
06A	MW-8	0.13	mg/L	0.13	12/23/92	DRB

Arsenic
Method: EPA 206.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.005	mg/L	0.005	12/21/92	DRB
02A	MW-3	< 0.005	mg/L	0.005	12/21/92	DRB
03A	MW-4	< 0.005	mg/L	0.005	12/21/92	DRB
04A	MW-6	< 0.005	mg/L	0.005	12/21/92	DRB
05A	MW-7	< 0.005	mg/L	0.005	12/21/92	DRB
06A	MW-8	< 0.005	mg/L	0.005	12/21/92	DRB

Barium
Method: EPA 208.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	0.14	mg/L	0.13	12/23/92	CAZ
02A	MW-3	< 0.13	mg/L	0.13	12/23/92	CAZ
03A	MW-4	< 0.13	mg/L	0.13	12/23/92	CAZ
04A	MW-6	< 0.13	mg/L	0.13	12/23/92	CAZ
05A	MW-7	< 0.13	mg/L	0.13	12/23/92	CAZ
06A	MW-8	1.9	mg/L	0.13	12/23/92	CAZ

Beryllium
Method: EPA 210.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.013	mg/L	0.013	12/23/92	CAZ
02A	MW-3	< 0.013	mg/L	0.013	12/23/92	CAZ
03A	MW-4	< 0.013	mg/L	0.013	12/23/92	CAZ
04A	MW-6	< 0.013	mg/L	0.013	12/23/92	CAZ
05A	MW-7	< 0.013	mg/L	0.013	12/23/92	CAZ
06A	MW-8	< 0.013	mg/L	0.013	12/23/92	CAZ

Cadmium
Method: EPA 213.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	0.0014	mg/L	0.0005	12/23/92	DRB
02A	MW-3	< 0.0005	mg/L	0.0005	12/23/92	DRB
03A	MW-4	< 0.0005	mg/L	0.0005	12/23/92	DRB
04A	MW-6	< 0.0005	mg/L	0.0005	12/23/92	DRB
05A	MW-7	0.00084	mg/L	0.0005	12/23/92	DRB
06A	MW-8	< 0.0005	mg/L	0.0005	12/23/92	DRB

Chromium
Method: EPA 218.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	0.030	mg/L	0.025	12/22/92	CAZ
02A	MW-3	< 0.025	mg/L	0.025	12/22/92	CAZ
03A	MW-4	0.026	mg/L	0.025	12/22/92	CAZ
04A	MW-6	< 0.025	mg/L	0.025	12/22/92	CAZ
05A	MW-7	< 0.025	mg/L	0.025	12/22/92	CAZ
06A	MW-8	< 0.025	mg/L	0.025	12/22/92	CAZ

Cobalt
Method: EPA 219.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.025	mg/L	0.025	12/21/92	AMN
02A	MW-3	< 0.025	mg/L	0.025	12/21/92	AMN
03A	MW-4	< 0.025	mg/L	0.025	12/21/92	AMN
04A	MW-6	< 0.025	mg/L	0.025	12/21/92	AMN
05A	MW-7	< 0.025	mg/L	0.025	12/21/92	AMN
06A	MW-8	< 0.025	mg/L	0.025	12/21/92	AMN

Copper
Method: EPA 220.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.013	mg/L	0.013	12/21/92	DRB
02A	MW-3	< 0.013	mg/L	0.013	12/21/92	DRB
03A	MW-4	< 0.013	mg/L	0.013	12/21/92	DRB
04A	MW-6	< 0.013	mg/L	0.013	12/21/92	DRB
05A	MW-7	< 0.013	mg/L	0.013	12/21/92	DRB
06A	MW-8	< 0.013	mg/L	0.013	12/21/92	DRB

Iron
Method: EPA 236.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	0.014	mg/L	0.013	12/23/92	CAZ
02A	MW-3	< 0.013	mg/L	0.013	12/23/92	CAZ
03A	MW-4	< 0.013	mg/L	0.013	12/23/92	CAZ
04A	MW-6	< 0.013	mg/L	0.013	12/23/92	CAZ
05A	MW-7	< 0.013	mg/L	0.013	12/23/92	CAZ
06A	MW-8	0.18	mg/L	0.013	12/23/92	CAZ

Lead
Method: EPA 239.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	0.040	mg/L	0.005	12/22/92	CAZ
02A	MW-3	< 0.005	mg/L	0.005	12/22/92	CAZ
03A	MW-4	< 0.005	mg/L	0.005	12/22/92	CAZ
04A	MW-6	< 0.005	mg/L	0.005	12/22/92	CAZ
05A	MW-7	< 0.005	mg/L	0.005	12/22/92	CAZ
06A	MW-8	< 0.005	mg/L	0.005	12/22/92	CAZ

Manganese
Method: EPA 243.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	2.1	mg/L	0.065	12/21/92	DRB
02A	MW-3	1.6	mg/L	0.13	12/21/92	DRB
03A	MW-4	1.8	mg/L	0.13	12/21/92	DRB
04A	MW-6	1.3	mg/L	0.13	12/21/92	DRB
05A	MW-7	1.1	mg/L	0.13	12/21/92	DRB
06A	MW-8	1.7	mg/L	0.13	12/21/92	DRB

Mercury
Method: EPA 245.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.0002	mg/L	0.0002	12/28/92	AMN
02A	MW-3	< 0.0002	mg/L	0.0002	12/28/92	AMN
03A	MW-4	< 0.0002	mg/L	0.0002	12/28/92	AMN
04A	MW-6	< 0.0002	mg/L	0.0002	12/28/92	AMN
05A	MW-7	< 0.0002	mg/L	0.0002	12/28/92	AMN
06A	MW-8	< 0.0002	mg/L	0.0002	12/28/92	AMN

Nickel
Method: EPA 249.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.013	mg/L	0.013	12/21/92	DRB
02A	MW-3	< 0.013	mg/L	0.013	12/21/92	DRB
03A	MW-4	< 0.013	mg/L	0.013	12/21/92	DRB
04A	MW-6	< 0.013	mg/L	0.013	12/21/92	DRB
05A	MW-7	< 0.013	mg/L	0.013	12/21/92	DRB
06A	MW-8	< 0.013	mg/L	0.013	12/21/92	DRB

Silver
Method: EPA 272.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.0005	mg/L	0.0005	12/21/92	DRB
02A	MW-3	< 0.0005	mg/L	0.0005	12/21/92	DRB
03A	MW-4	< 0.0005	mg/L	0.0005	12/21/92	DRB
04A	MW-6	< 0.0005	mg/L	0.0005	12/21/92	DRB
05A	MW-7	< 0.0005	mg/L	0.0005	12/21/92	DRB
06A	MW-8	< 0.0005	mg/L	0.0005	12/21/92	DRB

Vanadium
Method: EPA 279.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	< 0.02	mg/L	0.02	12/23/92	DRB
02A	MW-3	< 0.02	mg/L	0.02	12/23/92	DRB
03A	MW-4	< 0.02	mg/L	0.02	12/23/92	DRB
04A	MW-6	0.057	mg/L	0.02	12/23/92	DRB
05A	MW-7	< 0.02	mg/L	0.02	12/23/92	DRB
06A	MW-8	< 0.02	mg/L	0.02	12/23/92	DRB

Zinc
Method: EPA 289.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	MW-2	0.066	mg/L	0.005	12/21/92	DRB
02A	MW-3	< 0.005	mg/L	0.005	12/21/92	DRB
03A	MW-4	< 0.005	mg/L	0.005	12/21/92	DRB
04A	MW-6	< 0.005	mg/L	0.005	12/21/92	DRB
05A	MW-7	< 0.005	mg/L	0.005	12/21/92	DRB
06A	MW-8	< 0.005	mg/L	0.005	12/21/92	DRB

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CHAIN OF CUSTODY RECORD

PROJECT NO.:	SITE NAME:
002420	CANTON DROP FORGE

SAMPLERS (SIGNATURE): Joseph L. Hess

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	BASE/NEUTRAL & ACID	METALS	TCL-TOC & SERIES	TCL-VOA			REMARKS
	12/17			X	MW-2	2	X	X					* SAMPLE MW-1 ON HOLD FROM
	12/17			X	MW-3	1		X					WO #92-12-105 ANALYZE VOA per KARL
	12/17			X	MW-4	1		X					12-17-92 - LOGGED IN ON 92-12-105
	12/17			X	MW-6	1		X					
	12/17			X	MW-7	1		X					
	12/17			X	MW-8	2	X	X					IF YOU HAVE ANY QUESTIONS
													PLEASE CONTACT JOE HESS
					~~MW-1~~	~~2~~			X				OR MARK CAETTA AT
													666-2200
													PLEASE FILTER METALS

RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
Joseph L. Hess	12/18 9:00				
RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE / TIME	REMARKS:	
			12.18.92 10:20		

CDF012561

FORM 577

AMERICAN ANALYTICAL LABORATORIES, INC.

INDUSTRIAL HYGIENE AND ENVIRONMENTAL SCIENCES

American Analytical
Laboratories, Inc.
840 S. Main Street
Akron, Ohio 44311
Attn: Tim Lavey
Phone: (216) 535-1300

JAN 08 1993

R & R International
1234 S. Cleveland-Mass Rd.
P.O. Box 4383
Akron, Ohio 44321
Attn: Carl Valek
Invoice Number:

Order #: 92-12-410
Date: 01/07/93
Work ID: Project #002420
Date Received: 12/30/92
Date Completed: 01/07/93
Client Code: RRINTERNATNL

Facility: Canton Drop Forge
Soil results are reported on a dry weight basis.

SAMPLE IDENTIFICATION

Sample Number	Sample Description
01	M.W. 2
02	M.W. 8
03	Lagoon No. 3

BDL - Below Detection Limit

Certified By
T. J. Lavey

• ACCREDITED BY THE AMERICAN INDUSTRIAL HYGIENE ASSOCIATION •

Chromium
Method: EPA 218.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	< 0.025	mg/L	0.025	01/04/93	DRB

Cobalt
Method: EPA 219.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	< 0.025	mg/L	0.025	01/06/93	CAZ

Copper
Method: EPA 220.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	< 0.013	mg/L	0.013	01/04/93	DRB

Iron
Method: EPA 236.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	0.20	mg/L	0.013	01/06/93	CAZ

Lead
Method: EPA 239.2

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	< 0.005	mg/L	0.005	01/04/93	DRB

Lead (Dissolved)
Method: EPA 239.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
01A	M.W. 2	< 0.025	mg/L	0.025	01/05/93	DRB

Magnesium
Method: EPA 242.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	33	mg/L	20	01/07/93	CAZ

Manganese
Method: EPA 243.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	0.064	mg/L	0.013	01/06/93	CAZ

Zinc
Method: EPA 289.1

Samp	Sample Description	Result	Units	Detection Limit	Analyzed	By
03A	Lagoon No. 3	< 0.005	mg/L	0.005	01/02/93	AMN

R&R INTERNATIONAL, INC.

APPENDIX E
QUALITY ASSURANCE/QUALITY CONTROL PLAN

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QUALITY ASSURANCE/QUALITY CONTROL PLAN

The following sections outline the quality assurance/quality control procedures followed by R&R on Environmental Site Assessment projects.

Sampling Procedures:

All soil and water samples are collected following guidelines established by the USEPA in the Technical Enforcement Guidance Document (TEGD). Soil samples obtained during drilling operations are secured using a split spoon sampling device following ASTM-1586. Samples are promptly placed in Teflon® lined sample containers appropriate for the intended analysis. Water samples are obtained from properly developed and purged wells using clean Teflon® bailers. Samples are promptly placed in appropriate containers and preserved as required. All samples (soil and water) are immediately placed in an ice-pack filled (4°C) cooler for transport to the laboratory.

Decontamination:

All sampling tools (split spoon, bailer, etc.) that come in contact with the material being sampled are decontaminated between sampling events. Decontamination is performed via washing with a laboratory grade soap followed by a potable water rinse. The equipment is permitted to air dry prior to re-use. This procedure is implemented to avoid cross contamination between sampling events. Equipment blanks are employed to verify the effectiveness of this procedure.

To drilling equipment (sampling rods, augers, drilling rigs, etc.) is decontaminated between boring locations using high pressure steam. This procedure is performed to reduce the potential of cross contamination between boring locations.

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Sample Chain-of-Custody:

A chain-of-custody form is prepared to document the handling of each sample from the time that it is collected to the time it is analyzed by the laboratory. The chain-of-custody form for this project is included at the end of the analytical results in the appendix of this report.

Laboratory:

All analytical testing is conducted by an independent laboratory. The quality assurance/quality control procedures of the laboratory employed for this project are included herewith:

QUALITY ASSURANCE PROCEDURES FOR ENVIRONMENTAL ANALYTICAL METHODS

I. SAMPLING CONTAINERS

A.) All sample containers will be checked by lot for contamination. Any contaminated containers will be discarded and replaced with new uncontaminated stock.

B.) Field blanks will be included at a rate of ten percent for each analytical batch of samples. When samples are provided without field blanks, a laboratory blank will be added from the same lot of containers if possible.

C.) Field blanks consist of reagent water, ASTM type II, and any preservatives added to the sample for the specific parameter being analyzed.

D.) Sample containers will be given in duplicate for volatiles in water analysis.

II. SAMPLE PRESERVATION

A.) All sampling containers provided by American Analytical Laboratories, Inc. contain the appropriate preservatives either inside the container or provided in a separate container for addition to the sample after collection. Samples submitted to the laboratory unpreserved will have preservative added upon receipt of the samples.

B.) Samples requiring refrigeration will be kept at the appropriate temperature until the analysis is performed. Samples collected by American Analytical Laboratories, Inc. will be kept refrigerated from the time of collection until the analysis and/or the extraction can be performed. Samples submitted to the laboratory will be refrigerated upon receipt of the samples.

C.) Any samples that appear to be inappropriately preserved will be noted upon receipt of samples. Clients will be notified if samples cannot be be analyzed due to sample loss or lack of refrigeration.

D.) All samples will be analyzed and/or extracted before the specified hold times are exceeded for the analyses performed. Any sample that exceeds the specified holding time will not be analyzed unless directed by the client and will be noted on the final report.

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III. CALIBRATION

A.) All calibration standards will be of at least 95% purity, certified as a traceable quantitative standard or be adjusted for the rate purity or dilution.

B.) Whenever possible, the sample spiking standard should be of different origin than the calibration standard. This will serve as a double check for viability of both standards.

C.) All organic standard calibration curves will contain a minimum of three levels of concentration. A regression curve fit routine is determined by the software on the GC/MS. An average response factor is used for GC/ECD analysis.

D.) Organic analyses that use an average response factor for calculation of quantitative results will be acceptable if the difference between the levels varies by less than ten percent. In the event that the difference is greater than ten percent, the response factor closest to the value being measured will be used.

E.) Calibration curves for inorganic samples will contain a minimum of three levels of concentration. A minimum of three consecutive measurements will be made for each calibration level and mean values obtained for calculation of a linear calibration curve.

F.) Linear regression will be used to determine the slope of the calibration curves for inorganic samples. These calculations will be stored along with each sample batch for each parameter tested. If severe matrix effects are encountered, then a series of standard additions will be performed to maintain accuracy.

G.) All equipment used for calibration will have a documented log to verify the accuracy of the instrument (this includes all balances, pipettes, syringes, etc....). These records will be kept with the equipment and entries made daily before each use. Any equipment that fails to meet the accuracy requirements will either be repaired or replaced.

H.) All volumetric glassware will be traceable to a primary standard, (i.e., class A type). Glassware that becomes scratched, scored or visibly altered will be discarded and replaced.

I.) Documentation will be kept of preparation and analysis of all calibration standards for each analytical batch. This will include weights, dilutions, response factors and linear regression analyses. This information will be kept with each set of sample calculations.

IV. REAGENTS

A.) Reagents used for analytical procedures will be of reagent grade or better quality.

B.) Reagents will be marked upon date of receipt, date of opening and date of expiration (if applicable).

C.) Reagents found to be contaminated will be discarded and replaced with non-contaminated stock.

D.) Solvents used for sample extraction and concentration of organic parameters will be of pesticide grade or better quality.

V. INSTRUMENTATION

A.) Each instrument will have a documented log of repairs and routine maintenance. Logs will be kept with the instruments.

B.) Instruments will be calibrated and or tuned daily when sample analyses are to be performed.

C.) A system performance check compound (SPCC's) will be used to determine loss of sensitivity for all GC/MS and GC/ECD analyses. A minimum response factor must be achieved before sample analysis begins. Documentation of the SPCC's will be kept with the quality control data.

VI. SELECTION OF METHODS

A.) All methods for analysis of environmental samples will be validated methods from either Standard Methods for the Examination of Water and Wastewater, ASTM, AOAC or EPA reference materials.

B.) Any deviations from the referenced methods will be reflected in the American Analytical Laboratories, Inc. procedures manual.

C.) Methods will be selected by their applicability to the samples to be analyzed and the equipment available to the analyst.

QUALITY CONTROL PROCEDURES FOR ENVIRONMENTAL ANALYTICAL METHODS

I. ROUTINE SAMPLES

A.) Standard control charts illustrating the upper control limits (UCL) and the lower control limits (LCL) will be prepared for each method used for routine sample analysis. These limits will be determined by the first five to twenty spiked samples analyzed by this method. The control limits for accuracy will be determined by + or - three standard deviations of the mean reference value, control limits for precision will be determined using + or - three standard deviations of the mean relative percent difference or relative standard deviation. Reference values are expressed as percent recoveries of amounts.

B.) A basic difference exists between the precision and accuracy measurements for organic and inorganic analyses. Inorganic analyses require that precision determinations are made using duplicate sample runs from which a relative standard deviation (RSD) is derived. These values are very dependent on sample concentration and may vary greatly if the sample concentrations are low. Accuracy measurements are made from a single spike of the same sample and are expressed as a percentage recovery of the known spike value. Precision for organic samples is determined by using a spike and duplicate spike of the same sample from which a relative percent difference (RPD) is determined. The accuracy measurements are made using the mean percent recovery values from the two spiked samples.

C.) Quality control spike and duplicate samples for routine analyses will be run at a rate of ten percent of each analytical batch. Each spiked sample will be analyzed a minimum of two times to calculate the RPD (relative percent difference), or RSD (relative standard deviation), of the measurements and compared to the precision control chart. The mean reference value of these runs will then be compared to the accuracy control chart. The analysis is judged to be in control and sample analysis may proceed when the values are within the specified upper and lower control limits.

D.) An analysis is judged to be out of control when either of the following situations occur: a mean reference value falls outside of the specified control limits or if seven consecutive points fall on one side of the mean reference value of the control chart. If either situation occurs, the problem must be defined and corrected before sample analysis may begin.

E.) Control limits will be kept in a quality control notebook containing a copy of the quality control guidelines and referenced by the method. QC for volatiles is found in the GC/MS QC notebook under volatiles in water or soil. The same holds true for semi-volatiles by GC/MS. Pesticides and polychlorinated biphenyls are kept in a separate notebook for GC/ECD QC. A metals QC notebook is kept with the atomic absorption unit and referenced by the metal being analyzed (i.e., lead in water or soil).

F.) The QC coordinator will report any out of control situations to laboratory supervisor along with the corrective actions being taken. The laboratory supervisor will also be notified when the analysis is back to a controlled status.

G.) The corrective action will be noted in the QC manual for that procedure along with the date and the initials of the analyst involved.

H.) In addition to the duplicate spikes, each analytical batch must contain a duplicate sample analysis. Each duplicate sample analysis will be charted on the basis of relative percent difference (RPD). These duplicates will also be performed at a frequency of 10% of each analytical batch.

I.) All analyses performed using GC/MS methods (i.e., EPA 624, 625, 8240, 8270, etc...) require the use of appropriate tuning parameters and documentation of adherence to these standards before sample analysis can be performed. These tuning parameters must be met daily when samples are to be analyzed.

J.) Volatiles analysis requires tuning within specified mass ratios using 4-bromofluorobenzene (BFB) as a tuning standard. A two microliter injection of a 25 ug/mL (50 ng on column) standard must produce the following ratios:

M/Z	ION ABUNDANCE CRITERIA
50	15-40% of mass 95
75	30-60% of mass 95
95	100% relative abundance
96	5-9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5-9% of mass 174
176	95-101% of mass 174
177	509% of mass 176

K.) Semi-volatiles analysis requires tuning specifications using decafluorotriphenylphosphine (DFTPP). A two microliter injection of a 25 ug/mL (50 ng/injection standard must produce the following mass ratios:

M/Z	ION ABUNDANCE CRITERIA
51	30-60% of mass 198
68	less than 2% of mass 69
69	present
70	less than 2% of mass 69
127	40-60% of mass 198
197	less than 1% of mass 198

M/Z	ION ABUNDANCE CRITERIA
198	100% relative abundance
199	5-9% of mass 198
275	10-30% of mass 198
365	greater than 1% of mass 198
441	present but less than mass 443
442	greater than 40% of mass 198
443	17-23% of mass 442

L.) Peak tailing factors must be determined in addition to the tuning parameters specified for the semi-volatiles analysis. This also must be performed each day before sample analyses are performed. Tailing factors for acidic compounds, (phenolic series), use a 2 uL injection of a 25 ug/mL solution of pentachlorophenol and require a tailing factor of less than 3.0. Tailing factors for basic compounds require a 2 uL injection of a 50 ug/mL solution of benzidine and require a tailing factor of less than 5.0.

M.) Method and field blanks are recorded for each sample batch to track contamination problems. The required frequency is 10% of the total number of samples.

II. NONROUTINE SAMPLES

A.) In the case of nonroutine samples, duplicate spikes will also be performed, recorded and compared. This data will be compiled and after twenty data points are collected, a control chart will be assembled for that method. The duplicate spikes will be performed with the same frequency as routine samples (i.e., 10% of the analytical batch).

B.) A target range for these samples will be established using Contract Laboratory Program (CLP) data from the SW 846 methods manual. The analysis will be assumed under control if the sample is between the lower control limit and the upper control limits specified.

III. PROFICIENCY TESTING

A.) American Analytical Laboratories, Inc. participates in the PAT (Proficiency in Analytical Testing) program sponsored by the National Institute of Safety and Health (NIOSH). Our laboratory participates in all parameter analyses. Analytes supplied in this program include the following:

1. asbestos
2. organic solvents
3. metals (Cd, Pb, Zn)
4. silica

B.) American Analytical Laboratories, Inc. participates in the Environmental Protection Agency's (EPA) water pollution control study. This is a federally mediated, voluntary proficiency evaluation program given by EPA Region 5. Parameters involved in this study are as follows:

1. volatile organic hydrocarbons
2. pesticides and polychlorinated biphenyls (PCB's)
3. metals
4. inorganic anions (NO3, NO2, PO4, Cn, NH4, F, Cl)
5. demand analyses (BOD, COD)
6. pH, oil and grease

C.) American Analytical Laboratories, Inc. participates in the Ohio Environmental Protection Agency's (EPA) water supply study. This is a state run proficiency evaluation program for laboratory certification in drinking water analysis.

1. volatile organics
2. metals
3. inorganic anions

D.) American Analytical Laboratories, Inc. participates in a voluntary external quality control program provided by Environmental Resource Associates (ERA). The program is a quarterly evaluation of the following parameters.

1. volatile organic hydrocarbons
2. pesticides and polychlorinated biphenyls (PCB's)
3. acid and base neutral fractions
4. metals
5. inorganic anions (NO3, NO2, PO4, CN, NH4, F, Cl)
6. demand analyses (BOD, COD)
7. pH, oil and grease

E.) American Analytical Laboratories, Inc. routinely uses quality control check samples and quantitative analytical standards provided by the Quality Assurance Branch of the Environmental Protection Agency (EPA). These standards are used to check the accuracy of the standard calibrations and as matrix spiking standards.

F.) Standard reference materials from the National Institute of Standards and Technology (NIST, formerly NBS) are also utilized as external quality control check samples when they are available.

TH:pe
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APPENDIX D

QUALITY ASSURANCE/QUALITY CONTROL PLAN

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APPENDIX D

QUALITY ASSURANCE/QUALITY CONTROL PLAN

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Quality Assurance/Quality Control Plan

The following subsections outline the QA/QC procedures followed by R&R on Environmental Site Assessment projects for BP Oil Company.

Sampling Procedures:

All soil and water samples are collected following guidelines established by the U.S. EPA in the Technical Enforcement Guidance Document (TEGD). Soil samples obtained during drilling operations are secured using a split spoon sampling device following ASTM-1586. Samples are promptly placed in teflon lined sample containers appropriate for the intended analysis. Water samples are obtained from properly developed and purged wells using new, dedicated, PVC bailers. A field duplicate and a field blank consisting of distilled water are also obtained. Samples are promptly placed in appropriate containers and preserved as required. All samples (soil and water) are immediately placed in an ice-pack filled (4°C) cooler for transport to the laboratory.

Decontamination:

All sampling tools (i.e., split spoon, bailer, etc.) that come in contact with the material being sampled are decontaminated between sampling events. Decontamination is performed via washing with a laboratory grade soap followed by a potable water rinse. The equipment is permitted to air dry prior to re-use. This procedure is implemented to avoid cross contamination between sampling events. Equipment blanks are employed to verify the effectiveness of this procedure.

All drilling equipment (i.e., sampling rods, augers, drilling rigs, etc.) is decontaminated between boring locations using high pressure steam. This procedure is performed to reduce the potential of cross contamination between boring locations.

LAGOON #2 SLUDGE
DISPOSAL/TREATMENT OPTIONS

Prepared For:

Canton Drop Forge
4575 Southway Street, S.W.
Canton, Ohio 44706

March 1, 1995

Prepared by:
Gene G. Hill, M.S., E.T.
Hammontree & Associates, Limited
5233 Stoneham Road
North Canton, Ohio 44720

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Appendices

Appendix A: Site Map
Appendix B: Lab Results

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EXECUTIVE SUMMARY

Hammontree & Associates was retained by Canton Drop Forge (CDF) to sample the sludge lining "Lagoon #2" at the Southway Street S.W. facility and determine the most efficient means of handling the material. The intent of the investigation by Hammontree & Associates was not to determine means to remediate or clean the entire site, but to deal with the excavated sludges that would result from dredging the lagoon.

Samples of the lagoon lining were retrieved and tested for hazardous constituents as defined by the Resource Conservation and Recovery Act (RCRA). The materials were found to be non-hazardous yet high in Total Petroleum Hydrocarbons (TPH) (13,500 to 303,500 ppm). In Ohio TPH contaminated soils are not considered hazardous and may be landfilled. An alternative to landfilling is ex-situ bioremediation. Bioremediation simply places the contaminated soil in an environment which enhances the natural degradation process. This process can greatly reduce TPH levels while not generating any hazardous by-products. Although the site is technically under Ohio Environmental Protection Agency (OEPA) jurisdiction, sites similar to Canton Drop Forge are often required to reduce TPH contamination to the Bureau of Underground Storage Tank Regulation (BUSTR) level of 380 ppm (See attached).

It is recommended that Canton Drop Forge and Hammontree & Associates discuss the logistics and cost of ex-situ bioremediation of Lagoon #2. Without receiving a quote from a Bio-firm, the estimated cost for removing the sludge from Lagoon #2 and reducing the TPH contamination to target levels is $150,000.00 to $180,000.00, based on information received for Lagoon #1.

EXCHANGE WAS $194,640 FOR BOTH

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I. INTRODUCTION

The following report addresses the settled materials found lining "Lagoon 2" at the Canton Drop Forge facility located on Southway Street S.W. in Canton, Ohio.

Currently the lagoon receives industrial process water, surface run-off, and effluent from Lagoon #1. All of these water sources can be contaminated with petroleum products. The management is in the process of investigating methods to remove oils and greases from the process water stream through industrial pretreatment. The tentative plan is to remove the materials lining the lagoon and maintain the site for future use as a stormwater and treated water retention pond.

Sludge and sediment samples were retrieved from the lining of Lagoon #2 to determine whether the material is considered hazardous and to investigate biodegradability. The materials were non-hazardous but high in Total Petroleum Hydrocarbons (TPH) (13,500 to 303,500 ppm). TPH contaminated soils are regulated by both the Environmental Protection Agency (EPA) and the Bureau of Underground Storage Tank Regulations (BUSTR). Technically the site is not subject to BUSTR regulations but to the often more stringent EPA regulations. However due to the industrial nature of the site the EPA will generally allow the minimum BUSTR clean-up level. For this site that level is 380 ppm which represents the target concentration to be achieved.

This report will discuss the materials found and Hammontree & Associates' recommendations for the treatment of the material excavated from Lagoon #2.

II. SAMPLING

Sludge and sediment samples were retrieved from the bottom of Lagoon #2 using both a "Mucksucker" and standard auger type sampler. Materials were retrieved from various locations and depths throughout the lagoon in accordance with SW846. Due to the similarity of the samples and the analytical results, exhaustive sampling was not justified. The only contamination above allowable BUSTR (Category I, Analytical Group 3, 380 ppm) levels was Total Petroleum Hydrocarbons (TPH). See Figure 1, Lagoon #2 Site Plan for sample locations.

III. LABORATORY ANALYSIS

All samples were tested for contaminates as outlined in the Resource Conservation and Recovery Act (RCRA). This includes the following:

1. Full Toxicity Leaching Characteristic Procedure (TCLP) (excluding herbicides & pesticides) **This covers metals and organics for toxicity**
2. Reactive Cyanide - **reactivity**
3. Reactive Sulfur - **reactivity**
4. Flash Point - **ignitability**
5. pH - **corrosivity**

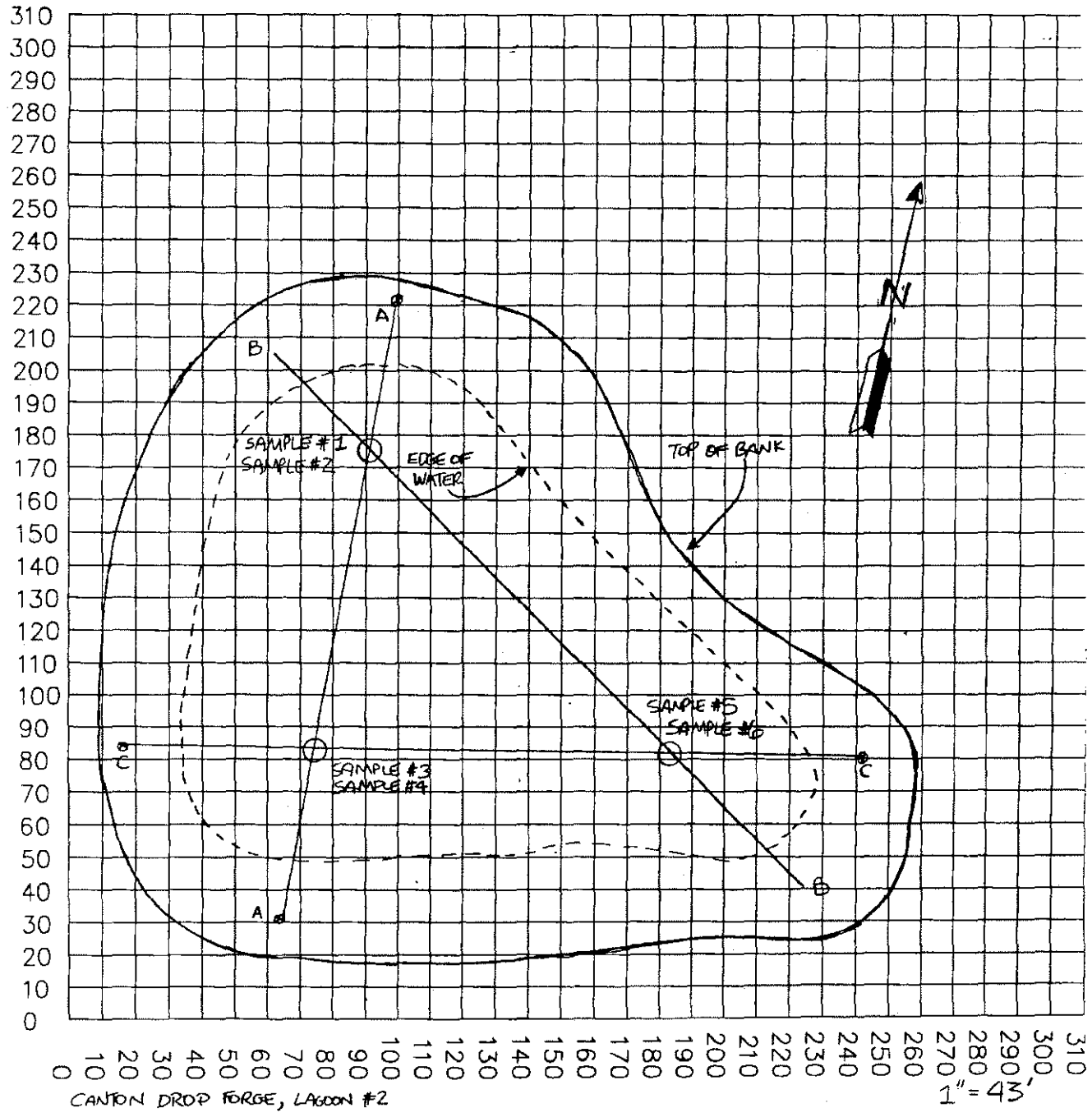
6. Paint Filter Liquids Test - **landfill requirements for solid wastes**
7. PCB's - **due to past detection** (Governed under Toxic Substance Control Act) (TSCA)
8. Total Petroleum Hydrocarbons (TPH) - **due to oil and grease contamination**

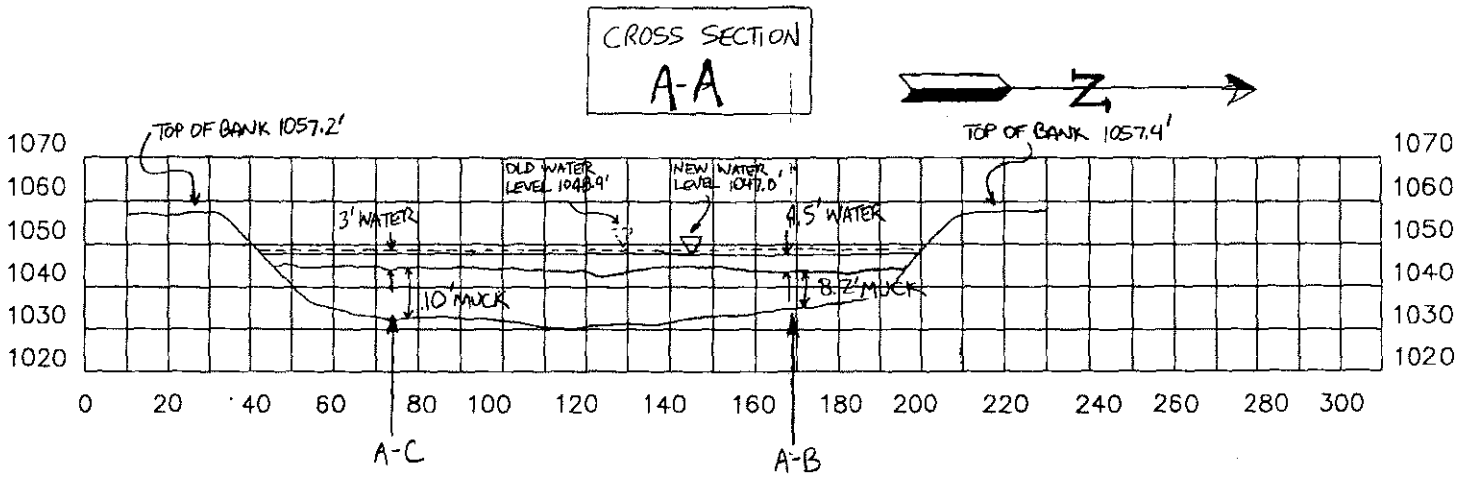
TABLE 1: LAGOON #2 LAB ANALYSIS SUMMARY

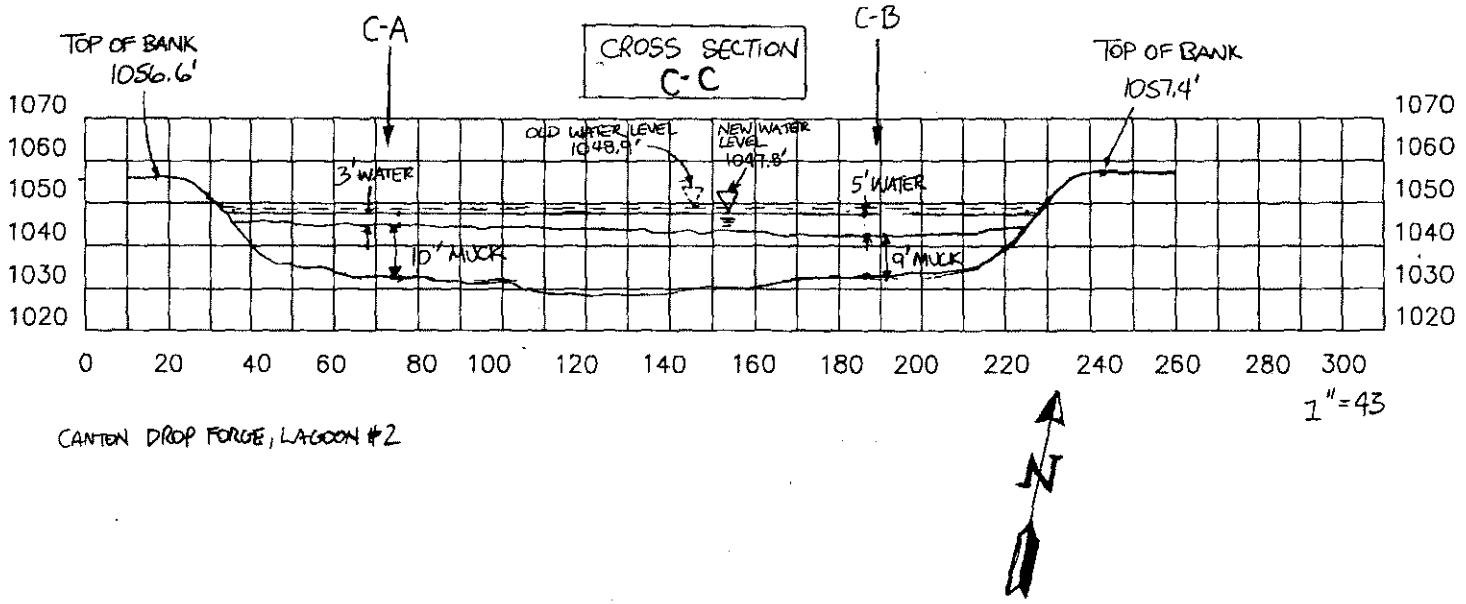
Sample # / Parameter	1	2	3	4	5	6	7	Regulatory Limit
Reactive Cyanide (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Reactive Sulfur (ppm)	<25	<25	<25	<25	<25	<25	<25	
Flash Point (°F)	>140	>140	>140	>140	100	<140	<140	
pH	7.65	7.77	7.47	7.73	7.77	5.88	5.88	
Paint Filter	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	
TPH (418.1) (ppm)	**13,981**	**13,532**	**33,204**	**14,594**	**57,536**	**31,243**	**303,459**	**380**
PCB's (ppm)	<2	<2	<2	<2	<2	<2	<2	
Cresols (ppm)	<0.02	<0.02	<0.1	<0.02	<0.1	<0.1	<0.02	200
1, 4-Dichlorobenzene	<0.02	<0.02	<0.1	<0.02	<0.1	<0.1	<0.02	7.5
2, 4-Dinitrotoluene	<0.02	<0.02	<0.1	<0.02	<0.1	<0.1	<0.02	0.13
Hexachlorobenzene	<0.02	<0.02	<0.1	<0.02	<0.1	<0.1	<0.02	0.13
Hexachloro-1, 3-butadiene	<0.02	0.50	<0.1	<0.02	<0.1	<0.1	<0.02	0.5
Nitrobenzene	<0.02	<0.02	<0.1	<0.02	<0.1	<0.1	<0.02	2
Pentachlorophenol	<0.05	<0.05	<0.25	<0.05	<0.25	<0.25	<0.05	100
Pyridine	<0.05	<0.05	<0.25	<0.05	<0.25	<0.25	<.05	5
2, 4, 5 Trichlorophenol	<0.05	<0.05	<0.25	<0.05	<0.25	<0.25	<.05	400
2, 4, 6 Trichlorophenol	<0.05	<0.05	<0.25	<0.05	<0.25	<0.25	<.05	2
Hexachloroethane	<0.02	<0.02	0.1	<0.02	<0.1	<0.1	<0.02	3
Benzene	<0.005	<0.005	<0.005	<0.02	<0.005	<0.005	<0.005	0.5
Carbon Tetrachloride	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.5
Chlorobenzene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	100
Chloroform	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	6
1, 2-Dichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.5
1, 1-Dichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.7
2-Butanone (MEK)	<0.01	<0.01	<.01	<.01	<.01	<.01	<.01	200
Tetrachloroethene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.7
Trichloroethene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.5
Vinyl Chloride	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
Lead	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	1
Chromium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Aersenic	<0.001	0.001	0.001	<0.01	<0.001	<0.001	<0.001	5
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.2
Baruim	19.0	12	<0.1	20	19	4	<0.1	100
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	1

Full Laboratory Analysis in Appendix B
Bold print in chart indicates samples exceeding regulated limits

SAMPLE#	LOCATION	DEPTH RANGE (FEET)
1	A - B	8.7 - 11.2
2	A - B	4.5 - 8.7
3	C - A	12.5 - 14.5
4	C - A	3 - 12.5
5	B - C	10.3 - 14
6	B - C	5 - 10.3







CANTON DROP FORGE, LAGOON #2

CDF012584

PARSONS ENGINEERING SCIENCE, INC.
A UNIT OF PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC

19101 Villaview Road, Suite 301 • Cleveland, Ohio 44119 • (216) 486-9005 • Fax (216) 486-6119
PARESCL/997/Dee/EJK7-37

8 September 1997

Mr. Keith Houseknecht
CANTON DROP FORGE, INC.
4575 Southway Street, SW
Canton, Ohio 44706

Reference: Summary Report of the Results of Environmental and Geotechnical Sampling, Analyses and Treatability Testing of Lagoon No. 2 Depositional Material at Canton Drop Forge, Inc.

Dear Keith:

Parsons Engineering Science Inc. (Parsons ES) is submitting this summary report, regarding the sampling, analysis and feasibility study services provided to Canton Drop Forge, Inc. (CDF) for Lagoon No. 2 depositional material, in accordance with our proposal dated 12 June 1997. This letter report is based on information collected during site visits to and a sampling event (on 9 July 1997) at CDF's plant, in several conversations with Messrs. Keith Houseknecht and Lloyd Bunnell, and on the results of environmental analyses received from Quanterra Environmental Services (Quanterra) of North Canton and the results of geotechnical analysis and treatability testing completed by Applied Construction Technologies, Inc. (ACT) of Cleveland. Copies of Quanterra's and ACT's reports of analytical results are enclosed.

SAMPLING AND ANALYSIS OF LAGOON NO. 2

Sampling and Analysis Plan

A pre-designated sampling pattern was not established for Lagoon No. 2 due to the unavailability of a scaled drawing of the lagoon. As an alternative, ten (10) sampling locations, which were designed to be representative and encompass the entire lagoon area (see Figure 1), were selected in the field.

Samples of the depositional material, i.e., sludge, from Lagoon No. 2, obtained for chemical analyses, were collected from a boat via the use of a sampling dredge. Samples were collected from approximately 0.0 feet to 0.5 feet below the surface of the sediment at each sampling location. Sample material was placed directly into laboratory-grade jars, sealed with Teflon -lined, screw-on lids, and placed on ice in a cooler for transport to a Voluntary Action Program - (VAP-) approved Certified Laboratory. The samples were transported, under chain-of custody procedures, to Quanterra Environmental Services laboratories in North Canton, Ohio for chemical analysis. Sludge samples were analyzed, following the VAP protocol for total petroleum hydrocarbons, middle range organics (TPH-MRO, by EPA Method SW 846-4015 A, modified), total petroleum hydrocarbons, heavy range organics (TPH-HRO, by EPA Method SW 846-4015 A, modified), total petroleum hydrocarbons (TPH, by EPA Method 418.1), and semi-volatile organic compounds (SVOCs, by EPA Method SW 846-8270B). Table 1 summarizes the analytical methods used for this effort.

Sludge from each sampling location was also obtained, composited and submitted for geotechnical analysis. The sampled material was transported, under chain-of-custody procedures, to Applied Construction Technologies, Inc. (ACT) in Cleveland, Ohio for treatablity testing. The composited sample material was mixed with varying amounts of line, fly ash and bentonite and subjected to the California Bearing Ratio test (ASTM D1883) to determine the relative bearing capacities of the resulting mixtures. Three treatability test runs were conducted, one each for mixtures with the following sludge, lime, fly ash and bentonite compositions:

Sludge with 25% lime, 25% fly ash, and 20% bentonite;
Sludge with 25% lime, 25% fly ash, and 30% bentonite; and
Sludge with 35% lime, 25% fly ash, and 30% bentonite.

Results of Analyses

Table 2 presents the results of laboratory chemical analysis. Table 2 summarizes the results of only those compounds which were detected during analysis. The complete analytical report, including quality assurance (QA) information, which was received from Quanterra, is included as Appendix A.

Please note that Table 2 includes values for Moisture Content, MRO, HRO, TPH (measured by EPA Method 418.1) and Pyrene. OEPA has established regulatory limits for MRO, HRO and Pyrene, among several additional analytes, under VAP for industrial use properties. These values have been indicated at the bottom of Table 2. [In this analysis, it has been assumed that CDF's property will remain in industrial use for the foreseeable future.

Results of Geotechnical Analyses

Table 3 contains the results of measurements of fluid and sludge thicknesses determined during the sampling event conducted on 9 July 1997. Assuming that the surface area of Lagoon No. 2 comprises 0.46 acres and based on the measurements made during the sampling event, approximately 5,000 cubic yards of depositional material are present in the lagoon. {Note:. The surface area was calculated based on a survey completed by Hammontree and Associates during sampling in 1995.]

Prior to conducting geotechnical analyses and treatability tests, ACT removed free water (which had separated by gravity) and determined the moisture content of the unstabilized material; the value measured was 68 percent (which is consistent with the results measured by Quanterra, averaging 69.5 percent for the ten samples collected). By incorporating the admixtures noted previously (e.g., lime, flyash and bentonite), the moisture content (reported as the fraction of moisture, by weight) was reduced to within a range from 29 percent to 38 percent. Also, as a result of adding the admixture quantities listed, the CBR was increased to within a range of 1.0 to 7.6. Appendix B contains ACT's preliminary report.

IMPLICATIONS OF ANALYTICAL RESULTS

Previous Investigations

Based on information developed for CDF during a hydrogeological site investigation conducted by R&R International, Inc. and Northcoast Drilling in December 1992, the stratigraphy underlying the CDF site may be characterized as a series of intervening layers of sand, sand and gravel and silt, silty clay or sandy silt. One boring advanced during the R&R investigation, indicated as B-5, is immediately adjacent to and between Lagoon No. 2 and Southway Street. As shown in the drilling log for B-5 (later developed as MW-5, see enclosed logs and map), at least 18 feet of the subsurface soils to the water table [e.g., 27.5 feet below ground surface (bgs)] were identified as silt, silty clay or sandy silt. This information is consistent with the use of the value for medium permeability when selecting the applicable regulatory limits for TPH concentrations in soil. Refer to Table 4, which indicates the VAP limits for TPH by organic fraction for different types of soils.

Additionally, RCRA characterization sampling and analysis, conducted during 1995, has demonstrated that the depositional material contained in Lagoon No. 2 is non-hazardous. The only issues of potential concern identified at the time were the concentration of TPH, detected as EPA Method 418.1 ranging from 13,500 to over 300,000 mg/kg, and Paint Filter test, i.e., stability of the material for landfill placement (although the disposal of Lagoon No. 2 depositional material is not intended for landfill placement, a similar requirement would apply for reuse of the material as fill on CDF's property).

Regulatory Implications

The impact of the preceding information, with respect to application of the Ohio Environmental Protection Agency's (OEPA's) Voluntary Action Program (VAP) rules, is as follows. As indicated previously, the action levels for petroleum hydrocarbons, as indicated in Table 4, depend on the type and hydraulic conductivity of soil underlying and in the immediate vicinity of Lagoon No. 2 and the fraction of hydrocarbons present. Based on the soil stratigraphy information obtained from the B-5 boring log and the results of chemical analysis obtained, under affidavit from Quanterra, the applicable regulatory limit for TPH-HRO (i.e., petroleum hydrocarbons in the range from C_{16} through C_{32}) is 20,000 mg/kg. As indicated in Table 2, one sample (e.g., #7, obtained from a location near the pump-house end of Lagoon No. 2) exceeded this level for TPH-HRO, with a result of 37,000 mg/kg.

Nevertheless, based on these findings and subsequent discussions with OEPA (on a non-disclosure basis), Parsons ES recommends that CDF consider using the results obtained to-date and that no new environmental sampling be conducted. Additionally, based on OEPA's non-binding review of the situation, a modeling or simple risk assessment exercise should be sufficient (when CDF is ready) to seek closure of Lagoon No. 2. The simple modeling or risk assessment effort would be used to demonstrate that the compounds of concern, i.e., TPH-HRO, are unlikely to impact groundwater quality in the area around Lagoon No. 2. Further discussions, with appropriate staff within OEPA, concerning the details of the appropriate approach and interpretation of regulatory limits, are required to finalize the requirements for this effort. It is not believed, however, based on discussions to-date that the required effort will be substantial or onerous, should CDF decide to pursue a VAP closure for this area. Since there is little precedence for this approach to closure under

VAP, it is suggested that, when the timing is appropriate but before initiating closure activities, CDF should meet with OEPA and discuss these requirements in detail. Based on recent discussions with OEPA, Parsons ES can arrange such a meeting for CDF on a non-binding and no-fee basis (i.e., without incurring any obligations or fees from OEPA).

FEASIBILITY ANALYSIS

Treatability Testing Results

Treatability test results indicate that the Lagoon No. 2 depositional material can be stabilized; refer to the preliminary draft report from ACT. Based on the testing completed by ACT, admixture ratios, by weight, of at least 25 percent lime, 25 percent fly ash and 30 percent bentonite are required to achieve a minimally stable (e.g., compatible) material, i.e., with a California Bearing Ratio (CBR), as measured by ASTM Method D-1883, of about 5.

Unfortunately, this approach has at least two draw-backs: first, due to the large amount of admixture required, the cost for implementation will be considerable, approaching $125 per cubic yard. Additionally, due to the volume of admixture materials required for stabilization, the resultant soil mixture will at least double the volume of the Lagoon No. 2 sludge. Consequently, in-place handling and placement of the stabilized material is not a practical option. In fact, it is conceivable that, if all stabilized material is emplaced in Lagoon No. 2, it will more than completely fill the lagoon depression, creating instead a mound in the place of Lagoon No. 2.

Alternative Approaches Considered

As indicated previously, the environmental and geotechnical nature of the Lagoon No. 2 depositional material makes it difficult to handle, stabilize and compact. With respect to removal and stabilization, the moisture content of the material is sufficiently high (ranging from 61 to 75 percent) to warrant consideration of special handling procedures. Also the relatively high levels of TPH-HRO, measured as C_{16} through C_{32}, and TPH, measured by EPA Method 418.1, detected in the samples recently collected by Parsons ES, poses additional handling concerns.

In reviewing the results of the environmental and geotechnical analyses and treatability testing summarized above, Parsons ES identified four possible courses of action. These approaches, and the relative merits of each, are presented below.

A) Remove, treat and handle the entire volume of depositional material as a liquid;

B) Remove, de-water, stabilize in the bio-cell area and dispose of all depositional material, into and/or in areas surrounding Lagoon No. 2 and/or off-site (in the American Landfill in Waynesburg), as necessary (due to volume and space constraints); and

C) Remove and dispose highly fluid material, most likely comprising the top 1.5 feet of depositional material; stabilize balance for in-place or on-site disposal. A variation of this approach, in which the top highly fluid material is pumped to the biocell for stabilization, is also considered.

D) Remove, stabilize only to the degree required for transportation and landfill disposal, and then transport to and dispose at American Landfill.

- **Option A**
  Preliminary cost estimates for Option A (i.e., handling the entire volume as a liquid) have been obtained from Research Oil in Cleveland. Assuming a total volume of about 5,000 cubic yards of depositional material, with an average solids content of 20 percent, the rough cost estimate for this approach would be about $630,000 to $700,000. [Please note that this estimate (and the other estimates in this report) is for handling the depositional material only. Costs for free-phase oil and water removal from Lagoon No. 2, design and construction of temporary and permanent bypass facilities for drainage of process and storm water around Lagoon No. 2, and re-construction of Lagoon No. 2 are not included in these estimates.]

  An additional concern with this approach is that unstable materials (with TPH-HRO levels potentially in excess of VAP standards) would be transported from CDF's property to another site. If treatment and/or handling of this material is demonstrated to be unsatisfactory in the future, CDF could become a potentially responsible party (PRP) for the affected site.

- **Option B**
  With respect to Option B, the projected costs for this effort, based on work completed to-date at CDF (i.e., in dealing with similar material in Lagoon No. 1), would be about $450,000 to $510,000. The advantages of implementing this option are that CDF has experienced similar activities previously in removing and drying depositional materials from Lagoon No. 2 and that, once dried, the material appears to be reasonably workable, potentially reducing the costs for and volumes generated by stabilization substantially. Additionally, a portion of the stabilized material would be used in the re-construction of Lagoon No. 2, as currently being done in Lagoon No. 1. Not all of the material can be placed in Lagoon No. 2, however, without creating a capacity problem in the lagoon. Thus, a portion (about 50%) would be used to create berms around Lagoon No. 2 or would be transported to American Landfill.

  The primary disadvantage is that the biocell area would once again be occupied and unusable for other purposes for a period of several months. Also, due to the larger volume of material expected to be removed from Lagoon No. 2 (in comparison with that removed from Lagoon No. 1), a larger (at least 50%) biocell area would be required or the process would need to be completed in phases. It is envisaged that, once removed, the Lagoon No. 2 material would remain in the biocell for at least the period through Spring 1998 (or through Spring 1999, if two phases were required). During this period, the depositional material would be exposed to about 100 freeze-thaw cycles (during the winter months) and the other natural forces of the elements, reducing the oil/water/solids matrix into the principal constituents, including the release of bound water.

STRIKE TO MOW OR DRIVE OVER
NO LEACHING CONCERN?
NO COVER ON BERM

- **Option C**
  Option C is a hybrid approach, wherein the most difficult materials (i.e., those with the highest moisture and possibly highest TPH-HRO contents) would be initially removed and treated for disposal as a fluid, say, by Research Oil; the balance of the material would then be stabilized in place for reuse as part of the lagoon lining and for placement within other areas of the CDF property. The preliminary cost estimate for this approach, assuming that only the top 1.5 feet of sludge (which was reported as the most fluid by Parsons ES' sampling personnel and by Beaver Excavating when Lagoon No. 1 was cleaned) would be required to be handled and treated as a fluid, would be $460,000 to $520,000.

  The advantages and disadvantages of this approach are that the bio-cell would not be occupied for several months but a portion of the materials would be transported off-site, creating future, potential liabilities for CDF.

- **Option C1**
  Option C1 is another hybrid approach, in which the most fluid portion (top 1.5 feet) of material would be pumped by turbo-vacuum into the biocell. The remaining, more dense depositional material would then be treated in place through the addition of admixtures. Approximately one-half of the stabilized material would be removed and placed in berms around or near Lagoon No. 2. The material stockpiled in the biocell would be weathered for several months (including one winter) then stabilized and, likewise placed in berms around Lagoon No. 2 (or hauled off-site for disposal at American Landfill). The estimated cost for Option C1 would be about $320,000 to $370,000.

  Besides the potential cost savings, the advantages of Option C1 would be similar to those for Option C. Additionally, through weathering of the depositional material, the volume of admixture required for stabilization would be reduced, reducing the volume of excess stabilized material which must be handled.

- **Option D**
  Option D includes stabilization of the depositional material, only to the degree required for transportation for off-site disposal, and then disposed, as a non-hazardous waste, in a landfill (American Landfill). The preliminary costs for this approach would be $520,000 to $580,000. As presented previously (pertaining to Lagoon No. 1), the disadvantages would probably offset the advantages when future, potential liabilities are considered.

Additional Activities Recommended

Prior to CDF making any decision, it is recommended that some additional sampling and treatability testing be conducted. Parsons ES, through work on other projects, has identified a contractor (Four Seasons) with a treatability laboratory specializing in handling similar materials from oil refineries and production activities throughout the Gulf Coast. Based on our discussions on 5 September 1997, about 10 gallons of material have been collected from representative sampling locations within Lagoon No. 2 and shipped to Four Seasons for further treatability testing. Although the cost to CDF for this activity is expected to be minimal (i.e., less than $500), a period of about 4-6 weeks will be required for the treatability testing and reporting of results.

Additionally, it is recommended that contact with OEPA (on a non-binding and non-disclosure basis) be made, via telephone conference, to discuss the modeling and/or risk assessment procedures required for addressing the one sample result which exceeded VAP limits for TPH-HRO. We expect that the cost for this activity, including OEPA charges, if any, will not exceed $2,000.

Finally, a complete design package and detailed cost estimate (for depositional material handling, treatment and placement/disposal, Lagoon No. 2 re-construction and temporary/permanent pretreatment and bypass facilities) should be developed prior to initiating implementation of any of these approaches. Parsons ES estimates that the effort and resulting costs for completing these deliverables will be about 250 hours and $20,000. Parsons ES is prepared to develop a comprehensive proposal and definitive cost estimate for these services, if requested.

RECOMMENDED OPTION

Based on the preceding analysis and consideration of the approaches identified, Parsons ES recommends that CDF implement Option C1, with an estimated cost range of $320,000 to $370,000. Additionally, we recommend completion of the incremental treatability testing, contact with OEPA regarding modeling and/or risk assessment procedures, and design package.

Option C1 is recommended because it takes advantage of the natural processes of weathering to break-down and de-hydrate the most fluid portion of the depositional material. This approach requires a reduced volume of admixture for stabilization and, hence, a lower overall cost for stabilization, handling and placement of the material.

For further information regarding the contents of this report, please contact Ed Karkalik or Richard Volpi (for analytical information) by telephone at (216) 486-9005 or by facsimile at (216) 486-6119. We look forward to providing continued support to Canton Drop Forge in fulfilling CDF's environmental services requirements.

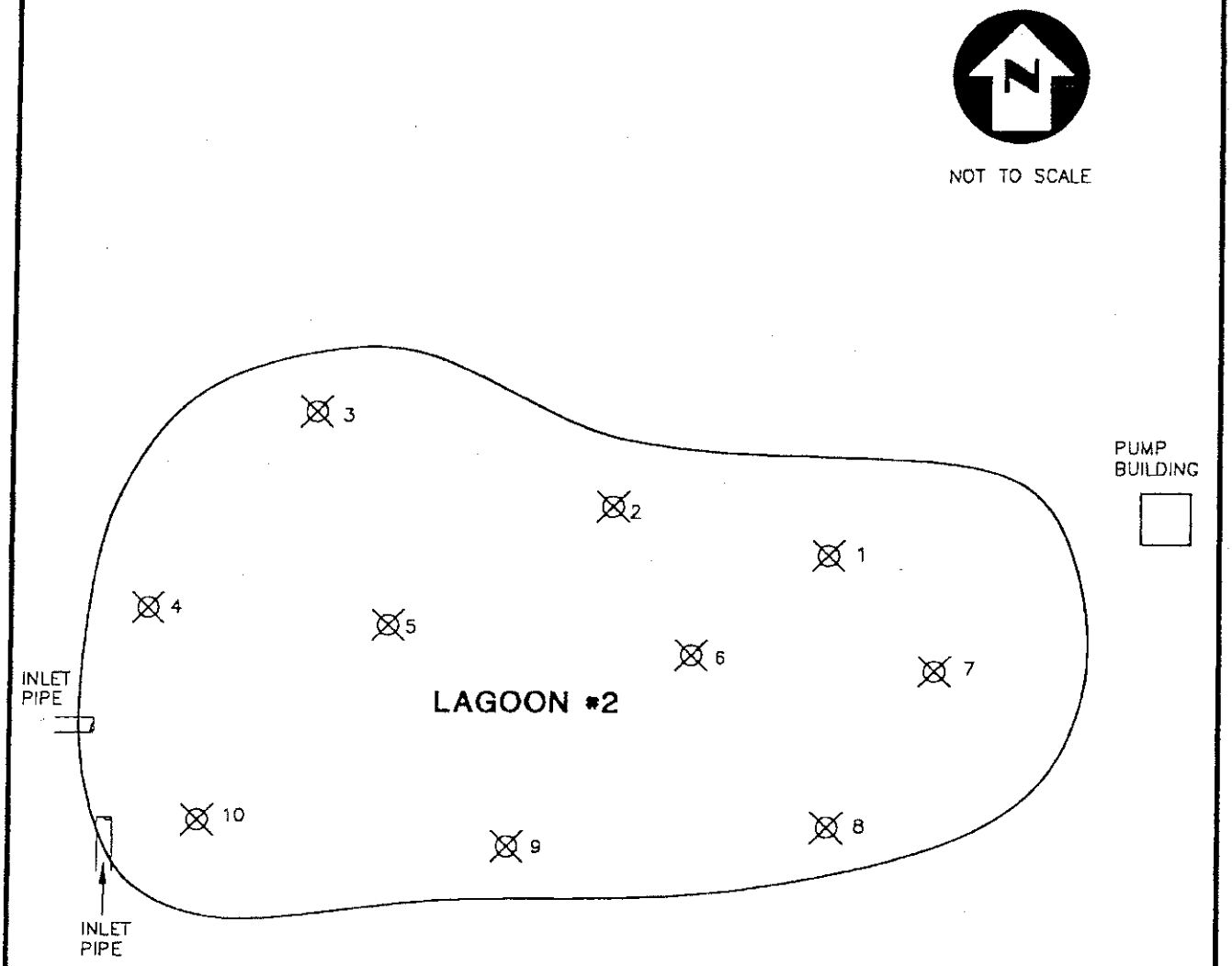
Very truly yours,

PARSONS ENGINEERING SCIENCE, INC.

Edward J. Karkalik, PE
Project Manager

EJK/dee
cc: File 731397.04000
Mr. Richard Volpi, CPG
Mr. Alan Resnik, CP
Mr. Gordon Melle, PE

FIGURE 1



LEGEND:

⊗ SLUDGE SAMPLE LOCATION

6 SAMPLE NUMBER

SLUDGE SAMPLING LOCATIONS
LAGOON #2
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

31397C01

PARSONS ENGINEERING SCIENCE, INC.

731397.04000

CDF012592

TABLE 2

RESULTS OF LABORATORY ANALYSIS - SLUDGE
LAGOON #2
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

9 July 1997

Sample ID	Moisture Content (%)	Middle Range Organics (mg/kg)	Heavy Range Organics (mg/kg)	TPH-418.1 (mg/kg)	Pyrene (mg/kg)
Lagoon Sample #1	67	<1,500	15,000	12,000	<20
Lagoon Sample #2	70	<1,600	8,700	12,000	<22
Lagoon Sample #3	72	<2,400	15,000	7,200	<12
Lagoon Sample #4	75	<1,200	12,000	5,000	1.7
Lagoon Sample #5	74	<1,900	4,600	4,700	<13
Lagoon Sample #6	74	<1,900	16,000	3,100	<1.3
Lagoon Sample #7	62	<4,400	37,000	59,000	<18
Lagoon Sample #8	67	<3,000	11,000	14,000	<33
Lagoon Sample #9	73	<1,800	12,000	5,700	<1.2
Lagoon Sample #10	61	<1,300	7,000	16,000	<5.7
VAP Limits for Industrial Use Properties	NA	See Table 4	See Table 4	NA	8,900

NA - Not applicable.

TABLE 3

ESTIMATED FLUID AND SLUDGE THICKNESS
LAGOON #2
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

9 July 1997

Sampling Location	Approximate Thickness of Fluid (feet)	Approximate Thickness of Sludge (feet)	Approximate Depth to Native Material (feet)
Lagoon Sample #1	7.5	6.5	14
Lagoon Sample #2	7	4	11
Lagoon Sample #3	7	6	13
Lagoon Sample #4	7	8	15
Lagoon Sample #5	7	5	12
Lagoon Sample #6	7	8	15
Lagoon Sample #7	7	6	13
Lagoon Sample #8	6	7	13
Lagoon Sample #9	7	6	13
Lagoon Sample #10	3	10	13
Average	6.55	6.65	13.2

TABLE 4

OHIO EPA'S VOLUNTARY ACTION PROGRAM

DIRECT CONTACT SOIL STANDARDS FOR PETROLEUM HYDROCARBONS (mg/Kg)

Petroleum Hydrocarbon Fraction	Soil Type and Hydraulic Conductivity		
	Sand and Gravel ($>10^{-4}$ cm/s)	Silty/Clayey Sand (10^{-4} to 10^{-5} cm/s)	Silty Clay ($>10^{-5}$ cm/s)
Light Range Organics (C_4 - C_7)	1,000	5,000	8,000
Middle Range Organics (C_7 - C_{16})	2,000	10,000	20,000
Heavy Range Organics (C_{16} - C_{32})	5,000	20,000	40,000

99 APR 29 AM 10:03

FLYNN ENVIRONMENTAL, INC.

401 CLARENDON AVENUE N.W. • CANTON, OH 44708 • 330-452-9409 • FAX 330-452-3508

Underground Storage Tank
Closure Assessment
of
Canton Drop Forge
4575 Southway Street, S.W.
Canton, Ohio
Stark County

Underground Storage Tank
Closure Assessment
of
Canton Drop Forge
4575 Southway Street, S.W.
Canton, Ohio
Stark County

BUSTR Incident #7600833-01
BUSTR Facility #760606

Flynn Project # 99-028

Prepared for:

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Tank Abandonment Date:
February 23, 1999

Soil Sampling Date:
November 25, 1998

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Appendix E	Waste Disposal Documentation
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The owner is responsible for forwarding one copy of this report as soon as possible to:

The Ohio State Fire Marshal
BUSTR
ATTENTION: UST Closure Specialist
PO Box 687
Reynoldsburg, Ohio 43068-0687

The UST owner, or responsible party, as required by the Environmental Protection Agency Rule #40 CFR, Part 280-74, must keep a copy of this document and other pertinent records, such as:

- The 30 day letter to the State Fire Marshal's Office, BUSTR;
- The permit from the local or state fire officials;
- The closure assessment report;
- Records indicating the methods of disposal and locations of disposal for tanks, soil, liquids, sludges and other contaminated waste materials generated during closure.

1 INTRODUCTION

Flynn Environmental, Inc., performed an underground storage tank (UST) closure assessment at Canton Drop Forge located at 4575 Southway Street, S.W., Canton, Stark County, Ohio. One (1) UST system was permanently abandoned at the site on February 23, 1999. The closure assessment was conducted in accordance with Ohio Administrative Code (OAC) 1301:7-9-12(K).

2 LIST OF REPRESENTATIVES

The owner and operator of the UST at this location is Canton Drop Forge, P.O. Box 6902, 4575 Southway Street, S.W., Canton, Ohio 44706, contact: Mr. Keith Houseknecht, telephone (330) 477-4511.

The local fire department with jurisdiction of the site is the Canton Township Fire Department, 202 49th Street, S.E., Canton, Ohio 44707, telephone (330) 484-6165.

The certified UST inspector on-site during the UST abandonment activities was Mr. Randal Heck, Ohio CUSTI #97-0065, 6981 Baymere S.W., Navarre, Ohio 44662, telephone (330) 588-8378.

The general contractor overseeing the project was Mr. K.C. Flynn with Flynn Environmental, Inc., 401 Clarendon Avenue, N.W., Canton, Ohio 44708, telephone (330) 452-9409.

The drilling contractor who installed the soil borings was Mr. James Bucksar with Bucksar Environmental Drilling Company, 5236 18th Street, S.W., Canton, Ohio 44706, telephone (330) 477-1878.

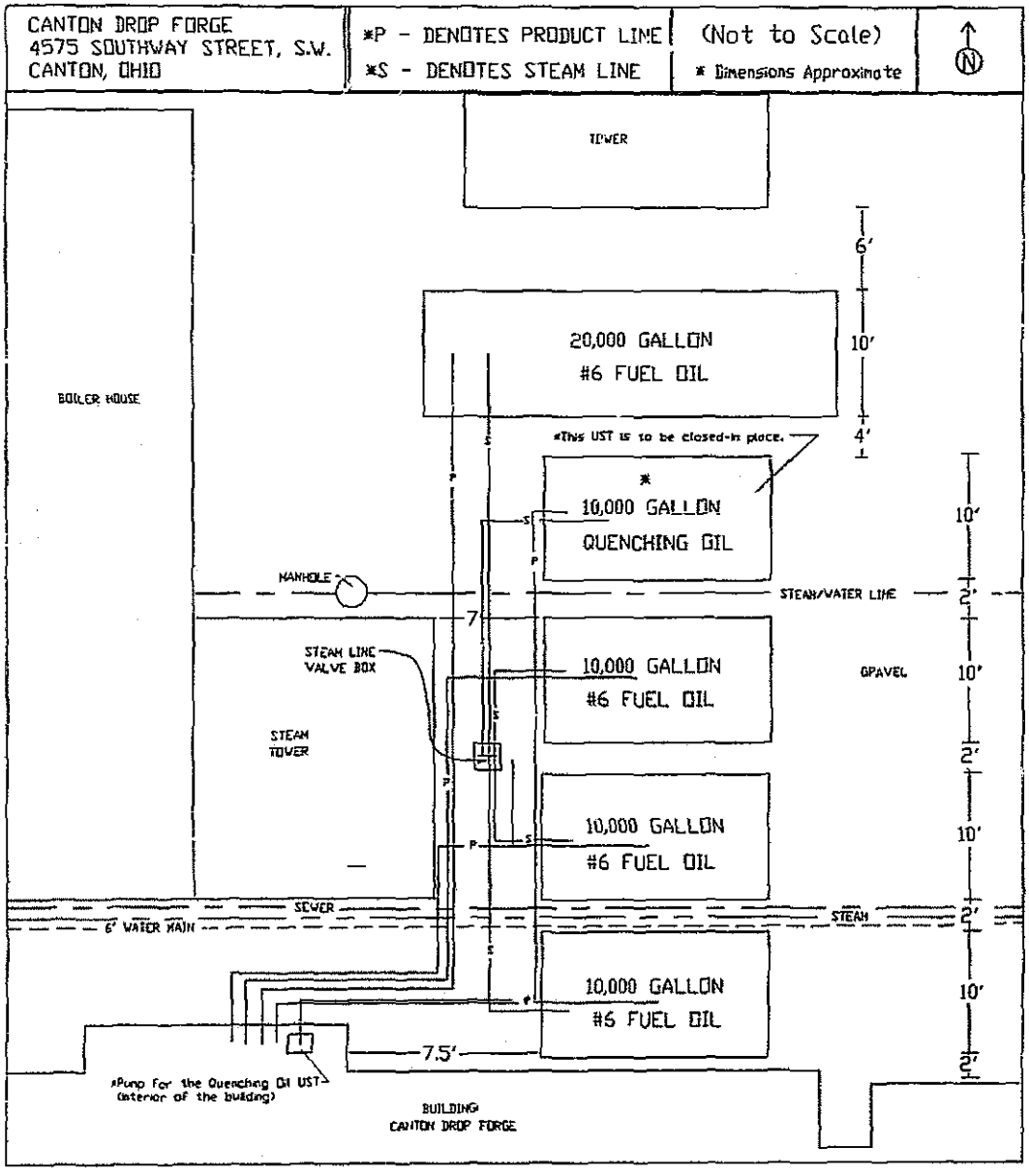
The certified UST installer on-site during the UST abandonment activities was Mr. Brian Stonemetz, Ohio Certified UST Installer ID #10-96-2711, with Flynn Environmental.

3 SITE DESCRIPTION

The site consists of the Canton Drop Forge manufacturing facility located on the north side of Southway Street in Canton, Ohio. A large manufacturing plant is located at the site. The site is located in a mixed commercial and industrial area. The site and surrounding properties are serviced by municipal water and sanitary sewer systems. Figure 1 is a general sketch of the section of the site where the USTs are located.

Five (5) UST systems were present at the site. Four (4) of the UST systems are used to contain heating oil for on-site consumptive use. The fifth UST, which was abandoned and is the subject of this report, was used to contain quenching oil used in the manufacturing process. All five (5) USTs were located to the east of the boiler house (see Figure 1).

FIGURE 1: GENERAL SITE SKETCH



4 SITE FEATURE SCORING SYSTEM

Based on the Site Feature Scoring System (SFSS) established by the Ohio State Fire Marshal, Bureau of Underground Storage Tank Regulations (BUSTR) in OAC 1301:7-9-13(E), the site falls into Category Three. Category Three action levels for petroleum constituents in soil are listed in Table 1 of this report. Soil containing concentrations of petroleum constituents above these action levels will be considered to be contaminated. A completed SFSS form is included in Appendix A. A SFSS justification/discussion is also presented in Appendix A.

5 PROJECT BACKGROUND

According to information provided by Mr. Keith Houseknecht, the UST which was abandoned was installed approximately thirty (30) years ago, and was last used in November, 1998. This UST was used to store quenching oil for use in the facility's manufacturing processes. The Material Safety Data Sheet (MSDS) for the quenching oil is included in Appendix F. The other four (4) USTs at the site are used to contain heating oil for on-site consumptive use. Therefore, these USTs are not regulated. Due to the proximity of the quenching oil UST to the other UST systems, it was determined that the UST should be abandoned in-place in lieu of removal. After a site inspection, BUSTR granted permission for the in-place abandonment (see Appendix C).

As part of the closure activities, Canton Drop Forge contracted with Flynn Environmental to conduct a UST closure assessment as required by OAC 1301:7-9-12.

6 VISUAL SITE EVALUATION

A visual site evaluation was performed prior to the abandonment of the UST system. There was not evidence of past or present operational problems such as surface soil staining, concrete or asphalt staining, or evidence of concrete patchwork. In addition, there were no signs of other potential sources of contamination at the site, with the exceptions of the four (4) heating oil USTs discussed in section 3 of this report.

7 DESCRIPTION OF UST SYSTEM

The UST which was abandoned was a ten thousand (10,000) gallon steel tank which was used to store quenching oil. Based on an inspection of the interior of the tank, the tank was in good condition; no holes or failure points were discovered in the tank.

The product piping associated with the quenching oil UST extended across the ends of three (3) other UST systems. The product piping then entered the building. Due to the proximity of other product piping and underground utilities, the product piping was abandoned in-place.

STICS OF SOIL/SUBSURFACE CONI

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nixture of clay and silty sand. The soil sa
bit any obvious signs of petroleum contar
oil borings.

NG ACTIVITIES

OAC 1301:7-9-12(K), soil samples were
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ıber 25, 1998. The samples were collect
the quenching oil UST.

ımentation

Location
Adjacent to the western end of the U 15'-17" below grade.
Adjacent to the eastern end of the U 15'-17" below grade.

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Collecting Samples

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ın was witnessed by Mr. James Bucksa

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The product piping associated with the quenching oil UST extended across the ends of three (3) other UST systems. The product piping then entered the building. Due to the proximity of other product piping and underground utilities, the product piping was abandoned in-place.

CDF012603

8 CHARACTERISTICS OF SOIL/SUBSURFACE CONDITIONS

The soil at the site as encountered in the soil borings installed near the ends of the quenching oil UST consisted of a mixture of clay and silty sand. The soil samples collected from the soil borings did not exhibit any obvious signs of petroleum contamination. Groundwater was not encountered in the soil borings.

9 SOIL SAMPLING ACTIVITIES

In accordance with OAC 1301:7-9-12(K), soil samples were collected at the site during the UST closure. Figure 2 shows the locations of each sample collection point. All samples were collected on November 25, 1998. The samples were collected from two (2) soil borings installed next to the ends of the quenching oil UST.

9.1 Sample Documentation

Sample #	Location	PID Reading (ppm)	Time
B-1	Adjacent to the western end of the UST, 15'-17" below grade.	0	9:40
B-2	Adjacent to the eastern end of the UST, 15'-17" below grade.	0	10:40

Note: Soil samples could not be collected from the product line area due to the presence of other USTs, product piping, and utilities which are still in operation.

9.2 Personnel Collecting Samples

All samples were collected by Mr. Gary Kotila with Flynn Environmental, Inc., who is trained and experienced in the sampling and record keeping techniques required by the State of Ohio. Sample collection was witnessed by Mr. James Bucksar with the Bucksar Environmental Drilling Company.

9.3 Sample Collection and Preservation Methods

Soil samples were collected from soil borings installed at each end of the UST. A drill rig was used to advance 8 1/4-inch augers to a depth of fifteen feet (15') below grade (depth of the bottom of the UST). A two-inch (2") outside diameter by two-foot (2') long split-spoon sampler was then advanced into the soil to collect a soil sample from the fifteen foot to seventeen foot (15'-17') interval. Care was taken to decontaminate all sampling equipment prior to sample collection by washing with an Alconox®/water solution and rinsing with distilled water.

Each soil sample collected was immediately split into two (2) parts; one (1) was packaged for field screening and the other for potential laboratory analysis. The samples used for field screening were placed into clean zip-lock plastic bags and immediately sealed. The other samples collected for potential laboratory analysis were immediately sealed in two hundred fifty (250) milliliter non-reactive glass containers with Teflon® lids. The sample containers were appropriately labeled at the site and immediately placed on ice in a cooler or refrigerated at 4 degrees Centigrade (or 40 degrees Fahrenheit) until relinquished to the laboratory.

9.4 Field Screening Instrument and Procedures

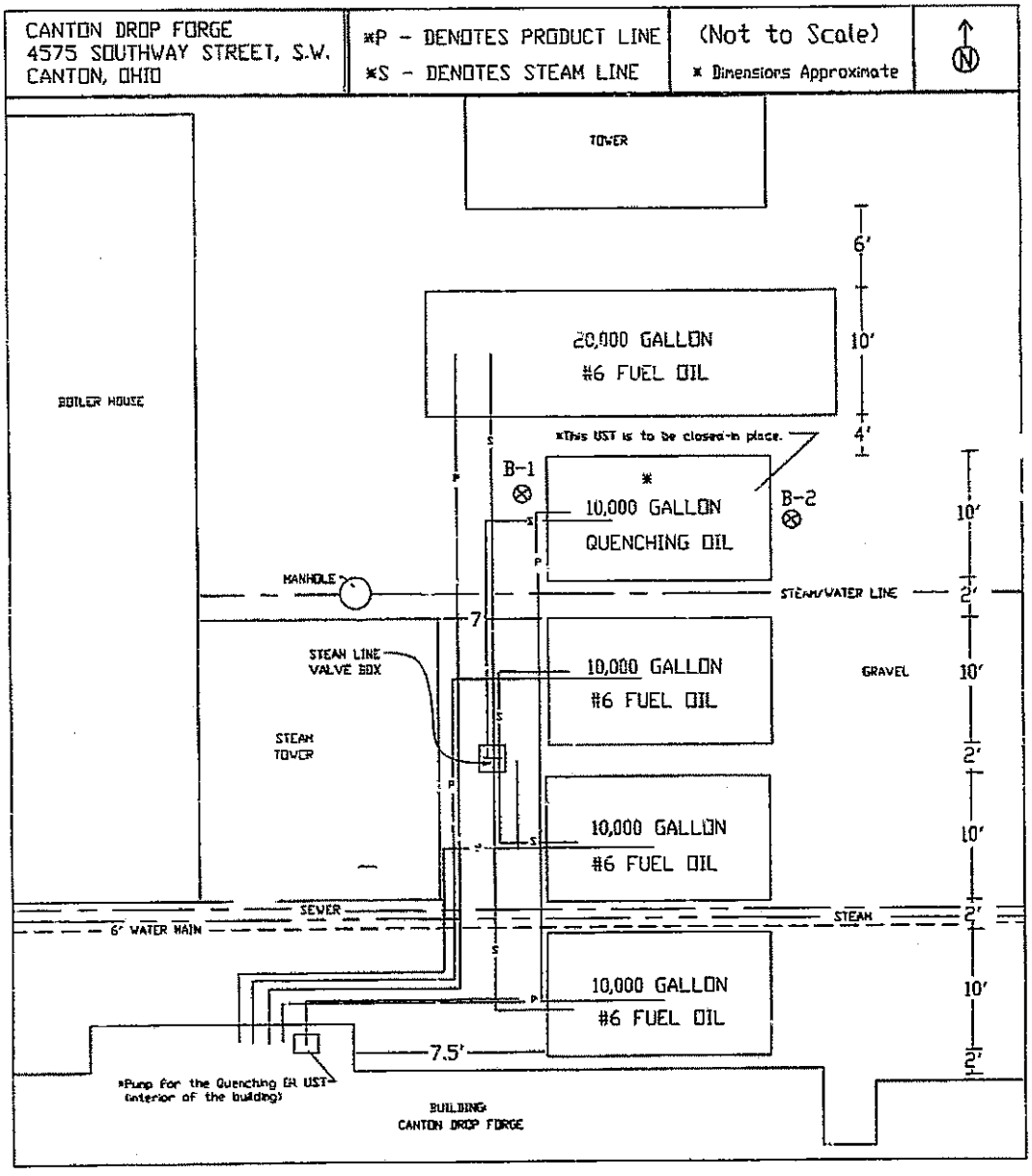
Field screening was conducted using the head space sampling technique with a photoionization detector (PID). The PID used was manufactured by Thermo Environmental Instruments, Inc., Model 580B OVM with a 10.2 EV lamp, Serial #580B-31544-289. This PID was calibrated using an isobutylene span gas with a known concentration of 100 parts per million (ppm) on November 25, 1998. The soil samples collected for field screening were allowed to reach room temperature (~70 degrees Fahrenheit) prior to taking the PID reading. The PID results for all of the soil samples are shown in Section 9.1.

9.5 Samples Submitted for Laboratory Analysis

Based on the PID results, and in accordance with OAC 1301:7-9-12(K), soil samples B-1(15'-17') and B-2(15'-17') were submitted for laboratory analysis. Both samples were analyzed for Total Petroleum Hydrocarbons (TPH method 418.1) and Polynuclear Aromatic Hydrocarbons (PAHs method 8100).

The temperature of the sample containers was kept at 4 degrees C until submittal to the laboratory. A Chain-of-Custody record was completed by the person collecting the samples, and was signed by the individual relinquishing and receiving the samples each time the samples changed hands until the samples reached the laboratory.

FIGURE 2: SAMPLE LOCATION MAP



10 ANALYTICAL RESULTS

The analytical results for the soil samples collected during the closure assessment are summarized in Table 1. A copy of the laboratory report is included in Appendix B. Figure 3 (Soil Analysis Map) shows the analytical results displayed at the sample collection points.

Sample B-1, collected from the west side of the tank at a depth of 15' to 17' below grade, and sample B-2, collected from the east side of the tank at a depth of 15' to 17' below grade, were both found to contain a TPH (method 418.1) concentration below the site action level for this parameter. No PAH constituents were detected in either sample.

11 UST ABANDONMENT PROCEDURES

The UST was cleaned of all residual liquids and sludges. Approximately fifty (50) tons of #9 gravel (pea gravel) were then placed into the UST. Concrete slurry was then poured into the tank to complete the filling of the UST system with inert material.

12 SUMMARY AND RECOMMENDATIONS

One (1) UST system formerly used to store quenching oil was permanently abandoned at the site. A UST closure assessment as required by OAC 1301:7-9-12(K) was conducted. Soil samples were collected from near the bottoms of each end of the tank on November 25, 1998, and submitted for laboratory analysis. These samples were collected using a drill rig.

The analytical results for both soil samples submitted for analysis were below the site action level for TPH (method 418.1) and non-detectable for PAHs (method 8100). Based on these analytical results, the soil at the location of the UST does not contain concentrations of petroleum constituents above the site action levels. Therefore, no further investigatory or remedial activities are warranted.

A copy of this closure assessment should be submitted to BUSTR for their review. BUSTR should then grant a "No Further Action" status regarding the UST closure.

CDF012607

TABLE 1: SOIL ANALYTICAL RESULTS

SAMPLE	[illegible]	[illegible]
Category Three Action Levels Soil	*904*	-
B-1 (15'-17')	431	*
B-2 (15'-17')	38	*

Notes: (*) The complete analytical report is included in Appendix B.
All concentrations are in parts per million (ppm).

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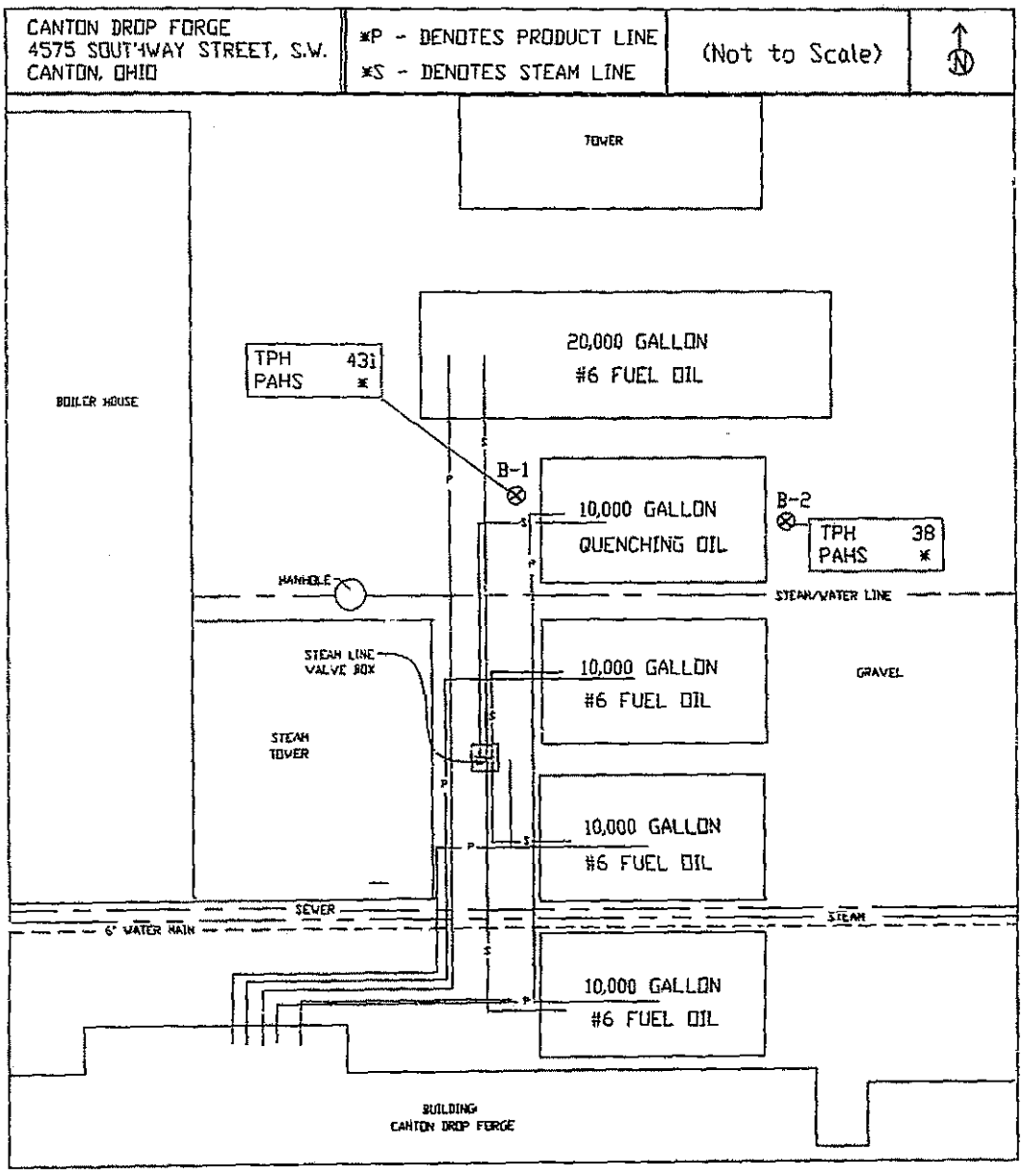
FIGURE 3: SOIL ANALYSIS MAP



APPENDIX A

SITE FEATURE SCORING SYSTEM DOCUMENTATION

CLOSURE FORM (PART II)
SITE FEATURE SCORING SYSTEM (SFSS) CHART

SITE FEATURES	COLUMN A		COLUMN B		COLUMN C		COLUMN D	
	SCORE 20	ENTER SCORE	SCORE 15	ENTER SCORE	SCORE 10	ENTER SCORE	SCORE 5	ENTER SCORE
1. DISTANCE OF UST SYSTEM FROM CLOSEST POTABLE WATER SUPPLY SOURCE CURRENTLY IN USE IS:	>1000 FT	20	300-1000 FT		<300 FT		INSIDE OF DESIGNATED SENSITIVE AREA	
2. DEPTH TO GROUND WATER IS:	>50 FT		31-50 FT		15-30 FT OR UNKNOWN	10	<15 FT	
3 PREDOMINANT SOIL TYPE OF SUBSTRATUM IS:	CLAY OR SHALE		SILT OR CLAYEY SANDS OR FINE SANDSTONE		SILTY SAND OR FINE SAND, UNKNOWN, OR SANDSTONE	10	CLEAN SAND, GRAVEL, OR CONGLOMERATE	
4 NATURAL AND/OR MAN-MADE CONDUITS OR RECEPTORS ARE: (COMPLETE WORKSHEET BELOW)	<8 POINTS		8-10 POINTS	15	11-13 POINTS		>13 POINTS	
ADD SUBTOTALS.		20	+	15	+	20	+	
							TOTAL SCORE	55

SITE FEATURE 4 WORKSHEET:

BASEMENT OR SUBSURFACE FOUNDATIONS WITHIN 100 FEET OF UST SYSTEM	4 POINTS 4
STORM SEWER WITHIN 50 FEET OF UST SYSTEM	4 POINTS ___
SANITARY SEWER WITHIN 50 FEET OF UST SYSTEM	4 POINTS 4
SEPTIC SYSTEM LEACH FIELD WITHIN 50 FEET OF UST SYSTEM	2 POINTS ___
WATER LINE MAIN WITHIN 50 FEET OF UST SYSTEM	1 POINT 1
NATURAL GAS LINE MAIN WITHIN 50 FEET OF UST SYSTEM	1 POINT ___
BEDROCK AREA PRONE TO DISSOLUTION ALONG JOINTS OF FRACTURES WITHIN 100 FEET OF UST SYSTEM	1 POINT ___
FAULTS OR KNOWN FRACTURES WITHIN 100 FEET OF UST SYSTEM	1 POINT ___
BURIED TELEPHONE/TELEVISION CABLE MAIN WITHIN 50 FEET OF UST SYSTEM	1 POINT ___
BURIED ELECTRICAL CABLE MAIN WITHIN 50 FEET OF UST SYSTEM	1 POINT ___
	TOTAL POINTS 9

IF TOTAL POINTS FROM SITE FEATURE 4 WORKSHEET ARE:

<8, ENTER SCORE OF 20 IN COLUMN A OF SITE FEATURE 4 IN SFSS CHART
8-10, ENTER SCORE OF 15 IN COLUMN B OF SITE FEATURE 4 IN SFSS CHART
11-13, ENTER SCORE OF 10 IN COLUMN C OF SITE FEATURE 4 IN SFSS CHART
>13, ENTER SCORE OF 5 IN COLUMN D OF SITE FEATURE 4 IN SFSS CHART

NOTE: AFTER COMPLETING SFSS CHART (ABOVE), COMPARE THAT SCORE WITH TOTAL SCORES IN ACTION LEVEL TABLE (BELOW) TO DETERMINE ACTION LEVELS FOR UST SITE.

SFSS ACTION LEVELS TABLE (PPM)

CONSTITUENT	CATEGORY 1	CATEGORY 2	CATEGORY 3*	CATEGORY 4
TOTAL SCORE	<31	31-50	51-70	>71
SOIL BTEX	.006/4/6/28	.170/7/10/47	.335/9/14/67	.300/12/18/85
GROUNDWATER BTEX	.005/1/.700/10	.005/1/.700/10	.005/1/.700/10	.005/1/.700/10
SOIL TPH (GASOLINE)	105	300	450	600
SOIL TPH (OTHERS)	380	642	904	1156

SITE FEATURE SCORING SYSTEM JUSTIFICATION

1. **Distance from closest potable water supply source**

   The closest potable water supply source is greater than one thousand feet (>1,000') from the UST system. The site and surrounding areas are serviced by a municipal water system.

2. **Depth to groundwater**

   The average depth to groundwater in unknown.

3. **Predominant Soil Type**

   The predominant soil type at the site is silty sand.

4. **Natural and/or Man-made Conduits**

   a. There is a subsurface foundation within one hundred feet (100') of the UST system.

   b. There is not a storm sewer within fifty feet (50') of the UST system.

   c. There is a sanitary sewer within fifty feet (50') of the UST system.

   d. There is not a septic system leach field within fifty feet (50') of the UST system.

   e. There is a water line main within fifty feet (50') of the UST system.

   f. There is not a natural gas line main within fifty feet (50') of the UST system.

   g. There are no known bedrock areas prone to dissolution along joints or fractures within one hundred feet (100') of the UST system.

   h. There are no faults or known fractures within one hundred feet (100') of the UST system.

   I. There are no buried telephone cables within fifty feet (50') of the UST system.

   j. There is not a buried electrical cable main within fifty feet (50') of the UST system.

APPENDIX B

ANALYTICAL RESULTS

Summit Environmental Technologies, Inc.
your connection to a cleaner environment

A2LA CERTIFICATION NO. 724.01

Offices in Major U.S. Cities

s.e.t.

December 3, 1998

Flynn Environmental, Inc.
401 Clarendon Ave., NW
Canton, OH 44708

Date Collected: 11/25/98
Date Received: 11/27/98
Project #: Canton Drop Forge
Client ID #: See Below
Laboratory ID #: See Below
Analysis: TPH-418.1
Detection Limit: 10.0 mg/kg
Initial Calibration Date: 6/17/97
Analyst: BY
Matrix: Solid
Date of Analysis: 12/2/98

Laboratory ID #	Client ID #	TPH-418.1 (mg/kg)
982665-01	B-1 (15' - 17')	431.0
982665-02	B-2 (15' - 17')	38.0

Laboratory Manager: Bassam Youssef

This report may not be reproduced except in full. The results were only representative of the samples received. Conditions can vary at different times and at different sampling conditions.

595 East Tallmadge Avenue, Akron, Ohio 44310 *TEL*: 330.253.8211 *FAX*: 330.253.4489

Summit Environmental Technologies, Inc.
your connection to a cleaner environment

A2LA CERTIFICATION NO. 724.01

Offices in Major U.S. Cities

s.e.t.

December 3, 1998 2/2

Flynn Environmental, Inc.
401 Clarendon Ave., NW
Canton, OH 44708

Date Collected: 11/25/98
Date Received: 11/27/98
Project #: Canton Drop Forge
Client ID #: See Below
Laboratory ID #: See Below
Matrix: Solid
Analysis: PAH (8100)
Units: mg/kg
Detection Limit: 0.15 mg/kg (Benzo(a)anthracene), 0.2 mg/kg (all others)
Date of Analysis: See Below

Laboratory ID #	982665-01	982665-02
Client ID #	B-1 (15' - 17')	B-2 (15' - 17')
Date Analyzed	12/3/98	12/3/98
Acenaphthene	< 0.2	< 0.2
Acenaphthylene	< 0.2	< 0.2
Anthracene	< 0.2	< 0.2
Benzo(a)anthracene	< 0.15	< 0.15
Benzo(a) pyrene	< 0.2	< 0.2
Benzo(b)fluoranthene	< 0.2	< 0.2
Benzo(ghi)perylene	< 0.2	< 0.2
Benzo(k)fluoranthene	< 0.2	< 0.2
Chrysene	< 0.2	< 0.2
Dibenzo(a,h)anthracene	< 0.2	< 0.2
Fluoranthene	< 0.2	< 0.2
Fluorene	< 0.2	< 0.2
Indeno(1,2,3-cd)pyrene	< 0.2	< 0.2
Naphthalene	< 0.2	< 0.2
Phenanthrene	< 0.2	< 0.2
Pyrene	< 0.2	< 0.2

Laboratory Manager: Bassam Youssef

595 East Tallmadge Avenue, Akron, Ohio 44310 *TEL*: 330.253.8211 *FAX*: 330.253.4489

SUMMIT ENVIRONMENTAL TECHNOLOGIES, INC.
595 EAST TALLMADGE AVENUE
AKRON, OHIO 44310
TEL: 330/253-8211; FAX: 330/253-4489

CHAIN OF CUSTODY

A2LA CERTIFICATION #: 0724-01

s.e.t.

PROJECT NAME: Canton Drop Forge PROJECT LOCATION: 4575 Southway St SW, Canton PO#: Facility 760160

CLIENT NAME: Flynn CLIENT ADDRESS: 401 Clarendon Ave NW, CANTON, OH 44708

CONTACT PERSON: Gary Kotila PHONE #: 330 452 9404 FAX #: 452 3508 SAMPLED BY: Gary C. Kotila

#	SAMPLE ID#	MEDIA	TIME	DATE	BTEX 8020	GRO 8015M	DRO 8015M	TPH 418.1	TCLP METALS	TCLP VOCS	TCLP BNAS	TCLP PEST/HERB	OTHERS PAH 8100
	B-1(15'-17')	SOIL	9:40AM	11/25/98				X					X
	B-2(5'-17')	SOIL	10:40AM	11/25/98				X					X

98265-01702

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: Gary C. Kotila DATE: RECEIVED BY: [signature] DATE: 11-27-98

RECEIVED AT THE LAB BY: M. Hill DATE: 11-27-98

CDF012616

APPENDIX C

UST ABANDONMENT DOCUMENTATION

DEPARTMENT OF COMMERCE, DIVISION OF STATE FIRE MARSHAL
BUREAU OF UNDERGROUND STORAGE TANK REGULATIONS
P.O. BOX 687
REYNOLDSBURG, OH 43068-9009
614-752-7938

PERMIT FOR UNDERGROUND STORAGE TANKS

Permit No: 20270

Issue Date:

I. OWNERSHIP OF TANK	II. LOCATION OF TANK
OWNER NO. 454 CANTON DROP FORGE P.O. BOX 6902 CANTON, OHIO 44706 ATTN: KEITH HOUSEKNECHT	INCIDENT NO. 7600833.01 FACILITY NO. 760606 CANTON DROP FORGE 4575 SOUTHWAY ST SW CANTON, OHIO 44706
III. CONTRACTOR	**IV. LOCAL FIRE DEPARTMENT**
FLYNN ENVIRONMENTAL INC.	CANTON TWP.

V. CONDITIONS: OWNER'S COPY OF PERMIT MUST BE AVAILABLE ON JOB SITE.
PERMIT EXPIRES SIX (6) MONTHS FROM DATE OF ISSUE. FEE IS NON-REFUNDABLE.
AS A CONDITION OF THIS PERMIT, AN INSPECTOR MUST BE ON THE JOB SITE.

VI. PERMIT ISSUED FOR: SEE BELOW

REMOVALS/ABANDONMENTS:
[101] TANK(S): N/A [102] PIPING: N/A (103) TOTAL SYSTEMS: (1)

INSTALLATIONS:
[201] TANK(S): N/A [202] PIPING: N/A [203] TOTAL SYSTEMS: N/A

REPLACEMENT:
[301] TANK(S): N/A [302] PIPING: N/A [303] TOTAL SYSTEMS: N/A

REPAIRS:
[401] TANK(S): N/A [402] PIPING: N/A

UPGRADES:
[501] TANK(S): N/A [502] PIPING: N/A [503] TOTAL SYSTEMS: N/A

[504] LEAK DETECTION: N/A

TEMPORARY CLOSURE:
[601] SYSTEMS: N/A

CHANGE IN SERVICE:
[701] SYSTEMS: N/A

BUREAU USE ONLY

Certified Installer Name: Byron Simonet Jr. No: 10-94-2711

Certified Inspector's Signature: Randal Heck No: 97-0065 Date: 2/23/99

COM 5208 Revised 8/97 Distribution: White-Owner Copy Canary-Agency Copy Pink-Inspector Copy

DEPARTMENT OF COMMERCE, DIVISION OF STATE FIRE MARSHAL
BUREAU OF UNDERGROUND STORAGE TANK REGULATIONS
P.O. BOX 687
REYNOLDSBURG, OH 43068-0687
614-752-7938

INSPECTION FIELD REPORT

[ ] Preliminary/Follow-up

[X] Final Inspection

Permit No: 20270

Issue Date: 11/5

I. OWNERSHIP OF TANK	II. LOCATION OF TANK
OWNER NO.454 CANTON DROP FORGE P.O. BOX 6902 CANTON, OHIO 44706 KEITH HOUSEKNECHT	INCIDENT NO.7600833.01 FACILITY NO.760606 CANTON DROP FORGE 4575 SOUTHWAY ST SW CANTON, OHIO 44706

III. INSPECTION CODES: 101 102 (103) 201 202 203 301 302 303 401 402 501 502 503 504 601 701

IV. INSTALLATION/REMOVAL

	TANK	TANK	TANK	TANK	TANK	TANK	TANK	TANK
Capacity	10,000 GAL							
Construction	STEEL							
Product Stored	QUENCH OIL							
LEL/O2 Level	<1%							
Inspection Code	103							

Release Detection Tank: N/A Piping

Corrosion Protection Tank: Piping

Spill & Overfill Protection (CIRCLE ONE) Drop Tube / Ball Float / Electronic

In Ground Test ✓ Piping Test Precision Test

V. TEMPORARY CLOSURE

Tanks Emptied Yes ___ No ___ N/A Fill Pipe/Dispenser Secured Yes ___ No ___ Vent Lines Open Yes ___ No ___

VI. TANK LINING

Opening Cover Test N/A Method of Cutting Positive Air Supply

Safety Precautions Attendant Protective Clothing

Lining Approved By: No. Date

VII. SITE INFORMATION

Cavity I: (Visible)
Holes (Tanks) Yes ___ No X Holes (Piping) Yes ___ No X Tank Cavity* - Piping Run* - Beneath Dispenser* -

Cavity II (Visible)
Holes (Tanks) Yes ___ No ___ Holes (Piping) Yes ___ No ___ Tank Cavity* ___ Piping Run* ___ Beneath Dispenser* ___

*Indicate O=Odor, W=Water, ST=Staining, FP=Free Product, SH=Sheen

Remarks: IN PLACE CLOSURE OF UST DUE TO LOCATION RELATIVE TO OTHER TANKS BEDS & EQUIPMENT. CLOSURE PRIOR APPROVED BY BUSTR TANK WAS FILLED WITH INERT MATERIAL. (PEA GRAVEL) AND TOPPED OFF WITH CEMENT SLURRY. - TANK WAS PUMPED & CLEANED PRIOR TO CLOSURE.

Start Time 9:00 End Time 12:00 Date: 2/23/99 Start Time End Time Date

Certified Installer Name: BRIAN STONEMETZ No. 10-96-2711 EXP: 3/1/00

Certified Inspector's Signature [signature] No. 97-0065 Date 2/23/99

Revised 1/97 Distribution: White-Agency Copy Canary-Owner Copy Pink-Inspector Copy

CDF012619

Ohio Department of Commerce
Division of State Fire Marshal
Bureau of Underground Storage Tank Regulations
6606 Tussing Road • P.O. Box 687
Reynoldsburg, OH 43068-9009
(614) 752-7938 FAX (614) 752-7942

Bob Taft
Governor

Gary C. Suhadolnik
Director

February 8, 1999

Keith Houseknecht
Canton Drop Forge
4575 Southway St.
Canton, OH 44706

RE: Abandonment of Underground Storage Tank, Facility No. 760606, Permit No. 20270, 4575 Southway Street, S.W., Canton, Ohio

Dear Mr. Houseknecht:

Based on the Bureau of Underground Storage Tank Regulations' inspection of an underground storage tank, it is hereby approved for abandonment in place with the following conditions:

1. The abandonment is to be done in accordance with API 1604;
2. Remove all flammable or combustible liquid from the tank and all connecting lines;
3. Disconnect the suction, inlet gauge, and vent lines;
4. Fill the tanks completely with an inert, solid material and cap the remaining underground piping;
5. Keep a record of tank size, location, date of abandonment, and method used for placing the abandoned tanks in a safe condition; and
6. Conduct a site closure, checking for contamination, as required by Ohio Administrative Code 1301:7-9-12.

If you have any questions, contact Steven Krichbaum at (614) 752-7938.

Sincerely,

Terry Weber
Acting State Fire Marshal

TW:SK:ag

OHIO DEPARTMENT OF COMMERCE
DIVISION OF STATE FIRE MARSHAL - BUSTR
P.O. BOX 687
REYNOLDSBURG, OH 43068-0687

98 OCT 14 AM 10:57

7600833-01

APPLICATION FOR UNDERGROUND STORAGE TANK PERMIT

OWNERSHIP OF TANKS	OWNER NO.	LOCATION OF TANKS	FACILITY NO.
OWNER/OPERATOR NAME: Canton Drop Forge		FACILITY NAME: Canton Drop Forge	
ADDRESS: 4575 Southway Street, S.W. PO Box 6902		ADDRESS: 4575 Southway Street, S.W.	
CITY: Canton STATE: OH ZIP: 44706		CITY: Canton STATE: OH ZIP: 44706	
ATTN: (CONTACT PERSON) Keith Houseknecht AREA CODE-PHONE 330-477-4511		AREA CODE-PHONE 330-477-4511 COUNTY: Stark	

GEOGRAPHIC LOCATION: RANGE _____ TOWNSHIP _____ SECTION _____ TRACT _____ SENSITIVE AREA? YES _____ NO X

CONTRACTOR INFORMATION	LOCAL FIRE DEPARTMENT INFORMATION
CONTRACTOR'S NAME: [redacted]	FIRE DEPARTMENT NAME: Canton Township Fire Department
CONTACT PERSON: K.C. Flynn AREA CODE-PHONE: 330-452-9409	ADDRESS: 202 49th Street, S.E.
ADDRESS: 401 Clarendon Avenue, N.W.	CITY: Canton STATE: OH ZIP: 44707-1071
CITY: Canton STATE: OH ZIP: 44708	

NOTE: PERMIT EXPIRES SIX (6) MONTHS FROM DATE OF ISSUE. FEE IS NON-REFUNDABLE.

REMOVALS ONLY TANKS PRESENTLY IN USE? YES X NO _____ Date Last Used: _____ (Attach Separate Sheet If Needed)

PLEASE INDICATE WORK TO BE PERFORMED:

[redacted]
TANKS ONLY _____
PIPING ONLY _____
FEET _____

INSTALLATIONS:
TOTAL SYSTEM* _____
TANKS ONLY _____
PIPING ONLY _____

REPLACEMENT:
TOTAL SYSTEM* _____
TANKS ONLY _____
PIPING ONLY _____
FEET _____

REPAIRS:
TANKS ONLY _____
PIPING ONLY _____

UPGRADES:
TOTAL SYSTEM _____
TANKS ONLY _____
PIPING ONLY _____
LEAK DETECTION _____

CHANGE IN SERVICE: _____

TEMPORARY CLOSURE: _____

*TOTAL SYSTEM INCLUDES TANK, PIPING, SPILL/OVERFILL, AND LEAK DETECTION.

98 OCT 14 AM 10:58

- THE PERMIT FEE IS $35.00 PER FACILITY WHEN APPLYING FOR A PERMIT.
- THE STATE INSPECTOR FEE PER FACILITY IS $60.00 PER HOUR OR FRACTION THEREOF WHILE ON SITE.
- INDICATE WHICH TYPE OF INSPECTOR WILL BE USED: _____ STATE INSPECTOR X CERTIFIED UST INSPECTOR
- WHEN USING A STATE INSPECTOR, YOU WILL BE BILLED AT A LATER DATE FOR THE INSPECTION FEE.
- PLEASE COMPLETE A SEPARATE PERMIT APPLICATION FOR EACH FACILITY.
- MAKE YOUR CHECK PAYABLE TO "TREASURER, STATE OF OHIO".
- IF YOU HAVE ANY QUESTIONS PLEASE CALL BEVERLY SPEARS AT 614-752-7938.

SIGNATURE OF APPLICANT: K.C. Flynn / dd DATE: 10/12/98

BUREAU USE ONLY

AMOUNT PAID: $35.00 CHECK NO: 8107 FEE NO: 30270 DISTRICT NUMBER: _____

COM 3205 Revised December 31, 1994

CDF012621

PERMANENT CLOSURE NOTIFICATION - THIRTY (30) DAY NOTICE

Release Prevention Supervisor
Division of State Fire Marshal
Bureau of Underground Storage Tanks
PO Box 687
Reynoldsburg, Ohio 43068-0687
(800) 686-2876

The following UST system(s) are scheduled for permanent closure:

1. Tank Location:

Canton Drop Forge

4575 Southway Street, S.W.

CITY: Canton COUNTY: Stark

ZIP CODE: 44706

PHONE: 330-477-4511

CONTACT: Keith Houseknecht

2. Owner Information:

Canton Drop Forge

4575 Southway Street, S.W.

CITY: Canton

ZIP CODE: 44706

PHONE: 330-477-4511

CONTACT: Keith Houseknecht

3. LOCAL JURISDICTION:

FIRE DEPARTMENT: Canton Township Fire Department

ADDRESS: 202 49th Street, SE

CITY: Canton COUNTY: Stark ZIP: 44707-1071

PHONE: 330-484-6165

4. CONTRACTOR INFORMATION:

NAME: Flynn Environmental, Inc.

ADDRESS: 401 Clarendon Avenue, N.W.

CITY: Canton STATE: OH ZIP: 44708

CONTACT: K.C. Flynn PHONE: (330) 452-9409

5. DESCRIPTION OF WORK TO BE COMPLETED:

Removal and permanent closure of one (1) ten thousand (10,000) gallon steel quench oil underground storage tank (UST).

APPENDIX D

BUSTR CLOSURE FORM

CLOSURE FORM (PART I)

CLOSURE CHECKLIST

OWNERSHIP OF TANKS	LOCATION OF TANKS
Canton Drop Forge P.O. Box 6902 Canton, Ohio 44706 Attn: Mr. Keith Houseknecht	Canton Drop Forge 4575 Southway Street, S.W. Canton, Ohio

FILING INSTRUCTIONS

1. In the column on the left side of the form, place either the page number of appendix designation where each item on the checklist can be found in the closure report or "N/A" (Not Applicable) for items that do not apply to your closure report.

2. UST owner must sign where indicated at the end of this form and attach it to the closure report. Deficient closure reports submitted to our office will be returned to the UST Owner for completion. Send the closure form and the closure report to the attention of the "Closure Review Section".

NOTE: UST Owner/Operator shall submit one copy of the written closure report which shall be received by the State Fire Marshal within 45 days of receipt by the UST Owner/Operator of soil and/or groundwater laboratory analysis but not later than 90 days from the date of collecting soil and/or groundwater samples.

I. UST SYSTEM OWNER, OPERATOR AND FACILITY DATA

1 UST OWNER (NAME; ADDRESS; ZIP CODE; COUNTY; PHONE NO.)
1 UST OPERATOR (NAME; ADDRESS; ZIP CODE; COUNTY; PHONE NO.)
1 UST FACILITY LOCATION (NAME; ADDRESS; ZIP CODE; COUNTY; PHONE NO.)
1 UST FACILITY OWNER (NAME; ADDRESS; ZIP CODE; COUNTY; PHONE NO.)

II. UST SYSTEM DATA

1 DATE OF UST REMOVAL OR ABANDONMENT
3 UST SYSTEM AGE (YEARS)
3 UST CAPACITY (GALLONS)
3 UST SYSTEM CONSTRUCTION (E.G., STEEL, FIBERGLASS, ETC.)
3 DATE UST SYSTEM LAST USED
1 PERSON WHO LAST USED UST SYSTEM
3 SUBSTANCE STORED IN UST BOTH PAST AND PRESENT (E.G., GASOLINE, DIESEL FUEL, USED OIL, ETC.)
3 UST SYSTEM USE (E.G., RETAIL SALES, RESIDENTIAL, FARM, BUSINESS, ETC.)
1 UST SYSTEM STATUS (PERMANENTLY REMOVED, ABANDONED-IN-PLACE, CHANGE-IN-SERVICE, OR TEMPORARY CLOSURE BEYOND TWELVE MONTHS)

III. WASTE DISPOSAL DATA

NA DISPOSAL OF UST SYSTEM
App E. DISPOSAL AND FINAL LOCATION OF ANY LIQUIDS FROM UST SYSTEM EXCAVATION

IV. SAMPLING DATA
(GROUNDWATER SAMPLING DATA ONLY REQUIRED IF GROUNDWATER ENCOUNTERED DURING CLOSURE ACTIVITIES)

5 SOIL AND/OR GROUNDWATER SAMPLE COLLECTION PROCEDURES
5 TYPE OF SAMPLE CONTAINERS AND SAMPLE PRESERVATION TECHNIQUES USED FOR SOIL AND/OR GROUNDWATER SAMPLES
4 LABELING NUMBER OR DESIGNATION OF SOIL AND/OR GROUNDWATER SAMPLE USED
5 TYPE OF SAMPLING EQUIPMENT USED (E.G., SPLIT SPOON, SHELBY TUBE, ETC.)
5 PROCEDURES USED FOR DECONTAMINATION OF SAMPLING EQUIPMENT
5 FIELD SCREENING METHODOLOGY USED FOR EACH SOIL AND/OR GROUNDWATER SAMPLE OBTAINED
5 TYPE OF FIELD SCREENING INSTRUMENT USED
4 LISTING OF FIELD SCREENING READINGS FOR EACH SOIL AND/OR GROUNDWATER SAMPLE OBTAINED
5 CALIBRATION DATE OF FIELD SCREENING INSTRUMENT
4 LOCATIONS AND DEPTHS OF ALL SOIL AND/OR GROUNDWATER SAMPLES OBTAINED
App B. COPY OF CHAIN OF CUSTODY DOCUMENTATION FOR SOIL AND/OR GROUNDWATER SAMPLES SUBMITTED TO LABORATORY
4 SAMPLE COLLECTOR NAME AND COMPANY AFFILIATION

V. LABORATORY DATA
(GROUNDWATER LABORATORY DATA ONLY REQUIRED IF GROUNDWATER ENCOUNTERED DURING CLOSURE ACTIVITIES)

App B. COPIES OF LABORATORY SAMPLE ANALYSIS DATA SHEETS FOR SOIL AND/OR GROUNDWATER SAMPLE
App B. DATE SOIL AND/OR GROUNDWATER SAMPLES COLLECTED
App B. DATE SOIL AND/OR GROUNDWATER SAMPLES RECEIVED BY LABORATORY
App B. DATE SOIL AND/OR GROUNDWATER SAMPLES ANALYZED BY LABORATORY AND TYPE OF MATRIX ANALYZED (SOIL OR WATER)
App B. NAME, ADDRESS, AND PHONE NUMBER OF LABORATORY AND NAME OF SAMPLE ANALYST
App B. ANALYTICAL TEST METHODS USED FOR SOIL AND/OR GROUNDWATER SAMPLES
App B. DETECTION/QUANTITATION LIMITS USED FOR LABORATORY TEST METHODS
App B. DATE OF LABORATORY INSTRUMENT CALIBRATION

VI. MISCELLANEOUS DATA

3 VISUAL SITE EVALUATION
2 SITE MAP ACCURATELY DEPICTING DIMENSIONS OF FACILITY PROPERTY BOUNDARIES, ABOVE GROUND STRUCTURES, ADJACENT STREET LOCATIONS, AND UST SYSTEMS (NUMBER OF TANKS AND PRODUCT LINES)
NA MAPPED LOCATIONS OF KNOWN PRIVATE WELLS, PUBLIC WATER WELLS, OR MONITORING WELLS ON FACILITY
2 MAPPED LOCATIONS OF ANY UTILITIES EXPOSED DURING UST SYSTEM EXCAVATION
4 DESCRIPTION OF NATIVE SOILS ENCOUNTERED DURING UST SYSTEM EXCAVATION (E.G., SAND, GRAVEL, CLAY, ETC.)
6 MAPPED DEPTHS AND LOCATIONS OF ALL SOIL AND/OR GROUNDWATER SAMPLES TAKEN FROM EXCAVATION
2 MAPPED LOCATION OF UST RECENTLY OR HISTORICALLY REMOVED, ABANDONED-IN-PLACE, OR HAS UNDERGONE A CHANGE IN SERVICE, OR TEMPORARY CLOSURE BEYOND TWELVE MONTHS
2 MAPPED LOCATIONS OF OTHER USTS STILL IN SERVICE
6 MAPPED LENGTH OF UST AND PRODUCT LINE
NA MAPPED EXCAVATION LIMITS
1 CERTIFIED FIRE SAFETY INSPECTOR NAME AND CERTIFICATE NUMBER
1 LOCAL FIRE DEPARTMENT (NAME; ADDRESS; ZIP CODE; COUNTY; PHONE)
App C. COPY OF 30 DAY CLOSURE NOTIFICATION AND CLOSURE PERMIT

CLOSURE FORM (PART III)

SOIL DISPOSAL/TREATMENT REQUIREMENTS

Please provide the page number or appendix designation where the following items may be found in the closure report:

NA Calculated stockpile volume in cubic yards
NA Description of stockpile storage and staging (e.g., bermed, covered, etc.)
NA Stockpile sampling and field screening procedures, locations, dates, and results
NA Stockpile laboratory reports and chain of custody form

In order to comply with the report requirements of OAC 1301:7-9-15, please refer to the Soil Disposal/Treatment Notification Form on the following page. The first page of the Soil Disposal/Treatment Notification Form should be completed for each stockpile generated. The second page of the Soil Disposal/Treatment Notification Form should be completed if the PCS is to be treated at a designated facility.

Please consolidate the Soil Disposal/Treatment Notification Form and related PCS information in a separate section of the closure report. The State Fire Marshal is required to track and manage all information derived from PCS generated in compliance with OAC 1301:7-9-15. Consolidating the PCS information in a separate section of the closure report will facilitate a faster review of the site file.

CLOSURE FORM (PART IV)

CLOSURE FORM CERTIFICATION STATEMENT

The following certification statement must be completed by the UST Owner/Operator. **The notarized written statement found at the end of the Soil Disposal/Treatment Notification Form must also be completed if the PCS is to be treated.**

I certify that I have personally examined and that I am familiar with the information submitted in this form, and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete.

Jerome P Bressanelli	Jerome P Bressanelli	4/26/99
Owner/operator's name (print)	*Signature*	*Date*

President.

APPENDIX E

WASTE DISPOSAL DOCUMENTATION

WASTE DISPOSAL DOCUMENTATION

Method and location of disposal of the excavated soil from this site:

No soil was excavated during the abandonment of the UST system.

Method and disposal location of the residual liquids and sludges within the UST:

The residual quenching oil was removed from the UST and used by the UST owner. The residual sludges were removed from the UST and properly disposed of by the UST owner.

Method and disposal location of the residual liquids within the UST excavation zone:

No excavation activities were conducted; therefore, no excavation zone was present.

APPENDIX F

MSDS

CDF#0181

Date: 09/23/85

CITGO PETROLEUM CORPORATION
P. O. Box 3758
Tulsa, Oklahoma 74102

MATERIAL SAFETY DATA SHEET

Trade Name: CITGO Amplex 68

Commodity Code: 38-038

Synonyms: Lubricating Oil

CAS Reg. No.: Mixture.

Citgo Index No. (CIN): 0286

Technical Contact: (918) 561-5165
Medical Emergency: (318) 491-6215

MATERIAL HAZARD EVALUATION
(Per OSHA's Hazard Communication Standard [29 CFR Part 1910.1200])

Health: Non-Hazardous.

Precautionary Statement: None.

I. GENERIC COMPOSITION/COMPONENTS

Components	CAS #	%	Hazard Data
Refined Petroleum Oil(s)	64742-63-8	62-70	Oral: LD50(rat): >15g/kg Eye: Practically Non-Irritating (0.7-1.7/110, Draize) Skin: Non-Irritating or Practically Non-Irritating (0-0.6/8, Draize) Ihln: LC50/4H(rat): >3,540mg/m^3
	—	or	
Refined Petroleum Oil(s)	64742-62-7	40-50	Oral: LD50(rat): >15g/kg Ihln: LC50/4H(rat): >3310mg/m^3
Refined Naphthenic Oil(s)		34-56	Oral: LD50(rat): >5g/kg

ND = No Data
NA = Not Applicable

LAS/38-038

SUBSIDIARY OF THE SOUTHLAND CORPORATION

CIN #: 0286

II. PHYSICAL DATA

Physical Hazard Classification (Per 29 CFR Part 1910.1200)

___	Combustible	___	Oxidizer
___	Compressed Gas	___	Pyrophoric
___	Explosive	___	Reactivity
___	Flammable	X	Stable
___	Organic Peroxide	___	Unstable

Boiling Point, 760 mmHg, °C(°F): -301 (-575)

Melting Point, °C(°F): NA

Vapor Pressure, mmHg (25°C): $\sim<1\times10^{-3}$

Specific Gravity (H_2O=1): 0.91

Solubility in H_2O, % By Wt.: Negligible

Vapor Density (Air=1):>1

Evaporation Rate (Butyl Acetate=1): <1

% Volatiles By Vol.: Negligible

pH of Undiluted Product: ND

Appearance and Odor: Amber liquid, mild odor.

III. FIRE AND EXPLOSION DATA

Flash Point, COC, °C(°F): 182(360)

Flash Point, PM, °C(°F): ND

Fire Point, COC, °C(°F): 199(390)

NFPA*

Health: 1

Flammability: 1

Reactivity: 0

Flammable Limits in Air, % Vol.: Lower: NA Upper: NA

Extinguishing Media: CO_2, dry chemical, foam or water fog.

Special Fire Fighting Procedure: None.

Unusual Fire or Explosion Hazard: Water may cause frothing.

*Citgo assignment based on our evaluation per NFPA guidelines. Hazard Rating least-0; slight-1; moderate-2; high-3; extreme-4.

ND = No Data
NA = Not Applicable

LAS/38-038

CDF012631

CIN #: 0286

IV. REACTIVITY DATA

Stability: X Stable ___ Unstable

Conditions Contributing to Instability: None.

Incompatibility: Strong oxidants.

Hazardous Decomposition Products (thermal, unless otherwise specified):
CO, CO_2.

Conditions Contributing to Hazardous Polymerization: None.

V. SPILL OR LEAK PROCEDURES

Procedures if Material is spilled:
Remove sources of heat or ignition, provide adequate ventilation, contain leak. Absorb small spills with suitable material such as rags, straw or sand. Report spills as required to appropriate authorities.

Waste Disposal:
It is the responsibility of the user to determine if the material is a hazardous waste at the time of disposal.
Check before disposing to be sure you are in compliance with all applicable laws and regulations.

Protective measures during repair and maintenance of contaminated equipment:

Refer to Section VII - Special Protection Information.
Avoid prolonged contact with used oil, wash skin thoroughly with soap and water.

ND = No Data
NA = Not Applicable

A SUBSIDIARY OF THE SOUTHLAND CORPORATION

CDF012632

VI. HEALTH HAZARD DATA

Health Hazard Classification (Per 29 CFR Part 1910.1200)

___ Carcinogen	___ Corrosive
___ Animal Carcinogen	___ Irritant
___ Suspect Carcinogen	___ Sensitizer
___ Mutagen	___ Teratogen
___ Highly Toxic	___ Target Organ
___ Toxic	

Toxicity Summary: Slightly toxic, 1 pt. to 1 qt. is approximate lethal oral dose for 150 lb. human adult.

Acute Exposure Symptoms:

Inhalation: Low risk of inhalation. In enclosed spaces or when hot, vapors may reach concentrations sufficient to cause drowsiness, dizziness, headache, nausea, or lung irritation. Mists above TLV may cause chemical pneumonitis.

Dermal Contact: Low irritant.

Absorption: No probable acute hazard.

Eye Contact: May be mildly irritating.

Ingestion: Generally low toxicity. Very large amounts may cause generalized depression, headache, drowsiness, nausea, vomiting or diarrhea. Small doses may produce irritation and diarrhea.

Chronic Exposure: Prolonged and/or frequent contact may cause drying, cracking (dermatitis) or folliculitis.

Other Special Effects: None expected.

First Aid and Emergency Procedures for Acute Effect

Inhalation: Remove to fresh air. Respiratory support if necessary. Seek medical aid.

Dermal: Wash with soap and water. Do not wear heavily contaminated clothing before laundering.

Eyes: Flush with large volumes of water. See physician if any complications arise.

Ingestion: Do not induce vomiting. Seek medical aid.

Injection: Subcutaneous injection is a medical emergency . . seek medical aid immediately.

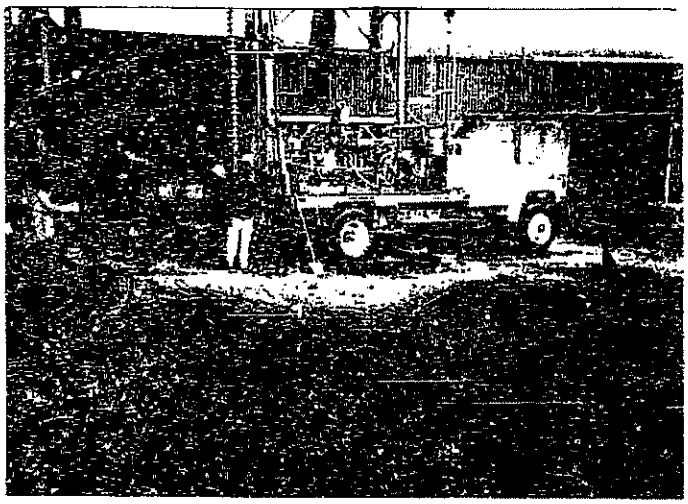
Notes to Physician: If viscosity is less than 100 SUS at 100°F careful gastric lavage with tight fitting or cuffed tube is to be preferred over emesis. If viscosity is greater than 100 SUS at 100°F, emesis may be induced for large quantities.
Aspiration may cause chemical pneumonitis or lipoid pneumonia.
Subcutaneous injection requires prompt surgical debridement. If not familiar with technique, seek skilled advice.
SUS viscosity at 100°F = 330.

ND = No Data
NA = Not Applicable

CDF012633

APPENDIX G

SITE PHOTOGRAPHS



Canton Drop Forge
4575 Southway Street, S.W.
Canton, Ohio

View of the installation of soil boring B-1 at the western end of the UST, looking to the north.

View of the installation of soil boring SB-2 at
the eastern end of the UST, looking to the north.

ENVIRONMENTAL SITE ASSESSMENT
30 ACRE PROPERTY AT
4575 SOUTHWAY STREET SW, PERRY TOWNSHIP
NORTHEAST QUARTER OF SECTION 13
STARK COUNTY, OHIO

September 2000

Prepared for:

Bank One
101 Central Plaza South
Canton, Ohio 44702-1418
(330) 438-8389

Prepared by:

Hammontree & Associates, Limited
Sara E. Greemore, E.I.T.
5233 Stoneham Road
North Canton, Ohio 44720
1-800-394-8817

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A. Environmental Database Search
B. Ohio Master Site List-1997
C. ASTM Transaction Screening Questionnaire
D. Historical Aerial Photos
E. Topographic maps
F. Title Search
G. Materials Safety Data Sheets (MSDS)
H. Miscellaneous Correspondence (Sanborn maps, oil/gas wells/water wells)
I. Portions of Previous Environmental Reports
J. Historical/Current Facility Layouts
K. Site Photos
L. Soils
M. Wetlands and Flood Zones
N. Site Visit
O. Preparer Qualifications

I. SUMMARY:

Hammontree & Associates, Limited, has been retained as an Environmental Consultant by Bank One to conduct a Phase I (visual) Environmental Site Assessment of a 30 acre tract of land located at 4575 South Way Street SW, northeast quarter of Section 13, Perry Township, Stark County, Ohio. The property is owned by Canton Drop Forging Manufacturing Company.

After a visual inspection of the site, an assessment of public records relating to the site and interviews with individuals who have knowledge of the property, this writer has concluded that:

- Secondary containment is needed around the above ground storage tanks and the 55-gallon drums located on the subject property to protect the water system and surrounding soils from any leakage and/or spillage from these storage containers.
- Soil samples should be taken at the lagoons, the solidification pit, the landfill area, and the Bioremediation Cell to determine the construction, content, and potential pollution potential of these structures. This information should be compared to an analysis of the nearest aquifer. HAMMONTREE DID THIS SEE SHEET A
- The oil/water separator used to treat the floor drain water, which is discharged into the storm water system, should be modified to prevent spillage/leakage from the oil skimmer onto the nearby soil.
- The information discovered regarding the past use or current use of the adjoining parcels suggest that adjoining properties have had environmental concerns in the past. The impact on the subject property is unknown.

II. INTRODUCTION

A. Purpose

The objective of this site assessment is the investigation of any potential contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), petroleum products, hazardous materials or waste, polychlorinated biphenyls (PCB's), underground storage tanks, etc. The following Phase I Environmental Site Assessment has been completed in accordance with ASTM Standard E 1527 for Environmental Site Assessments.

As such, this report is intended to permit the user to qualify for the innocent landowner defense to CERCLA liability.

B. Special Terms and Conditions

The services performed by Hammontree and Associates, Limited for this Phase I Environmental Site Assessment were conducted in a manner consistent with the level of care and skill ordinarily exercised by firms similar to Hammontree and Associates, Limited, which are currently providing comparable services during the time frame in which this assessment was conducted.

The client must recognize that the data, interpretations and recommendations by Hammontree and Associates, Limited are based solely on information reviewed by Hammontree and Associates, Limited.

C. Limitations and Exceptions of Assessment

It is expressly understood that the undersigned has not conducted any detailed engineering studies as to the integrity of the facilities or properties, nor has any test been performed to determine the presence of toxic, carcinogenic, or hazardous materials. The statements set forth in this assessment are based solely on visual observations and interviews with individuals and governmental agencies believed to be informed and knowledgeable. The nature of this survey is necessarily limited in scope and therefore can not assure any party that all problems have been identified nor that all individuals having knowledge have been interviewed. The statements set forth in this assessment are not to be construed as a guarantee or warranty. There has been no analysis performed to identify lead-based paint, asbestos, drinking water quality, PCB's or radon.

This site assessment of Canton Drop Forge does not include the four (4) parcels also owned by Canton Drop Forge to the south of Southway Street (Joseph Soehnlen's Allotment Lot 6, 7, 11, and 12).

Parties other than the client and their agents may not rely on this report without the express written consent of Hammontree & Associates, Limited.

D. Limiting Conditions and Methodology Used

No environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in connection with a property. Performance of this Phase I Environmental Site Assessment according to ASTM E 1527 methodology is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions in connection with a property.

Appropriate inquiry does not mean an exhaustive assessment of a clean property. There is a point at which the cost of information obtained or the time required to gather it outweighs the usefulness of the information and, in fact, may be a material detriment to the orderly completion of transactions.

Not every property will warrant the same level of assessment. Consistent with good commercial or customary practice, the appropriate level of environmental site assessment will be guided by the type of property subject to assessment and the information developed in the course of inquiry.

III. SITE DESCRIPTION

A. Locations and Legal Description

The property occupies approximately 30 acres and is located at 4575 Southway Street SW in Canton, Ohio. The site is on the north side of Southway Street and is between Navarre Road and Perry Drive. Attachment F "Title Search" contains a copy of the legal description and sixty-year title search as recorded with the County Recorder's Office. There is a traffic control and telephone easement along the southeastern corner of the property. There is a railroad switch, roadway, East Ohio Gas, and an Ohio Power Company easement along the eastern property line.

B. Site and Vicinity Characteristics

The site is relatively flat with the lowest elevations in the center of the property. There are three ponds on the subject property. These ponds appear to be man made and are utilized for stormwater retention and waste stream precipitation. Approximately 25% of the site is occupied by structures, 4% by parking and drives, 5% by bodies of water, and 66% by open fields. To the north of the site is a railroad and vacant land; to the east are private residences and farmland; to the south is Southway Street; beyond Southway are various commercial and industrial properties, and to the west of the site is East Ohio Gas, Distribution Division.

C. Site Improvements

The property has access to public sanitary sewer, but does not have access to public water or storm sewer. The property contains several water wells, a water storage tower, an oil/water separator, and several pumping stations. The existing structures include a two-story brick office and aluminum-sided forging, storage, and shipping center. Also there are buildings used for laboratory testing.

PUMP HOUSE – At the eastern edge of the lagoon #2 there is a concrete block building. This structure serves as a pump house for the storm water and waste stream to be transferred from lagoon #2 to lagoon #3. To the north of the current pump house are the remnants of a former pump house that was utilized for storm water transport to Lagoon #3.

WATER WELLS – There have been at least two (2) water wells drilled on the subject property. The current wells are located to the northeast of the forging facility and near the powerhouse. These wells are housed in concrete block enclosure. M.J. Engel Drilling Company of Massillon, Ohio drilled these water wells in 1942 and 1943. The water pumped from these wells is stored in the elevated water storage tank.

ELEVATED WATER STORAGE TANK – This water storage tank was constructed prior to 1950. This water is utilized for process water, potable water, and fire protection to the facility. The tank has a capacity of 110,000-gallons and composed of steel.

OIL/WATER SEPARATOR – The oil/water separator was installed in January of 1996. This separator skims the oil from the processing facility floor drains into 55-gallon drums and pumps the 'clean' water into Lagoon #2. The oil placed in the drums is an open system and the drum must be placed correctly under the discharge piping to prevent spillage. There is a concrete curb located around the oil/water separator to direct oil overflow from the drums back into the oil/water separator.

There is a second oil/water separator to remove emulsified oil from the process stream. Bench tests were performed at Canton Drop Forge facility to determine the most effective filtration method. The final separator combines the outflow from two separate treated Boiler House streams in order to lower the combined separator effluent to below 50 ppm of lime prior to being discharged in to the City of Massillon sanitary sewer system. This separator was installed in 1998. The City of Massillon does not require monitoring of this effluent.

FORGING FACILITY AND OFFICE SPACE – This building has historically and is currently being used as a forging facility and office space. The current structure was built in several stages starting in 1945 and ending in 1958 on former private residences and farmland. The interior of the building contains numerous offices, shipping/loading area, storage facility, and processing facility. Several storage containers containing hydraulic oil, propane, and various other oils were observed in the facility. There are several floor drains within the structure that the operator stated drain to the storm system located on the subject property. Several of the floor drains in the Power House that are discharged to the Stark County Sanitary Sewer System and treated by the City of Massillon Wastewater Treatment Plant. Almost all of the storm sewer catch basins located in the parking area of the subject site are discharged into lagoon #2. There is one catch basin that is discharged to Lagoon #1.

NO FLOOR DRAINS TO THE SANITARY SEWER SYSTEM

D. User Information Regarding Liens for Environmental Hazards

The owners report no knowledge of environmental liens or environmental hazards on the property.

E. Current Uses of the Property

The site is currently used as a steel forging facility.

F. Past Uses of the Property

Prior use of the site was investigated using Attachments B through K, including, where available, information from an ASTM Transaction Screening

Questionnaire, Historical Aerial Photos, Topographic Maps, 60-year Title Search, and appropriate local officials. The following persons/agencies were contacted as part of the preparation for this report:

- Historical Aerial Photos, from the Stark County Engineer and Stark County Regional Planning
- Ohio Department of Natural Resources: Division of Oil & Gas
- Ohio Department of Natural Resources: Division of Water
- Historical Topographic Maps, from Environmental Data Resources, Inc.
- 60 Year Title Search, from the Stark County Deeds and Records
- City Directory Search, (not available)
- Ohio Department of Commerce: Bureau of Underground Storage Tank Register
- Fire Insurance Maps, from Environmental Data Resource, Inc.
- Canton Drop Forging Manufacturing Company-owner

All information indicates that the building on the property has been there since 1942. Before 1942, the property was used as a private residence.

Between 1942 and 1950 the property was owned by the United States Defense Plant Corporation. This plant was utilized during World War II to forge propeller hubs for aircraft.

In 1950 the subject property was sold to Canton Drop Forge Manufacturing Company. The facility built by the United States Air Corp was utilized by Canton Drop Forge.

Prior to 1979 a portion of the subject property was utilized as a landfill for all wastes generated at the site including oil sludge, floor sweepings, trash, rags, demolition wastes, concrete, and other wastes. No records were found to suggest that this landfill was mitigated.

G. Current and Past Uses of Adjoining Properties

South of the subject property are several commercial and residential properties including the Silver Dollar Lounge, McKinney Trudans, Beaver Excavating Company, W&W Auto Sales, Allied Truck and Leasing, Northern Mobile Electric Company, and CND Machine Inc. To the west of the subject property is East Ohio Gas Distribution Office. North of the subject property is the Conrail Railroad and Beaver Excavating property. East of the subject property is

farmland and private residences. Historical records indicate that this land has a history of farmland, private residences, industrial, and commercial properties.

The Beaver Excavating property to the north of the subject property is used to dispose of soils removed during the cutting and filling of construction projects.

IV. RECORDS REVIEW

A. Standard Environmental Record Sources, Federal and State

A search of environmental records was conducted by Environmental Data Resources, Inc. The following databases were reviewed.

- National Priority List
- NPL Deletions
- Resource Conservation and Recovery Information System
- State Hazardous Waste
- Comprehensive Environmental Response, Compensation, and Liability Information System
- Corrective Action Report
- Licensed Solid Waste Facilities
- Leaking Underground Storage Tank (LUST) File
- Underground Storage Tank (UST) File
- RCRA Administrative Action tracking System
- Resource Conservation and Recovery Information System
- Resource Conservation and Recovery Information System - Corrective Action Activity
- Hazardous Materials Information Reporting System
- PCB Activity Database System
- Emergency Response Notification System
- Facility Index System
- Toxic Chemical Release Inventory System
- NPL Liens
- Toxic Substances Control Act
- Material Licensing Tracking System
- Records of Decision of a Superfund site
- Superfund (CERCLA) Consent Decrees
- OH (Ohio) Spills
- Former Manufactured Gas (Coal Gas) Sites
- Mines Master Index File
- Bureau of Underground Storage Tank Registrar

While reviewing these databases for the subject site, there were properties identified as environmental hazards within 1 mile of the site.

1. Canton Drop Forge Inc, 4575 Southway St SW Box 6902, map ID #1, Subject Property
   - Two (2) Leaking Underground Storage Tank (LUST) – No further action letter issued by BUSTR for both (For reports, see attachment H: Miscellaneous Correspondence).
     - One of the LUST was removed in 1990 containing 1,000-gallons of gasoline.

- The other LUST was removed in 1999 containing 10,000-gallons of quench oil.

- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) No further remedial action planned. Four (4) assessments have been performed at the facility.

- Resource Conservation and Recovery Information System (RCRIS)- small quantity generator of regulated wastes (<200 kg/mo), no reported violations.

- Facility Index System/Facility Identification Initiative Program Summary Report (FINDS) - the following systems are utilized:
  - Aerometric Information Retrieval System (AIRS) Facility System
  - Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes (DOCKET)

- Master Sites List (SHWS) – the facility ID number is 276-0130 and the Environmental Protection Agency ID number is OHD004465142.

- Emergency Response Database (SPILLS) – Damaged equipment caused an unknown amount of smoke to affect the air with air contaminants, odors, and smoke.

- Division of Emergency & Remedial Response's Database (DERR) – the facility ID number is 276-0130.

2. Beaver Excavating Company, Inc., 4650 Southway Street S.W., Map ID# A2-A4

   - Resource Conservation and Recovery Information System (RCRIS) – Small quantity generator of regulated wastes (<200 kg/mo), no reported violations.

   - Two (2) Underground Storage Tanks (UST)
     - One (1) tank stores 10,000-gallons of gasoline. The tank and piping have cathodic protection and are 10 years old.
     - The other tank (2) stores 20,000-gallons of diesel fuel. The tank and piping have cathodic protection and are 10 years old.

   - Leaking Underground Storage Tank (LUST) – in 1999 a 4,000-gallon tank containing new hydraulic oil was removed. A closure report was reviewed by BUSTR and a deficiency letter has been sent to the facility.

3. Truck Repair Building, 4700 Southway Street S.W., Map ID #B5

   - Leaking Underground Storage Tank (LUST) – No further action letter issued by BUSTR.

4. East Ohio Gas Company, 4725 Southway S.W., Map ID #B6

   - Two (2) Underground Storage Tanks (UST).

- One (1) tank stores 6,000-gallons of gasoline. The tank and piping have cathodic protection.
- The other tank (2) stores 1,000-gallons of diesel fuel. The tank and piping have cathodic protection and are 10 years old.

- Leaking Underground Storage Tank (LUST) – No further action letter issued by BUSTR.

- Resource Conservation and Recovery Information System (RCRIS) – large quantity generator of regulated wastes (>200 kg/mo), no reported violations.

5. Maaco Auto Painting and Body Works, 1818 Hopple Avenue S.W., Map ID #9

   - Resource Conservation and Recovery Information System (RCRIS) – Small quantity generator of regulated wastes (<200 kg/mo), no reported violations.

6. Ohio Bell Telephone, 4313 Southway Street, Map ID#C10

   - Leaking Underground Storage Tank (LUST) – No further action letter issued by BUSTR.

7. Overlane Transport, 4310 Southway, Map ID #C11

   - Leaking Underground Storage Tank (LUST) – 10,000 – gallon diesel fuel tank removed in 1999. No further action letter issued by BUSTR.

8. Kohn Beverage Company, 4850 Southway Street, Map ID #12

   - Leaking Underground Storage Tank (LUST) – the tank was removed. No further action letter issued by BUSTR.

9. Blue Velvet Transportation, Inc., 4821 Corporate St. SW, Map ID #D13
   - Leaking Underground Storage Tank (LUST), a 10,000-gallon diesel fuel tank and a 1,000-gallon waste oil tank were removed. No Further Action Letter issued by BUSTR.

10. Ziegler Bolt & Nut House, Inc., 4848 Corporate St. SW, Map ID #D14
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.

11. Rollins Trucking Company, 4884 Corporate St. SW, Map ID #15
    - Leaking Underground Storage Tank (LUST), a 2,000-gallon oil tank, a 2,000-gallon diesel tank removed. No Further Action Letter issued by BUSTR.

12. Roadway Express, 4925 Southway SW, Map ID # E16
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.

13. Cramers Inc., 4926 Southway SW, Map ID # F17
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.

14. Vliet Asphalt Sealer Co. Inc., 4520 Vliet St. SW, Map ID # 18
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.

15. Allied Truck Parts, 4216 Southway St. SW, Map ID #19
    - Leaking Underground Storage Tank (LUST). Initial Corrective Action Program Report has been received by BUSTR.

16. Samsel Pipeline Co. 4938 Southway SW, Map ID # F21, E20
    - Two (2) Leaking Underground Storage Tank (LUST), one (1) tank has a permit and/or SRR in file at BUSTR, pending submittal of closure report. The other tank (2) has a No Further Action Letter issued by BUSTR.

17. Buckeye Co. Welding Supplies, 4969 Southway SW, Map ID # F22
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.

18. Young White GMC Truck, 4970 Southway St. SW, Map ID # F23
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.

19. Bitzel Excavating, Inc., 4141 Southway St. SW, Map ID # G24
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.
    - Underground Storage Tank (UST) - 3,000-gallon tank containing diesel fuel. The tank is 7 years old with cathodic/galvanized steel piping.

20. Custom Design Tech., 1545 Whipple SW, Map ID # 25
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.
    - Underground Storage Tank (UST) - 3,000-gallon tank containing diesel fuel. The tank is 7 years old with cathodic/galvanized steel piping.

21. Rees Plating, 5020 Southway St., Map ID # 26
    - Leaking Underground Storage Tank (LUST). No Further Action Letter issued by BUSTR.
    - Underground Storage Tank (UST) - 3,000-gallon tank containing diesel fuel. The tank is 7 years old with cathodic/galvanized steel piping.

22. MPS Corporation, 4124 Southway St. SW, Map ID # G27

- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) - No further remedial action planned. Four (4) assessments have been performed at the facility.
- Resource Conservation and Discovery Information System (RCRIS) - large quantity generator of regulated water (>299 kg/mo). One violation exists for the compliance evaluation inspection concerning the generator in 1985.
- Facility Index System/Facility Identification Initiative Program Summary Report (FINDS) - Aerometric Information Retrieval System (AIRS) Facility System.
- Master Sites List (SHWS) - The facility ID number is 276-0546 and the Environmental Protection Agency ID Number is OH0980610091.
- Division of Emergency & Remedial Response's Database (DERR) - The facility ID number is 276-0546.

B. Physical Setting Sources

Aerial Photos, Historic Topographic Maps, Soils Maps, Floodplain Maps, Wetland Maps and a site visit were used to identify the physical setting of the site.

C. Historical Use Information

Review of historical topographic maps, aerial photos, and an interview of the owner of the property identified historical uses.

All of the information that was discovered during the preparation of this assessment indicates that the site has previously been used as a steel forging facility, a landfill, and a private residence prior to World War II.

V. INFORMATION FROM SITE RECONNAISSANCE AND INTERVIEWS

The site reconnaissance was performed on September 18, 2000 with the assistance of Mr. Keith Houseknecht, the Canton Drop Forge Plant Engineering Manager. Access to the forging facility was limited. Access to several areas was restricted to Hammontree & Associates personnel. Areas that were not investigated fully include: die storage, bar cutting, tensile testing and laboratory, die shop, power/boiler house, one of the water wells, storage building, underground storage tank farms, heat and beat area, process lime oil/water separator, and the facilities south of Southway Street. No photographs were permitted inside of the processing facility due to protection of the Canton Drop Forge process.

A. Hazardous Substances in Connection with Identified Uses

Various materials are used in connection with the normal operation of the forging facility, such as running forklifts, compressors, and other machinery. See Attachment G for the list of material safety data sheets on file at Canton Drop Forge. The following materials are stored regularly at the subject property and utilized in the steel forging process:

- Between 1,000 and 9,999 pounds of Soda Ash stored in bags located in the Power/Boiler House.
- Between 10,000 and 99,999 pounds of Lime stored in a silo located north of the Power/Boiler House.
- Between 10,000 and 99,999 pounds of Lime stored in bags located in the Power/Boiler House.
- Between 100,000 and 999,999 pounds of Coal stored in vats or open-topped vessels (hopper) located in the Power/Boiler House.
- Between 100,000 and 999,999 pounds of Alloy steel bars and forgings located throughout the facility.
- Between 1,000 and 9,999 pounds of Aluminum Oxide (an abrasive compound) stored in bags located in the Heat Treat area.
- Between 1,000 and 9,999 pounds of Aluminum Oxide (used for grinding wheels) stored in boxes located in the Heat Treat area.
- Between 10,000 and 99,999 pounds of Petroleum Distillates (Lube and Hydraulic Oil) stored in Steel Drums throughout the facility.
- Between 10,000 and 99,999 pounds of Petroleum Distillates (Lube and Hydraulic Oil) stored in Steel Drums located south of the Die Storage area.
- 4,300-gallons of Petroleum Distillates (Quench Oil) stored in vats or open-top vessels (three tanks) located in the Heat Treat area.
- 1,300-gallons of Petroleum Distillates (Quench Oil) stored in vats or open-top vessels (one tank) located in the Die Shop area.
- Between 100,000 and 999,999 pounds of Refractory Materials stored throughout the facility.

Three (3) 55-gallon drums of Sodium Hydrochlorite were located near the water well to the northeast of the forging buildings. These tanks are utilized to treat the water from the water well before being stored in the elevated water storage tower.

B. Hazardous Substance Containers

There were several 55-gallon drums located in the forging building that contained oil products. Some of the drums were stored on wood pallets in order for easy relocation by forklift. None of these drums appeared to have secondary containment. These substances have been identified in section V.A. There were

floor drains located in the forging facility that connect to the oil/water separator and storm water system.

There are several acetylene and oxygen tanks are located on the north edge of the subject property. These tanks are located in a covered storage area.

A quart of motor oil was observed within the well house located to the northeast of the forging facility.

Several 400-gallon portable storage tanks (totes) were observed through the facility. These tanks appeared to contain lube hydraulic oil. No secondary containment surrounded these tanks.

C. On Site Storage Tanks

Underground storage tanks (UST's) are currently regulated by the USEPA, the Bureau of Underground Storage Tank Regulations (BUSTR) and through regulations found in 40 CFR Part 280. If tanks were removed prior to the closure regulations, no soils or water analysis would have been taken to meet the present USEPA and BUSTR clean up limits for Benzene, Toluene, Ethylbenzene, Xylene, Total Lead and Total Petroleum Hydrocarbons.

UST's that have been properly registered with BUSTR are termed Registered Underground Storage Tanks (RST's). RST's and leaking RST's (LRST's) are, identified by BUSTR records. Unregistered UST's and leaking UST's (LUST's) are identified by interviews, historical fire insurance maps, fire department records and on site evidence.

Two (2) leaking underground storage tanks (LUST) were abandoned/removed February 19, 1990 and February 23, 1999 by Joseph A. Jeffries Company Inc and Flynn Environmental Inc, respectively. Tank #1 was a 1,000-gallon tank of steel construction, which stored and dispensed gasoline. The location of the fill line was directly above the location of the removed LUST on the east side of the forging building. After reviewing the Underground Storage Tank Closure Assessment of Canton Drop Forge (attachment H) analytical results showed that Total Petroleum Hydrocarbons (TPH) ranges from 70 to 440 mg/kg, where as the detectable limit is 70 mg/kg. The analytical result showed that Lead ranges from 27 to 36 mg/kg, where as the detectable limit is 2.5 mg/kg. Tank #2 was a 10,000-gallon steel tank, which stored quenching oil. The location of this LUST was east of the power/boiler house. After reviewing the Underground Storage tank Closure assessment of Canton Drop Forge (attachment H) analytical results showed that Total Petroleum Hydrocarbons (TPH) ranges from 38 to 431 mg/kg, where as the detectable limit is 10 mg/kg. This tank was cleaned and abandoned in place due to the proximity of other underground storage tanks. Both of these removed/abandoned underground storage tanks were issued a no further action letter by BUSTR.

There are several underground storage tanks located around the facility containing heating oil. The capacity, location, and material stored are as follows:

- 20,000-gallon Fuel Oil #6 tank located east of the Power/Boiler House.
- Three (3) 10,000-gallon Fuel Oil #6 tanks located east of the Power/Boiler House.
- Four (4) 25,000-gallon Fuel Oil #2 tanks located south of the Die Storage area.

There are several aboveground storage tanks located around the facility. The capacity, location, and material stored are as follows:

- 3,000-gallon Petroleum Distillates (used oil) tank located to the north of the Power/Boiler House. This tank was not observed.
- 1,500-gallon Petroleum Distillates (used oil) tank located to the southeast of Lagoon #2, attached to the oil skimmer. Due site visit appeared to be approximately 80% full. There was no secondary containment around this tank.
- 250-gallon Kerosene tank located south of the Die Storage area. This tank was not observed.
- 150-gallon Diesel Fuel #2 located north of the storage building. This tank was not observed.
- 20,000-gallon Petroleum Distillates (used oil) located northeast of the equipment storage area. This tank was to be removed in the near future and did not have secondary containment.
- 1,000-gallon Propane tank located on the north edge of the subject property as well as several smaller portable propane tanks.
- 1,000-gallon Diesel Fuel #2 tank located east of the storage building. This tank had secondary containment surrounding the tank.
- 110,000-gallon water storage tank located on the north edge of the subject property.

D. Indications of PCB's

PCB's are associated with electrical transformers, capacitors and substations both public and private. They were used to reduce the possibility of electrical fires, and also sometimes appeared in hydraulic fluids. Fluids contained in some transformers (PCB-bearing) have been determined to be carcinogenic. Transformers are either PCB contaminated (more than 50 ppm) or non-PCB contaminated.

There was an electric substation on the northeast side of the operating building, these transformers are non-PCB contaminated according to Canon Drop Forge facility personnel. These transformers have been retrofitted by SD Meyers to contain less than 50 ppm of PCBs. The gages are inspected regularly.

There were also four (4) PCB-bearing transformers located within the facility, two (2) in the heat treating shop, one (1) in the equipment storage area, and one (1) in the forge shop. All of these transformers are locked, enclosed, and the gages are regularly inspected.

The local electric company is American Electric Power.

E. Solid Waste Disposal

In 1993, samples were taken from Lagoon #1 to determine the depth and concentration of the oil sludge that had settled to the bottom of the lagoon. This sludge was then removed and placed in a Bioremediation Cell on the eastern portion of the subject property. The cell was originally created to reduce the amount of hydrocarbons in the sludge removed from Lagoon #1 and Lagoon #2. This Bioremediation Cell failed to rid the sludge of the desired amount of hydrocarbons and was therefore returned to Lagoon #1. Lagoon #1 was lined with clay, the Bioremediation Cell material as placed on top of the clay liner, and a clay cap covered the cell material. The area were the Bioremediation Cell was located was cleaned up according to Canton Drop Forge personnel and covered with slag approximately a year later and used to store steel material.

A portion of the subject property was utilized as a landfill for all wastes generated at the site prior to 1979 including oil sludge, floor sweepings, trash, rags, demolition wastes, concrete, and other wastes. Approximately eight acres of land on the eastern portion of the subject property near lagoon #3 was utilized as a dump and cover landfill. It is reported that the landfill was covered with a clay soil, the thickness of this is unknown. Some reports state that part of this landfill might have still been utilized up until 1981.

At the northeast corner of the subject property there was a pile of reinforced concrete slabs from former buildings. The adjoining property to the east had a large pile of tires stored behind the facility. The adjoining property to the north is utilized to dispose of soil and construction materials.

Abandoned machinery was observed to the northwest of Lagoon #3. Hammontree & Associates personnel were assured that all fluids had been drained from this equipment.

To the north of Lagoon #2 is a Fly Ash Solidification pit. This pit is used to dewater the fly ash. The fly ash is then removed from this pit and piled to the south of the pit prior to being removed from the property.

Various materials are disposed of off-site. Industrial waste such as dirt, ash, scale, and oil has been removed from the facility and landfilled 46 times as of 9/00. Fly ash from the boilers has been removed from the subject property ten times before 8/4/00. Waste blow down lime has been removed from the subject property six times as of 9/00. One to two times per year the presses are shutdown and the hydraulic oil is removed from the presses. This oil is mixed together and cleaned by several filters before being placed back into the presses.

PARSONS ENGINEERING WAS MANAGING THE PROJECT

#1 ONLY

THIS CAN'T BE RIGHT

F. Air Pollution Potential

Canton Drop Forge has to meet Stark County emission limits for sulfur dioxide on three (3) of the boilers. On boiler #1 a maximum of 5.0 pounds of sulfur dioxide per MM Btu actual heat input is allowed. On boiler #2 and #3 a maximum of 1.6 pounds of sulfur dioxide per MM Btu actual heat input from each boiler is allowed.

UNKNOWN ONLY TO HAMMONTREE

Within the processing facility several unattended open fires were observed by the Hammontree & Associates personnel. The source of these fires is unknown. Canton Drop Forge admits to occasional fires including motors burning up and pallets catching on fire. In the past ten years, Canton Drop Forge has required assistance from the Perry Township Fire Department once. There are routine inspections performed on the fire extinguishers.

G. Physical Setting and Migration Potential

According to the Stark County Soils Survey the soil at the subject site is predominantly Urban Land (Ur). These soils occur in large industrial complexes. Due to the large amounts of cut and fill operations in these soil areas a soil profile does not exist. The lots located south of Southway Street contain soils predominately composed of Chili Silt Loam, 2 to 6 percent slopes (CpB), Canadice Silt Loam (Ca), and Conotton Gravelly Loam, 18 to 25 percent slopes, moderately eroded (CyE2). Erosion is a hazard of these soils as well as droughtiness in the Conotton soils and wetness in the Canadice soils.

Due to the topography and the tendency of ground water to follow the surface topography, the likely groundwater gradient is flowing both to the northwest and to the south.

Near the southwestern corner of the property is Lagoon #1. This lagoon is used to collect storm water from the facility as well as to store the Bioremediation Cell material between two layers of clay. Lagoon #2 is located near the south central portion of the property. This lagoon is used to collect the water from the oil/water separator as well as collect storm water from the facility by way of overland flow. Residual oil is removed from Lagoon #2 by way of an oil skimmer and the water is pumped to Lagoon #3.

There was very stressed vegetation surrounding Lagoon #1 and Lagoon #2. Explanations for the vegetation at Lagoon #1 include very steep banks and removal of the sludge on the bottom of this lagoon in 1995. Due to the steep slopes, water quality could not be observed. Lagoon #2 had oil stains on the soil around the entire perimeter of the lagoon as high as two feet above the water level. The soil below the oil skimmer and the pump house appeared to be a sludge-like material. There was oil sheen on the surface of Lagoon #2. The oil skimmer was not running during the site visit and Hammontree & Associates personnel were told that the skimmer only runs when it is necessary. In 1995, Lagoon #2 was also excavated in order to clean the sludge from the bottom and sidewalls of the lagoon.

NO

VI. FINDINGS AND CONCLUSIONS

We have performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E 1527 of a 30 acre tract of land located at 4575 Southway Street SW, northeast quarter of section 13 in Perry Township, Canton, Ohio. Any exceptions to, or deletions from, this practice are described in Section II.C. of this report.

We recommend:

- Contractors performing demolition, renovation, or construction activities on the site should inform the owner should suspicious or stained soils be encountered. These contractors should also use appropriate precautions when dealing with lead-based paints and asbestos containing materials.

- Secondary containment should be added around the aboveground storage tanks. Secondary containment of these structures will deter leakage from draining directly into the water and storm water system by way of the floor drains or onto the soil surrounding the facility.

- Two (2) active water wells are located on the subject property. When these wells are no longer necessary, they should be properly abandoned and sealed according to the Ohio Environmental Protection Agency and Ohio Department of Natural Resources guidelines. For more information regarding this procedure contact The Ohio Department of Natural Resources: Division of Water, Water Resources Section at 1939 Fountain Square, Columbus, OH 43224-1360, (614) 265-6740.

- This writer observed several practices within the facility that were questionable concerning safe operation. A review should be initiated to resolve potential hazards before they become a problem. In relation to his assessment, all hazardous material containers should be provided with secondary containment whether a 55-gallon drum or a 400-gallon tote. All of these have the potential to contaminate the property if not properly contained.

- All unused storage tanks and drums should be drained and removed from the subject property and disposed of properly.

- Soil samples should be taken from all three (3) lagoons and the Fly Ash Solidification pit. Due to the clay layers surrounding the Bioremediation Cell material, samples taken from Lagoon #1 should not be taken deeper than the bottom clay layer. These samples should be analyzed to determine the construction of the lagoons and the pit and to determine the extent of potential pollution and the depth of the sludge. This information should be utilized to estimate the sludge accumulation rate and therefore the timeframe in which sludge should be removed from the lagoons to prohibit the transfer of materials to the finish lagoon. Lagoon #1 and #2 were mitigated in 1995, however the oil/water separator was not installed until 1996 and it appeared that oil is still entering Lagoon #2.

SEE PREVIOUS HAMMONTREE WORK

- Soil samples should be taken at various locations within the landfill area on the eastern portion of the property. The general content of this landfill should be determined as well as the extent of this landfill activity throughout the property.

- The groundwater assessment performed by R & R International, Inc. should be used to determine if operations at Canton Drop Forge have affected the integrity of the aquifer.

- The oil/water separator located to the south of the facility should be modified to reduce the amount of oil spillage during transfer to the portable storage containers. The soil surrounding this oil/water separator should be removed/cleaned to allow the spill and storm water pollution prevention team at Canton Drop Forge to detect potential leakage/spillage of the oil.

- Unused process equipment located on the eastern portion of the property should be properly drained of all fluids and removed from the subject property if not being used for spare parts. This action will reduce future contamination of the subject property.

- Soil samples should be taken from the location of the former Bioremediation Cell located on the eastern portion of the subject property. These samples should determine if all contaminated material was removed when the contents were transferred to Lagoon #1.

We hereby state that to the best of our knowledge and belief,...

The statements of fact contained in this report are true and correct.

The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions and are Hammontree and Associates, Limited's unbiased professional analysis, opinion and conclusions.

Hammontree and Associates, Limited's compensation is not contingent on an action or event resulting from the analysis opinions, and conclusions developed in this report.

We have made a personal inspection of the property that is the subject of this report.

This report, to the best of our knowledge, is forwarded as an accurate representation of the site condition at the time of this report.

Sara E. Greemore, E.I.T.

CANTON DROP FORGE AND MANUFACTURING FACILTY
PHASE I ENVIRONMENTAL SITE ASSESSMENT

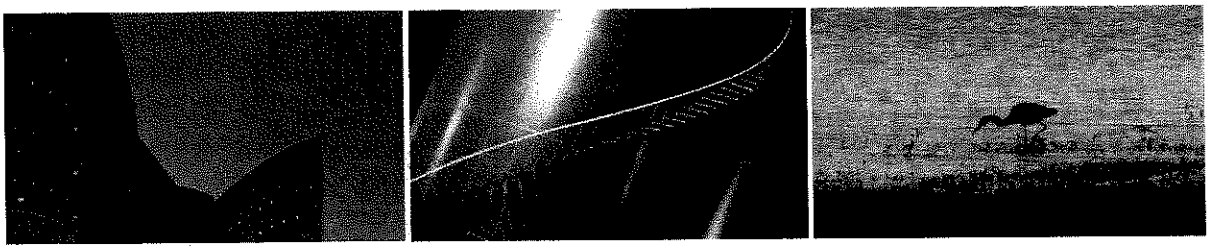
INTERVIEW
WITH KEITH HOUSEKNECHT, MANAGER OF PLANT ENGINEERING
SEPTEMBER 18, 2000

- LAGOONS PUMPED 1 to 2 to 3
- STORM WATER from OVERLAND FLOW and CATCH BASINS FLOW to LAGOON 1 and PUMPED to LAGOON 2
- ...have UST EXEMPTION (heating oil, fuel #2 and #6)
- ABOVE GROUND STORAGE TANKS
- NFA LETTER from BUSTR for LUSTs
- FLOOR DRAINS FLOW to OIL/WATER SEPERATOR where OIL is DISCHARGED into DRUMS for REUSE/RECYCLE and WATER DRAINS to STORM WATER SYSTEM
- PROCESS LIME SOLUTION is FILTERED and DISCHARGED to TANK and LIQUID is DISCHARGED to MUNICIPAL SANITARY at COUNTY'S REQUEST (the discharged liquid is not monitored)
- PROCESS STAGES
  1. FORGE RECEIVES STEEL BARS (size varies from 4" round to 14" square and 20' long)
  2. BARS are CUT into SMALLER PIECES, APPROXIMATELY 10" to 6' LONG
  3. PIECES are HEATED to BETWEEN 1800°F and 2400°F in FORGE
  4. PIECES are SHAPED by BEATING, SHOT BLASTING, FLASH, and GRINDING
- FORGE CONDUCTS SOME TESTING, INCLUDING TENSILE TESTING, but does not PAINT or ACID ETCH
- ...have MSDA SHEETS for MINERAL BASED OIL, GRAPHITE, and LUBRICATING OILS & DIE LUBRICANT
- OIL RETAINED by OIL SKIMMER at LAGOON 2 is DISCHARGED into an ABOVEGRAOUND STORAGE TANK and HAULED OFFSITE
- ...to IMPROVE OIL'S VISCOSITY, GRAPHITE (primary lubricant) is ADDED to DIE LUBE
- 1 to 2 TIMES A YEARS, HYDRAULIC OIL is REMOVED from PRESSES during SHUTDOWN and MIXED TOGETHER and CLEANED BY A SERIES OF FILTERS TO REMOVE PARTICULATE and MOISTURE BEFORE BEING REPLACED
- CYLINDER OIL COMBINES with STEAM in PISTONS and is DISCHARGED to a TANK AT THE POWERHOUSE
- EVERY 1 to 2 YEARS, HYDROCHLORIC ACID is USED to in LINE CLEANING by a PRIVATE CONTRACTOR
- INDUSTRIAL WASTE such as DIRT, ASH, SCALE, and OIL has been REMOVED to a LANDFILL 46 TIMES this YEAR
- FLY ASH from BOILER has been REMOVED 10 times BEFORE 8/4 of this YEAR
- WASTE BLOW DOWN LIME has been REMOVED 6 times this year

CANTON DROP FORGE AND MANUFACTURING FACILTY
PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

- 2 NATURAL GAS 1 or #6 FUEL OIL BOILERS USE BRICK STACK
- COAL BOILER USES OWN STACK WITH SCRUBBER (covered under Title)
- The BIOCELL was located up on the hill at the eastern portion of property to get rid of HYDROCARBONS removed from Lagoon #1
  - Added "stuff" to it but did not remove HYDROCARBONS
  - Therefore the biocell material was removed from this area and placed between clay layers in Lagoon #1
  - TESTING and CLEANING of the SOIL was performed by CRITTER company
- LAGOON #1 contains a LINER, BIOCELL MATERIAL, and a CLAY LAYER
- ...have PERMIT to DUMP, but DON'T
- USED to DUMP FLASH TRAPPINGS over a LARGE AREA, then MOVED to OFFSITE HOPPER to WAIT for a HIGHER PRICE (now they ship it off site) NO
- BIOCELL area has been FLATTENED, filled with clean material, and COVERED with 8" to 10" of SLAG and USED to STORE STEEL (covered approximately one year after cleaning)
- FORGE USES NATURAL GAS, not HEATING OIL
- OCCASIONAL FIRES INCLUDE PALLETS and MOTORS burning up and FORGE has had 1 FIRE that REQUIRED ASSISTANCE from FIRE DEPARTMENT since K. H. has been at the FORGE (10 YEARS)
- ...have INSPECTION PROGRAM for FIRE EXTINGUISHERS (routine inspection)
- 4 PURE PCB TRANSFORMERS LOCATED at FORGE
  1. 2. ...in HEAT TREATING SHOP
  2. 1...in EQUIPMENT STORAGE
  3. 1...in FORGE SHOP
     - ALL 4 are LOCKED and ENCLOSED and INSPECTED by SD MYERS (contracted to clean up PCB spill)
     - ALL OTHER TRANSFORMERS have been RETOFILLED (level < 50)
     - TRANSFORMERS have GAGES to inspect PCB levels
- ...have LAB, but NO INVENTORY LIST
- SPC/SWP3 IMPLEMENTED
- CONDUCT OIL ANALYSIS for DIELECTRIC PROPERTIES
- PERFORM HOT TENSILE TESTS in the GREEN BUILDING across Southway Street

Privileged and Confidential
Prepared at the Request of Counsel



Phase I Environmental Site Assessment

Canton Drop Forge, Inc.
4575 Southway Street
Canton, Ohio

Prepared for:
Godfrey & Kahn, S.C.
Milwaukee, Wisconsin

On behalf of:
Canton Drop Forge, Inc.
Canton, Ohio

Prepared by:
ENVIRON International Corporation
Milwaukee, Wisconsin

Date:
September 2012

Project Number:
21-30264A

ENVIRON

Signature and Environmental Professional Statement

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in §312.10 of 40 CFR 312.

We have the specific qualifications based on education, training, and experience to assess a property of the nature, history and setting of the subject property. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Ashish Deshmukh, PhD
Manager

Jeanne M. Tarvin, PG, CPG
Principal

ENVIRON International Corporation
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1 Introduction

1.1 Objective

ENVIRON International Corporation (ENVIRON) was retained by Godfrey & Kahn, S.C. on behalf of Canton Drop Forge, Inc. ("CDF" or the "Company") to conduct an environmental review of the CDF facility at 4575 Southway Street in Canton, Ohio (the "site" or the "facility").

The objective of the Phase I ESA, which was conducted in conformance with the scope and limitations of ASTM International's *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* E1527-05 (the "ASTM Standard"), was to identify Recognized Environmental Conditions (RECs), as defined in the ASTM Standard. ENVIRON's regulatory compliance review is a limited screening tool and is not a substitute for a comprehensive multi-media compliance audit.

1.2 Scope of Work

The environmental review included the following tasks:

- A visit to the site by Ashish Deshmukh and Meghna Nooyi of ENVIRON on July 18, 2012, to observe the exterior and interior features of the site and to identify the uses and conditions specified in Sections 9.4.1 through 9.4.4.7 of the ASTM Standard. In addition, ENVIRON observed the adjoining properties from the site or adjacent public thoroughfares. Photographs taken during the site visit are presented in Appendix A.
- Interviews during the visit with the following site employees (year of initial hire at the site indicated in parentheses): Brad Ahbe, President (1987); Sean Denman, Safety Director (2012); and Michael Slates, Maintenance Superintendent (1987). The aforementioned individuals are referred to herein as "facility personnel." The facility personnel interviewed by ENVIRON were identified by the Company as having good knowledge of the uses and physical characteristics of the site, as well as of regulatory compliance matters.
- A review of information contained in federal and state environmental databases, as obtained from the sources noted below:
  - A radius report prepared by Environmental Data Resources, Inc. (EDR) (see Appendix B), which presents the results of searches of federal and state databases for the subject site, as well as properties near the subject site. The radius searched for each database, as well as the databases themselves, was selected in accordance with the ASTM Standard.
  - The United States Environmental Protection Agency's (USEPA's) Envirofacts database, which provides site information, contained in multiple USEPA regulatory databases.
  - The USEPA's Enforcement and Compliance History Online (ECHO) database, which provides information on sites' enforcement and compliance history.
- The USEPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-Potentially Responsible Party (PRP) database, which was searched to determine whether the Company is listed as a PRP at any Superfund sites.
- The USEPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database, which was searched to determine if any current

or past off-site waste management facilities used by the Company or its known predecessors are listed on the National Priorities List (NPL) or CERCLIS.

- The Occupational Safety and Health Administration (OSHA) Establishment Search database, which provides site-specific information on OSHA inspections.
- A review of standard historical sources and local agency inquiries, as defined in the ASTM Standard. The following resources were reviewed:
  - Readily available historical sources (as identified in Section 4.2 of this report and included as Appendix C) to develop a history of the previous uses of the site and surrounding area.
  - Historical and site-specific information obtained from the following local agencies: Stark County Auditor's Office (Auditor), the Stark County Recorder of Deeds (Recorder), Ohio State Fire Marshall's Office - Bureau of Underground Storage Tanks Registration (BUSTR), Stark County Health Department (Health Department), and the Canton Fire Department.
  - Documents received from Ohio EPA's Northeast District Office, and Ohio EPA's Division of Emergency Remedial Response regarding the presence or absence of contamination at the site.
- A review of documents provided to ENVIRON by facility personnel, including environmental permits, waste manifests/off-site waste disposal information, correspondence with regulatory agencies, facility-prepared plans and procedures, and chemical use information. In addition, ENVIRON was provided with the following previous environmental assessment reports:
  - Solid Waste Disposal Site, prepared by Canton Drop Forge, dated June 1978 (the "1978 Waste Disposal report");
  - Correspondence between Ohio EPA and Canton Drop Forge regarding historically buried drums and sludge at the facility, in July and August 1983 (the "1983 correspondence");
  - Closure Report for One Underground Storage Tank at Canton Drop Forge, Canton Ohio, prepared by The Joseph A. Jeffries Company, Inc., dated March 1990 (the "1990 Jeffries Company UST Closure report");
  - Screening Site Inspection Report, prepared by Ecology and Environment, Inc., dated August 1991 (the "1991 E&E Screening Site Inspection report");
  - Letter report regarding the Expanded Site Inspection Prioritization for Canton Drop Forge and Manufacturing Company, prepared by PRC Environmental Management, Inc., dated May 1992 (the "1992 PRC Expanded SI Letter report");
  - Preliminary Soil and Groundwater Assessment of Canton Drop Forge, Inc., prepared by Hammontree & Associates, Ltd., dated February 1993 (the "1993 Hammontree Phase II report");
  - Preliminary Soil and Groundwater Assessment, prepared by R&R International, Inc., dated March 1993 (the "1993 R&R Phase II report");

- Lagoon #1 Re-Construction/Biocell disposal Summary Report of Feasibility Analyses, prepared by Parsons Engineering Science, Inc., dated May 1997 (the "1997 Parsons Lagoon 1 report");
- Environmental and Geotechnical Sampling, Analyses and Treatability Testing of Lagoon No. 2 Depositional Material at Canton Drop Forge, Inc., prepared by Parsons Engineering Science, Inc., dated September 1997 (the "1997 Parsons Lagoon 2 Sampling report");
- Small Quantity Generator Review, prepared by Parsons Engineering and Science, Inc. dated March 1998 (the "1998 Parsons SQG Review report");
- Underground Storage Tank Closure Assessment for Canton Drop Forge, prepared by Flynn Environmental, dated February 1999 (the "1999 Flynn UST Closure report"); and
- Environmental Site Assessment, prepared by Hammontree & Associates, Ltd., dated September 2000 (the "2000 Hammontree Phase I report").

- A review of physical setting sources, as defined in the ASTM Standard, including:
  - the current USGS 7.5-minute topographic map that shows the area on which the site is located; and
  - geologic, hydrogeologic, or hydrologic sources as provided in the EDR report, and in the above-listed previous reports.

1.3 Reliance and General Limitations

This report has been prepared for the exclusive use of Godfrey & Kahn, S.C. and may not be relied upon by any other person or entity without ENVIRON's prior express written permission.

This Phase I ESA is considered current only for a period of 180 days from the site inspection. The conclusions presented in this report represent ENVIRON's best professional judgment based upon the information available and conditions existing as of the date of the review. In performing its assignment, ENVIRON must rely upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions in this report are valid only to the extent that the information provided to ENVIRON was accurate and complete. This review is not intended as legal advice, nor is it an exhaustive review of site conditions or facility compliance. ENVIRON makes no representations or warranties, express or implied, about the conditions of the site.

ENVIRON's scope of work for this assignment did not include collecting samples of any environmental media. As such, this review cannot rule out the existence of latent conditions, and is intended, consistent with normal standards of practice and care, to assist the client in identifying the risks of such conditions.

The scope of work for this assessment did not include an asbestos survey or inspection. According to federal OSHA regulations (29 CFR §1910.1001) and the Model Accreditation Plan (MAP; 40 CFR Part 763, Subpart E, Appendix C), the inspection, testing, evaluation, and/or sampling of suspect asbestos-containing materials must be conducted by an accredited inspector; these activities were not performed as part of this environmental review.

2 Summary of Conclusions

ENVIRON was retained by Godfrey & Kahn, S.C. on behalf of CDF to conduct an environmental review of the CDF facility in Canton, Ohio, which it operates as a steel forging facility. The purpose of the assessment was to identify RECs, which are defined in Section 6.

To help evaluate the business risk of the identified environmental findings, ENVIRON considered various factors, exercised its judgment, and categorized these findings, based on a materiality threshold of $25,000, as follows:

Material – Confirmed or otherwise demonstrated impairment of environmental media or regulatory non-compliance that typically would require expenditures in excess of the materiality threshold.

Potentially Material – Suspect impairment of environmental media or potential regulatory non-compliance that has not been confirmed or otherwise demonstrated through appropriate collection of data or technical analysis. Expenditures in excess of the materiality threshold could be required if suspect impairment or regulatory non-compliance were to be confirmed.

Noteworthy – Issues that are not expected to result in expenditures in excess of the materiality threshold.

Table 2.1 presents an overview of ENVIRON's findings and the business risk that these findings represent. Additional discussion of the individual findings is presented in Sections 2.1 through 2.3 below and in the body of this report.

Table 2.1: Overview of ENVIRON's Findings

Finding	ASTM Characterization	Business Risk
Three on-site lagoons that receive process water	REC	Material
Historical on-site landfill	REC	Material
Management of fly-ash in sub-grade pits near Building E and Lagoon 2	REC	Material
Relocation of excavated sediment for biological treatment	REC	Potentially Material
Exterior soil staining	REC	Potentially Material
Underground Storage Tanks (USTs)	REC	Potentially Material
Oil staining in sub-grade Chip Basement (below Building B)	REC	Potentially Material
Aboveground Storage Tanks (ASTs) without secondary containment	REC	Noteworthy
Septic System	Other Finding	Noteworthy
Former use of chlorinated solvents	Other Finding	Noteworthy
Possible impacts from neighboring properties	*De minimis*	Noteworthy

Table 2.1: Overview of ENVIRON's Findings		
Finding	**ASTM Characterization**	**Business Risk**
Historical agricultural use of the site	*De minimis*	Noteworthy

2.1 Recognized Environmental Conditions

ENVIRON performed a Phase I ESA of the facility at 4575 Southway Street, Canton, Ohio, in conformance with the scope and limitations of the ASTM Standard. Any exceptions to, or deletions from, this practice are described in Section 6.4 of this report. This assessment has revealed the following RECs in connection with the facility:

- **Three on-site lagoons that receive process wastewater:** Discharge of oil-containing process water to the three on-site lagoons for several years has impacted the sediments in the lagoons and groundwater on the property, as reported in the 1997 Parsons Lagoon 2 Sampling Report and 1993 R&R Phase II Report. ENVIRON observed oil floating on the surface of Lagoons 1 and 2 and observed soil staining in the area of Lagoon 2. The 1997 Parsons Lagoon 2 Sampling Report indicated that one of ten sediment samples obtained from Lagoon 2 had a Total Petroleum Hydrocarbon – Heavy Range Organics (TPH-HRO) concentration of 37,000 mg/kg, which was in excess of the applicable regulatory threshold (20,000 mg/kg). The 1993 R&R Phase II Report stated that petroleum hydrocarbon impacted soil and groundwater was present along the southwestern corner of Lagoon 3, and elevated levels of barium. In groundwater, the petroleum hydrocarbon concentration was reported as 34 mg/L and the barium concentrations ranged between 1.9 and 3.4 mg/L. While no limit for petroleum hydrocarbon in groundwater had been established by the Ohio EPA or USEPA at the time of the report, barium concentrations exceeded the Ohio EPA MCL of 2.0 mg/L. The area's elevation relative to surrounding properties indicates that an off-site source is unlikely. The impacts in and around Lagoon 2 may have been further compounded by a historical report of drums containing lubricants buried in this vicinity. ENVIRON considers this to be a REC.
- **Historical on-site landfill:** The 1978 Waste Disposal Report, the 1991 E&E Screening Site Inspection Report, and the 1993 R&R Phase II Report, revealed that an approximately 8-acre landfill was located to the east of Lagoon 2 until the early 1980s. The landfill was licensed by the Stark County Health Department (SCHD) in June 1976. It is unclear when the landfill began operating. The landfill was divided into two zones. Zone A was used for the disposal of all wastes generated on site like oil sludge, boiler stack scrubber sludge, floor sweepings, trash and rags, while Zone B was used for the disposal of demolition wastes, concrete, and other exempt wastes. The two zones were separated by a scrap metal salvage area. The unlined landfill represents a REC due to the nature of materials disposed of at this location.
- **Management of fly-ash in sub-grade pits near Building E and Lagoon 2:** ENVIRON observed two sub-grade pits that are used for the temporary storage of fly-ash, generated by the coal fired boiler. The first pit, located adjacent and east of Building E is concrete-lined. It receives a mixture of water and fly-ash, which is carried in totes to the larger sub-grade pit in the north central portion of the property, near Lagoon 2. The water is allowed

to evaporate, and the remaining fly-ash is then collected by J&J Refuse for off-site disposal. The facility has recently re-lined the first pit, located near Building E with concrete. Because the condition of the prior concrete liner is not known, whether there is an impact from metals and other contaminants associated with fly-ash on adjoining soils and groundwater is also not known. ENVIRON considers the two fly ash pits to be RECs.

- **Relocation of excavated sediment for biological treatment:** According to the 2000 Hammontree Phase I Report, oil-contaminated sediment was excavated from Lagoon 1 and transferred to a bioremediation cell located in the eastern portion of the property. The cell failed to achieve the targeted hydrocarbon removal rate, and the sludge was returned to Lagoon 1. Lagoon 1 was lined with clay; the sludge was placed over this; and a clay cap was used to cover the cell material. The report indicates that the location of the bioremediation cell was covered with slag. It is not known if the entire sediment was transferred back to Lagoon 1, or whether there were any soil or groundwater impacts at the location of the former bioremediation cell. ENVIRON considers the location of the former bioremediation cell to be a REC.
- **Exterior soil staining:** ENVIRON observed stained soil adjacent to the southwestern property boundary, near Lagoon 1. In this area, the staining was concentrated near the oil-water separator associated with Lagoon 1. Soil to the southwest of Building C (Forge Shop) which is adjacent to the oil-water separator also appeared to be stained. This area is currently used to store virgin oil, used oil, kerosene, and diesel in drums, totes, and ASTs. ENVIRON considers this staining to be a REC.
- **Underground Storage Tanks (USTs):** The 1993 R&R Phase II Report and the 2000 Hammontree Phase I Report refer to the presence of ten single-walled USTs, which were previously used for storing Number 2 fuel oil, Number 6 fuel oil, quench oil, and gasoline. Closure documentation has been received for two of these tanks. According to documents received from BUSTR, one 10,000-gallon quench oil UST from Tank Farm 2 (see Figure 2) and one 1,000-gallon gasoline UST, located near Building M, were removed (in 1999 and 1990 respectively), for which NFAs were received. Facility personnel stated that the eight remaining tanks are no longer in use. These tanks have not been closed or removed; however, site personnel informed ENVIRON that oil levels in the tanks are measured on a bi-annual basis and that the levels have not changed over time. These tanks are exempt from registration under BUSTR. Even though no investigation of impacts from these tanks to soil and groundwater has been conducted, given the age of the tanks, and the fact that they were used for storing petroleum hydrocarbons, ENVIRON considers the UST locations at the site to be a REC.
- **Oil staining in sub-grade Chip Basement (below Building B):** A below-grade basement, located below Building B, is used to house a pumping station for quench oil tanks located on the first floor of Building B. Heavy oil staining was observed on the floor in this area. Even though the floor is concrete, it appeared to be in poor condition, with evidence of cracking. ENVIRON considers the Chip Basement to be a REC.
- **Aboveground Storage Tanks (ASTs) without secondary containment:** During ENVIRON's reconnaissance, ASTs used for storing oil, diesel, kerosene, and other petroleum products were observed at multiple locations. ENVIRON did not observe secondary containment for several of these tanks. According to facility personnel,

secondary containment was provided for 17 of the 20 ASTs at the site in the recent past. ENVIRON cannot rule out the possibility of soil and groundwater contamination having occurred due to past leaks and spills from the exterior ASTs at the site. ENVIRON considers the exterior AST locations at the site to be a REC.

2.2 Other Findings

Although not considered RECs based on currently available information, ENVIRON identified the following other findings. The term "other finding" is not defined by ASTM; rather, ENVIRON uses the term to connote areas of contingent risk that are not clearly defined by the ASTM Standard.

- **Septic System:** According to facility personnel, a septic system located east of Building M was historically operated for the management of sanitary wastewater. This was confirmed by the City of Massillon's Sewer and Waste Collections. However, they could not verify whether there was a leach field associated with the septic system. Discharges to this system were reported to be only from domestic sources. ENVIRON cannot verify the nature of the material disposed of in this septic tank, and whether it was removed. Absent further information and its intended use for sanitary wastewater, ENVIRON considers this matter an "other finding."
- **Former Use of Chlorinated Solvents:** Chlorinated solvents were historically used as mold release agents in the iron and steel forging industry. The 1993 R&R Phase II Report states that 1,1,1-trichloroethane and tetrachloroethylene were detected in soil borings sampled in the vicinity of Lagoon 3. Additionally, the 1998 Parsons SQG Review Report indicates that in 1991, trichloroethylene was identified in the floor scrapings generated at the site at levels well below hazardous concentrations. The facility personnel have no information on past use of solvents at this site. This matter is not considered a REC; however, past reports indicate that chlorinated solvents were used which could have adversely affected the conditions at the site.

2.3 *De Minimis* Conditions

ENVIRON identified the following *de minimis* conditions, which are considered noteworthy from a business risk perspective: 1) possible impacts from neighboring properties; and 2) the possible former use of pesticides associated with the site's historical agricultural use. Additional discussion of these findings is provided in Section 6.3.

3 Site Description

3.1 Site Setting

CDF operates a steel forge engaged in manufacturing parts for the aeronautical, locomotive, and off-road transportation industries located in Canton, Ohio (the "site" or the "facility"). The site consists of three parcels: The largest is at 4575 Southway Street, Canton, Ohio. Two parcels, across Southway Street, are also owned by Canton Drop Forge and are used largely for the storage of old equipment and for quality control testing of products. The nearly 33-acre site is located approximately 65 miles southeast of Cleveland, Ohio (Figure 1). The site is developed with multiple buildings, with a total square-footage of approximately 254,000, located towards the western portion of the property. Other smaller structures on the site consist of dumpsters used for storage of general facility trash, trailers for the storage of final product, cylinder storage area, pump rooms, a well room, and laboratory testing areas. Details of each major on-site building are listed in Table 3.1. The layout and relative locations of each of these structures are depicted in Figure 2.

Table 3.1: Major On-site Buildings

Name	Abbreviation on Map	Description	Year of Construction	Approximate Area (sq-ft)
Building A	B-A	Three story office space	1942	11,900
Building B	B-B	Manufacturing area, housing the Rough Turn Department, heat treat, inspection and shipping operations	Between 1942 and 1957	76,800
Building C	B-C	Forge shop	1942	52,700
Building D	B-D	Die storage and maintenance operations	1942	17, 200
Building E	B-E	Boiler House	1942	5,300
Building G	B-G	Upsetter Department	1942	21,000
Building K	B-K	Saw Department	1952	10,100
Building M	B-M	Die Shop, Quality Control lab and office, Engineering Department	1951	35,500
Building O	B-O	Press Room and Old Press Building	Between 1951 and 1957	15,000
Beaver Building	None	Storage of old equipment	1929	2,730
Hot Tensile Building	None	Testing Department	1925	480

The site is accessed from Southway Street at the southern site boundary via three gates. The access road from the main gate, G2, is surfaced with asphalt and leads to an asphalt-paved parking area present in the southern portion of the site. Other roads at the site, including those leading from Gates 1 and 3, are unpaved and covered with gravel or steel-mill slag. An unused

rail spur is located along the northern property boundary. Three ponds or lagoons are located on site. The facility's wastewater discharges to these lagoons via an oil/water separator. These lagoons also receive storm water. Table 3.2 provides an overview of physical setting and utility information for the site.

Table 3.2: Physical Setting and Utility Information

Conditions	Source	Description
Topography		
Elevation (above mean sea level)	USGS topographic map (Canton, Ohio, 1994)	Ranges from approximately 1092 feet near the northern boundary to 1050 feet near the southern property boundary.
Topographic Gradient	USGS topographic map; visual observations	Relatively flat, with a gentle downward slope to the south-southwest. Regional topography slopes gently downward to the south.
Hydrology		
Surface Water Runoff	Visual observations	Percolates into the ground surface at unpaved areas. In paved areas, storm water enters catch basins that discharge to Lagoon 1.
Nearest Surface Water Body	USGS topographic map; visual observations	Sippo Lake, located approximately 1.4 miles northeast.
Flood Plain	FEMA*	Facility personnel reported no known occurrences of flooding at the site. The site is not located within a 500-year flood zone.
Wetlands	NWI*	No on-site federally designated wetlands. However, nine state wetlands are located on site.
Geology and Hydrogeology		
Presumed Direction of Shallow Groundwater Flow	1993 R&R Phase II Report	Shallow groundwater was found to flow north.
Depth to Groundwater	1993 R&R Phase II Report	Of the eight wells drilled during the 1993 Phase II investigation, ground water was encountered between 35 and 51 feet below ground level in seven wells around the site. One static well, located in the southwestern property boundary, recorded depth to groundwater to be 6.47 feet.
On-site Wells	Facility personnel; visual observations	Two wells (250 feet deep) are located on site.

Table 3.2: Physical Setting and Utility Information

Conditions	Source	Description
Nearest Groundwater Supply Wells	EDR database report	One federally registered well is present within 1 mile southeast of the site; it is registered as a public supply well. Two private or municipal wells that may be used for water supply are located within 1 mile south, and at lower elevation of the site.
Geologic Conditions	NCSS*	Regional soils are well drained loams with moderate infiltration rates.
Site Utility Information		
Electricity Supplier	Facility personnel	American Electric Power
Natural Gas Supplier	Facility personnel	Dominion East Ohio
Use of Fuel Oil for Building Heat	Facility personnel	Facility personnel indicated that Number 2 and Number 6 heating oils were historically used in forge furnaces, and Number 2 fuel oil is currently being used in the boilers.
Water Supplier	Facility personnel	Two on-site wells
Sanitary Sewer	Facility personnel	City of Massillon
Septic Systems	Facility personnel	There are no current septic systems on site. However, a septic system was historically located in the vicinity of Building M.

Notes:

FEMA = Federal Emergency Management Agency; NCSS = National Cooperative Soil Survey; NWI = National Wetlands Inventory

* Source was provided in the EDR database report.

3.2 Current Use of Property

CDF employs approximately 400 individuals in the manufacture of steel forgings. Based on the operations conducted and information provided by the facility, it appears that the most appropriate primary Standard Industrial Classification (SIC) code for the facility is 3462, *Iron and Steel Forgings*; the corresponding North American Industry Classification System (NAICS) code is 332111, *Iron and Steel Forging*.[1] Operations at the site are conducted in three shifts, 8 hours each, 7 days per week. The major operations conducted at the facility consist of receiving raw material, cutting, heating, forging and heat treating steel, and cleaning, inspecting and shipping the finished product. These operations are described in more detail below.

[1] A formal determination of the most appropriate SIC/NAICS code for the site was beyond the scope of ENVIRON's review.

- *Receiving* – The primary raw material used at the facility is steel bars. Various grades of steel are received by the facility in the loading docks in the eastern portion of Building B, and are stored in the Steel Storage Yard to the west of Lagoon 3. Other materials received at the facility include, but are not limited to, lubricating oil, hydraulic oil, quench oil, diesel, kerosene, and calcium carbonate. Solvents, used for maintenance purposes, are also received in limited quantities. These materials are received in steel drums, totes, fiber-drums, and retail size containers, and are stored at their points of use in the facility.
- *Main Processing* – The major processes performed at the facility include:
  - *Heating* – Steel is heated prior to forging in furnaces located in Building C. Temperatures in the furnaces are maintained at 2,300°F. However, this may vary, depending on the grade of the steel and product specifications.
  - *Forging* – Heated steel bars are transported via forklifts to dies located adjacent to the furnaces in Building C. One half of the die is attached to the hammer (the upper half) and the other half is attached to the anvil (the lower half). The hot metal is placed in the anvil, and struck repeatedly with the hammer. This forces the steel to flow in all directions, filling the die cavity and attaining the required shape.
  - *Trimming* – Forged steel is moved to an adjacent press to trim flash.
- *Finishing* – Many different finishing processes are conducted at the facility depending on the part being manufactured. The forged product may be heat treated and cooled using quench oils, or cleaned by shot blasting and grit cleaning. This is primarily carried out in Buildings B and G. This is followed by testing the product for cracks and other structural weaknesses using non-destructive methods. This is performed using a proprietary fluorescent penetrant called Magnaflux Zyglo, and is done in Building B. Finished products are packaged and stored in the Finished Material Storage area to the north of Lagoon 2 and in Building B, prior to shipment.
- *Wastewater Treatment* – Wastewater generated at the site includes sanitary wastewater, boiler blowdown, air compressor condensate, plate press filtrate, laboratory sink waste, non-contact cooling water, die-cleaning solutions, and floor-wash water. The facility discharges only sanitary wastewater, boiler blowdown, air compressor condensate and plate press filtrate to the local sanitary sewer. All other water is treated and stored on-site by channeling it through a system of lagoons. Wastewater, often in contact with lubricating oil, kerosene, and other petroleum-based substances, is initially routed to an oil-water separator located in the southwestern portion of the property. Overflows from this oil-water separator, and storm water in this region are directed to Lagoon1, located in the southwestern corner of the property. Water from the oil/water separator is transferred to Lagoon 2 located to the east of the manufacturing buildings via underground piping. At Lagoon 2, residual oil is skimmed off the top and the remaining water is then pumped to Lagoon 3, located in the eastern portion of the property. Water from Lagoon 3 is lost by evaporation and infiltration.
- *Ancillary Operations* – The facility performs packaging, shipping/receiving, and administrative operations, none of which involve the use of significant quantities of chemicals. Other ancillary operations conducted at the facility include operation of three boilers for steam generation, two wells for process water withdrawal, and die

manufacturing, cleaning and storage. Metal dies are produced in a tool room, which is equipped with grinders, lathes, and milling machines. CDF also operates a quality control laboratory, in which physical tests are conducted on products. To move finished products within the buildings, the site uses thirty diesel-powered and two propane-powered forklifts, and two tractor trailers, all of which are serviced on-site by outside contractors. Portions of the building such as the office space and quality control laboratory are cooled with air conditioners, and heated with steam heat.

The primary raw materials used on-site are steel bars of various grades. In addition, CDF uses maintenance-related materials, such as oils, lubricants, greases, non-chlorinated degreasers, welding gases, boiler/cooling tower/wastewater treatment chemicals, non-destructive testing chemicals, and sanitizers and detergents.

According to facility personnel, CDF's operations have remained generally consistent during its period of occupancy at the facility.

According to facility personnel, no chlorinated solvents are currently used at the facility and personnel have no knowledge of their historical use. Based on the nature of the operations at the site, the historical use of chlorinated solvents at the site is likely. This is further discussed in Sections 6.1 and 6.3 of this report.

3.3 Current Use of Adjoining Properties

The facility is located in a mixed land use area. The nearest residential area is located across Southway Street to the south of the facility. Based on discussions with facility personnel, ENVIRON's visual observations from the property boundary and public rights-of-way, and a limited review of publicly available information, a general determination of the current use of adjacent properties was developed, as described in Table 3.3.

Table 3.3: Current Use of Adjacent Properties

Direction	Property/Land Use	ENVIRON's Observations
North	Unused railroad tracks, followed by largely undeveloped land. To the northeast is Gaspar, a metal fabrication company. Adjacent to and west of Gaspar are two unoccupied properties.	Extensive storage of scrap metal was observed along Gaspar's property boundary. Scrap metal, rubber and construction material storage was observed on the properties adjacent to Gaspar.
East	An unmarked, approximately 10,000 sq-foot warehouse	Scrap metal was observed to be stored to the west of the building.
South	Southway Street, followed by (from west to east) Dave's Auto Sales, an automobile repair shop; Safety Resources Company, a safety consulting company; GM Electric, Inc., an electrical system design; single family homes; CND Machine, Inc., a steel structural manufacturer; Terri's Dispatch Service; and RH Little Company, a rail road equipment and supplies manufacturer.	ENVIRON observed the outdoor storage of approximately ten drums of unknown material to the east of the GM Electric, Inc. building No other exterior storage or chemical operations were noted to the north, west and east of the other properties. Due to access constraints, ENVIRON was unable to observe the southern boundaries of these properties.

Table 3.3: Current Use of Adjacent Properties

Direction	Property/Land Use	ENVIRON's Observations
West	Dominion East Ohio	No apparent exterior manufacturing or chemical storage operations were observed during ENVIRON's reconnaissance.

Notes:

Observations were made by ENVIRON during the site visit. ENVIRON walked or drove by the borders of these properties that are shared with the subject site. ENVIRON did not enter the neighboring properties and was, therefore, unable to observe the rear and sides of the properties.

4 Review of Public Records and Other Information Sources

4.1 Environmental Regulatory Database Review

ENVIRON contracted with EDR in July 2012 to prepare a summary of listings in federal and state agency databases for the site and facilities within applicable radii of property, as specified by the ASTM standard[2]. A copy of the EDR report is presented in Appendix B.

4.1.1 Database Review for the Site

ENVIRON reviewed the results of the state and federal environmental database searches performed by EDR (see Appendix B). The site is listed on 12 environmental databases, as discussed in Table 4.1.

Table 4.1: Summary of Environmental Database Listings for the Site

Listing Name or Address	Database	Comments	Reference for Further Discussion
Databases Related to Potential Site Conditions			
Canton Drop Forge, Inc.	SPILLS	The site is listed as having had two releases: a 1992 release of smoke to the air, and a 1994 waste oil spill.	N/A
Canton Drop Forge, Inc.	Ohio EPA – Division of Emergency and Remedial Response (DERR)	The site is listed on the DERR database of the Ohio EPA for being on their Site Assessment Program.	N/A
Canton Drop Forge, Inc.	LUST	The site is listed on the Leaking Underground Storage Tank (LUST) database for an undated release of an unknown material from a regulated UST. The reported release incident has been granted No Further Action or NFA status. The LUST database also reports the closure of a regulated UST in 1999. This listing has been granted No Further Action Data Cleaning status and is still listed as 'active.' The Ohio State Fire Marshall's Office - BUSTR did not have any additional information regarding this listing.	Section 6.3
Canton Drop Forge, Inc.	UST	This database listing indicates that one 10,000-gallon regulated UST, which was installed in 1942, was removed from the site in 1999.	Section 6.3

[2] EDR uses the term "radii" to refer to the ASTM terminology, "approximate minimum search distance" in the environmental database report.

Table 4.1: Summary of Environmental Database Listings for the Site

Listing Name or Address	Database	Comments	Reference for Further Discussion
Databases Related to Regulatory Compliance			
Canton Drop Forge, Inc.	NY MANIFEST	CDF is listed on this database with regard to disposal of its Polychlorinated Biphenyl (PCB) wastes (waste code B007). The listing states that 800 pounds of PCB-contaminated waste, in metal drums and barrels were landfilled at SCA Chemical Waste Services' site in Model City, NY in 1988. This landfill is not listed on the NPL, and has an NFRAP status.	N/A
Canton Drop Forge, Inc.	ICIS	According to the listings on Integrated Compliance Information System (ICIS), CDF has received one Section 16 TSCA violation. It is unclear why this notice was received. Facility personnel were not aware of any documentation received regarding this.	N/A
Canton Drop Forge, Inc.	AIRS	The AIRS database indicates that CDF has 34 significant emission units, 30 insignificant emission units, and no trivial units per Engineering Guide #62. It provides details (such as design capacity, installation date, major pollutants released, and operational hours) regarding these emission units.	N/A
Canton Drop Forge, Inc.	Tier II; Toxic Release Inventory System (TRIS)	CDF is listed on the Tier II database as having submitted Tier II chemical inventory reports for the following materials: Aluminum, cobalt, copper, manganese, nickel, vanadium and chromium. Tier II forms have been submitted annually since 1987.	N/A
Canton Drop Forge, Inc.	CERCLIS – NFRAP	The site is listed on the CERCLIS database as being on the No Further Remedial Action Planned (NFRAP) and does not qualify for the National Priorities List (NPL) based on existing information. Following preliminary assessments in 1985 and 1990, and a site inspection in 1991, the site was archived in 1994.	N/A
Canton Drop Forge, Inc.	Facility Index System/ Facility Registration System (FINDS)	The site is listed in FINDS (a pointer database) regarding its listings on other regulatory and compliance databases. Specifically, the site is listed in the Ohio – Core (OH-CORE) database, Integrated Compliance Information System (ICIS), the National Emissions Inventory (NEI), RCRAInfo, Aerometric Information Retrieval System (AIRS) Facility Subsystem (AIRS), and the US EPA Toxics Release Inventory System (TRIS). Additional information in RCRAInfo is included below; however, no other information was provided for the OH-CORE or NEI databases.	N/A

Table 4.1: Summary of Environmental Database Listings for the Site			
Listing Name or Address	**Database**	**Comments**	**Reference for Further Discussion**
Canton Drop Forge, Inc.	Resource Conservation and Recovery Act (RCRA) – SQG	CDF is listed in the RCRA database as a small quantity generator of hazardous waste, and has been reported as such since 1980. Wastes listed on the database as being generated on-site include D002 and F010. The site has received two notices of violation (NOVs) relating to reporting and recordkeeping requirements in the last five years. These violations have been closed.	N/A

4.1.2 Database Review for Surrounding Properties

There are several listings in the EDR report for off-site facilities within applicable ASTM search radii. Several of these listings (e.g., hazardous waste generators, registered USTs/ASTs, RCRA and FINDS), by themselves, are not necessarily indicative of environmental concern and, therefore, are not discussed herein. A number of facilities appear on databases indicating potential contamination concerns (e.g., CERCLIS). Of the sites representing a potential environmental concern, only those facilities that are located adjacent to or upgradient of the property are discussed in Table 4.2 below.[3] These facilities were selected for further discussion based on the assumption that a hazardous material released to the subsurface generally does not migrate laterally within the unsaturated soil for a significant distance, but a hazardous material can migrate in the groundwater in a generally downgradient direction; however, the direction of groundwater flow may be affected by localized topographic, hydraulic, and hydrogeologic conditions.

Table 4.2: Summary of Environmental Database Listings Potentially Indicative of Environmental Concern for Upgradient or Adjacent Properties to the Site			
Listing Name or Address	**Database**	**Comments**	**Reference for Further Discussion**
Meredith Investments	SWF/LF	Meredith Investments, located 38 feet and potentially upgradient from the subject site is listed on the SWF/LF database. This database lists licensed solid waste facilities. The listing does not specify when and what type of material is or was historically disposed off at this site.	Section 6.3

[3] Based on information contained in the 1993 R&R Phase II report, shallow groundwater beneath the site flows to the north.

Table 4.2: Summary of Environmental Database Listings Potentially Indicative of Environmental Concern for Upgradient or Adjacent Properties to the Site

Listing Name or Address	Database	Comments	Reference for Further Discussion
Van Kay Inc, Canton	VCP	The Van Kay, Inc. site, located within one-quarter mile east of the subject site is listed on the VCP database. It indicates that the Van Kay site (with EPA ID# OHD980610091) is enrolled in the Site Assessment Voluntary Action Program. It is not on the NPL and is listed with NFRAP status.	Section 6.3
Rees Plating Site	CERCLIS	This site, located within one-half mile west of the subject site is listed on the CERCLIS database (with EPA ID# OHN000510550). It is not listed on the NPL as it is a Removal Only Site (No Site Assessment Work Needed).	Section 6.3
Miscellaneous Sites	LUST	There are six sites listed on the LUST database that are located within a 1/8-mile radius of the subject site. All the six listings are listed as inactive and have been granted 'No Further Action' or NFA status.	N/A

The EDR report indicates that poor or inadequate address information was available for several sites located in the vicinity of the property; therefore, these sites could not be readily mapped by EDR. Because the location of these sites with respect to the property could not be evaluated, ENVIRON is limited in its ability to express an opinion regarding the potential for impact to the property from these sites. It was beyond the scope of this review to accurately locate each of the unmapped sites identified by EDR; however, ENVIRON reviewed the list of unmapped sites and verified that none appeared to be adjacent to the subject site.

4.2 Historical Use Information of the Site and Surrounding Area

Based on ENVIRON's review of readily available historical sources of information (Table 4.3) and discussions with facility personnel, the site was farmland until it was first developed in 1942 by the U.S. Army Air Corps to manufacture parts for aircraft and land-based fighting equipment. Between this time and 1951, the plant was operated by CDF. In 1951, CDF, owned by the Brauchler family, officially acquired property rights to the site, and continued to operate the facility. CDF was purchased by The Cordier Group in 1981. It is currently owned by Engineering Materials, Inc.

The properties in the vicinity of the site have primarily been used for industrial purposes, since at least the 1950s. Notable operations on surrounding properties include auto repair garages, excavators, and gas distribution facilities.

A discussion of potential soil and groundwater contamination findings associated with historical uses of the site is presented in Section 6.2.

Table 4.3: Review of Historical Reference Sources

Time Period	Reference	Description of Site	Description of Surrounding Properties
1900s	1903 topographic map	The site is depicted as undeveloped on the topographic map.	Properties surrounding the subject site are also depicted as undeveloped.
1910s – 1940s	Historical references sources were not reasonably ascertainable for this time period		
1950s	1952 and 1957 aerial photograph; 1958 topographic map;	The site appears to be developed, with Buildings A, B, C, D, E, G, K, and M in their current locations in the 1952 aerial photograph. The 1952 aerial photograph also shows the presence of Lagoon 1. The 1957 aerial photograph and the 1958 topographic map show the presence of Lagoons 2 and 3.	An increasing level of residential and industrial development is observed in the 1952 and 1957 aerial photographs. The properties south of the site, across Southway Street, appear to be used largely for agricultural purposes, with the additional presence of what appear to be single family homes. Industrial development is evident to the west and east of the subject site in the aerial photographs. This is corroborated by depictions of buildings in the topographic map.
1960s	1960 and 1967 aerial photograph; 1967 topographic map	In the 1960 aerial photograph, the site appears to be in the same general configuration as in the 1950s historical sources. In the 1967 photograph, an additional structure appears to be located north of Lagoon 3. Additionally, land in the location of the former landfill, northeast of Lagoon 2 appears to be disturbed. However, the structure north of Lagoon 3 in the 1967 aerial photograph is not depicted in the topographic map.	The properties directly east and west of the building appear to be developed in the aerial photographs. In the 1960 aerial photograph, the properties to the south of the subject site appear to be largely agricultural; however, in the 1967 aerial photograph, they appear to be residential or commercial. Buildings are depicted to the north, south, east and west of the subject site in the 1967 topographic map.
1970s	1971 and 1976 aerial photographs; 1978 topographic map	Due to their low resolution, no inference could be drawn from the 1971 and 1976 aerial photographs. The site is depicted in the same general configuration as depicted in the 1960s historical sources.	There are no significant changes to the properties in the vicinity of the site, except for increased development in all directions relative to the site.
1980s	1981 city directory; 1982 aerial photograph; 1985 topographic map	The site is listed as 'Canton Drop Forging and Manufacturing Company' on the 1981 city directory. Due to its low resolution, no inference could be drawn from the 1982 aerial photograph. The site appears to be in its current configuration in the 1985 topographic map.	The city directory lists H&N Service Center, Beaver Excavating Company, Inc., and Quality Asphalt Paving Company as being located on properties adjacent to the site. Significant development is observed to the south of the subject site.

Table 4.3: Review of Historical Reference Sources

Time Period	Reference	Description of Site	Description of Surrounding Properties
1990s	1991 and 1994 aerial photographs; 1994 topographic map; 1995 city directory	The site is listed in the 1995 city directory as 'Canton Drop Forge Manufacturing.'	No changes relative to the 1980s sources. CND Machine, W&W Auto Sales, Northern Mobile Electric, Inc., and Beaver Excavating, Inc. are listed in the 1995 city directory on properties surrounding the subject site.
2000s	2002 city directory; 2005 and 2006 aerial photographs	The site is listed in the city directory as 'Canton Drop Forge.'	No changes relative to the 1990s sources. CND Machine, Northern Mobile Electric, Inc., and various individual landowners are listed in the 2002 city directory on properties near the subject site.
2010s	2012 aerial photograph*	There are no significant changes relative to the 2000s sources.	No significant changes relative to the 2000s sources.

Notes:

The site address was not listed in the searched city directories dated between 1921 and 1980. EDR reported that Sanborn fire insurance coverage is not available for the site.

* Aerial photograph/satellite imagery was viewed at Google Earth. Printed copies were not obtained, and imagery dates were not independently verified.

5 Site Reconnaissance

5.1 Methodology and Limiting Conditions

Ashish Deshmukh and Meghna Nooyi of ENVIRON conducted a visit to the site on July 18, 2012. During the site visit, observations of both the interior of the buildings and exterior portions of the site were made to evaluate if any RECs, as defined in Chapter 2.0, are present. ENVIRON did not observe the roof of the buildings.

5.2 Underground Storage Tanks

According to the 1993 R&R Phase II Report, the 2000 Hammontree Phase I Report, and documentation from BUSTR, there are eight USTs present at the site and two former USTs that have been closed and removed. Facility personnel stated that the eight remaining tanks are no longer in use and that they have not been closed or excavated. Facility personnel also stated that they monitor the depth of oil in each tank annually and have reported no changes in oil levels over time in the tanks. Because of their use, the tanks are not required to be registered with BUSTR. In addition, facility personnel had no further information regarding the construction of the tanks. Available details of the USTs are provided in Table 5.1.

Two USTs were subject to registration under BUSTR and were properly closed. ENVIRON was provided with closure documentation from BUSTR for two other USTs: one 10,000-gallon quench oil UST in Tank Farm 2, and one 1,000-gallon gasoline UST east of Building M. Both received 'No Further Action' or NFA status. A discussion of investigation activities associated with the closure of these USTs is presented in Section 6.1.

Table 5.1: Summary of Underground Storage Tanks

Number and Size (gal.)	Location	Contents	Key Dates	Regulatory Closure Granted	Notes
Without Closure Documentation					
4 x 25,000	Tank Farm 1, between Building C and Building G	Number 2 Fuel Oil	Installed in the early 1940s (presumably 1942), CDF ceased using these tanks in the late 1990s – early 2000s.	Not subject to BUSTR.	None
3 x 10,000	Tank Farm 2, east of Building E	Number 6 Fuel Oil	Installed in the early 1940s (presumably 1942), CDF ceased using these tanks in the late 1990s – early 2000s.	Not subject to BUSTR.	None
1 x 20,000	Tank Farm 2, east of Building E	Number 6 Fuel Oil	Installed in the early 1940s (presumably 1942), CDF ceased using these tanks in the late 1990s – early 2000s.	Not subject to BUSTR.	None

Table 5.1: Summary of Underground Storage Tanks

Number and Size (gal.)	Location	Contents	Key Dates	Regulatory Closure Granted	Notes
Decommissioned/Closed-in-Place/Removed					
1 x 10,000	Tank Farm 2, east of Building E	Quench Oil	Installed in 1942, this UST was removed in 1999	NFA status granted in May 1999	None
1 x 1,000	East of Building M	Gasoline	The tank, installed in 1942, was closed in place in March 1990	NFA status granted in March 1990	None

Although not considered to be a UST, trenches in Building C are used to capture the kerosene-water mixture that is used to clean dies. The dies are placed on a grate over these trenches and hosed down. The trenches discharge the water to the oil-water separator in the southwestern portion of the property. Additionally, a pit is associated with this oil-water separator, where oil is stored temporarily prior to its transfer to tanks, drums and totes for disposal at an off-site facility.

5.3 Aboveground Storage Tanks

Several ASTs are maintained at the site. They are used for the storage of petroleum products such as used oil, diesel and kerosene, and are detailed in Table 5.2. An 110,000-gallon water tank is present along the property's northern boundary. Facility personnel reported that there are underground transfer lines used to convey material from the tanks. Facility personnel were not aware of any leaks or spills relating to the ASTs.

Table 5.2: Summary of Aboveground Storage Tanks

Number and Approximate Size (gal.)	Contents	Location	Secondary Containment	Notes / Observations
1 x 12,000	Used Oil	North of Building E	No	None
1 x 8,000	Used Oil	Southeastern corner of Lagoon 2	No	This AST is used for the temporary storage of oil skimmed from Lagoon 2, prior to transfer to drums and totes for off-site disposal. Heavy oil-staining of soil was observed in its vicinity.

Table 5.2: Summary of Aboveground Storage Tanks				
Number and Approximate Size (gal.)	**Contents**	**Location**	**Secondary Containment**	**Notes / Observations**
1 x 300	Kerosene	To be installed west of Building C	Yes; double walled	Heavy oil-staining of soil was observed in the tank's vicinity.
1 x 300	Diesel	North of Building B	Double walled	None
1 x 150	Kerosene	Within Building C	Yes	None
1 x 8,000	Diesel	North of Bulding D	Yes; trough	None
1 x 2,200	Quench Oil	Within Building B	Yes	None
1 x 1,200				
1 x 1,150				
4 x 500	Lubricant Oil	South of Building C	Yes; berm	None
6 x 280	Lubricating Oil	South of Building C	Yes; berm	None
1 x 100,000	Well Water	East of Building K	No	None

Although not considered to be ASTs, hydraulic oil reservoirs are present in manipulators, presses, saws, straightening presses, brinell machines and pressure washers. Releases from hydraulic oil tanks are generally collected in drains and routed to the oil-water separator near Lagoon 1.

5.4 Drum and Other Storage Areas

Drums and totes are stored in various locations at the site. These are listed below:

- **Southeast corner of Lagoon 2:** During the site reconnaissance, ENVIRON observed around thirty 55-gallon drums and fifty 400-gallon totes located to the southeast of Lagoon 2. These totes and drums are used for the storage of oil that is skimmed off the surface of the oil-water mixture pumped into Lagoon 2. The totes and drums are regularly shipped off-site for disposal. They were not provided with secondary containment, and extensive staining of soil in this area was noted. A detailed discussion is provided in Section 6.2.
- **East of Well 1:** Approximately 15 drums containing sodium hypochlorite used for the treatment of well water were located adjacent to and east of Well 1, along the property's northern boundary. The drums were not provided with secondary containment, and minor staining of soil adjacent to them was observed.
- **North of Building G (Upsetter Department):** Several cylinders of oxygen, propane, carbon dioxide and acetylene were stored in a shed near the northwestern corner of the property, north of Building G. The cylinders were segregated based on the nature and level of their contents. No major stains were observed in this area.

- **West of Building C (Forge Shop):** Storage of material was observed in the location of former Tank Farm 1, to the west of Building C. Among the materials observed were 55-gallon drums of lubricating, hydraulic, and used oil, and unlabeled 400-gallon totes. Soil staining was observed in this area.
- **Die Shop:** At least five 55-gallon drums of hydraulic oil and three 55-gallon drums of used oil were located near the western wall of the die shop. The hydraulic oil drums were provided with secondary containment, but the used oil drums were not. Minor staining was observed on the floor in this area.

In addition to these areas, other chemicals are positioned at their points of use throughout the building interior and include: hydraulic fluids, quench oil, lubricants, kerosene, and non-destructive testing materials. Retail-sized quantities of paint (aerosol cans and gallon containers), and five-gallon pails of acetone and acetylene glycol are stored inside metal flammable cabinets at various locations in the building.

5.5 Polychlorinated Biphenyls

Facility personnel maintain a log of on-site equipment that is known to contain PCBs. According to this log, there are currently six capacitors and four transformers on the property that contain PCBs. The six capacitors contain 10 kg of PCB-contaminated oil each, and are located (in pairs) in Buildings B, E, and G. The PCB-contaminated transformers, each containing approximately 2,200 kilograms of PCB-contaminated oil, are also located in Buildings B, E, and G. The units are located in areas with limited access, and are labeled as to their PCB content. Although not listed on the PCB log, given the date of construction of the buildings, it is likely that light ballasts, hydraulic lifts and other equipment contain PCBs.

ENVIRON observed no indication of leaks or releases from electrical equipment observed during the site visit.

6 Findings, Opinions, and Conclusions

ENVIRON conducted a Phase I ESA of the facility located at 4575 Southway Street, Canton, Ohio. The objective of the ESA was to identify RECs, which the ASTM Standard defines as follows:

> The presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be *de minimis* are not recognized environmental conditions.

Information on the soil and groundwater conditions at the site, as well as ENVIRON's findings and opinions, are presented in Section 6.1 through 6.3.

6.1 Prior Environmental Activities

Based on a review of historical site documents and interviews with facility personnel, a number of prior environmental assessment, sampling, or remediation activities have been conducted at the site, as described below:

- **1983 Inspection by Ohio EPA:** In 1983, following an anonymous complaint regarding buried drums and sludge, Ohio EPA inspected the CDF facility. In a letter report from the Ohio EPA to CDF dated July 28, 1983, the former reported that 15 to 20 partially exposed and leaking drums of used lubricants were buried adjacent to Lagoon 2 in the 1960s. The letter recommends that the facility cover the drums and the lagoon wall with a minimum of 2 feet of clay. It is unclear whether this was carried out. ENVIRON did not observe any partially buried drums on site during the walkover. This matter is discussed in Section 6.2.
- **1990 UST Closure:** One 1,000-gallon gasoline UST was excavated and removed in 1990 by the Joseph A. Jeffries Company, Inc. According to the UST closure report, the contents of the tank were purged with dry ice. Once cleaned, the tank was removed and sent off-site for shearing and disposal. The area was backfilled with clean limestone. No holes were reported as having been observed in the UST and an analysis of three soil samples collected to the north, south and center of the UST was performed. Groundwater was not encountered in the excavation. Based on the analytical results and the closure report reviewed, BUSTR granted this closure a 'No Further Action' or NFA status.
- **1991 Screening Site Inspection:** Ecology and Environment, Inc., at the behest of the USEPA, conducted a screening site inspection (SSI) of CDF in 1991. The purpose of the SSI was to identify and remediate any immediate threats to human health and the environment. It was also performed to determine whether the site qualifies to be on the National Priorities List or NPL. The 1991 E&E Screening Site Inspection Report identified the presence of an unlined on-site landfill, and three man-made lagoons. The report

identifies all three lagoons as being unlined. Further discussion of these issues is contained in relevant sections of this report.

- **1992 Expanded Site Inspection Prioritization:** An Expanded Site Inspection Prioritization was done by PRC Environmental Management, Inc. in 1992. This inspection identified issues similar to the 1991 E&E Screening Site Inspection Report detailed above. Pertinent historical and site-related information contained in this report has been incorporated into other sections of this report.
- **1993 Soil and Groundwater Investigation:** In February 1993, R&R Environmental was retained by Hammontree & Associates to perform a Phase II environmental assessment of soil and groundwater. The investigation included the advancement of eight soil borings at potential areas of concern including at Tank Farm 2, at the historical on-site landfill, and adjacent to the on-site lagoons. Soil and groundwater samples were collected from each boring and analyzed for TPH, VOCs, semi-VOCs, PCBs, cyanide, recoverable phenolics, and metals. Shallow soil samples were collected from locations near three transformer areas located outside of the plant buildings and tested for PCBs. TPH were detected in soil samples obtained from three of the eight borings, located south of Lagoon 3. Their concentrations ranged from 4,400 to 6,800 ppm. This is greater than current Ohio EPA Voluntary Action Program (VAP) regulatory closure levels of 1,000 ppm. In groundwater, the petroleum hydrocarbon concentration was reported as 34 mg/L and the barium concentrations ranged between 1.9 and 3.4 mg/L. While no groundwater limit for petroleum hydrocarbon had been established by Ohio EPA or USEPA at the time of the report, barium concentrations exceeded the Ohio EPA MCL of 2.0 mg/L. The report indicated that soil materials recovered from this area were heavily stained by hydrocarbons, had a strong hydrocarbon odor and a sheen that was observed on the groundwater during sampling. PCBs were detected in shallow soils sampled in two locations: north of Building E, and east of Building B. This soil and groundwater contamination is further discussed in Section 6.2.
- **1997 Sampling and Analysis of Lagoon 2:** An environmental and geotechnical sampling, analysis and treatability testing was performed on Lagoon 2 in 1997 by Parsons Engineering. Sediment samples were collected from approximately 0 to 0.5 feet below sediment surface at ten sampling locations within Lagoon 2. They were analyzed for total petroleum hydrocarbons, middle range organics, heavy range organics and semi-volatile compounds. Sludge from each sampling location was submitted for geotechnical analysis. Only one sludge sample, collected from the eastern corner of the lagoon indicated a heavy range organics concentration (37,000 mg/kg) greater than its corresponding regulatory standard (20,000 mg/kg). The geotechnical test revealed that approximately 5,000 cubic yards of depositional material was present in the lagoon.
- **1999 UST Closure:** One 10,000-gallon quench oil UST was closed in place in 1999. It was abandoned in place due to the proximity of other product piping and underground utilities. The UST closure report states that the UST was cleaned of all residual liquids and sludge prior to filling with gravel and concrete slurry. Soil samples were collected from the eastern and western ends of the tank. Based on the soil analytical results and the closure report, BUSTR granted this closure an NFA status.

- **2000 Phase I Environmental Site Assessment:** A Phase I ESA was performed by Hammontree & Associates in September 2000 in relation to a potential financial transaction. The 2000 Hammontree Phase I report provided CDF with several recommendations, namely, providing secondary containment to ASTs, drums and totes, disposing of unused tanks and drums and totes, modifying the oil-water separator located to the south of the facility to reduce oil leaks, disposal of unused process equipment, and miscellaneous soil and groundwater assessments. Pertinent historical and site-related information contained in the 2000 Phase I Report has been incorporated into other sections of this report.

Based on the above-described environmental activities, prior Phase I assessments, discussions with facility personnel, a review of site-related documents, and ENVIRON's site observations, a few known and potential site contamination findings have been identified. These findings are described in more detail in Sections 6.2 and 6.3.

6.2 Known Site Conditions

The following known contamination conditions were identified in relation to the site.

- **Three on-site lagoons that receive process wastewater:** Three lagoons that receive discharge of process water via an oil/water separator are located on site. A mixture of oil and water generated in the forging operations is initially directed to an oil-water separator, located to the south of Building C, which is used to remove the oil associated with the water. Overflows from the oil/water separator are routed to Lagoon 1, located in the southwestern corner of the facility. Water from the oil/water separator is transferred to Lagoon 2 located to the east of the manufacturing buildings. Residual oil floating on Lagoon 2 is skimmed off by another oil water separator located to the east of Lagoon 2. The remaining water is then pumped to Lagoon 3, located on the easternmost side of the property. Water from Lagoon 3 is lost by evaporation, percolation and infiltration. The handling of oil-water mixtures in these lagoons for several years has impacted the sediments in the lagoons and groundwater on the property.

  According to the 1993 R&R Phase II Report, and the 1983 correspondence, an inspection was performed by the Ohio EPA in 1983 in response to an anonymous complaint regarding historically buried drums. Ohio EPA discovered 15 to 20 partially exposed and leaking drums containing used lubricants buried along the edges of Lagoon 2. It is believed that the drums were originally buried in the 1960s. The 1983 Ohio EPA correspondence states that:

  > "No violations of State Hazardous Waste regulations were observed during this investigation. However, the following improvements should be made in order to help alleviate potential ground water contamination. The partially exposed drums mentioned above should be covered with a minimum of two (2) feet of compacted clay-type material. This clay should be implaced around the entire lagoon wall where drums are suspected to exist."

  It is unclear whether this has been done. The leaking lubricants could have an adverse impact on the soil and groundwater in this location. ENVIRON observed no evidence of partially buried drums in this area during our walkover.

In 1997, Parsons Engineering conducted sampling of the sediment in Lagoon 2. Sediment samples were collected from approximately 0 to 0.5 feet below sediment surface at ten sampling locations within Lagoon 2. The 1997 Parsons Lagoon 2 Sampling Report revealed that petroleum hydrocarbons were found to be associated with all samples. However, only one sludge sample, collected from the eastern corner of the lagoon indicated a heavy range organics concentration (37,000 mg/kg) greater than its corresponding regulatory standard (20,000 mg/kg).

In addition, ENVIRON observed heavy staining of soil with oil along the southern boundary of Lagoon 2. Soil in this area appeared to be saturated with used oil. Used oil recovered from the lagoons is stored in drums and totes near Lagoon 2. No secondary containment is provided for these containers. Based on the existence of impacted sediments in the lagoons, and the presence of heavy staining near Lagoon 2, ENVIRON considers the lagoons to represent a REC.

The 1993 Phase II investigation by R&R Environmental, Inc., and reported by both R&R and Hammontree and Associates, showed elevated levels of petroleum hydrocarbons and metals (dissolved barium) in the groundwater sample collected from a monitoring well adjacent to Lagoon 3 in the southeastern corner of the property. The petroleum hydrocarbon concentration was reported as 34 mg/L and barium concentration 1.9 to 3.4 mg/L. While no limit for petroleum hydrocarbon had been established by Ohio EPA or USEPA at the time of the report, barium concentrations exceeded the Ohio EPA MCL of 2.0 mg/L. The area's elevation relative to surrounding properties indicates that an off-site source is unlikely. Additionally, TPH were detected in soil samples obtained from three of the eight borings, located south of Lagoon 3. Their concentrations ranged from 4,400 to 6,800 ppm. This is greater than current Ohio EPA VAP regulatory closure levels of 1,000 ppm.

- **Historical on-site landfill:** The 1978 Waste Disposal Report, the 1991 E&E Screening Site Inspection Report, and the 1993 R&R Phase II Report, revealed that an approximately 8-acre landfill was located to the east of Lagoon 2 until the early 1980s. Although the landfill was licensed by the SCHD in June 1976, it is unclear when the landfill began operating. The landfill was divided into two zones. Zone A was used for the disposal of all wastes generated on-site like oil sludge, boiler stack scrubber sludge, floor sweepings, trash and rags, while Zone B was used for the disposal of demolition wastes, concrete, and other exempt wastes. The two zones were separated by a scrap metal salvage area. The unlined landfill represents a REC due to the nature of materials disposed of at this location.
- **Relocation of excavated sediment for biological treatment:** According to the 2000 Hammontree Phase I Report, oil-contaminated sediment was excavated from Lagoon 1 and transferred to a bioremediation cell located in the eastern portion of the property. When the cell failed to achieve the targeted hydrocarbon removal rate, the sludge was returned to Lagoon 1. Lagoon 1 was lined with clay; the sludge was placed over this; and a clay cap was used to cover the cell material. The report indicates that the location of the bioremediation cell was covered with slag. It is not known if the entire sediment was transferred back to Lagoon 1, and whether there were any soil or groundwater impacts at the location of the former bioremediation cell. ENVIRON considers the location of the former bioremediation cell to be a REC.

- **Exterior soil staining:** ENVIRON observed oil-stained soil adjacent to the southwestern property boundary, near Lagoon 1. In this area, the staining was concentrated near the oil-water separator associated with Lagoon 1. Soil to the southwest of the Forge Shop (Building C), which is adjacent to the oil-water separator, also appeared to be stained. This area is currently used to store virgin oil, used oil, kerosene, and diesel in drums, totes, and ASTs.

6.3 Potential Site Conditions

Based on current information and conditions at the facility, ENVIRON considers the likelihood of significant undiscovered soil or groundwater contamination to be low. Nevertheless, ENVIRON identified the following findings relating to potential site conditions:

- **Management of fly-ash in sub-grade pits near Building E and Lagoon 2:** ENVIRON observed two sub-grade pits that are used for the temporary storage of fly-ash, generated by the coal fired boiler. The first pit, located adjacent and east of Building E is concrete-lined. It receives a mixture of water and fly-ash, which is carried in totes to the larger sub-grade pit in the north central portion of the property, near Lagoon 2. The water is allowed to evaporate, and the remaining fly-ash is then collected by J&J Refuse for off-site disposal. ENVIRON could not verify the quality of the concrete lining in the first pit, or whether the pits have been used for storing other wastes in the past. The extent of the impact of metals and other contaminants associated with fly-ash on adjoining soils and groundwater is not known. Since ENVIRON's site visit, the concrete-lined pit was emptied out and relined with concrete. ENVIRON considers the two fly ash pits to be RECs.
- **Oil staining in sub-grade Chip Basement (below Building B):** A below-grade basement, located below Building B, is used to house a pumping station for quench oil tanks located on the first floor of Building B. Heavy oil staining was observed on the floor in this area. Even though the floor is concrete, it appeared to be in poor condition, with evidence of cracking. ENVIRON considers the Chip Basement to be a REC.
- **USTs:** The 1993 R&R Phase II Report and the 2000 Hammontree Phase I Report refer to the presence of ten USTs, which were previously used for storing Number 2 fuel oil, Number 6 fuel oil, quench oil, and gasoline. Facility personnel stated that the eight remaining tanks are no longer in use, but have not been closed in place or removed. Closure documentation has been received for two of these tanks. According to documents received from BUSTR, one 10,000-gallon quench oil UST from Tank Farm 2 (see Figure 2) and one 1,000-gallon gasoline UST, located near Building M, were removed (in 1999 and 1990 respectively), for which NFAs were received. It is not known whether any of the remaining USTs were leaking and whether they have impacted soil and groundwater at the site. ENVIRON considers the UST locations at the site to be a REC.
- **ASTs without secondary containment:** During ENVIRON's reconnaissance, ASTs used for storing oil, diesel, kerosene, and other petroleum products were observed at multiple locations. No secondary containment was observed for most of these ASTs. Since ENVIRON's site visit, secondary containment has been provided for 17 of the 20 ASTs at the site. ENVIRON cannot rule out the possibility of soil and groundwater contamination having occurred due to leaks and spills from the exterior ASTs at the site. ENVIRON considers the exterior AST locations at the site to be a REC.

- **Septic System:** According to facility personnel, a septic system located east of Building M was historically operated for the management of sanitary wastewater. This was confirmed by the City of Massillon's Sewer and Waste Collections. However, they could not verify whether there was a leach field associated with the septic system. Discharges to this system were reported to be only from domestic sources. ENVIRON cannot verify the nature of the material disposed of in this septic tank, and whether it was removed. Absent further information and its intended use for sanitary wastewater, ENVIRON considers this matter an "other finding."
- **Former Use of Chlorinated Solvents:** Chlorinated solvents were historically used as mold release agents in the iron and steel forging industry. The 1993 R&R Phase II Report states that trichloroethylene and tetrachloroethylene were detected in soil borings sampled in the vicinity of Lagoon 3. Additionally, the 1998 Parsons SQG Review Report indicates that in 1991, trichloroethylene was discovered in the floor scrapings generated at the site. The report does not indicate the concentration of the substances. Neither report states the origin of the materials. No additional information regarding quantities, storage locations, or disposal methods of these chemicals was provided to ENVIRON. Although this matter is not considered a REC, it is possible that chlorinated solvents or associated wastes may have been mishandled, which could have adversely affected the soil and groundwater conditions at the site.

***De Minimis* Conditions**

- **Potential Impact from Nearby Property:** Meredith Investments, Van Kay, Inc., and Rees Plating, listed on databases indicative of environmental concern, are located within a half-mile radius of the site. Fourteen listings of leaking USTs (LUSTs) are also located adjacent to, and potentially upgradient of the subject site. All listings have received regulatory closure. Although this matter is not considered a REC, there has been no apparent regulatory impetus to investigate whether contamination from these sites has migrated to the CDF site. If contamination associated with these sites was found to have migrated onto the CDF property, it is expected that any remedial activities would be the responsibility of the facility from which the contamination originated, and not CDF.
- **Historical Agricultural Use of the Property:** Based on ENVIRON's review of historical information sources, the property may historically have been used for agricultural purposes prior to CDF's development of the site in 1942. ENVIRON was not provided with any specific information regarding historical agricultural chemical use, but pesticides or other agricultural chemicals may have been applied on the property. It is possible that residual concentrations of agricultural chemicals may be present in soil and potentially groundwater. If residual concentrations of these chemicals are present, it is unlikely that they would be the subject of regulatory scrutiny in the context of a non-residential land use scenario. As such, ENVIRON characterizes this finding as a *de minimis* condition, provided the site use remains industrial and the property is not re-zoned for residential use.

6.4 Analysis of Data Gaps

The Phase I ESA component of this review was conducted in accordance with the methodology specified in ASTM Standard E1527-05, as agreed upon by ENVIRON and Godfrey & Kahn, S.C. in July 2012. The standard ASTM scope was expanded to include a limited review of regulatory

compliance, asbestos-containing materials, and off-site waste management facilities. Issues considered outside the scope of the ASTM Standard and this review include radon, lead-based paint, lead in drinking water, wetlands, PCBs in building materials, cultural and historic resources, ecological resources, endangered species, and high voltage power lines.

The ASTM Standard defines a data gap as "a lack of or inability to obtain information required by the practice despite good faith efforts by the environmental professional to gather such information." A data gap is only significant if other information obtained during the ESA, or professional experience, raises reasonable concerns and affects the ability of the environmental professional to identify whether a given issue is a REC. The ASTM Standard requires that the ESA report identify and comment on significant data gaps. As such, this section also provides a discussion of issues with significant data gaps, if any, that were identified as part of this assessment.

Site reconnaissance limitations and exceptions to the ASTM Standard for the assessment are discussed below.

- During the site visit, certain undeveloped portions of the site were not accessible due to the presence of fencing and dense vegetation. These areas were observed from perimeter areas. In addition, ENVIRON did not observe the roof of the buildings.
- Historical information, such as aerial photographs, was not readily available to characterize the property from the present back to the property's obvious first developed use or 1940, whichever is earlier. The earliest readily available historical source that would indicate specific site uses is an aerial photograph dated 1952, which shows the property to be used for industrial purposes.
- Because this assessment is being prepared on behalf of the owner of this site, the information required in the User Questionnaire consistent with Appendix X3 of the ASTM Standard was obtained through the site reconnaissance and interviews. As such, a User Questionnaire was not completed.
- As it is a user requirement, ENVIRON did not conduct a review of records to identify environmental liens or activity and use limitations (AULs) imposed by judicial authorities with respect to the property.

None of the exceptions, deletions, deviations, or site reconnaissance limitations noted above is considered to represent significant data gaps except the lack of documentation regarding chlorinated solvent use at the site.

7 References

7.1 Documents

EDR. 2012. "Certified Sanborn® Map Report, Inquiry Number 3368308.3." July 16.

EDR. 2012. "EDR Historical Topographic Map Report, Inquiry Number 3368308.4." July 17.

EDR. 2012. "The EDR Aerial Photo Decade Package, Inquiry Number 3368308.5." July 17.

EDR. 2012. "The EDR Radius Map™ Report with GeoCheck®, Inquiry Number 3368308.2s," July 16.

EDR. 2012. "The EDR-City Directory Abstract, Inquiry Number 3368308.6." July 17.

Canton Drop Forge. 1978. "Solid Waste Disposal Site at Canton Drop Forging & Manufacturing, Company." June.

Correspondence between Ohio EPA and Canton Drop Forge regarding historically buried drums and sludge at the facility, dated July – August 1983.

Joseph A. Jeffries Company, Inc. 1990. "Closure Report for One Underground Storage Tank at Canton Drop Forge, Canton, Ohio." March.

Ecology and Environment, Inc. 1991. "Screening Site Inspection Report for Canton Drop Forge, Inc." August.

PRC Environmental Management, Inc. 1992. "Expanded Site Inspection Prioritization for Canton Drop Forge and Manufacturing Company." May.

Wadsworth Altert Laboratories. 1992. "Twenty-nine bulk samples – Asbestos." October.

Hammontree & Associates, Ltd. 1993. "Preliminary Soil and Groundwater Assessment of the Canton Drop Forge 4575 Southway Street, Canton, Ohio." February.

R&R International, Inc. 1993. "Preliminary Soil and Groundwater Assessment of Canton Drop Forge, Inc." March.

Parsons Engineering Science, Inc. 1997. "Lagoon #1 Re-Construction/Biocell disposal Summary Report of Feasibility Analyses." May.

Parsons Engineering Science, Inc. 1997. "Environmental and Geotechnical Sampling, Analyses and Treatability Testing of Lagoon No. 2 Depositional Material at Canton Drop Forge, Inc." September.

Parsons Engineering Science, Inc. 1998. "Small Quantity Generator Review." March.

Flynn Environmental, Inc. 1999. "Underground Storage Tank Closure Assessment for Canton Drop Forge." February.

Hammontree & Associates, Ltd. 2000. "Environmental Site Assessment." September.

Canton Drop Forge. 2010. "Annual Record and Annual Document Log." January-December.

7.2 Interviews

Brad Ahbe, Canton Drop Forge. 2012. Personal interview. July 18.

Mark Abbott, Perry Township Fire Department – Fire Prevention. Telephone interview. July 19.

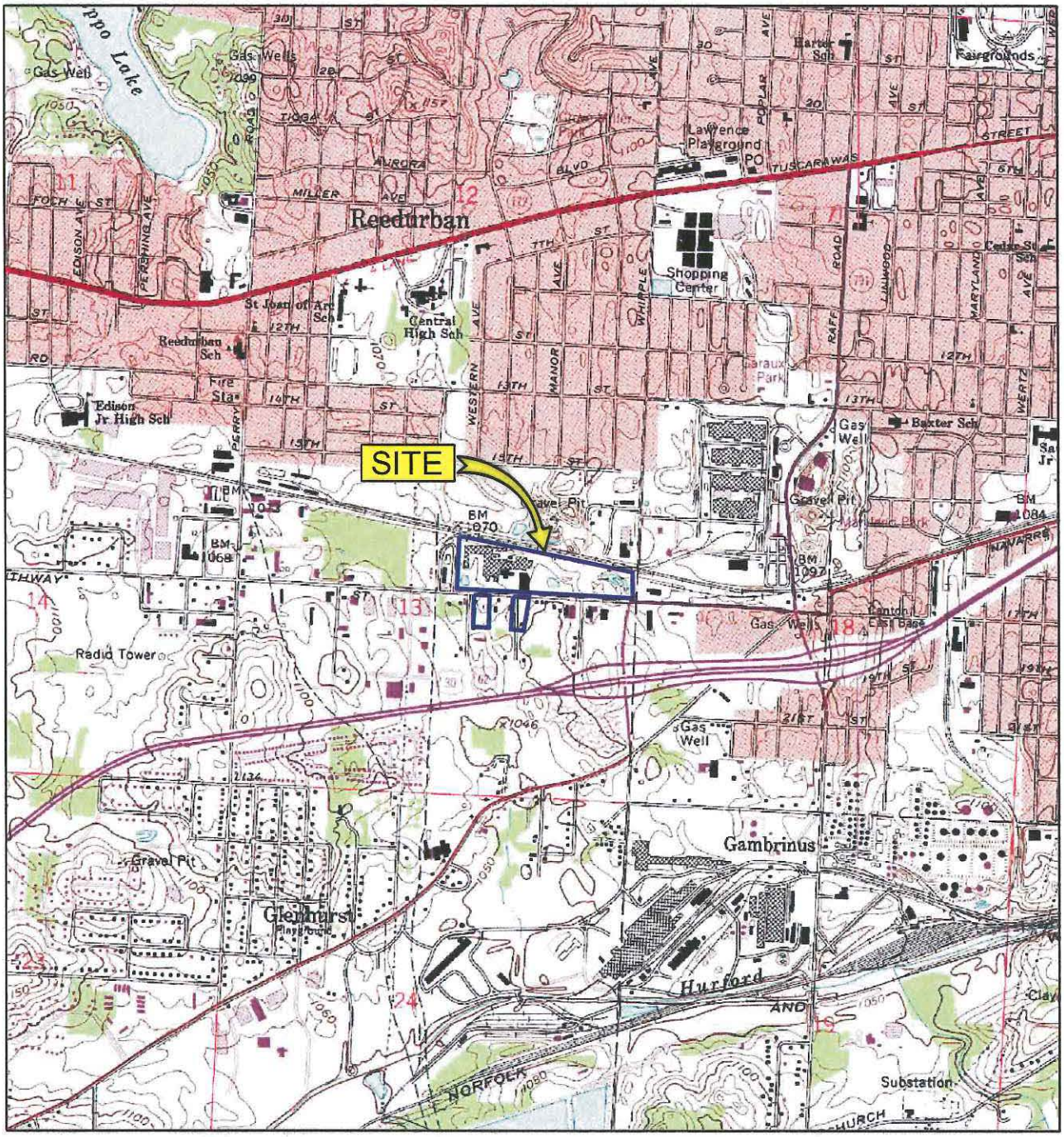
Michael Slates, Canton Drop Forge. 2012. Personal interview. July 18.

Randy Ruszkowski, Stark County Health Department. Telephone interview. July 17.

Sean Denman, Canton Drop Forge. 2012. Personal interview. July 18.

Sonia Bergener, Stark County Building Department. Telephone Interview. July 17.

Figures



SCALE 1:24000

1 1/2 0 1 MILE

2000 0 2000 4000 6000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

SOURCE: U.S.G.S. 7.5 minute series (topographic)
Canton West, Ohio Quadrangle, 1967 (Photorevised 1985).

N W E S

LEGEND
APPROXIMATE PROPERTY BOUNDARY

ENVIRON

SITE LOCATION MAP
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

Figure 1

Drafter:	ALL	Date:	8/17/12	Contract Number:	21-30264A	Approved:	Revised:

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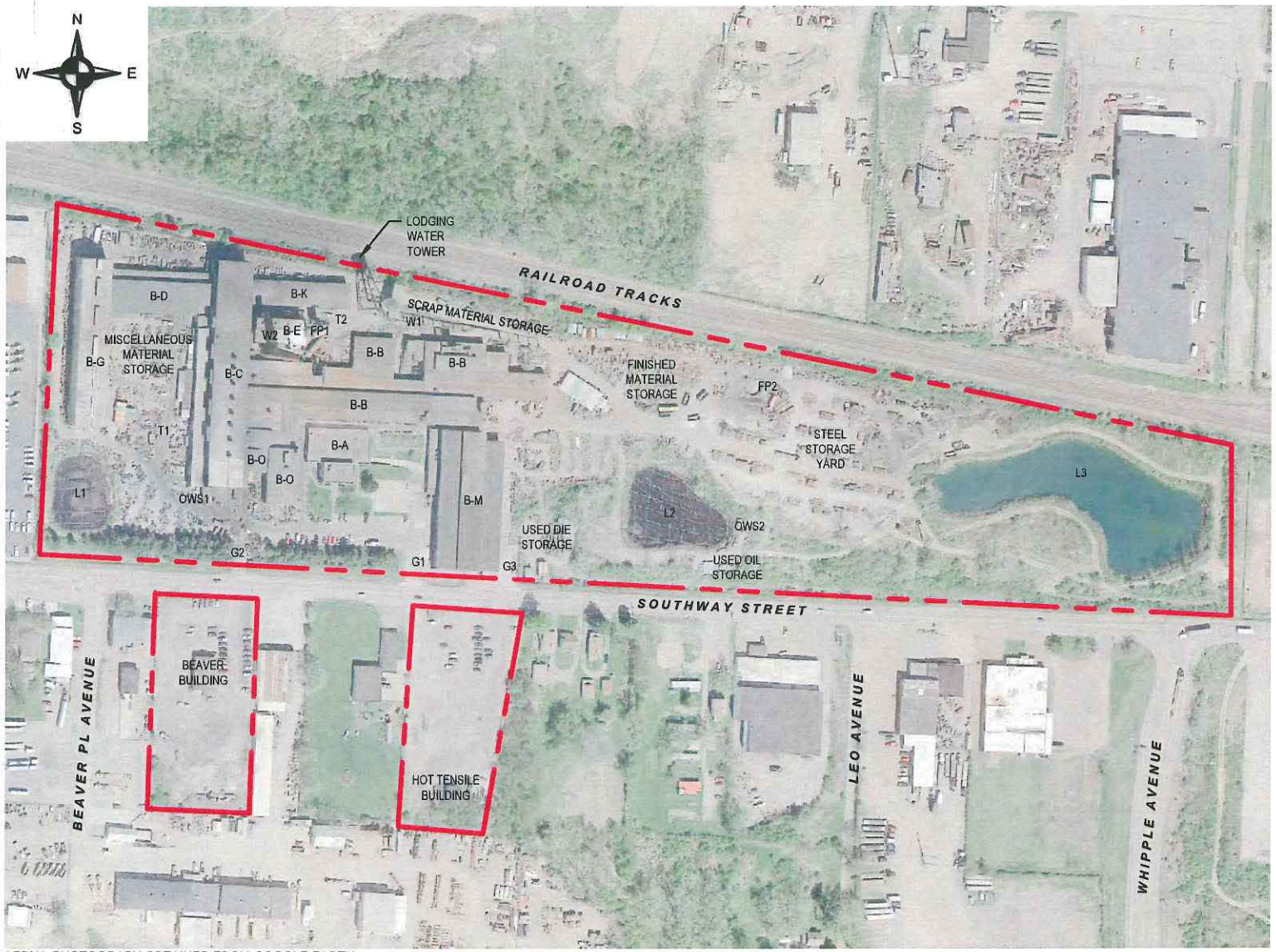

AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH

LEGEND

APPROXIMATE PROPERTY BOUNDARY

SITE FEATURES:

L1	LAGOON 1
L2	LAGOON 2
L3	LAGOON 3
B-A	BUILDING A: OFFICES
B-B	BUILDING B: ROUGH TURN, HEAT TREAT, FINISHING & STOCK ROOM
B-C	BUILDING C: FORGE SHOP
B-D	BUILDING D: DIE STORAGE
B-E	BUILDING E: BOILER HOUSE
B-G	BUILDING G: UPSETTER DEPARTMENT
B-K	BUILDING K: SAW DEPARTMENT
B-M	BUILDING M: DIE SHOP
B-O	BUILDING O: PRESS ROOM, OLD PRESS BUILDING
T1	FORMER UST TANK FARM 1
T2	FORMER UST TANK FARM 2
W1	WELL 1
W2	WELL 2
OWS1	OIL WATER SEPARATOR 1
OWS2	OIL WATER SEPARATOR 2
G1	GATE 1: MAIN GATE
G2	GATE 2: ALTERNATE GATE
G3	GATE 3: TRUCK ENTRANCE
FP1	FLY ASH PIT 1
FP2	FLY ASH PIT 2

APPROX. SCALE (ft.)

0 300

SITE LAYOUT

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

Figure 2

ENVIRON

Drafter:	ALL	Date:	8/17/12	Contract Number:	21-30264A	Approved:	Revised:

nton Drop Forge Phase I ESA ECR 21-30264A\02_Site Layout.dwg

CDF012695

Appendix A

Site Photographs

Photo 1: View of the facility from Gate 2.

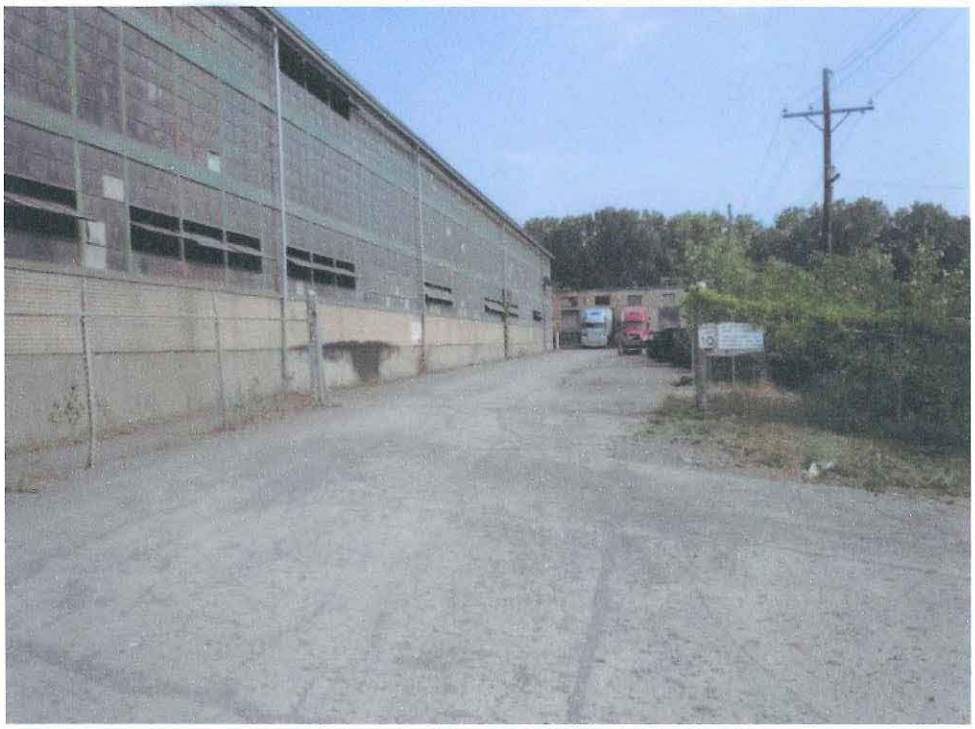

Photo 2: View of the facility from Gate 3. To the left of the picture is Building M. The former septic system, and 1,000-gallon UST are reported to have been located here.

CDF012697

Title:	Site Photographs – Canton Drop Forge, Inc.	**Date:** July 2012
Site:	4575 Southway Street, Canton, Ohio	ENVIRON

Photo 3: View of the steel storage yard, located to the west of Lagoon 3.

Photo 4: Lagoon 3, located in the eastern portion of the property.

Photo 5: Piping that forms the inlet to Lagoon 3.

Photo 6: Mound of coal-ash, located near the northern property boundary.

Photo 7: Old paint buckets, stored along the property's northern border.

Photo 8: Storage of old machinery and scrap metal along the northern facility boundary.

CDF012700

Photo 9: Unlined fly-ash pit located near the steel storage yard.

Photo 10: Lagoon 2, located in the south –central portion of the property.

CDF012701

Photo 11: Storage of used-oil along the southeastern boundary of Lagoon 2.

Photo 12: Heavy oil staining observed adjacent to Lagoon 2.

CDF012702

Photo 13: Drums of sodium hypochlorite used to treat well water, located adjacent to Well 1 along the northern property boundary.

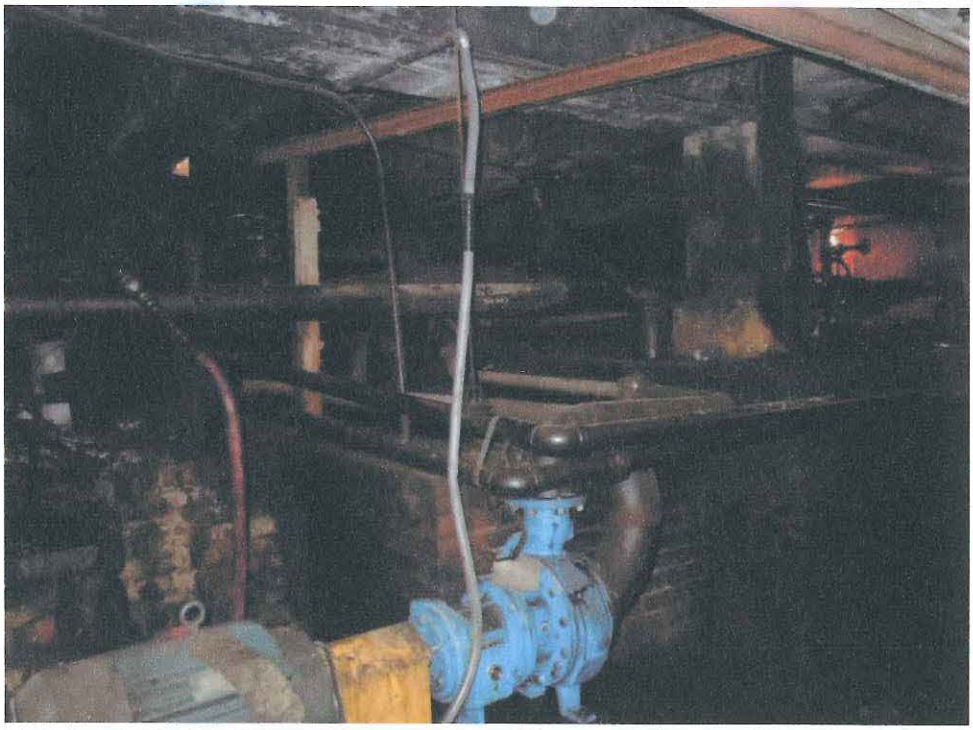

Photo 14: The Chip Basement, located below Building B.

CDF012703

Photo 15: Labeling of asbestos containing material (ACM) in Building E (Boiler House), as required by federal regulations.

Photo 16: Concrete-lined fly-ash pit located adjacent to Building E (Boiler House)..

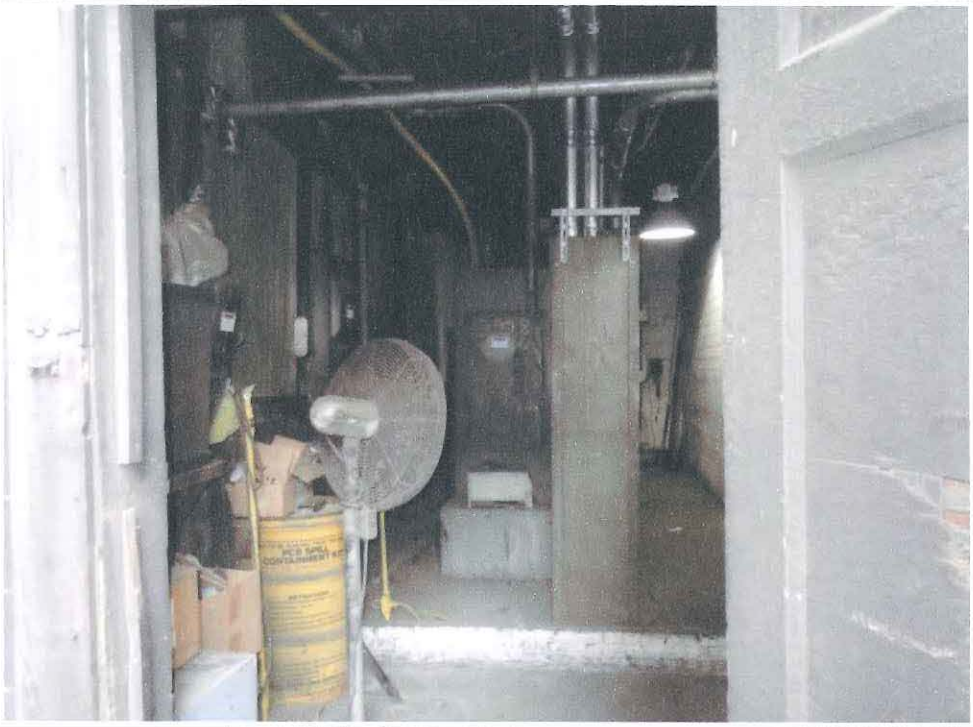

Photo 17: Transformer room, known to contain PCBs, located adjacent to Buildings C and K (Forge Shop and Saw Department respectively)..

Photo 18: Gas cylinder storage area, north of Buildings G and D (Upsetter Department and Die Storage respectively)..

Photo 19: Lagoon 1, located in the southwestern corner of the site.

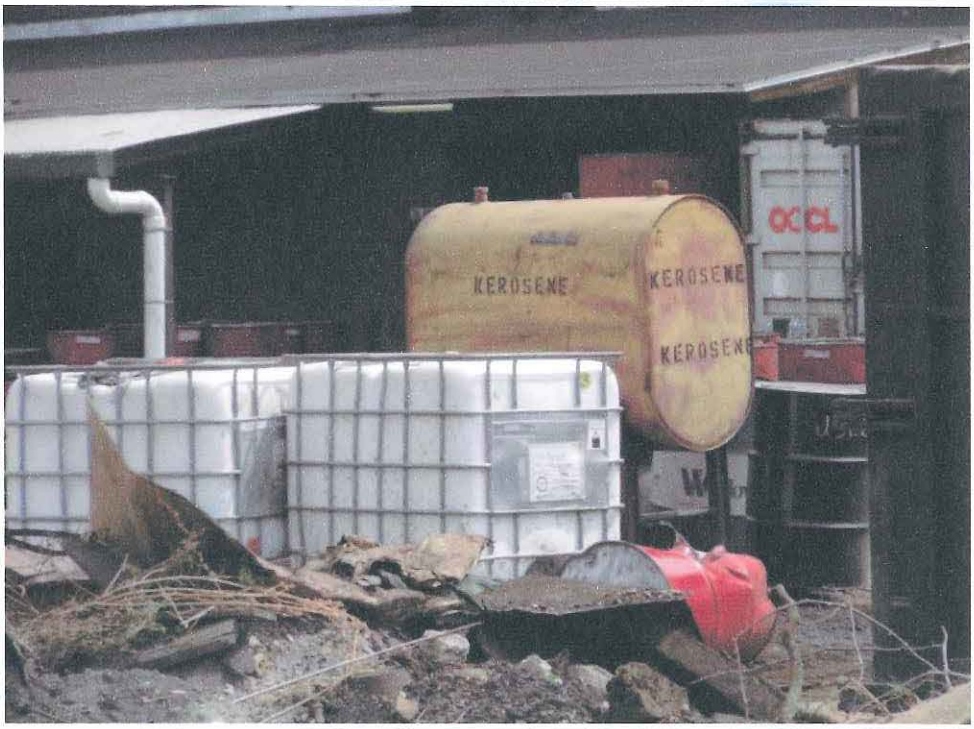

Photo 20: View of floor scrapings, including cardboard, scrap metal, rags, and vegetation to the west of Building C (Forge Shop).

Photo 21: Oil water separator associated with Lagoon 1, located to the south of Building C (Forge Shop).

Photo 22: Heavy oil staining observed in the southwestern portion of the property.

CDF012707

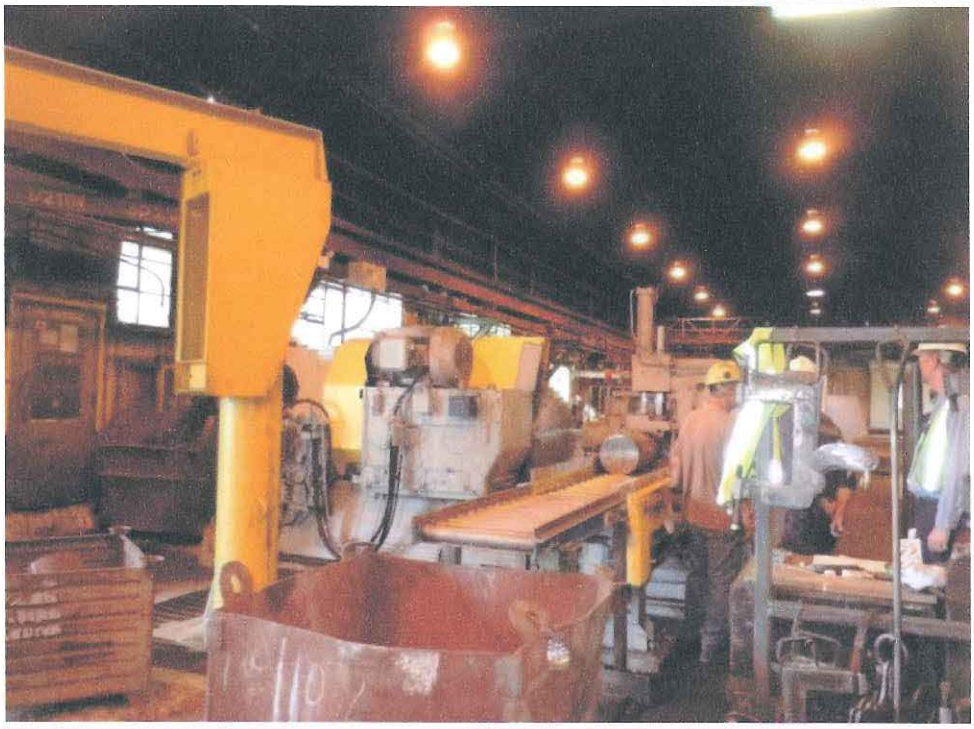

Photo 23: View of the operations in Building K (Saw Department).

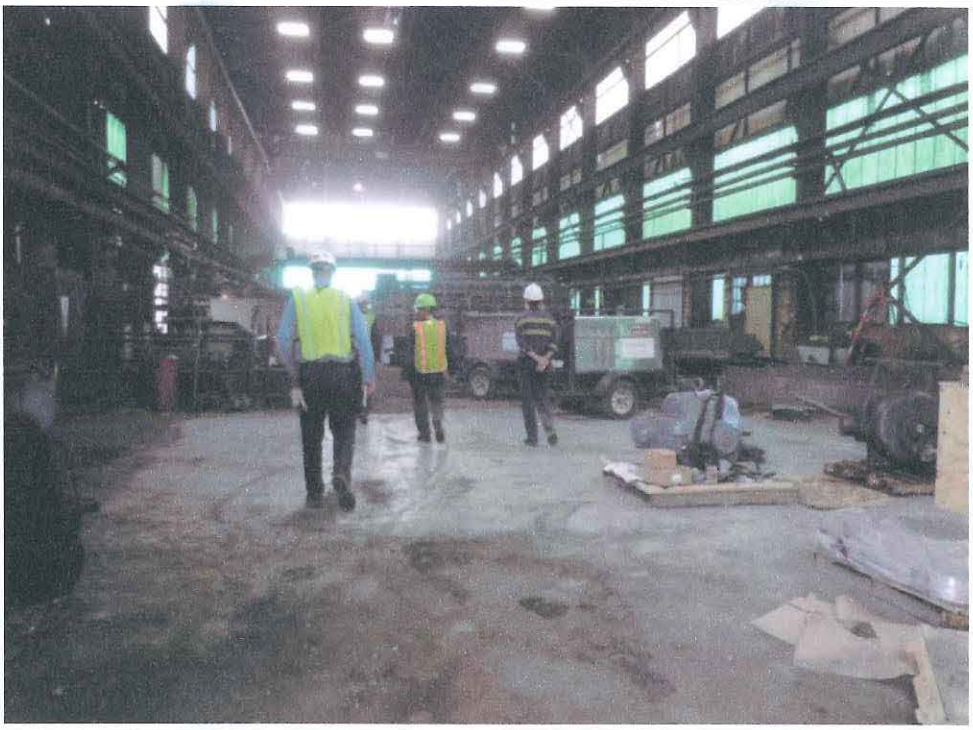

Photo 24: View of the operations in Building G (Upsetter Department).

Photo 25: View of the operations in Building D (Die Storage).

Photo 26: Maintenance area located in Building D (Die Storage).

CDF012709

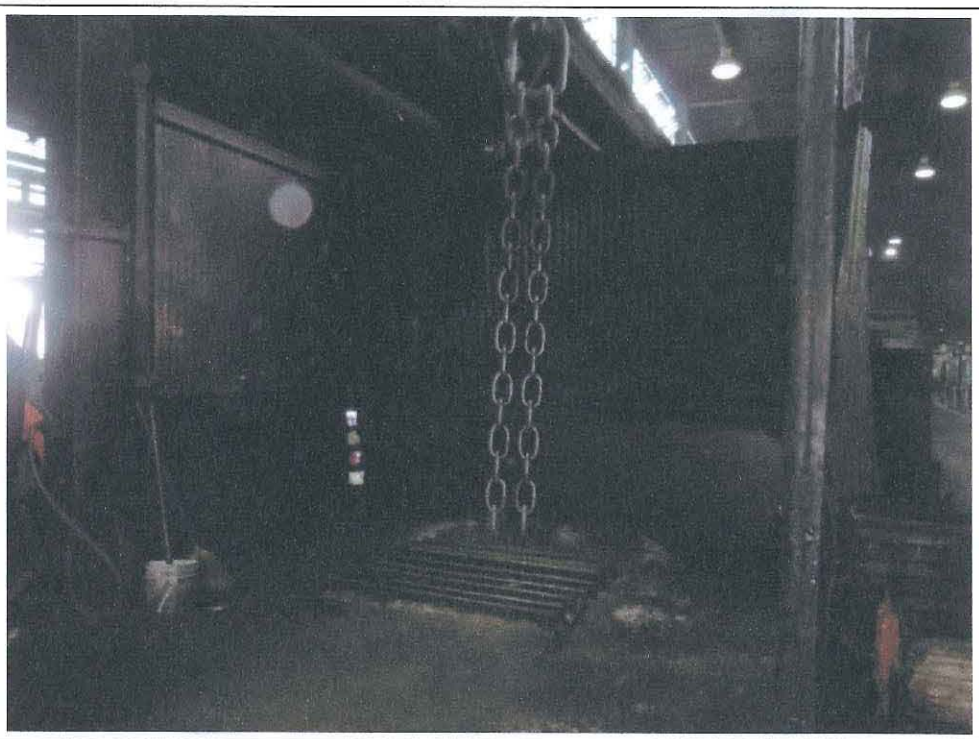

Photo 27: Die-cleaning area, located in Building C (Forge Shop).

Photo 28: View of the operations in Building C (Forge Shop).

CDF012710

Photo 29: View of the drop forging operations in Building C (Forge Shop).

Photo 30: Solvent (kerosene) storage in the forging area.

CDF012711

Photo 31: Quench oil tank located in Building B (Rough Turn, Heat Treat, Finishing and Stock Room).

Photo 32: Non-destructive testing area in Building B (Rough Turn, Heat Treat, Finishing and Stock Room)

Photo 33: The process of non-destructive testing using Magnaflux in Building B (Rough Turn, Heat Treat, Finishing and Stock Room).

Photo 34: View of a portion of Building M (Die Shop).

CDF012713

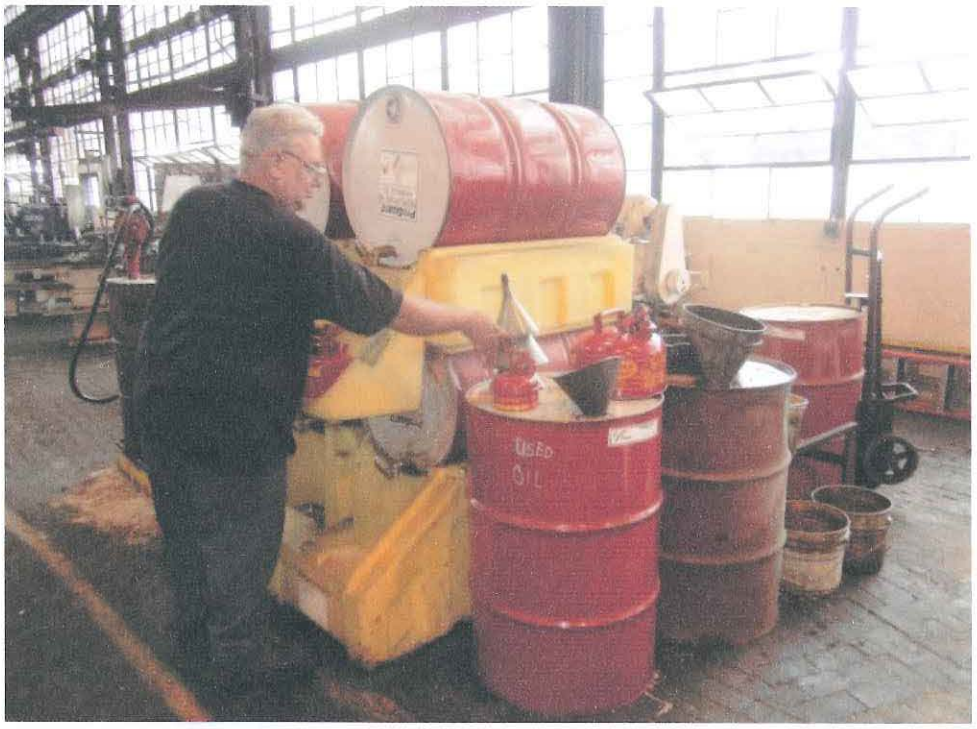

Photo 35: Oil storage in Building M (Die Shop).

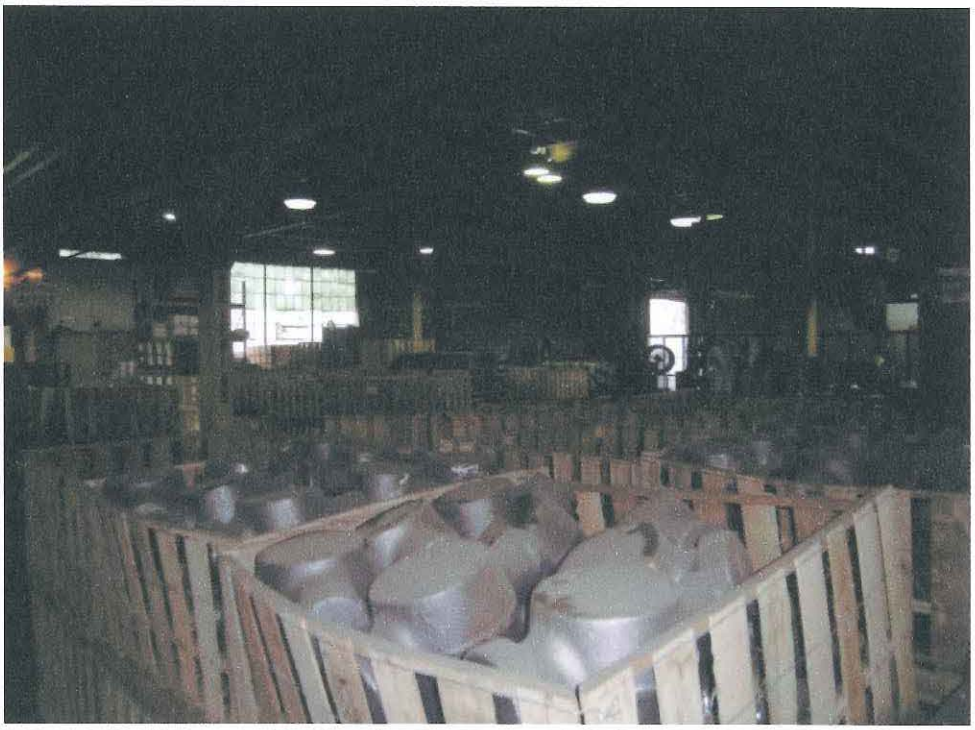

Photo 36: Finished product storage in Building B (Rough Turn, Heat Treat, Finishing and Stock Room).

Appendix B

Environmental Database Report

EDR conducted its searches for the standard environmental record sources and the minimum search distances, as specified by the ASTM Standard. The ASTM Standard uses the terminology "approximate minimum search distance" to refer to the radii searched in the environmental database report.

EDR conducted the search of environmental databases in July 2012. Because the environmental databases themselves are sometimes not updated by the specific regulatory agencies for periods of up to one year or more (depending on the database and the state), the database search conducted herein will not necessarily list any facility or site for which an environmental investigation/listing has been initiated subsequent to the last update.

Canton Drop Forge
4575 Southway Street
Canton, OH 44706

Inquiry Number: 3368308.2s
July 16, 2012

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

4575 SOUTHWAY STREET
CANTON, OH 44706

COORDINATES

Latitude (North):	40.7824000 - 40° 46' 56.64"
Longitude (West):	81.4318000 - 81° 25' 54.48"
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	463564.8
UTM Y (Meters):	4514480.0
Elevation:	1058 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	40081-G4 CANTON WEST, OH
Most Recent Revision:	1994

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	2009, 2010
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 7 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
CANTON DROP FORGE 4575 SOUTHWAY STSW CANTON, OH 44706	TRIS	44706CNTND45
CANTON DROP FORGE 4575 SOUTHWAY STREET S.W. CANTON, OH 44706	AIRS	N/A
CANTON DROP FORGE 4575 SOUTHWAY SW CANTON, OH	SPILLS	N/A

EXECUTIVE SUMMARY

CANTON DROP FORGE INC 4575 SOUTHWAY ST SW CANTON, OH 44706	CERC-NFRAP RCRA-SQG FINDS DERR Activity: SA LUST FR Status: Inactive FR Status: NFA: No Further Action FR Status: Active FR Status: NFC: No Further Action Data Cleaning Facility Status: Inactive FR Status: NFA: No Further Action Facility Status: Active FR Status: NFC: No Further Action Data Cleaning MANIFEST SPILLS	OHD004465142
CANTON DROP FORGING & MFG CO 4575 SOUTHWAY ST. S.W. CANTON OH 447061995 CANTON, OH 44706	ICIS	N/A
CANTON DROP FORGE 4575 SOUTHWAY ST SW CANTON, OH 44706	UST	N/A

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ..... National Priority List
Proposed NPL ..... Proposed National Priority List Sites
NPL LIENS ..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ..... National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ..... Federal Facility Site Information listing

Federal RCRA CORRACTS facilities list

CORRACTS ..... Corrective Action Report

Federal institutional controls / engineering controls registries

US ENG CONTROLS ..... Engineering Controls Sites List

US INST CONTROL..... Sites with Institutional Controls

Federal ERNS list

ERNS..... Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS..... This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State and tribal leaking storage tank lists

INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

INDIAN UST..... Underground Storage Tanks on Indian Land
FEMA UST..... Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

ENG CONTROLS..... Sites with Engineering Controls
HIST INST CONTROLS..... Institutional Controls Database
HIST ENG CONTROLS..... Operation & Maintenance Agreements Database

State and tribal voluntary cleanup sites

INDIAN VCP..... Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS..... Ohio Brownfield Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

ODI..... Open Dump Inventory
DEBRIS REGION 9..... Torres Martinez Reservation Illegal Dump Site Locations
SWRCY..... Recycling Facility Listing
HIST LF..... Old Solid Waste Landfill
INDIAN ODI..... Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL..... Clandestine Drug Labs
CDL..... Clandestine Drug Lab Locations
US HIST CDL..... National Clandestine Laboratory Register

Local Lists of Registered Storage Tanks

ARCHIVE UST..... Archived Underground Storage Tank Sites

Local Land Records

LIENS 2 ..... CERCLA Lien Information
LUCIS ..... Land Use Control Information System

Records of Emergency Release Reports

HMIRS ..... Hazardous Materials Information Reporting System
SPILLS ..... Emergency Response Database

Other Ascertainable Records

DOT OPS ..... Incident and Accident Data
DOD ..... Department of Defense Sites
FUDS ..... Formerly Used Defense Sites
CONSENT ..... Superfund (CERCLA) Consent Decrees
ROD ..... Records Of Decision
UMTRA ..... Uranium Mill Tailings Sites
MINES ..... Mines Master Index File
TSCA ..... Toxic Substances Control Act
FTTS ..... FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS ..... FIFRA/TSCA Tracking System Administrative Case Listing
SSTS ..... Section 7 Tracking Systems
PADS ..... PCB Activity Database System
MLTS ..... Material Licensing Tracking System
RADINFO ..... Radiation Information Database
RAATS ..... RCRA Administrative Action Tracking System
TOWNGAS ..... DERR Towngas Database
UIC ..... Underground Injection Wells Listing
DRYCLEANERS ..... Drycleaner Facility Listing
NPDES ..... NPDES General Permit List
USD ..... Urban Setting Designation Sites
HIST USD ..... Urban Setting Designations Database
INDIAN RESERV ..... Indian Reservations
SCRD DRYCLEANERS ..... State Coalition for Remediation of Drycleaners Listing
FINANCIAL ASSURANCE ..... Financial Assurance Information Listing
COAL ASH ..... Coal Ash Disposal Site Listing
CRO ..... Cessation of Regulated Operations Facility Listing
COAL ASH DOE ..... Sleam-Electric Plan Operation Data
PRP ..... Potentially Responsible Parties
EPA WATCH LIST ..... EPA WATCH LIST
US FIN ASSUR ..... Financial Assurance Information
PCB TRANSFORMER ..... PCB Transformer Registration Database
COAL ASH EPA ..... Coal Combustion Residues Surface Impoundments List
2020 COR ACTION ..... 2020 Corrective Action Program List

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants ..... EDR Proprietary Manufactured Gas Plants
EDR Historical Auto Stations .. EDR Proprietary Historic Gas Stations

EXECUTIVE SUMMARY

EDR Historical Cleaners_____ EDR Proprietary Historic Dry Cleaners

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal CERCLIS list

CERCLIS: The Comprehensive Environmental Response, Compensation and Liability Information System contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

A review of the CERCLIS list, as provided by EDR, and dated 12/27/2011 has revealed that there is 1 CERCLIS site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
REES PLATING SITE	5020 SOUTHWAY ST. SW	W 1/4 - 1/2 (0.438 mi.)	M41	181

Federal CERCLIS NFRAP site List

CERC-NFRAP: Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

A review of the CERC-NFRAP list, as provided by EDR, and dated 12/28/2011 has revealed that there is 1 CERC-NFRAP site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MPS INCORPORATION	4124 SOUTHWAY STREET SO	E 1/8 - 1/4 (0.176 mi.)	H27	143

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

A review of the RCRA-TSDF list, as provided by EDR, and dated 03/15/2012 has revealed that there is 1 RCRA-TSDF site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
REES PLATING CO INC	***5020 SOUTHWAY ST SW***	***W 1/4 - 1/2 (0.438 mi.)***	***M42***	***182***

Federal RCRA generators list

RCRA-LQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

A review of the RCRA-LQG list, as provided by EDR, and dated 03/15/2012 has revealed that there is 1 RCRA-LQG site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
HERCULES POLISHING & PLATING C	***4883 SOUTHWAY S.W.***	***W 1/8 - 1/4 (0.214 mi.)***	***I28***	***143***

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 03/15/2012 has revealed that there are 2 RCRA-SQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
GASPAR WELDING INC	1545 WHIPPLE AVE SW	ENE 1/8 - 1/4 (0.136 mi.)	F20	131
MAACO AUTO PAINTING & BODY WOR	***1818 HOPPLE AVE SW***	***WSW 1/8 - 1/4 (0.162 mi.)***	***G22***	***134***

RCRA-CESQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-CESQG list, as provided by EDR, and dated 03/15/2012 has revealed that there are

5 RCRA-CESQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
BEAVER EXCAVATING CO INC	*4650 SOUTHWAY ST SW*	*WSW 0 - 1/8 (0.006 mi.)*	*C9*	*99*
DOMINION EAST OHIO - CANTON PE	*4725 SOUTHWAY AVE SW*	*WSW 0 - 1/8 (0.016 mi.)*	*B13*	*106*
CND INC	*4520 SOUTHWAY SW*	*SE 0 - 1/8 (0.047 mi.)*	*14*	*119*
BRECHBUHLER TRUCK SALES	*4216 SOUTHWAY ST SW*	*ESE 0 - 1/8 (0.073 mi.)*	*E16*	*123*
PENSKE TRUCK LEASING INC	*1829 HOPPLE AVE SW*	*WSW 1/8 - 1/4 (0.170 mi.)*	*G24*	*137*

State- and tribal - equivalent CERCLIS

DERR: The DERR database is an index of sites for which Ohio EPA maintains files. It includes sites with known or suspected contamination, but a site's inclusion in the database does not mean that it is now or has ever been contaminated.

A review of the DERR list, as provided by EDR, and dated 05/21/2012 has revealed that there are 2 DERR sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
VAN KAY INC, CANTON Activity: SA, VAP	*4124 SOUTHWAY ST SW*	*E 1/8 - 1/4 (0.176 mi.)*	*H25*	*139*
ASHLAND PETROLEUM Activity: SA	*2408 GAMBRINUS*	*SE 1/2 - 1 (0.733 mi.)*	*45*	*213*

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: The Solid Waste Facilities/Landfill Sites records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. The data come from the Ohio Environmental Protection Agency's Licensed Solid Waste Facilities.

A review of the SWF/LF list, as provided by EDR, and dated 04/12/2012 has revealed that there is 1 SWF/LF site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MEREDITH INVESTMENTS	4448 SOUTHWAY ST SW	ESE 0 - 1/8 (0.007 mi.)	D11	103

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Commerce Division of State Fire Marshal's List of Reported Petroleum Underground Storage Tank Release Incidents.

A review of the LUST list, as provided by EDR, and dated 04/27/2012 has revealed that there are 24 LUST sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
TRUCK REPAIR BLDG FR Status: Inactive FR Status: NFA: No Further Action Facility Status: Inactive FR Status: NFA: No Further Action	*4700 SOUTHWAY ST SW*	*WSW 0 - 1/8 (0.006 mi.)*	*B7*	*94*

EXECUTIVE SUMMARY

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
BEAVER EXCAVATING COMPANY	***4650 SOUTHWAY STREET, S***	***WSW 0 - 1/8 (0.006 mi.)***	***C8***	***95***
FR Status: Inactive FR Status: NFA: No Further Action				
FR Status: Inactive FR Status: NFA: No Further Action				
**Additional key fields are available in the Map Findings section*				
Facility Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
**Additional key fields are available in the Map Findings section*				
CROWN ENTERP REAL ESTATE DEPT	***4310 SOUTHWAY***	***ESE 0 - 1/8 (0.007 mi.)***	***D10***	***102***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
EAST OHIO GAS CO. PERRY YARD S	***4725 SOUTHWAY SW***	***WSW 0 - 1/8 (0.016 mi.)***	***B12***	***104***
FR Status: Inactive FR Status: NFA: No Further Action				
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
ALLIED TRUCK PARTS CO.	***4216 SOUTHWAY ST***	***ESE 0 - 1/8 (0.073 mi.)***	***E15***	***121***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
KOHN, INC.	***4850 SOUTHWAY SW***	***W 1/8 - 1/4 (0.126 mi.)***	***17***	***125***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
CANTON BAPTIST TEMPLE	***1540 WHIPPLE AVE SW***	***ENE 1/8 - 1/4 (0.130 mi.)***	***F18***	***128***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
CUSTOM DESIGN TECHNOLOGIES	***1545 WHIPPLE AVE SW***	***ENE 1/8 - 1/4 (0.136 mi.)***	***F19***	***129***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
VLIET ASPHALT SEALER CO., INC.	***4520 VLIET ST SW***	***NE 1/8 - 1/4 (0.151 mi.)***	***F21***	***132***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
BITZEL EXCAVATING, INC.	***4141 SOUTHWAY ST SW***	***E 1/8 - 1/4 (0.166 mi.)***	***H23***	***135***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
BLUE VELVET TRANSPORT, INC.	***4821 CORPORATE ST SW***	***SW 1/8 - 1/4 (0.248 mi.)***	***J29***	***160***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
ROADWAY EXPRESS, INC.	***4925 SOUTHWAY SW***	***W 1/4 - 1/2 (0.256 mi.)***	***I30***	***163***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
ZIEGLER BOLT & PARTS CO.	***4848 CORPORATE ST SW***	***SW 1/4 - 1/2 (0.267 mi.)***	***J31***	***164***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
CRAMERS, INC.	***4926 SOUTHWAY SW***	***W 1/4 - 1/2 (0.280 mi.)***	***K32***	***165***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
FORMER MATLAK INC	***4108 NAVARRE RD SW***	***SE 1/4 - 1/2 (0.302 mi.)***	***33***	***167***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
ROLLINS LEASING CORP. #208A	***4884 CORPORATE SW***	***WSW 1/4 - 1/2 (0.305 mi.)***	***34***	***169***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MEREDITH ERECTORS, INC.	***3926 SOUTHWAY SW***	***E 1/4 - 1/2 (0.310 mi.)***	***35***	***171***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
SAMPSEL PIPELINE CO.	***4938 SOUTHWAY SW***	***W 1/4 - 1/2 (0.314 mi.)***	***K36***	***173***
FR Status: Active FR Status: NFC: No Further Action Data Cleaning				
Facility Status: Active FR Status: NFC: No Further Action Data Cleaning				
YOUNG WHITE GMC TRUCK	***4970 SOUTHWAY ST SW***	***WSW 1/4 - 1/2 (0.368 mi.)***	***37***	***175***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
BUCKEYE CORP.	***4969 SOUTHWAY AVE***	***W 1/4 - 1/2 (0.372 mi.)***	***38***	***176***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
SPEEDWAY 9400	***3805 SOUTHWAY ST SW***	***E 1/4 - 1/2 (0.401 mi.)***	***L39***	***177***
FR Status: Inactive FR Status: NFA: No Further Action				
FR Status: Inactive FR Status: NFA: No Further Action				
**Additional key fields are available in the Map Findings section*				
Facility Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
**Additional key fields are available in the Map Findings section*				
REES PLATING CO INC	***5020 SOUTHWAY ST SW***	***W 1/4 - 1/2 (0.438 mi.)***	***M42***	***182***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
CONSUMER DIRECT	***1400 RAFF RD***	***ENE 1/4 - 1/2 (0.473 mi.)***	***N43***	***211***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				
CANTON INDUS PARK	***1401 RAFF RD SW***	***ENE 1/4 - 1/2 (0.485 mi.)***	***N44***	***212***
FR Status: Inactive FR Status: NFA: No Further Action				
Facility Status: Inactive FR Status: NFA: No Further Action				

UNREG LTANKS: A suspected or confirmed release of petroleum from a non-regulated UST.

A review of the UNREG LTANKS list, as provided by EDR, and dated 08/25/1999 has revealed that there is 1 UNREG LTANKS site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
SPEEDWAY	***3805 SOUTHWAY ST SW***	***E 1/4 - 1/2 (0.401 mi.)***	***L40***	***180***
Facility Status: NFA				

State and tribal registered storage tank lists

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Commerce Division of State Fire Marshal's Facility File.

A review of the UST list, as provided by EDR, and dated 01/25/2012 has revealed that there are 11 UST

sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
TRUCK REPAIR BLDG	*4700 SOUTHWAY ST SW*	*WSW 0 - 1/8 (0.006 mi.)*	*B7*	*94*
BEAVER EXCAVATING COMPANY	*4650 SOUTHWAY STREET, S*	*WSW 0 - 1/8 (0.006 mi.)*	*C8*	*95*
CROWN ENTERP REAL ESTATE DEPT	*4310 SOUTHWAY*	*ESE 0 - 1/8 (0.007 mi.)*	*D10*	*102*
EAST OHIO GAS CO. PERRY YARD S	*4725 SOUTHWAY SW*	*WSW 0 - 1/8 (0.016 mi.)*	*B12*	*104*
ALLIED TRUCK PARTS CO.	*4216 SOUTHWAY ST*	*ESE 0 - 1/8 (0.073 mi.)*	*E15*	*121*
KOHN, INC.	*4850 SOUTHWAY SW*	*W 1/8 - 1/4 (0.126 mi.)*	*17*	*125*
CANTON BAPTIST TEMPLE	*1540 WHIPPLE AVE SW*	*ENE 1/8 - 1/4 (0.130 mi.)*	*F18*	*128*
CUSTOM DESIGN TECHNOLOGIES	*1545 WHIPPLE AVE SW*	*ENE 1/8 - 1/4 (0.136 mi.)*	*F19*	*129*
VLIET ASPHALT SEALER CO., INC.	*4520 VLIET ST SW*	*NE 1/8 - 1/4 (0.151 mi.)*	*F21*	*132*
BITZEL EXCAVATING, INC.	*4141 SOUTHWAY ST SW*	*E 1/8 - 1/4 (0.166 mi.)*	*H23*	*135*
BLUE VELVET TRANSPORT, INC.	*4821 CORPORATE ST SW*	*SW 1/8 - 1/4 (0.248 mi.)*	*J29*	*160*

State and tribal institutional control / engineering control registries

INST CONTROL: Sites with Engineering and/or Institutional controls.

A review of the INST CONTROL list, as provided by EDR, and dated 05/15/2012 has revealed that there is 1 INST CONTROL site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
VAN KAY INC, CANTON	*4124 SOUTHWAY ST SW*	*E 1/8 - 1/4 (0.176 mi.)*	*H25*	*139*

State and tribal voluntary cleanup sites

VCP: Ohio EPA, Voluntary Action Program Sites.

A review of the VCP list, as provided by EDR, and dated 05/15/2012 has revealed that there is 1 VCP site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
VAN KAY INC, CANTON	*4124 SOUTHWAY ST SW*	*E 1/8 - 1/4 (0.176 mi.)*	*H25*	*139*

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

RCRA-NonGen: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA-NonGen list, as provided by EDR, and dated 03/15/2012 has revealed that there is

EXECUTIVE SUMMARY

1 RCRA-NonGen site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
*VAN KAY INC **	*4124 SOUTHWAY STREET*	*SWE 1/8 - 1/4 (0.176 mi.)*	*H26*	*140*

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 20 records.

Site Name	Database(s)
OHIO POWER CO. - CANTON SERVICE CT	FTTS,HIST FTTS INSP
CANTON WORKS DU PONT EI DE NEMOURS	CERCLIS-NFRAP,DERR
HY-WAY INC STATION #671	LUST,UST
ODOT HIGHWAY BRIDGE	RCRA-LQG
	ERNS
	ERNS
	ERNS
	ERNS
	ERNS
	ERNS
	ERNS
	ERNS
CANTON WWTP	SPILLS
CANTON METAL RECYCLING	SPILLS
CANTON SANITATION DEPT	SPILLS
CANTON AUTO REPAIR AND TOWING	SPILLS
CASCADE PETROLEUM CO CANTON IND PA	SPILLS
CANTON WWTP	SPILLS
CANTON CITY	SPILLS
CANTON STP	SPILLS

OVERVIEW MAP - 3368308.2s

0 1/4 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Canton Drop Forge	CLIENT:	ENVIRON International Corporation
ADDRESS:	4575 Southway Street Canton OH 44706	CONTACT:	Meghna Nooyi
		INQUIRY #:	3368308.2s
LAT/LONG:	40.7824 / 81.4318	DATE:	July 16, 2012 7:40 pm

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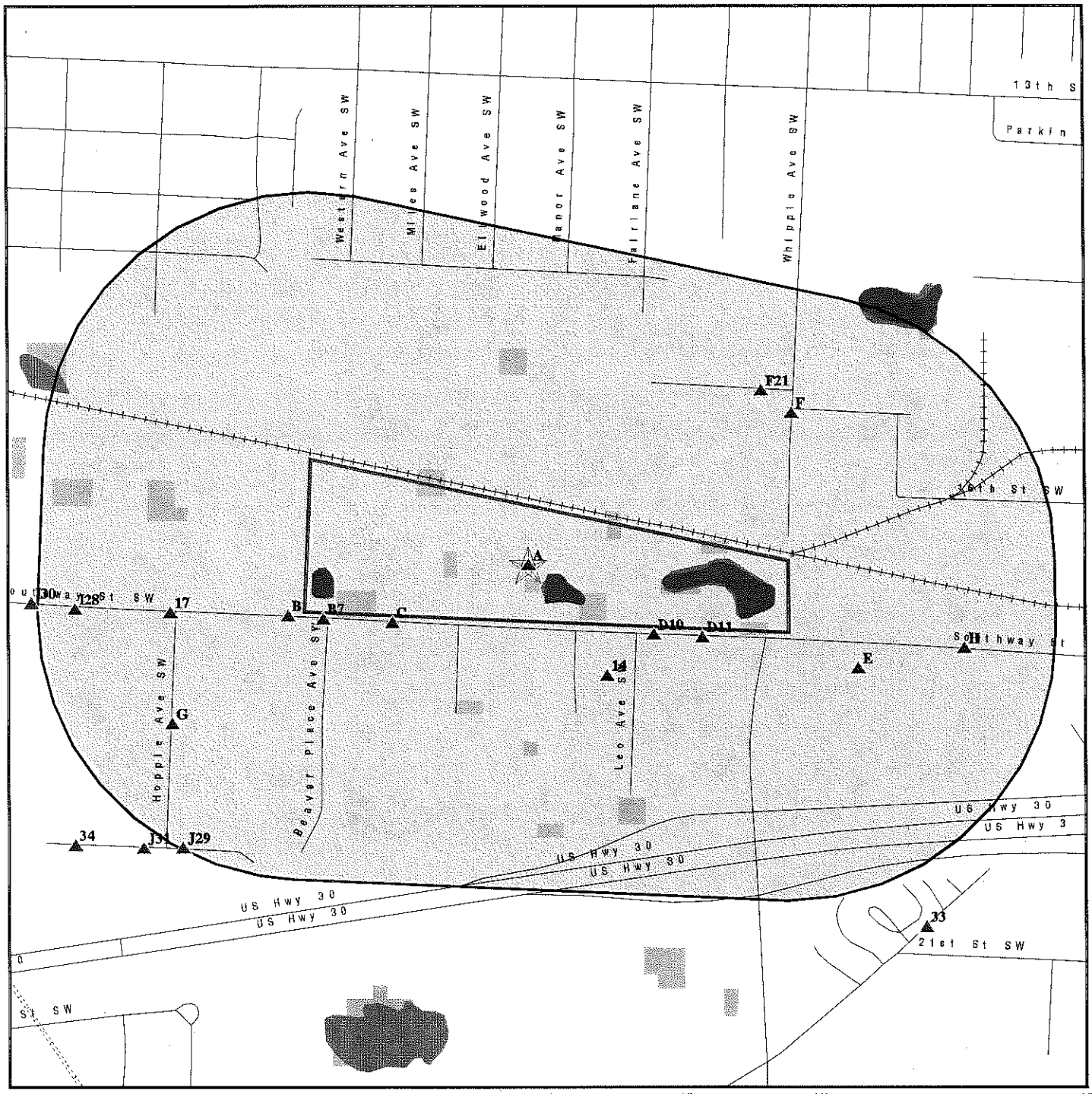
DETAIL MAP - 3368308.2s



0 1/8 1/4 1/2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Canton Drop Forge	CLIENT: ENVIRON International Corporation
ADDRESS: 4575 Southway Street Canton OH 44706	CONTACT: Meghna Nooyi
LAT/LONG: 40.7824 / 81.4318	INQUIRY #: 3368308.2s DATE: July 16, 2012 7:40 pm

CDF012731

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	1	NR	NR	1
FEDERAL FACILITY	1.000		0	0	0	0	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500	1	0	1	0	NR	NR	2
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	1	NR	NR	1
Federal RCRA generators list								
RCRA-LQG	0.250		0	1	NR	NR	NR	1
RCRA-SQG	0.250	1	0	2	NR	NR	NR	3
RCRA-CESQG	0.250		4	1	NR	NR	NR	5
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
DERR	1.000	1	0	1	0	1	NR	3
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		1	0	0	NR	NR	1
State and tribal leaking storage tank lists								
LUST	0.500	1	5	6	13	NR	NR	25
UNREG LTANKS	0.500		0	0	1	NR	NR	1
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250	1	5	6	NR	NR	NR	12

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS	0.500		0	0	0	NR	NR	0
INST CONTROL	0.500		0	1	0	NR	NR	1
HIST INST CONTROLS	0.500		0	0	0	NR	NR	0
HIST ENG CONTROLS	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	1	0	NR	NR	1
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
ARCHIVE UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP	2	NR	NR	NR	NR	NR	2
Other Ascertainable Records								
RCRA-NonGen	0.250		0	1	NR	NR	NR	1
DOT OPS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP	1	NR	NR	NR	NR	NR	1
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP	1	NR	NR	NR	NR	NR	1
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP	1	NR	NR	NR	NR	NR	1
RAATS	TP		NR	NR	NR	NR	NR	0
TOWNGAS	1.000		0	0	0	0	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
AIRS	TP	1	NR	NR	NR	NR	NR	1
USD	0.500		0	0	0	NR	NR	0
HIST USD	0.500		0	0	0	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
FINANCIAL ASSURANCE	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
CRO	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
EDR PROPRIETARY RECORDS								
EDR Proprietary Records								
Manufactured Gas Plants	1.000		0	0	0	0	NR	0
EDR Historical Auto Stations	0.250		0	0	NR	NR	NR	0
EDR Historical Cleaners	0.250		0	0	NR	NR	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

A1
Target
Property

CANTON DROP FORGE
4575 SOUTHWAY STSW
CANTON, OH 44706

TRIS **1007446614**
44706CNTND45

Site 1 of 6 in cluster A

Actual:
1058 ft.

TRIS:

Click this hyperlink while viewing on your computer to access
3 additional US_TRIS: record(s) in the EDR Site Report.

A2
Target
Property

CANTON DROP FORGE
4575 SOUTHWAY STREET S.W.
CANTON, OH 44706

AIRS **S110636890**
N/A

Site 2 of 6 in cluster A

Actual:
1058 ft.

AIRS:

Facility Id:	1576000073
Permit Classification:	EX
# Emission Units Meeting Def of Trivial Outlined in EngGuide62:	0
Insignificant Emission Units:	30
Significant Emission Units:	34
Contact First Name:	Keith
Contact Last Name:	Houseknecht
Mailing Address 1:	4575 Southway St SW
Mailing Address 2:	Not reported
Mailing City/State/Zip:	Canton, OH 44706
Contact Phone:	3304774511
Contact EMail:	khouseknecht@cantondropforge.com

Emissions:

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.07
Stack:	0
Total:	0.07

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.79
Stack:	0
Total:	0.79

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.14

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	2.14
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.24
Stack:	0
Total:	0.24
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.12
Stack:	0
Total:	0.12
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Poliutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	42.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.06
Stack:	0
Total:	0.06

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.05
Stack:	0
Total:	0.05

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.63
Stack:	0
Total:	0.63

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	1.71
Stack:	0
Total:	1.71

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.19
Stack:	0
Total:	0.19

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.1
Stack:	0
Total:	0.1

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	34.1
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.05
Stack:	0
Total:	0.05

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.07
Stack:	0
Total:	0.07

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.8

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	0.8
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.16
Stack:	0
Total:	2.16
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.24
Stack:	0
Total:	0.24
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.12
Stack:	0
Total:	0.12
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0
Stack:	2.02
Total:	2.02

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	17.88
Total:	17.88

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	39.34
Total:	39.34

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	0.18
Total:	0.18

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	3.57
Total:	3.57

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	9.45
Total:	9.45

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	1.78
Total:	1.78

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.89
Total:	0.89

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	164.54
Total:	164.54

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	B001
Design Capacity Unit:	86
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200204
Winter %Throughput Processed:	30
Spring %Throughput Processed:	31
Summer %Throughput Processed:	28
Fall %Throughput Processed:	11
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	3915
Through Value:	7152.5
Material Units:	TONs
Primary Material of Throughput:	Bituminous/Subbituminous Coal
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.18
Total:	0.18

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0
Stack:	0.2
Total:	0.2

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	5.21
Total:	5.21

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	6.2
Total:	6.2

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	0.68
Total:	0.68

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0.12
Total:	0.12
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.12
Total:	0.12
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.12
Total:	0.12
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.12
Total:	0.12
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	0.04
Total:	0.04
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B002
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	19
Summer %Throughput Processed:	21
Fall %Throughput Processed:	35
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3784
Through Value:	124
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.34
Total:	0.34
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0
Stack:	0.2
Total:	0.2

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	5.36
Total:	5.36

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	6.38
Total:	6.38

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	0.7
Total:	0.7

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.12
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.12
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.12
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.12
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	0.04
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	B003
Design Capacity Unit:	88
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	10200602
Winter %Throughput Processed:	25
Spring %Throughput Processed:	17
Summer %Throughput Processed:	22
Fall %Throughput Processed:	36
Days Week:	6
Weeks Year:	50
Hours Day:	24
Hours Yr:	3844
Through Value:	128
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.35
Total:	0.35

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.08
Stack:	0
Total:	0.08

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.88
Stack:	0
Total:	0.88

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.39
Stack:	0
Total:	2.39

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.26

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	0.26
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.14
Stack:	0
Total:	0.14
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.05
Stack:	0
Total:	0.05
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.05
Stack:	0
Total:	0.05
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.05
Stack:	0
Total:	0.05

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P001
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	47.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.07
Stack:	0
Total:	0.07

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.05
Stack:	0
Total:	0.05

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.57
Stack:	0
Total:	0.57

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	1.55
Stack:	0
Total:	1.55

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.17
Stack:	0
Total:	0.17

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.09
Stack:	0
Total:	0.09

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	31
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	0.01
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P005
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.06
Stack:	0
Total:	0.06
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.07
Stack:	0
Total:	0.07
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.76
Stack:	0
Total:	0.76
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.05
Stack:	0
Total:	2.05

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.22
Stack:	0
Total:	0.22

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.12
Stack:	0
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P006
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.06
Stack:	0
Total:	0.06

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.07
Stack:	0
Total:	0.07

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.75
Stack:	0
Total:	0.75

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.04
Stack:	0
Total:	2.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.22
Stack:	0
Total:	0.22

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.12
Stack:	0
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.04

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	0.04
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P007
Design Capacity Unit:	16
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	6
Weeks Year:	45
Hours Day:	20
Hours Yr:	3630
Through Value:	40.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.06
Stack:	0
Total:	0.06
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.02
Stack:	0
Total:	0.02
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.22
Stack:	0
Total:	0.22

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0.59
Stack:	0
Total:	0.59

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.06
Stack:	0
Total:	0.06

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	11.7
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.02
Stack:	0
Total:	0.02

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.08
Stack:	0
Total:	0.08

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.92
Stack:	0
Total:	0.92

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.49
Stack:	0
Total:	2.49

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.27
Stack:	0
Total:	0.27

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.14
Stack:	0
Total:	0.14

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.05
Stack:	0
Total:	0.05

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.05
Stack:	0
Total:	0.05

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.05

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	0.05
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P026
Design Capacity Unit:	12
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-42 1
SCC Id:	30990003
Winter %Throughput Processed:	22
Spring %Throughput Processed:	26
Summer %Throughput Processed:	28
Fall %Throughput Processed:	24
Days Week:	5
Weeks Year:	32
Hours Day:	24
Hours Yr:	4555
Through Value:	49.8
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.07
Stack:	0
Total:	0.07
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.07
Stack:	0
Total:	0.07
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.8
Stack:	0
Total:	0.8
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	2.16
Stack:	0
Total:	2.16
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6

CANTON DROP FORGE (Continued) **S110636890**

Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.24
Stack:	0
Total:	0.24

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.12
Stack:	0
Total:	0.12

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20

CANTON DROP FORGE (Continued) **S110636890**

Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1

CANTON DROP FORGE (Continued) **S110636890**

SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.04
Stack:	0
Total:	0.04

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P040
Design Capacity Unit:	10

CANTON DROP FORGE (Continued) **S110636890**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-76 1
SCC Id:	30990003
Winter %Throughput Processed:	36
Spring %Throughput Processed:	20
Summer %Throughput Processed:	22
Fall %Throughput Processed:	22
Days Week:	6
Weeks Year:	47
Hours Day:	24
Hours Yr:	4854
Through Value:	43.2
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.06
Stack:	0
Total:	0.06

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Ammonia
Fugitives:	0.03
Stack:	0
Total:	0.03

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18

CANTON DROP FORGE (Continued) **S110636890**

Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0.33
Stack:	0
Total:	0.33

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0.9
Stack:	0
Total:	0.9

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.

CANTON DROP FORGE (Continued) **S110636890**

City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0.1
Stack:	0
Total:	0.1

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0.05
Stack:	0
Total:	0.05

CANTON DROP FORGE (Continued) **S110636890**

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0.02
Stack:	0
Total:	0.02

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0.02

CANTON DROP FORGE (Continued) **S110636890**

Stack:	0
Total:	0.02
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0.02
Stack:	0
Total:	0.02
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

CANTON DROP FORGE (Continued) **S110636890**

Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0.01
Stack:	0
Total:	0.01
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	P041
Design Capacity Unit:	22
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-85 1
SCC Id:	30990003
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	38
Hours Day:	20
Hours Yr:	3025
Through Value:	17.9
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.03
Stack:	0
Total:	0.03
Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81.26 18
Group Id:	Not reported
EPA EMU Id:	Z002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-69 1
SCC Id:	30902099
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	6000

CANTON DROP FORGE (Continued) **S110636890**

Through Value:	1.94
Material Units:	TONs
Primary Material of Throughput:	Product
Mat Act:	Produced
Pollutant:	Organic Compounds
Fugitives:	1.94
Stack:	1.94
Total:	3.88

Facility Id:	1576000073
Facility Name:	Canton Drop Forge
Address1:	4575 Southway Street S.W.
City/State/Zip:	Canton, OH 44706 1995
County Name:	Stark
Lat/Long(d m s):	40 47 5 / -81 26 18
Group Id:	Not reported
EPA EMU Id:	Z002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-69 1
SCC Id:	30902099
Winter %Throughput Processed:	24
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	27
Days Week:	5
Weeks Year:	50
Hours Day:	24
Hours Yr:	6000
Through Value:	1.94
Material Units:	TONs
Primary Material of Throughput:	Product
Mat Act:	Produced
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.94
Stack:	1.94
Total:	3.88

A3 Target Property **CANTON DROP FORGE**
4575 SOUTHWAY SW
CANTON, OH

SPILLS **S106958782**
N/A

Site 3 of 6 in cluster A

Actual: 1058 ft.

SPILLS:

Spill No.:	9404-76-1658
Spill Year:	1994
Date Spill Reported:	04/15/1994
Spill Month:	4
Spill Number:	1658
Reporter Name:	BRUCE MILLER
Confidential:	No
District Code:	NE
Employee Number:	1754
Lat/Long:	Not reported
Product Spilled Name:	WASTE OIL

A4
Target
Property

CANTON DROP FORGE INC
4575 SOUTHWAY ST SW
CANTON, OH 44706

Site 4 of 6 in cluster A

Actual:
1058 ft.

CERC-NFRAP **1000416682**
RCRA-SQG **OHD004465142**
FINDS
DERR
LUST
MANIFEST
SPILLS

CERC-NFRAP:
Site ID: 0504233
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: NFRAP-Site does not qualify for the NPL based on existing information

CERCLIS-NFRAP Assessment History:
Action: DISCOVERY
Date Started: Not reported
Date Completed: 08/20/1985
Priority Level: Not reported

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 08/20/1985
Priority Level: Low priority for further assessment

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 03/28/1990
Priority Level: NFRAP-Site does not qualify for the NPL based on existing information

Action: SITE INSPECTION
Date Started: Not reported
Date Completed: 01/11/1991
Priority Level: NFRAP-Site does not qualify for the NPL based on existing information

Action: ARCHIVE SITE
Date Started: Not reported
Date Completed: 09/16/1994
Priority Level: Not reported

RCRA-SQG:
Date form received by agency: 08/11/2008
Facility name: CANTON DROP FORGE INC
Facility address: 4575 SOUTHWAY ST SW
CANTON, OH 44706
EPA ID: OHD004465142
Mailing address: PO BOX 6902
CANTON, OH 44706
Contact: KEITH J HOUSEKNECHT
Contact address: Not reported
Not reported
Contact country: Not reported
Contact telephone: (330) 477-4511
Telephone ext.: 188
Contact email: khouseknecht@cantondropforge.com
EPA Region: 05
Land type: Private
Classification: Small Small Quantity Generator

CANTON DROP FORGE INC (Continued) **1000416682**

Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name:	BRAD AHBE
Owner/operator address:	PO BOX 6902
	CANTON, OH 44706
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	04/01/2004
Owner/Op end date:	Not reported

Owner/operator name:	JIM O'SULLIVAN
Owner/operator address:	PO BOX 6902
	CANTON, OH 44706
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	10/01/1997
Owner/Op end date:	Not reported

Owner/operator name:	NAME NOT REPORTED
Owner/operator address:	ADDRESS NOT REPORTED
	CITY NOT REPORTED, AK 99998
Owner/operator country:	Not reported
Owner/operator telephone:	(312) 555-1212
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	NAME NOT REPORTED
Owner/operator address:	ADDRESS NOT REPORTED
	CITY NOT REPORTED, AK 99998
Owner/operator country:	Not reported
Owner/operator telephone:	(312) 555-1212
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No

CANTON DROP FORGE INC (Continued) **1000416682**

Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 08/18/1980
Facility name: CANTON DROP FORGE INC
Classification: Small Quantity Generator

Hazardous Waste Summary:
Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Waste code: F010
Waste name: QUENCHING BATH RESIDUES FROM OIL BATHS FROM METAL HEAT TREATING OPERATIONS WHERE CYANIDES ARE USED IN THE PROCESS.

Facility Has Received Notices of Violations:
Regulation violated: Not reported
Area of violation: Generators - Records/Reporting
Date violation determined: 10/14/2010
Date achieved compliance: 11/04/2010
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/14/2010
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - Records/Reporting
Date violation determined: 08/06/2008
Date achieved compliance: 08/26/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/06/2008
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

CANTON DROP FORGE INC (Continued) **1000416682**

Evaluation Action Summary:

Evaluation date:	07/01/2011
Evaluation:	FOCUSED COMPLIANCE INSPECTION
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA
Evaluation date:	10/14/2010
Evaluation:	NON-FINANCIAL RECORD REVIEW
Area of violation:	Generators - Records/Reporting
Date achieved compliance:	11/04/2010
Evaluation lead agency:	State
Evaluation date:	08/06/2008
Evaluation:	NON-FINANCIAL RECORD REVIEW
Area of violation:	Generators - Records/Reporting
Date achieved compliance:	08/26/2008
Evaluation lead agency:	State

FINDS:

Registry ID: 110000391040

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

The NEI (National Emissions Inventory) database contains information on stationary and mobile sources that emit criteria air pollutants and their precursors, as well as hazardous air pollutants (HAPs).

US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

HAZARDOUS WASTE BIENNIAL REPORTER

CRITERIA AND HAZARDOUS AIR POLLUTANT INVENTORY

The OH-CORE (Ohio - Core) database contains information commonly

CANTON DROP FORGE INC (Continued) **1000416682**

shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

ICIS (Integrated Compliance Information System) is the Integrated Compliance Information System and provides a database that, when complete, will contain integrated Enforcement and Compliance information across most of EPA's programs. The vision for ICIS is to replace EPA's independent databases that contain Enforcement data with a single repository for that information. Currently, ICIS contains all Federal Administrative and Judicial enforcement actions. This information is maintained in ICIS by EPA in the Regional offices and it Headquarters. A future release of ICIS will replace the Permit Compliance System (PCS) which supports the NPDES and will integrate that information with Federal actions already in the system. ICIS also has the capability to track other activities occurring in the Region that support Compliance and Enforcement programs. These include; Incident Tracking, Compliance Assistance, and Compliance Monitoring.

DERR:
DERR ID: 276000130
District: NEDO
Alias: Not reported
Lat/Long: 40.7791 -81.3958
EPA ID: OHD004465142
Program: Site Assessment
Contact Phone: (330) 963-1200

LUST:
Release Number: 76000606-N00001
Release Date: Not reported
Facility Status: Inactive
LTF Status: 1 SUS/CON from regulated UST
FR Status: NFA: No Further Action
Priority: 2
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Release Number: 76000606-N00002
Release Date: 04/29/1999
Facility Status: Active
LTF Status: 6 Closure of regulated UST
FR Status: NFC: No Further Action Data Cleaning
Priority: 3
Review Date: 10/20/2010
Class: Viable Responsible Party has been identified

NY MANIFEST:
EPA ID: OHD004465142
Country: USA
Mailing Name: CANTON DROP FORGE
Mailing Contact: CANTON DROP FORGE
Mailing Address: 4575 SOUTH WAY STREET SW

CANTON DROP FORGE INC (Continued) **1000416682**

Mailing Address 2:	Not reported
Mailing City:	CANTON
Mailing State:	OH
Mailing Zip:	44706
Mailing Zip4:	Not reported
Mailing Country:	USA
Mailing Phone:	216-477-4511

Document ID:	NYA5707026
Manifest Status:	Completed after the designated time period for a TSDF to get a copy to the DEC
Trans1 State ID:	Not reported
Trans2 State ID:	Not reported
Generator Ship Date:	880722
Trans1 Recv Date:	880722
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	880725
Part A Recv Date:	880831
Part B Recv Date:	880801
Generator EPA ID:	OHD004465142
Trans1 EPA ID:	OKD981586605
Trans2 EPA ID:	Not reported
TSDF ID:	NYD049836679
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	00800
Units:	P - Pounds
Number of Containers:	002
Container Type:	DM - Metal drums, barrels
Handling Method:	L Landfill.
Specific Gravity:	100
Year:	88

SPILLS:

Spill No.:	9201-76-0261
Spill Year:	1992
Date Spill Reported:	01/24/1992
Spill Month:	1
Spill Number:	0261
Reporter Name:	CO
Confidential:	No
District Code:	NE
Employee Number:	Not reported
Lat/Long:	Not reported
Product Spilled Name:	SMOKE

A5
Target Property
Actual: 1058 ft.

CANTON DROP FORGING & MFG CO **ICIS 1011606173**
4575 SOUTHWAY ST. S.W. CANTON OH 447061995 **N/A**
CANTON, OH 44706

Site 5 of 6 in cluster A

ICIS:

Enforcement Action ID:	05-1986-0111
FRS ID:	110000391040
Program ID:	NEI NTI40494
Action Name:	CANTON DROP FORGING & MANUFACTURING
Facility Name:	CANTON DROP FORGING & MFG CO

CANTON DROP FORGING & MFG CO (Continued) **1011606173**

Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: OH-CORE 38255
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE WELL NO 2
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: FRS 110000391040
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE WELL NO 2
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: RCRAINFO OHD004465142
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE INC
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: BR OHD004465142
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE INC
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: EIS 7403311
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995

CANTON DROP FORGING & MFG CO (Continued) **1011606173**

Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: AIRS/AFS 3915100013
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: NEI NEI40494
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: Not reported
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: OH-CORE 38254
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGING AND MFG CO STU 1
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Enforcement Action ID: 05-1986-0111
FRS ID: 110000391040
Program ID: TRIS 44706CNTND4575S
Action Name: CANTON DROP FORGING & MANUFACTURING
Facility Name: CANTON DROP FORGE
Facility Address: 4575 SOUTHWAY ST. S.W. CANTON OH 447061995
CANTON, Ohio 447061995
Enforcement Action Type: TSCA 16 Action For Penalty
Facility County: Stark
EPA Region #: 5

Program ID: AIRS/AFS 3915100013
Facility Name: CANTON DROP FORGE WELL NO 2
Address: 4575 SOUTHWAY ST. S.W.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3462
Latitude: 40.781546

CANTON DROP FORGING & MFG CO (Continued) **1011606173**

Longitude:	-81.432276
Program ID:	AIRS/AFS 3915100013
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276
Program ID:	BR OHD004465142
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3462
Latitude:	40.781546
Longitude:	-81.432276
Program ID:	BR OHD004465142
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276
Program ID:	EIS 7403311
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3462
Latitude:	40.781546
Longitude:	-81.432276
Program ID:	EIS 7403311
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276
Program ID:	FRS 110000391040
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No

CANTON DROP FORGING & MFG CO (Continued) **1011606173**

NAIC Code: Not reported
SIC Code: 3462
Latitude: 40.781546
Longitude: -81.432276

Program ID: FRS 110000391040
Facility Name: CANTON DROP FORGE WELL NO 2
Address: 4575 SOUTHWAY ST. S.W.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3463
Latitude: 40.781546
Longitude: -81.432276

Program ID: NEI NEI40494
Facility Name: CANTON DROP FORGE WELL NO 2
Address: 4575 SOUTHWAY ST. S.W.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3462
Latitude: 40.781546
Longitude: -81.432276

Program ID: NEI NEI40494
Facility Name: CANTON DROP FORGE WELL NO 2
Address: 4575 SOUTHWAY ST. S.W.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3463
Latitude: 40.781546
Longitude: -81.432276

Program ID: NEI NTI40494
Facility Name: CANTON DROP FORGE WELL NO 2
Address: 4575 SOUTHWAY ST. S.W.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3462
Latitude: 40.781546
Longitude: -81.432276

Program ID: NEI NTI40494
Facility Name: CANTON DROP FORGE WELL NO 2
Address: 4575 SOUTHWAY ST. S.W.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3463
Latitude: 40.781546
Longitude: -81.432276

Program ID: OH-CORE 38254
Facility Name: CANTON DROP FORGE WELL NO 2

CANTON DROP FORGING & MFG CO (Continued) **1011606173**

Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3462
Latitude:	40.781546
Longitude:	-81.432276

Program ID:	OH-CORE 38254
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276

Program ID:	OH-CORE 38255
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3462
Latitude:	40.781546
Longitude:	-81.432276

Program ID:	OH-CORE 38255
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276

Program ID:	RCRAINFO OHD004465142
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3462
Latitude:	40.781546
Longitude:	-81.432276

Program ID:	RCRAINFO OHD004465142
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276

CANTON DROP FORGING & MFG CO (Continued) **1011606173**

Program ID:	TRIS 44706CNTND4575S
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3462
Latitude:	40.781546
Longitude:	-81.432276

Program ID:	TRIS 44706CNTND4575S
Facility Name:	CANTON DROP FORGE WELL NO 2
Address:	4575 SOUTHWAY ST. S.W.
Tribal Indicator:	N
Fed Facility:	No
NAIC Code:	Not reported
SIC Code:	3463
Latitude:	40.781546
Longitude:	-81.432276

A6
Target Property

CANTON DROP FORGE
4575 SOUTHWAY ST SW
CANTON, OH 44706

UST **U004086613**
N/A

Site 6 of 6 in cluster A

Actual: 1058 ft.

Facility:

Facility ID:	76000606
Facility Type:	Commercial
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	Yes
Owner Id:	W000446
Owner Name:	CANTON DROP FORGE
Owner Address:	PO BOX 6902
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	(216) 477-4511

Inspection:

Facility Id:	76000606
Inspection Id:	2/23/99
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000606
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	2/1/2000
Lfd Permit Id:	Not reported

UST:

CANTON DROP FORGE (Continued) **U004086613**

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Other
Capacity:	10000
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1942
Date Removed:	2/23/1999
Date Last Used:	2/23/1999
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	Not reported

B7 **TRUCK REPAIR BLDG** **LUST U004102796**
WSW **4700 SOUTHWAY ST SW** **UST N/A**
< 1/8 **CANTON, OH 44706**
0.006 mi.
30 ft. **Site 1 of 3 in cluster B**

Relative:
Higher

Actual:
1068 ft.

LUST:

Release Number:	76010119-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76010119
Facility Type:	Not reported
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W019361
Owner Name:	TRUCK REPAIR BLDG
Owner Address:	4700 SOUTHWAY ST SW
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	Not reported

UST:

Tank ID:	Not reported
Tank Status:	**Not reported**
Tank Type:	Not reported

TRUCK REPAIR BLDG (Continued) **U004102796**

Capacity:	Not reported
Content:	Not reported
CAS #:	Not reported
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	Not reported
Installation Date:	Not reported
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Not reported
Piping Type:	Not reported
Release Detection on Piping:	Not reported

C8 **BEAVER EXCAVATING COMPANY** **MLTS 1001494823**
WSW **4650 SOUTHWAY STREET, SW** **UIC N/A**
< 1/8 **CANTON, OH 44706** **LUST**
0.006 mi. **UST**
33 ft. **Site 1 of 2 in cluster C**

Relative:
Higher

Actual:
1070 ft.

MLTS:

License Number:	34-23320-02
First License Date:	1/5/1984
License Date:	9/14/2005
Lic. Expiration Date:	10/31/2013
Contact Name:	PATRICK A KING
Contact Phone:	330/478-2151
Institution Code:	23320
Department/Bldg:	Not reported
States Allowing Use:	Not reported
Store Material Use:	No
Redistribution Use:	No
Incinerate Use:	No
Burial Use:	No
Last Inspection Date:	2/1/2009
Next Inspection Date:	2/1/2014
Licensee Contact:	RSO
Inspector Name:	PATRICK KING

UIC:

Facility Id Number:	71798
Facility Status:	PLUGGED
Latitude:	40.78156
Longitude:	-81.43652
Number Of UIC Wells:	Not reported
Type Of UIC Well:	Motor Vehicle Waste Disposal Wells
Type Description:	Not reported
Status:	Not reported
UIC Number:	Not reported
Well Id:	29958
Latitude Of Well1:	Not reported
Longitude Of Well1:	Not reported

BEAVER EXCAVATING COMPANY (Continued) **1001494823**

Latitude Of Well2:	Not reported
Longitude Of Well2:	Not reported
Latitude Of Well3:	Not reported
Longitude Of Well3:	Not reported
Latitude Of Well4:	Not reported
Longitude Of Well4:	Not reported
Latitude Of Well5:	Not reported
Longitude Of Well5:	Not reported
Latitude Of Monitoring Well:	Not reported
Longitude Of Monitoring Well:	Not reported

LUST:

Release Number: 76000852-N00001
Release Date: 04/19/1999
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 08/07/2003
Class: Viable Responsible Party has been identified

Release Number: 76000852-N00002
Release Date: 01/10/1990
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 2
Review Date: 08/30/2006
Class: Viable Responsible Party has been identified

Release Number: 76000852-N00003
Release Date: 09/02/2009
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 2
Review Date: 02/05/2010
Class: Viable Responsible Party has been identified

Facility:

Facility ID:	76000852
Facility Type:	Contractor
24 Hr Emergency Contact:	JEFF STERLING
24 Hr Emergency Phone:	(330)388-1240
Number Of Tanks On Site:	2
Local Fire Department:	PERRY TWP FIRE DEPARTMENT
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W001258
Owner Name:	BEAVER EXCAVATING CO., INC.
Owner Address:	2000 BEAVER PL AVE SW
Owner City/State/Zip:	CANTON, OH 44706-1935
Owner Phone:	(216) 478-2151

Inspection:

Facility Id: 76000852

BEAVER EXCAVATING COMPANY (Continued) **1001494823**

Inspection Id: 12/4/98
Code: 103
Permit Number: P00001
Inspection Type: Final

Facility Id: 76000852
Inspection Id: 4/19/99
Code: 601
Permit Number: P00002
Inspection Type: Final

Facility Id: 76000852
Inspection Id: 4/8/02
Code: 504
Permit Number: P00003
Inspection Type: Final

Facility Id: 76000852
Inspection Id: 9/2/09
Code: 502
Permit Number: P00004
Inspection Type: Preliminary

Facility Id: 76000852
Inspection Id: 9/9/09
Code: 502
Permit Number: P00004
Inspection Type: Preliminary

Facility Id: 76000852
Inspection Id: 9/18/09
Code: 502
Permit Number: P00004
Inspection Type: Final

Permit:
Facility Id: 76000852
Permit Id: P00001
Permit Status: Expired
Issued Date: 12/21/1998
Lfd Permit Id: Not reported

Facility Id: 76000852
Permit Id: P00002
Permit Status: Closed
Issued Date: 11/23/1999
Lfd Permit Id: Not reported

Facility Id: 76000852
Permit Id: P00003
Permit Status: Closed
Issued Date: 3/26/2002
Lfd Permit Id: Not reported

Facility Id: 76000852
Permit Id: P00004
Permit Status: Closed

BEAVER EXCAVATING COMPANY (Continued) **1001494823**

Issued Date: 8/13/2009
Lfd Permit Id: Not reported

UST:
Tank ID: T00001
Tank Status: **Removed**
Tank Type: Steel
Capacity: 4000
Content: Unknown
CAS #: Not reported
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 7/1/1978
Date Removed: 4/19/1999
Date Last Used: 4/19/1999
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Bare Steel
Piping Type: Suction: valve at tank
Release Detection on Piping: Not reported

Tank ID: T00002
Tank Status: **Removed**
Tank Type: Steel
Capacity: 4000
Content: Unknown
CAS #: Not reported
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 7/1/1978
Date Removed: 4/19/1999
Date Last Used: 4/19/1999
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Bare Steel
Piping Type: Suction: valve at tank
Release Detection on Piping: Not reported

Tank ID: T00003
Tank Status: **Currently In Use**
Tank Type: Cathodically Protected STIP3
Capacity: 10000
Content: Gasoline
CAS #: 8006-61-9
Regulated: Yes
Overfill Device Installed: Yes
Spill Device Installed: Yes
AST/UST: UST
Installation Date: 1/1/1990

BEAVER EXCAVATING COMPANY (Continued) **1001494823**

Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Factory Galvanic Anodes
Release Detection on Tank:	Automatic Tank Gauging;Interstitial Monitoring Double Walled
Corrosion Protection Piping:	None Required
Piping Material:	Galvanized Steel
Piping Type:	Pressure
Release Detection on Piping:	Mechanical Line Leak Detector

Tank ID:	T00004
Tank Status:	**Currently In Use**
Tank Type:	Cathodically Protected STIP3
Capacity:	20000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	Yes
Spill Device Installed:	Yes
AST/UST:	UST
Installation Date:	1/1/1990
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Factory Galvanic Anodes
Release Detection on Tank:	Automatic Tank Gauging;Interstitial Monitoring Double Walled
Corrosion Protection Piping:	None Required
Piping Material:	Galvanized Steel
Piping Type:	Pressure
Release Detection on Piping:	Mechanical Line Leak Detector

C9 **BEAVER EXCAVATING CO INC** **RCRA-CESQG 1000430458**
WSW **4650 SOUTHWAY ST SW** **FINDS OHD981785272**
< 1/8 **CANTON, OH 44706**
0.006 mi.
33 ft. **Site 2 of 2 in cluster C**

Relative:
Higher

Actual:
1070 ft.

RCRA-CESQG:

Date form received by agency:	07/14/2010
Facility name:	BEAVER EXCAVATING COMPANY
Facility address:	4650 SOUTHWAY ST SW CANTON, OH 44706
EPA ID:	OHD981785272
Contact:	HUGH BROWN
Contact address:	PO BOX 6059 CANTON, OH 44706
Contact country:	US
Contact telephone:	(330) 478-2151
Contact email:	HUGHB@BEAVEREXCAVATING.COM
EPA Region:	05
Land type:	Private
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or

BEAVER EXCAVATING CO INC (Continued) **1000430458**

other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	BEAVER EXCAVATING COMPANY
Owner/operator address:	4650 SOUTHWAY ST SW CANTON, OH 44706
Owner/operator country:	US
Owner/operator telephone:	(330) 478-2151
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	BEAVER EXCAVATING COMPANY
Owner/operator address:	4650 SOUTHWAY ST SW CANTON, OH 44706
Owner/operator country:	US
Owner/operator telephone:	(330) 478-2151
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	NAME NOT REPORTED
Owner/operator address:	ADDRESS NOT REPORTED CITY NOT REPORTED, AK 99998
Owner/operator country:	Not reported
Owner/operator telephone:	(312) 555-1212
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	BEAVER EXCAVATING CO INC - DON STERLING
Owner/operator address:	4650 SOUTHWAY ST SW CANTON, OH 44706
Owner/operator country:	Not reported
Owner/operator telephone:	(330) 478-2151
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No

BEAVER EXCAVATING CO INC (Continued) **1000430458**

Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Historical Generators:

Date form received by agency:	01/26/1998
Facility name:	BEAVER EXCAVATING COMPANY
Site name:	BEAVER EXCAVATING COMPANY INC
Classification:	Small Quantity Generator

Hazardous Waste Summary:

Waste code:	D001
Waste name:	IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Facility Has Received Notices of Violations:

Regulation violated:	Not reported
Area of violation:	Used Oil - Generators
Date violation determined:	07/14/2010
Date achieved compliance:	07/23/2010
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	07/27/2010
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Evaluation Action Summary:

Evaluation date:	07/14/2010
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Used Oil - Generators
Date achieved compliance:	07/23/2010
Evaluation lead agency:	State

FINDS:

Registry ID: 110004645457

Environmental Interest/Information System
RCRAinfo is a national information system that supports the Resource

BEAVER EXCAVATING CO INC (Continued) **1000430458**

Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

D10 **CROWN ENTERP REAL ESTATE DEPT** **LUST U004088562**
ESE **4310 SOUTHWAY** **UST N/A**
< 1/8 **CANTON, OH 44706**
0.007 mi.
36 ft. **Site 1 of 2 in cluster D**

Relative: Higher

Actual: 1071 ft.

LUST:
Release Number: 76005898-N00001
Release Date: Not reported
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76005898
Facility Type: Trucking/Transport
24 Hr Emergency Contact: Not reported
24 Hr Emergency Phone: Not reported
Number Of Tanks On Site: Not reported
Local Fire Department: Zero
Delegated Authority: No
Elig For Green Buckeye Award: Not reported
Active Release Site: No
Owner Id: W005728
Owner Name: CROWN ENTERPRISES
Owner Address: 12225 STEPHENS RD
Owner City/State/Zip: WARREN, MI 48089
Owner Phone: 586-939-7000

Inspection:
Facility Id: 76005898
Inspection Id: 3/15/99
Code: 103
Permit Number: P00001
Inspection Type: Final

UST:
Tank ID: T00001
Tank Status: Removed
Tank Type: Steel

CROWN ENTERP REAL ESTATE DEPT (Continued) **U004088562**

Capacity:	10000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1965
Date Removed:	3/15/1999
Date Last Used:	3/15/1999
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	10000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1965
Date Removed:	3/15/1999
Date Last Used:	3/15/1999
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Not reported
Release Detection on Piping:	Not reported

D11 **MEREDITH INVESTMENTS** **SWF/LF** **S109546046**
ESE **4448 SOUTHWAY ST SW** **N/A**
< 1/8 **CANTON, OH 44706**
0.007 mi.
38 ft. **Site 2 of 2 in cluster D**

Relative:
Higher

Actual:
1069 ft.

LF:

Facility Address:	Not reported
Facility ID:	Not reported
Status:	Not reported
Facility Phone:	Not reported
Last Update:	Not reported
SWMD:	Not reported
Type:	Not reported
Closed Facility:	Not reported
Class:	Not reported
Captive:	Not reported
Docket #:	76-C4R-1045

MEREDITH INVESTMENTS (Continued) **S109546046**

Core Place ID: 286127
Start Date: 04/06/2009
End Date: Not reported
District Office: NEDO
Phone Number: (330)209-3686
Organization ID: Not reported
Org. Comments: Not reported
Contact Name: Not reported
Contact Phone: Not reported
Issue Date: Not reported
Expire Date: Not reported
Report ID: Not reported
Registration #: Not reported
Operator: Not reported
Operator Address: Not reported
Operator City,St,Zip: Not reported
Operator Phone: Not reported
Licence Holder: Not reported
Licence Holder Address: Not reported
Licence Holder City,St,Zip: Not reported
Licence Holder Phone: Not reported
Owner Name: Not reported
Owner Address: Not reported
Owner City,St,Zip: Not reported
Owner Phone: Not reported
Applicant Name: Not reported
Applicant Address: Not reported

B12 **EAST OHIO GAS CO. PERRY YARD SHO** **LUST U000694926**
WSW **4725 SOUTHWAY SW** **UST N/A**
< 1/8 **CANTON, OH 44706**
0.016 mi.
83 ft. **Site 2 of 3 in cluster B**

Relative:
Higher

Actual:
1069 ft.

LUST:
Release Number: 76000578-N00001
Release Date: Not reported
Facility Status: **Inactive**
LTF Status: 1 SUS/CON from regulated UST
FR Status: **NFA: No Further Action**
Priority: 2
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Release Number: 76000578-N00002
Release Date: 02/14/2011
Facility Status: **Inactive**
LTF Status: 6 Closure of regulated UST
FR Status: **NFA: No Further Action**
Priority: Not reported
Review Date: 11/17/2011
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76000578
Facility Type: Industrial
24 Hr Emergency Contact: GAS DISPATCH CENTER

EAST OHIO GAS CO. PERRY YARD SHO (Continued) **U000694926**

24 Hr Emergency Phone:	(800)300-3333
Number Of Tanks On Site:	2
Local Fire Department:	PERRY TWP FIRE DEPARTMENT
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W000053
Owner Name:	DOMINION EAST OHIO GAS CO.
Owner Address:	c/o Dominion Resources, 500 Davisson Run Road
Owner City/State/Zip:	Clarkburg, WV 26301
Owner Phone:	(304) 627-3235

Inspection:

Facility Id:	76000578
Inspection Id:	11/15/10
Code:	502
Permit Number:	P00001
Inspection Type:	Preliminary
Facility Id:	76000578
Inspection Id:	11/18/10
Code:	502
Permit Number:	P00001
Inspection Type:	Preliminary
Facility Id:	76000578
Inspection Id:	11/24/10
Code:	502
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000578
Permit Id:	P00001
Permit Status:	Closed
Issued Date:	7/30/2010
Lfd Permit Id:	Not reported

UST:

Tank ID:	T00001
Tank Status:	**Currently In Use**
Tank Type:	Cathodically Protected Steel
Capacity:	6000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	Yes
Spill Device Installed:	Yes
AST/UST:	UST
Installation Date:	1/1/1990
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Factory Galvanic Anodes
Release Detection on Tank:	Automatic Tank Gauging
Corrosion Protection Piping:	Field Galvanic Anodes
Piping Material:	Cathodically Protected

EAST OHIO GAS CO. PERRY YARD SHO (Continued) **U000694926**

Piping Type:	Suction: valve at tank
Release Detection on Piping:	No Monitoring Suction/Gravity System
Tank ID:	T00002
Tank Status:	**Currently In Use**
Tank Type:	Cathodically Protected Steel
Capacity:	1000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	Yes
Spill Device Installed:	Yes
AST/UST:	UST
Installation Date:	1/1/1990
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Factory Galvanic Anodes
Release Detection on Tank:	Automatic Tank Gauging
Corrosion Protection Piping:	Field Galvanic Anodes
Piping Material:	Cathodically Protected
Piping Type:	Suction: valve at tank
Release Detection on Piping:	No Monitoring Suction/Gravity System

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B13 **DOMINION EAST OHIO - CANTON PERRY YARD** **RCRA-CESQG 1000393288**
WSW **4725 SOUTHWAY AVE SW** **FINDS OHD073134389**
< 1/8 **CANTON, OH 44706** **MANIFEST**
0.016 mi.
83 ft. **Site 3 of 3 in cluster B**

Relative: Higher

Actual: 1069 ft.

RCRA-CESQG:

Date form received by agency:	07/28/2010
Facility name:	DOMINION EAST OHIO - CANTON PERRY YARD
Facility address:	4725 SOUTHWAY AVE SW CANTON, OH 44706
EPA ID:	OHD073134389
Contact:	TROY E HAWKINS
Contact address:	320 SPRINGSIDE DR STE 320 AKRON, OH 44333
Contact country:	US
Contact telephone:	(330) 664-2577
Contact email:	TROY.E.HAWKINS@DOM.COM
EPA Region:	05
Land type:	Private
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	THE EAST OHIO GAS COMPANY
Owner/operator address:	1201 E 55TH STREET
	CLEVELAND, OH 44103
Owner/operator country:	US
Owner/operator telephone:	(216) 736-6676
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/01/2000
Owner/Op end date:	Not reported
Owner/operator name:	DOMINION EAST OHIO
Owner/operator address:	1201 E 55TH ST
	CLEVELAND, OH 44103
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/01/2000
Owner/Op end date:	Not reported
Owner/operator name:	EAST OHIO GAS CO
Owner/operator address:	1717 E 9TH ST
	CLEVELAND, OH 44114
Owner/operator country:	Not reported
Owner/operator telephone:	(216) 432-3232
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported
Owner/operator name:	NAME NOT REPORTED
Owner/operator address:	ADDRESS NOT REPORTED
	CITY NOT REPORTED, AK 99998
Owner/operator country:	Not reported
Owner/operator telephone:	(312) 555-1212
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported
Owner/operator name:	DOMINION EAST OHIO
Owner/operator address:	1202 E 55TH ST
	CLEVELAND, OH 44103
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	01/01/2000
Owner/Op end date:	Not reported
Owner/operator name:	EAST OHIO GAS COMPANY
Owner/operator address:	4725 SOUTHWAY AVE SW
	CANTON, OH 44706

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/2000
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 03/31/2008
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Classification: Small Quantity Generator

Date form received by agency: 02/28/2008
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Classification: Large Quantity Generator

Date form received by agency: 02/19/2007
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Classification: Large Quantity Generator

Date form received by agency: 02/24/2006
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Classification: Large Quantity Generator

Date form received by agency: 02/25/2005
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Classification: Large Quantity Generator

Date form received by agency: 02/26/2004
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Classification: Small Quantity Generator

Date form received by agency: 02/19/2003
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Site name: DOMINION EAST OHIO - PERRY YARD
Classification: Large Quantity Generator

Date form received by agency: 02/28/2002
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Site name: DOMINION EAST OHIO - PERRY YARD
Classification: Large Quantity Generator

Date form received by agency: 02/29/2000
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Site name: EAST OHIO GAS PERRY YARD
Classification: Small Quantity Generator

Date form received by agency: 03/04/1998
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Site name: EAST OHIO GAS CO
Classification: Large Quantity Generator

Date form received by agency: 02/20/1998
Facility name: DOMINION EAST OHIO - CANTON PERRY YARD
Site name: EAST OHIO GAS PERRY YARD
Classification: Large Quantity Generator

Hazardous Waste Summary:
Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D018
Waste name: BENZENE

Waste code: D035
Waste name: METHYL ETHYL KETONE

Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Violation Status: No violations found

Evaluation Action Summary:
Evaluation date: 07/28/2010
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110000893640

Environmental Interest/Information System

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

HAZARDOUS WASTE BIENNIAL REPORTER

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

NY MANIFEST:

EPA ID:	OHD073134389
Country:	USA
Mailing Name:	EAST OHIO GAS - PERRY YARD
Mailing Contact:	LARRY BRAMER
Mailing Address:	4725 SOUTHWAY AVE SW
Mailing Address 2:	Not reported
Mailing City:	CANTON
Mailing State:	OH
Mailing Zip:	44706
Mailing Zip4:	Not reported
Mailing Country:	USA
Mailing Phone:	304-623-8000

Document ID:	NYB9298377
Manifest Status:	Not reported
Trans1 State ID:	NYD980769947
Trans2 State ID:	Not reported
Generator Ship Date:	02/21/2000
Trans1 Recv Date:	02/21/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	02/22/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	10239PNY
Waste Code:	B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Quantity:	01843
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	TT - Cargo tank, tank trucks
Handling Method:	B Incineration, heat recovery, burning.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYB9405423

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Manifest Status: Not reported
Trans1 State ID: NYD980769947
Trans2 State ID: Not reported
Generator Ship Date: 08/31/2000
Trans1 Recv Date: 08/31/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 09/01/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: 10241PNY
Waste Code: B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Quantity: 01892
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: TT - Cargo tank, tank trucks
Handling Method: B Incineration, heat recovery, burning.
Specific Gravity: 01.00
Year: 2000

Document ID: NYB9333783
Manifest Status: Not reported
Trans1 State ID: NYD980769947
Trans2 State ID: Not reported
Generator Ship Date: 05/17/2000
Trans1 Recv Date: 05/17/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 05/18/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: 10241PNY
Waste Code: B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Quantity: 02299
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: TT - Cargo tank, tank trucks
Handling Method: B Incineration, heat recovery, burning.
Specific Gravity: 01.00
Year: 2000

Document ID: NYB9426114
Manifest Status: Not reported
Trans1 State ID: NYD980769447
Trans2 State ID: Not reported
Generator Ship Date: 12/05/2000
Trans1 Recv Date: 12/05/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 12/06/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	10239PNY
Waste Code:	B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Quantity:	01039
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	TT - Cargo tank, tank trucks
Handling Method:	B Incineration, heat recovery, burning.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG2997234
Manifest Status:	Not reported
Trans1 State ID:	OHD987050564
Trans2 State ID:	Not reported
Generator Ship Date:	04/07/2006
Trans1 Recv Date:	04/07/2006
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	04/10/2006
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	TLK5908OH
Trans2 EPA ID:	Not reported
TSDF ID:	NYD049836679
Waste Code:	B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Quantity:	02002
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	TT - Cargo tank, tank trucks
Handling Method:	B Incineration, heat recovery, burning.
Specific Gravity:	01.00
Year:	2006

Document ID:	NYG2368638
Manifest Status:	Not reported
Trans1 State ID:	PAD987399292
Trans2 State ID:	Not reported
Generator Ship Date:	06/22/2000
Trans1 Recv Date:	06/22/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	06/23/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	XC65609PA
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	04890
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	CM - Metal boxes, cases, roll-offs

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYG2368764
Manifest Status: Not reported
Trans1 State ID: PAD987399292
Trans2 State ID: Not reported
Generator Ship Date: 07/20/2000
Trans1 Recv Date: 07/20/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 07/21/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: XC65609PA
Waste Code: B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity: 03629
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: CM - Metal boxes, cases, roll-offs
Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYG2368881
Manifest Status: Not reported
Trans1 State ID: PAD987399292
Trans2 State ID: Not reported
Generator Ship Date: 08/17/2000
Trans1 Recv Date: 08/17/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 08/18/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: XC65609PA
Waste Code: B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity: 06232
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: CF - Fiber or plastic boxes, cartons
Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYG2190069
Manifest Status: Not reported
Trans1 State ID: PAD987399292
Trans2 State ID: Not reported

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Generator Ship Date: 09/14/2000
Trans1 Recv Date: 09/14/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 09/15/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: XC65609PA
Waste Code: B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity: 06722
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: CM - Metal boxes, cases, roll-offs
Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYG2190177
Manifest Status: Not reported
Trans1 State ID: PAD987399292
Trans2 State ID: Not reported
Generator Ship Date: 09/28/2000
Trans1 Recv Date: 09/28/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 09/29/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: XC65609PA
Waste Code: B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity: 03393
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: CM - Metal boxes, cases, roll-offs
Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYG2190222
Manifest Status: Not reported
Trans1 State ID: PAD987399292
Trans2 State ID: Not reported
Generator Ship Date: 10/26/2000
Trans1 Recv Date: 10/26/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 10/27/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

TSDF ID:	XC65609PA
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	05407
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	CM - Metal boxes, cases, roll-offs
Handling Method:	L Landfill.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG2190357
Manifest Status:	Not reported
Trans1 State ID:	PAD987399292
Trans2 State ID:	Not reported
Generator Ship Date:	11/08/2000
Trans1 Recv Date:	11/08/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	11/15/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	XK73298PA
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	06550
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	CM - Metal boxes, cases, roll-offs
Handling Method:	L Landfill.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG2190537
Manifest Status:	Not reported
Trans1 State ID:	PAD987399292
Trans2 State ID:	Not reported
Generator Ship Date:	12/07/2000
Trans1 Recv Date:	12/07/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	12/08/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	XC65609PA
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	05062
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	CM - Metal boxes, cases, roll-offs
Handling Method:	L Landfill.
Specific Gravity:	01.00
Year:	2000

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Document ID:	NYG2190645
Manifest Status:	Not reported
Trans1 State ID:	NYD980769947
Trans2 State ID:	Not reported
Generator Ship Date:	11/30/2000
Trans1 Recv Date:	11/30/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	12/01/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	11712PNY
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	14443
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	017
Container Type:	CM - Metal boxes, cases, roll-offs
Handling Method:	L Landfill.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG1796643
Manifest Status:	Not reported
Trans1 State ID:	OH0000000539
Trans2 State ID:	Not reported
Generator Ship Date:	05/09/2000
Trans1 Recv Date:	05/09/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	05/11/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	P5W90COH
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	00300
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	003
Container Type:	DM - Metal drums, barrels
Handling Method:	L Landfill.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG1797435
Manifest Status:	Not reported
Trans1 State ID:	OH0000000539
Trans2 State ID:	Not reported
Generator Ship Date:	02/09/2000
Trans1 Recv Date:	02/09/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	02/11/2000
Part A Recv Date:	Not reported

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	P5W89COH
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	00025
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	DM - Metal drums, barrels
Handling Method:	L Landfill.
Specific Gravity:	01.00
Waste Code:	B003 - PETROLEUM OIL WITH 500 PPM OR > PCB
Quantity:	00200
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	DM - Metal drums, barrels
Handling Method:	B Incineration, heat recovery, burning.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG1798524
Manifest Status:	Not reported
Trans1 State ID:	OH0000000539
Trans2 State ID:	Not reported
Generator Ship Date:	08/23/2000
Trans1 Recv Date:	08/23/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	08/25/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389
Trans1 EPA ID:	NYD049836679
Trans2 EPA ID:	Not reported
TSDF ID:	F5W89COH
Waste Code:	B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity:	00300
Units:	K - Kilograms (2.2 pounds)
Number of Containers:	001
Container Type:	DM - Metal drums, barrels
Handling Method:	L Landfill.
Specific Gravity:	01.00
Year:	2000

Document ID:	NYG0994356
Manifest Status:	Not reported
Trans1 State ID:	OHR000028498
Trans2 State ID:	Not reported
Generator Ship Date:	06/08/2000
Trans1 Recv Date:	06/08/2000
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	06/14/2000
Part A Recv Date:	Not reported
Part B Recv Date:	Not reported
Generator EPA ID:	OHD073134389

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: T933CNOH
Waste Code: B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity: 00454
Units: K - Kilograms (2.2 pounds)
Number of Containers: 004
Container Type: TP - Tanks, portable
Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYG0661437
Manifest Status: Not reported
Trans1 State ID: PAD987399292
Trans2 State ID: Not reported
Generator Ship Date: 05/26/2000
Trans1 Recv Date: 05/26/2000
Trans2 Recv Date: Not reported
TSD Site Recv Date: 05/31/2000
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: XA74615PA
Waste Code: B007 - OTHER MISCELLANEOUS PCB WASTES
Quantity: 08491
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: CM - Metal boxes, cases, roll-offs
Handling Method: L Landfill.
Specific Gravity: 01.00
Year: 2000

Document ID: NYB9428904
Manifest Status: Not reported
Trans1 State ID: NYD980769947
Trans2 State ID: Not reported
Generator Ship Date: 02/28/2001
Trans1 Recv Date: 02/28/2001
Trans2 Recv Date: Not reported
TSD Site Recv Date: 03/01/2001
Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OHD073134389
Trans1 EPA ID: NYD049836679
Trans2 EPA ID: Not reported
TSDF ID: 10239PNY
Waste Code: B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Quantity: 01084
Units: K - Kilograms (2.2 pounds)
Number of Containers: 001
Container Type: TT - Cargo tank, tank trucks
Handling Method: B Incineration, heat recovery, burning.

DOMINION EAST OHIO - CANTON PERRY YARD (Continued) **1000393288**

Specific Gravity: 01.00
Year: 2001

Click this hyperlink while viewing on your computer to access
14 additional NY_MANIFEST: record(s) in the EDR Site Report.

14
SE
< 1/8
0.047 mi.
247 ft.

CND INC
4520 SOUTHWAY SW
CANTON, OH 44706

RCRA-CESQG **1004766698**
FINDS **OHR000013078**

Relative:
Higher

Actual:
1058 ft.

RCRA-CESQG:

Date form received by agency:	01/13/2000
Facility name:	CND INC
Facility address:	4520 SOUTHWAY SW CANTON, OH 44706
EPA ID:	OHR000013078
Contact:	ROBERT BRENNER
Contact address:	4520 SOUTHWAY SW CANTON, OH 44706
Contact country:	US
Contact telephone:	(330) 478-8811
Contact email:	Not reported
EPA Region:	05
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	CLYDE SHETLER & DENY DEVAULT
Owner/operator address:	306 2ND ST MASSILLON, OH 44646
Owner/operator country:	Not reported
Owner/operator telephone:	(330) 832-8677
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No

CND INC (Continued) **1004766698**

Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Hazardous Waste Summary:

Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D006
Waste name: CADMIUM

Waste code: D008
Waste name: LEAD

Waste code: D018
Waste name: BENZENE

Waste code: D035
Waste name: METHYL ETHYL KETONE

Waste code: D039
Waste name: TETRACHLOROETHYLENE

Waste code: D040
Waste name: TRICHLOROETHYLENE

Violation Status: No violations found

FINDS:

Registry ID: 110004716745

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific

CND INC (Continued) **1004766698**

programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

E15 **ALLIED TRUCK PARTS CO.** **UIC U004083988**
ESE **4216 SOUTHWAY ST** **LUST N/A**
< 1/8 **CANTON, OH 44706** **UST**
0.073 mi.
385 ft. **Site 1 of 2 in cluster E**

Relative:
Higher

Actual:
1080 ft.

UIC:

Facility Id Number:	68605
Facility Status:	PLUGGED
Latitude:	40.78116
Longitude:	-81.61929
Number Of UIC Wells:	Not reported
Type Of UIC Well:	Motor Vehicle Waste Disposal Wells
Type Description:	Not reported
Status:	Not reported
UIC Number:	Not reported
Well Id:	27386
Latitude Of Well1:	Not reported
Longitude Of Well1:	Not reported
Latitude Of Well2:	Not reported
Longitude Of Well2:	Not reported
Latitude Of Well3:	Not reported
Longitude Of Well3:	Not reported
Latitude Of Well4:	Not reported
Longitude Of Well4:	Not reported
Latitude Of Well5:	Not reported
Longitude Of Well5:	Not reported
Latitude Of Monitoring Well:	Not reported
Longitude Of Monitoring Well:	Not reported

Facility Id Number:	72937
Facility Status:	PLUGGED
Latitude:	Not reported
Longitude:	Not reported
Number Of UIC Wells:	Not reported
Type Of UIC Well:	Motor Vehicle Waste Disposal Wells
Type Description:	Not reported
Status:	Not reported
UIC Number:	Not reported
Well Id:	27387
Latitude Of Well1:	Not reported
Longitude Of Well1:	Not reported
Latitude Of Well2:	Not reported
Longitude Of Well2:	Not reported
Latitude Of Well3:	Not reported
Longitude Of Well3:	Not reported
Latitude Of Well4:	Not reported
Longitude Of Well4:	Not reported
Latitude Of Well5:	Not reported
Longitude Of Well5:	Not reported
Latitude Of Monitoring Well:	Not reported
Longitude Of Monitoring Well:	Not reported

ALLIED TRUCK PARTS CO. (Continued) **U004083988**

LUST:
Release Number: 76000016-N00001
Release Date: 07/30/1996
Facility Status: Inactive
LTF Status: 1 SUS/CON from regulated UST
FR Status: NFA: No Further Action
Priority: 2
Review Date: 11/06/2002
Class: Viable Responsible Party has been identified

Facility:

Facility ID:	76000016
Facility Type:	Commercial
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W009561
Owner Name:	ALLIED TRUCK PARTS CO.
Owner Address:	4216 SOUTHWAY ST
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	( ) -

Inspection:

Facility Id:	76000016
Inspection Id:	7/26/96
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000016
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	8/20/1996
Lfd Permit Id:	Not reported

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	1000
Content:	Used Oil
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	8/1/1979
Date Removed:	7/26/1996
Date Last Used:	7/26/1996
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported

ALLIED TRUCK PARTS CO. (Continued) **U004083988**

Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Unknown
Piping Type: Suction: no valve at tank
Release Detection on Piping: Not reported

E16
ESE
< 1/8
0.073 mi.
385 ft.

BRECHBUHLER TRUCK SALES **RCRA-CESQG 1000248836**
4216 SOUTHWAY ST SW **FINDS OHD017571324**
CANTON, OH 44706

Site 2 of 2 in cluster E

Relative:
Higher

Actual:
1080 ft.

RCRA-CESQG:
Date form received by agency: 01/23/2003
Facility name: BRECHBUHLER TRUCK SALES
Facility address: 4216 SOUTHWAY ST SW
CANTON, OH 44706
EPA ID: OHD017571324
Contact: KIM BRECHBUHLER
Contact address: 4216 SOUTHWAY ST SW
CANTON, OH 44706
Contact country: US
Contact telephone: (330) 479-4087
Contact email: Not reported
EPA Region: 05
Land type: Facility is not located on Indian land. Additional information is not known.
Classification: Conditionally Exempt Small Quantity Generator
Description: Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:
Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: (312) 555-1212
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

BRECHBUHLER TRUCK SALES (Continued) **1000248836**

Owner/operator country: Not reported
Owner/operator telephone: (312) 555-1212
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: KIM BRECHBUHLER
Owner/operator address: 4216 SOUTHWAY ST SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: (330) 479-4087
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/1900
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 09/03/1985
Facility name: BRECHBUHLER TRUCK SALES
Site name: ALLIED TRUCK PARTS CO
Classification: Small Quantity Generator

Hazardous Waste Summary:
Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Facility Has Received Notices of Violations:
Regulation violated: SR - 3745-279-22(C)
Area of violation: Used Oil - Definitions
Date violation determined: 01/23/2003
Date achieved compliance: 01/24/2003

BRECHBUHLER TRUCK SALES (Continued) **1000248836**

Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/05/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 01/23/2003
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Used Oil - Definitions
Date achieved compliance: 01/24/2003
Evaluation lead agency: State

FINDS:

Registry ID: 110004600717

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

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17 West 1/8-1/4 0.126 mi. 663 ft.

KOHN, INC.
4850 SOUTHWAY SW
CANTON, OH 44706

LUST U004094533
UST N/A

Relative: Higher

Actual: 1059 ft.

LUST:
Release Number: 76007630-N00001
Release Date: Not reported
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76007630
Facility Type: Trucking/Transport
24 Hr Emergency Contact: Not reported

KOHN, INC. (Continued) **U004094533**

24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W002238
Owner Name:	KOHN, INC.
Owner Address:	4850 SOUTHWAY SW
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	(216) 478-2163

Inspection:

Facility Id:	76007630
Inspection Id:	6/12/92
Code:	103
Permit Number:	P00002
Inspection Type:	Final
Facility Id:	76007630
Inspection Id:	4/21/93
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76007630
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	1/13/1994
Lfd Permit Id:	Not reported
Facility Id:	76007630
Permit Id:	P00002
Permit Status:	Expired
Issued Date:	1/31/1994
Lfd Permit Id:	Not reported

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Other
Capacity:	Not reported
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	6/12/1992
Date Last Used:	6/12/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown

KOHN, INC. (Continued) **U004094533**

Piping Type:	Not reported
Release Detection on Piping:	Not reported
Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Other
Capacity:	Not reported
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	6/12/1992
Date Last Used:	6/12/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown
Piping Type:	Not reported
Release Detection on Piping:	Not reported
Tank ID:	T00003
Tank Status:	**Removed**
Tank Type:	Other
Capacity:	Not reported
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	6/12/1992
Date Last Used:	6/12/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown
Piping Type:	Not reported
Release Detection on Piping:	Not reported
Tank ID:	T00004
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	10000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	4/21/1993

KOHN, INC. (Continued) **U004094533**

Date Last Used:	4/20/1993
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel
Piping Type:	Gravity Feed
Release Detection on Piping:	Not reported

F18 **CANTON BAPTIST TEMPLE** **LUST U004086608**
ENE **1540 WHIPPLE AVE SW** **UST N/A**
1/8-1/4 **CANTON, OH 44710**
0.130 mi.
687 ft. **Site 1 of 4 in cluster F**

Relative:
Higher

Actual:
1089 ft.

LUST:

Release Number:	76000084-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76000084
Facility Type:	Not reported
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W009824
Owner Name:	CANTON BAPTIST TEMPLE
Owner Address:	515 WHIPPLE AVE NW
Owner City/State/Zip:	CANTON, OH 44708
Owner Phone:	(216) 477-6267

Inspection:

Facility Id:	76000084
Inspection Id:	6/2/98
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000084
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	11/4/1999
Lfd Permit Id:	Not reported

CANTON BAPTIST TEMPLE (Continued) **U004086608**

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Fiberglass Reinforced Plastic
Capacity:	4000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	6/2/1998
Date Last Used:	6/2/1998
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	Not reported

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Fiberglass Reinforced Plastic
Capacity:	6000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	6/2/1998
Date Last Used:	6/2/1998
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	Not reported

F19 **CUSTOM DESIGN TECHNOLOGIES** **LUST U004088697**
ENE **1545 WHIPPLE AVE SW** **UST N/A**
1/8-1/4 **CANTON, OH 44710**
0.136 mi.
720 ft. **Site 2 of 4 in cluster F**

Relative:
Higher

Actual:
1089 ft.

LUST:

Release Number:	76006772-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3

CUSTOM DESIGN TECHNOLOGIES (Continued) **U004088697**

Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76006772
Facility Type: Not reported
24 Hr Emergency Contact: Not reported
24 Hr Emergency Phone: Not reported
Number Of Tanks On Site: Not reported
Local Fire Department: Zero
Delegated Authority: No
Elig For Green Buckeye Award: Not reported
Active Release Site: No
Owner Id: W006560
Owner Name: CUSTOM DESIGN TECHNOLOGIES
Owner Address: 1545 WHIPPLE AVE SW
Owner City/State/Zip: CANTON, OH 44710
Owner Phone: (216) 477-3508

Inspection:
Facility Id: 76006772
Inspection Id: 12/16/92
Code: 103
Permit Number: P00001
Inspection Type: Final

Permit:
Facility Id: 76006772
Permit Id: P00001
Permit Status: Expired
Issued Date: 1/11/1994
Lfd Permit Id: Not reported

UST:
Tank ID: T00001
Tank Status: Removed
Tank Type: Other
Capacity: 2500
Content: Gasoline
CAS #: 8006-61-9
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 1/1/1986
Date Removed: 12/16/1992
Date Last Used: 1/1/1990
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Unknown
Piping Type: Not reported
Release Detection on Piping: Not reported

F20
ENE
1/8-1/4
0.136 mi.
720 ft.

GASPAR WELDING INC
1545 WHIPPLE AVE SW
CANTON, OH 44710

Site 3 of 4 in cluster F

RCRA-SQG **1007113540**
OHR000117671

Relative:
Higher

Actual:
1089 ft.

RCRA-SQG:

Date form received by agency:	12/01/2003
Facility name:	GASPAR WELDING INC
Facility address:	1545 WHIPPLE AVE SW CANTON, OH 44710
EPA ID:	OHR000117671
Mailing address:	4106 MAHONING RD NE CANTON, OH 44705
Contact:	JOHN GIBSON
Contact address:	4106 MAHONING RD NE CANTON, OH 44705
Contact country:	US
Contact telephone:	(330) 453-7735
Telephone ext.:	138
Contact email:	Not reported
EPA Region:	05
Classification:	Small Small Quantity Generator
Description:	Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name:	WHIPPLE AVE ENTERPRISES
Owner/operator address:	4106 MAHONING RD NE CANTON, OH 44705
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/01/1967
Owner/Op end date:	Not reported

Owner/operator name:	GASPAR INC
Owner/operator address:	4106 MAHONING RD NE CANTON, OH 44705
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	01/01/1967
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No

GASPAR WELDING INC (Continued) **1007113540**

Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Hazardous Waste Summary:

Waste code:	D002
Waste name:	A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Violation Status: No violations found

F21 **VLIET ASPHALT SEALER CO., INC.** **LUST U004104157**
NE **4520 VLIET ST SW** **UST N/A**
1/8-1/4 **CANTON, OH 44710**
0.151 mi.
799 ft. **Site 4 of 4 in cluster F**

Relative:
Higher

Actual:
1085 ft.

LUST:

Release Number:	76001029-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76001029
Facility Type:	Gas Station
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W004164
Owner Name:	VLIET ASPHALT SEALER CO., INC.
Owner Address:	4520 VLIET ST SW
Owner City/State/Zip:	CANTON, OH 44710
Owner Phone:	(216) 478-1848

Inspection:

Facility Id:	76001029
Inspection Id:	8/25/94
Code:	103
Permit Number:	P00001

VLIET ASPHALT SEALER CO., INC. (Continued) **U004104157**

Inspection Type: Final

Permit:
Facility Id: 76001029
Permit Id: P00001
Permit Status: Expired
Issued Date: 9/1/1994
Lfd Permit Id: Not reported

UST:
Tank ID: T00001
Tank Status: **Removed**
Tank Type: Epoxy/Ashpalt Coated Steel
Capacity: 1000
Content: Gasoline
CAS #: 8006-61-9
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 8/1/1987
Date Removed: 8/25/1994
Date Last Used: 8/25/1994
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Cathodically Protected
Piping Type: Not reported
Release Detection on Piping: Not reported

Tank ID: T00002
Tank Status: **Removed**
Tank Type: Epoxy/Ashpalt Coated Steel
Capacity: 1000
Content: Gasoline
CAS #: 8006-61-9
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 8/1/1987
Date Removed: 8/25/1994
Date Last Used: 8/25/1994
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Cathodically Protected
Piping Type: Not reported
Release Detection on Piping: Not reported

G22
WSW
1/8-1/4
0.162 mi.
854 ft.

MAACO AUTO PAINTING & BODY WORKS
1818 HOPPLE AVE SW
CANTON, OH 44706

Site 1 of 2 in cluster G

RCRA-SQG **1000175034**
FINDS **OHD080156821**

Relative:
Higher

Actual:
1059 ft.

RCRA-SQG:

Date form received by agency:	10/07/1985
Facility name:	MAACO AUTO PAINTING AND BODYWORKS
Facility address:	1818 HOPPLE AVE SW CANTON, OH 44706
EPA ID:	OHD080156821
Contact:	BRUCE KEESEY
Contact address:	1818 HOPPLE AVE SW CANTON, OH 44706
Contact country:	US
Contact telephone:	(216) 478-0242
Contact email:	Not reported
EPA Region:	05
Classification:	Small Small Quantity Generator
Description:	Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name:	NAME NOT REPORTED
Owner/operator address:	ADDRESS NOT REPORTED CITY NOT REPORTED, AK 99998
Owner/operator country:	Not reported
Owner/operator telephone:	(312) 555-1212
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	NAME NOT REPORTED
Owner/operator address:	ADDRESS NOT REPORTED CITY NOT REPORTED, AK 99998
Owner/operator country:	Not reported
Owner/operator telephone:	(312) 555-1212
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No

MAACO AUTO PAINTING & BODY WORKS (Continued) **1000175034**

User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Hazardous Waste Summary:
Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Violation Status: No violations found

FINDS:

Registry ID: 110004624283

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

H23
East
1/8-1/4
0.166 mi.
874 ft.

BITZEL EXCAVATING, INC.
4141 SOUTHWAY ST SW
CANTON, OH 44706

LUST U000895872
UST N/A

Site 1 of 4 in cluster H

Relative:
Higher

Actual:
1087 ft.

LUST:
Release Number: 76009404-N00001
Release Date: Not reported
Facility Status: **Inactive**
LTF Status: 6 Closure of regulated UST
FR Status: **NFA: No Further Action**
Priority: 3
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76009404
Facility Type: Contractor

BITZEL EXCAVATING, INC. (Continued) **U000895872**

24 Hr Emergency Contact:	PETE BITZEL
24 Hr Emergency Phone:	(330)477-9653
Number Of Tanks On Site:	2
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W009175
Owner Name:	BITZEL EXCAVATING, INC.
Owner Address:	4141 SOUTHWAY ST SW
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	330-477-9653

UST:

Tank ID:	T00001
Tank Status:	**Currently In Use**
Tank Type:	BM - Bare Metal
Capacity:	2000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	Yes
Spill Device Installed:	Yes
AST/UST:	UST
Installation Date:	7/27/1992
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	FLDA - Field Galvanic Anodes
Release Detection on Tank:	Automatic Tank Gauging
Corrosion Protection Piping:	NCWG - No Piping In Contact With
Piping Material:	BM - Bare Metal
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	None Required

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Not reported
Capacity:	1000
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	7/27/1992
Date Last Used:	7/27/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel;Cathodically Pr
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	Not reported

Tank ID:	T00003
Tank Status:	**Removed**

BITZEL EXCAVATING, INC. (Continued) **U000895872**

Tank Type:	Not reported
Capacity:	500
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	7/27/1992
Date Last Used:	7/27/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel;Cathodically Pr
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	Not reported

Tank ID:	T00004
Tank Status:	**Currently In Use**
Tank Type:	BM - Bare Metal
Capacity:	1000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	Yes
Spill Device Installed:	Yes
AST/UST:	UST
Installation Date:	7/29/1992
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	FLDA - Field Galvanic Anodes
Release Detection on Tank:	Automatic Tank Gauging
Corrosion Protection Piping:	NCWG - No Piping In Contact With
Piping Material:	BM - Bare Metal
Piping Type:	Suction: no valve at dispensers
Release Detection on Piping:	None Required

G24 **PENSKE TRUCK LEASING INC** **RCRA-CESQG 1004767294**
WSW **1829 HOPPLE AVE SW** **FINDS OHR000033803**
1/8-1/4 **CANTON, OH 44706**
0.170 mi.
895 ft. **Site 2 of 2 in cluster G**

Relative:
Higher

Actual:
1061 ft.

RCRA-CESQG:

Date form received by agency:	11/24/1998
Facility name:	PENSKE TRUCK LEASING INC
Facility address:	1829 HOPPLE AVE SW BLDG B CANTON, OH 44706
EPA ID:	OHR000033803
Mailing address:	RTE 10 GREEN HILLS PO BOX 7635 READING, PA 19603
Contact:	MIKE MACKERTY
Contact address:	7600 FIRST PLACE

PENSKE TRUCK LEASING INC (Continued) **1004767294**

OAKWOOD, OH 44146
Contact country: US
Contact telephone: (440) 232-5811
Contact email: Not reported
EPA Region: 05
Classification: Conditionally Exempt Small Quantity Generator
Description: Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:
Owner/operator name: PENSKE TRUCK LEASING CO LP
Owner/operator address: RTE 10 GREEN HILLS PO BOX 563
READING, PA 19603
Owner/operator country: Not reported
Owner/operator telephone: (610) 775-6000
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Hazardous Waste Summary:
Waste code: D008
Waste name: LEAD

Waste code: D018
Waste name: BENZENE

PENSKE TRUCK LEASING INC (Continued) **1004767294**

Waste code: D039
Waste name: TETRACHLOROETHYLENE

Waste code: D040
Waste name: TRICHLOROETHYLENE

Violation Status: No violations found

FINDS:

Registry ID: 110004731700

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

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H25 **VAN KAY INC, CANTON** **DERR S107761568**
East **4124 SOUTHWAY ST SW** **INST CONTROL N/A**
1/8-1/4 **CANTON, OH 44706** **VCP**
0.176 mi. **NPDES**
931 ft. **Site 2 of 4 in cluster H**

Relative:
Higher

Actual:
1088 ft.

DERR:
DERR ID: 276000546
District: NEDO
Alias: MPS Inc, Canton
Lat/Long: 40.7804 -81.4239
EPA ID: OHD980610091
Program: Site Assessment Voluntary Action Program
Contact Phone: (330) 963-1200

INST CONTROL:
NFA Number: 09NFA331
Land Use: Commercial/Industrial
Site Id: 276000546
Project Id: 276000546005
District: NEDO
Lat/Long: 40.780445999999998 / -81.424000000000007
Program Area: VAP
Project Type: NFA 90 Day
IC Type: Not reported
IC Mechanism: Not reported

OH VCP:
OH EPA District: NEDO

VAN KAY INC, CANTON (Continued) **S107761568**

Alias Name: Not reported
Latitude: 40.78044
Longitude: -81.42399
Old Program Id: 09NFA331
Project Type: VAP Audit
DERR ID: 276000546

OH EPA District: NEDO
Alias Name: Not reported
Latitude: 40.78044
Longitude: -81.42399
Old Program Id: 09NFA331
Project Type: NFA 90 Day
DERR ID: 276000546

OH EPA District: NEDO
Alias Name: MPS Inc, Canton
Latitude: 40.78044
Longitude: -81.42399
Old Program Id: 06PAY043
Project Type: VAP PAYGO
DERR ID: 276000546

OH EPA District: NEDO
Alias Name: MPS Inc, Canton
Latitude: 40.78044
Longitude: -81.42399
Old Program Id: 06TA019
Project Type: VAP Technical Assistance
DERR ID: 276000546

OH NPDES:
Issue Date: 2/2/2012
Township: Not reported
Facility Npdes Permit: 3GRN00619*DG
Applicant Name: VANKAY INC
Applicant Address: 4124 SOUTHWAY ST SW

H26 **VAN KAY INC *** **RCRA-NonGen 1000118849**
East **4124 SOUTHWAY STREET SW** **FINDS OHD004464483**
1/8-1/4 **CANTON, OH 44706**
0.176 mi.
931 ft. **Site 3 of 4 in cluster H**

Relative:
Higher

Actual:
1088 ft.

RCRA-NonGen:
Date form received by agency: 02/28/2011
Facility name: VAN KAY INC
Facility address: 4124 SOUTHWAY ST SW
CANTON, OH 44706
EPA ID: OHD004464483
Contact: GARY J WALTER
Contact address: 4124 SOUTHWAY ST SW
CANTON, OH 44706
Contact country: US
Contact telephone: (330) 477-3475
Contact email: GWALTER@VANKAYINC.COM
EPA Region: 05

VAN KAY INC * (Continued) **1000118849**

Land type: Private
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:
Owner/operator name: VANKAY INC
Owner/operator address: 4124 SOUTHWAY ST SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: (330) 477-3475
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 11/14/1955
Owner/Op end date: Not reported

Owner/operator name: VANKAY INC
Owner/operator address: 4124 SOUTHWAY ST SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: (330) 477-3475
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 11/14/1955
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 02/27/2009
Facility name: VAN KAY INC
Classification: Not a generator, verified

Date form received by agency: 01/30/2003
Facility name: VAN KAY INC
Classification: Not a generator, verified

Date form received by agency: 02/17/2002
Facility name: VAN KAY INC
Site name: VAN-KAY INC
Classification: Not a generator, verified

VAN KAY INC * (Continued) **1000118849**

Date form received by agency: 12/12/1997
Facility name: VAN KAY INC
Classification: Not a generator, verified

Date form received by agency: 01/24/1990
Facility name: VAN KAY INC
Classification: Large Quantity Generator

Facility Has Received Notices of Violations:
Regulation violated: Not reported
Area of violation: Generators - General
Date violation determined: 11/14/1984
Date achieved compliance: 01/24/1985
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/03/1985
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 11/14/1984
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 01/24/1985
Evaluation lead agency: State

FINDS:

Registry ID: 110001629827

Environmental Interest/Information System

US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

HAZARDOUS WASTE BIENNIAL REPORTER

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

H27 **MPS INCORPORATION** **CERC-NFRAP** **1003872203**
East **4124 SOUTHWAY STREET SOUTHWEST** **OHD980610091**
1/8-1/4 **CANTON, OH 44706**
0.176 mi.
931 ft. **Site 4 of 4 in cluster H**

Relative:
Higher

Actual:
1088 ft.

CERC-NFRAP:
Site ID: 0504622
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: NFRAP-Site does not qualify for the NPL based on existing information

CERCLIS-NFRAP Site Alias Name(s):
Alias Name: MPS INC
Alias Address: 4124 SOUTHWAY ST SW
CANTON, OH 44706

CERCLIS-NFRAP Assessment History:
Action: DISCOVERY
Date Started: Not reported
Date Completed: 06/01/1981
Priority Level: Not reported

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 05/01/1983
Priority Level: Low priority for further assessment

Action: ARCHIVE SITE
Date Started: Not reported
Date Completed: 09/01/1983
Priority Level: Not reported

Action: SITE INSPECTION
Date Started: Not reported
Date Completed: 09/01/1983
Priority Level: NFRAP-Site does not qualify for the NPL based on existing information

Action: HAZARD RANKING SYSTEM PACKAGE
Date Started: Not reported
Date Completed: 09/01/1983
Priority Level: NFRAP-Site does not qualify for the NPL based on existing information

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I28 **HERCULES POLISHING & PLATING CO** **RCRA-LQG** **1000182075**
West **4883 SOUTHWAY S.W.** **FINDS** **OHD981190895**
1/8-1/4 **CANTON, OH 44706** **MANIFEST**
0.214 mi.
1131 ft. **Site 1 of 2 in cluster I**

Relative:
Higher

Actual:
1077 ft.

RCRA-LQG:
Date form received by agency: 06/16/2011
Facility name: HERCULES POLISHING & PLATING
Facility address: 4883 SOUTHWAY SW
CANTON, OH 44706
EPA ID: OHD981190895
Contact: TRACEY MORELAND
Contact address: 4883 SOUTHWAY SW
CANTON, OH 44706
Contact country: US

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Contact telephone: (330) 455-8871
Contact email: Not reported
EPA Region: 05
Land type: Private
Classification: Large Quantity Generator
Description: Handler: generates 1,000 kg or more of hazardous waste during any calendar month; or generates more than 1 kg of acutely hazardous waste during any calendar month; or generates more than 100 kg of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month; or generates 1 kg or less of acutely hazardous waste during any calendar month, and accumulates more than 1 kg of acutely hazardous waste at any time; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates more than 100 kg of that material at any time

Owner/Operator Summary:
Owner/operator name: NICK PAXOS
Owner/operator address: 4883 SOUTHWAY SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/2001
Owner/Op end date: Not reported

Owner/operator name: HERCULES POLISHING & PLATING
Owner/operator address: 4883 SOUTHWAY SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: HERCULES POLISHING & PLATING
Owner/operator address: 4883 SOUTHWAY SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: HERCULES POLISHING & PLATING CO
Owner/operator address: 4883 SOUTHWAY SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/2001

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 02/24/2010
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Large Quantity Generator

Date form received by agency: 02/27/2009
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Large Quantity Generator

Date form received by agency: 02/19/2008
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Large Quantity Generator

Date form received by agency: 03/01/2007
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Large Quantity Generator

Date form received by agency: 11/14/2006
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Not a generator, verified

Date form received by agency: 02/23/2006
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Large Quantity Generator

Date form received by agency: 02/28/2005
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/26/2004

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/27/2003
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 11/07/2002
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/25/2000
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/25/1998
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/29/1996
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/28/1994
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO.
Classification: Large Quantity Generator

Date form received by agency: 02/26/1992
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/09/1990
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING & PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 01/28/1986
Facility name: HERCULES POLISHING & PLATING
Site name: HERCULES POLISHING AND PLATING INC
Classification: Large Quantity Generator

Hazardous Waste Summary:
Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Waste code: D007
Waste name: CHROMIUM

Waste code: F006
Waste name: WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS EXCEPT FROM THE FOLLOWING PROCESSES: (1) SULFURIC ACID ANODIZING OF ALUMINUM; (2) TIN PLATING ON CARBON STEEL; (3) ZINC PLATING (SEGREGATED BASIS) ON CARBON STEEL; (4) ALUMINUM OR ZINC-ALUMINUM PLATING ON CARBON STEEL; (5) CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC AND ALUMINUM PLATING ON CARBON STEEL; AND (6) CHEMICAL ETCHING AND MILLING OF ALUMINUM.

Waste code: D007
Waste name: CHROMIUM

Biennial Reports:

Last Biennial Reporting Year: 2011

Annual Waste Handled:
Waste code: F006
Waste name: WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS EXCEPT FROM THE FOLLOWING PROCESSES: (1) SULFURIC ACID ANODIZING OF ALUMINUM; (2) TIN PLATING ON CARBON STEEL; (3) ZINC PLATING (SEGREGATED BASIS) ON CARBON STEEL; (4) ALUMINUM OR ZINC-ALUMINUM PLATING ON CARBON STEEL; (5) CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC AND ALUMINUM PLATING ON CARBON STEEL; AND (6) CHEMICAL ETCHING AND MILLING OF ALUMINUM.
Amount (Lbs): 4000

Facility Has Received Notices of Violations:
Regulation violated: Not reported
Area of violation: Universal Waste - Small Quantity Handlers
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/06/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Preparedness and Prevention
Date violation determined: 11/14/2006
Date achieved compliance: 01/31/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: State Statute or Regulation
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 05/16/2008
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: 90000
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: State Statute or Regulation
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/06/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/06/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/03/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Used Oil - Generators
Date violation determined: 11/14/2006
Date achieved compliance: 03/08/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/06/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: State Statute or Regulation
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/30/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Universal Waste - Small Quantity Handlers
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/03/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-General Facility Standards
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/06/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: State Statute or Regulation
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: NOV/INITIAL STATE ADMIN CONSENT ORDER
Enforcement action date: 10/09/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-General Facility Standards
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-General Facility Standards
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/03/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Container Use and Management
Date violation determined: 11/14/2006
Date achieved compliance: 01/31/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: NOV/INITIAL STATE ADMIN CONSENT ORDER
Enforcement action date: 10/09/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Tank System Standards
Date violation determined: 11/14/2006
Date achieved compliance: 01/31/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Used Oil - Generators
Date violation determined: 11/14/2006
Date achieved compliance: 03/08/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Universal Waste - Small Quantity Handlers
Date violation determined: 11/14/2006
Date achieved compliance: 01/31/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Regulation violated:	Not reported
Area of violation:	Universal Waste - Small Quantity Handlers
Date violation determined:	11/14/2006
Date achieved compliance:	05/01/2007
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/14/2006
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	Not reported
Area of violation:	TSD IS-Contingency Plan and Emergency Procedures
Date violation determined:	11/14/2006
Date achieved compliance:	05/16/2008
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/14/2006
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	Not reported
Area of violation:	TSD IS-Contingency Plan and Emergency Procedures
Date violation determined:	11/14/2006
Date achieved compliance:	05/01/2007
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/14/2006
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	Not reported
Area of violation:	LDR - General
Date violation determined:	11/14/2006
Date achieved compliance:	11/16/2006
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/14/2006
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	Not reported

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Area of violation: Generators - Pre-transport
Date violation determined: 11/14/2006
Date achieved compliance: 01/31/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/30/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 05/16/2008
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: 90000
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: State Statute or Regulation
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/14/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/06/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date violation determined: 11/14/2006
Date achieved compliance: 05/01/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/03/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: State Statute or Regulation
Date violation determined: 11/14/2006
Date achieved compliance: 05/16/2008
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/03/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - Records/Reporting
Date violation determined: 05/24/2005
Date achieved compliance: 05/24/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/24/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(2)
Area of violation: Generators - Pre-transport
Date violation determined: 12/05/1991

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Date achieved compliance:	02/26/1992
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/26/1991
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-66-73(A)
Area of violation:	Generators - Pre-transport
Date violation determined:	12/05/1991
Date achieved compliance:	02/26/1992
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/26/1991
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-52-34(D)(5)(b)
Area of violation:	Generators - Pre-transport
Date violation determined:	12/05/1991
Date achieved compliance:	02/26/1992
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/26/1991
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-66-74(B)
Area of violation:	Generators - Pre-transport
Date violation determined:	12/05/1991
Date achieved compliance:	02/26/1992
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/26/1991
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-65-33
Area of violation:	Generators - Pre-transport
Date violation determined:	12/05/1991
Date achieved compliance:	02/26/1992

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/26/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-59-07(A)(1)(c), 268.7(a)
Area of violation: LDR - General
Date violation determined: 12/05/1991
Date achieved compliance: 02/26/1992
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/26/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 06/16/2011
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/16/2008
Evaluation: NOT A SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 09/07/2007
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/01/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: State Statute or Regulation
Date achieved compliance: 05/16/2008
Evaluation lead agency: State

Evaluation date: 05/01/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance: 05/16/2008
Evaluation lead agency: State

Evaluation date: 03/08/2007
Evaluation: NON-FINANCIAL RECORD REVIEW

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Area of violation: TSD IS-General Facility Standards
Date achieved compliance: 05/01/2007
Evaluation lead agency: State

Evaluation date: 03/08/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance: 05/16/2008
Evaluation lead agency: State

Evaluation date: 03/08/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Universal Waste - Small Quantity Handlers
Date achieved compliance: 05/01/2007
Evaluation lead agency: State

Evaluation date: 03/08/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance: 05/01/2007
Evaluation lead agency: State

Evaluation date: 03/08/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: State Statute or Regulation
Date achieved compliance: 05/16/2008
Evaluation lead agency: State

Evaluation date: 01/31/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Used Oil - Generators
Date achieved compliance: 03/08/2007
Evaluation lead agency: State

Evaluation date: 01/31/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Universal Waste - Small Quantity Handlers
Date achieved compliance: 05/01/2007
Evaluation lead agency: State

Evaluation date: 01/31/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD IS-General Facility Standards
Date achieved compliance: 05/01/2007
Evaluation lead agency: State

Evaluation date: 01/31/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance: 05/16/2008
Evaluation lead agency: State

Evaluation date: 01/31/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance: 05/01/2007
Evaluation lead agency: State

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Evaluation date:	01/31/2007
Evaluation:	NON-FINANCIAL RECORD REVIEW
Area of violation:	State Statute or Regulation
Date achieved compliance:	05/16/2008
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Universal Waste - Small Quantity Handlers
Date achieved compliance:	05/01/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	TSD IS-Container Use and Management
Date achieved compliance:	01/31/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	TSD IS-Preparedness and Prevention
Date achieved compliance:	01/31/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	TSD IS-General Facility Standards
Date achieved compliance:	05/01/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance:	05/01/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	State Statute or Regulation
Date achieved compliance:	05/16/2008
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Generators - Pre-transport
Date achieved compliance:	01/31/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	TSD IS-Tank System Standards
Date achieved compliance:	01/31/2007
Evaluation lead agency:	State
Evaluation date:	11/14/2006
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Universal Waste - Small Quantity Handlers

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

Date achieved compliance: 01/31/2007
Evaluation lead agency: State

Evaluation date: 11/14/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD IS-Contingency Plan and Emergency Procedures
Date achieved compliance: 05/16/2008
Evaluation lead agency: State

Evaluation date: 11/14/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Used Oil - Generators
Date achieved compliance: 03/08/2007
Evaluation lead agency: State

Evaluation date: 11/14/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 11/16/2006
Evaluation lead agency: State

Evaluation date: 05/24/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Records/Reporting
Date achieved compliance: 05/24/2005
Evaluation lead agency: State

Evaluation date: 12/05/1991
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 02/26/1992
Evaluation lead agency: State

Evaluation date: 12/05/1991
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 02/26/1992
Evaluation lead agency: State

FINDS:

Registry ID: 110000904709

Environmental Interest/Information System

US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

HAZARDOUS WASTE BIENNIAL REPORTER

HERCULES POLISHING & PLATING CO (Continued) **1000182075**

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

NY MANIFEST:

EPA ID:	OHD981190895
Country:	USA
Mailing Name:	HERCULES POLISHING & PLATING
Mailing Contact:	HERCULES POLISHING & PLATING
Mailing Address:	4883 SOUTH WAY SW
Mailing Address 2:	Not reported
Mailing City:	CANTON
Mailing State:	OH
Mailing Zip:	44706
Mailing Zip4:	Not reported
Mailing Country:	USA
Mailing Phone:	216-455-8871

Document ID:	NYB1007892
Manifest Status:	Completed after the designated time period for a TSDF to get a copy to the DEC
Trans1 State ID:	815X14
Trans2 State ID:	Not reported
Generator Ship Date:	891226
Trans1 Recv Date:	891226
Trans2 Recv Date:	Not reported
TSD Site Recv Date:	891227
Part A Recv Date:	900214
Part B Recv Date:	900109
Generator EPA ID:	OHD981190895
Trans1 EPA ID:	OHD982075343
Trans2 EPA ID:	Not reported
TSDF ID:	NYD000691949
Waste Code:	F006 - WW TREAT SL FM ELECTROPLATING OPER
Quantity:	03000
Units:	G - Gallons (liquids only)* (8.3 pounds)
Number of Containers:	001
Container Type:	TT - Cargo tank, tank trucks
Handling Method:	T Chemical, physical, or biological treatment.
Specific Gravity:	100
Year:	89

J29 **BLUE VELVET TRANSPORT, INC.** **LUST U004085388**
SW **4821 CORPORATE ST SW** **UST N/A**
1/8-1/4 **CANTON, OH 44706**
0.248 mi.
1308 ft. **Site 1 of 2 in cluster J**

Relative:
Higher

Actual:
1067 ft.

LUST:

Release Number:	76000628-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST

BLUE VELVET TRANSPORT, INC. (Continued) **U004085388**

FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76000628
Facility Type:	Trucking/Transport
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W001235
Owner Name:	BLUE VELVET TRANSPORT, INC.
Owner Address:	4821 CORPORATE ST SW
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	(216) 478-2114

Inspection:

Facility Id:	76000628
Inspection Id:	5/18/98
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000628
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	6/23/1998
Lfd Permit Id:	Not reported

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	10000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1979
Date Removed:	8/10/1998
Date Last Used:	8/10/1998
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel
Piping Type:	Pressure
Release Detection on Piping:	Not reported

BLUE VELVET TRANSPORT, INC. (Continued) **U004085388**

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	10000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1979
Date Removed:	8/10/1998
Date Last Used:	8/10/1998
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel
Piping Type:	Pressure
Release Detection on Piping:	Not reported

Tank ID:	T00003
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	550
Content:	Unknown
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1979
Date Removed:	8/10/1998
Date Last Used:	8/10/1998
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel
Piping Type:	Pressure
Release Detection on Piping:	Not reported

Tank ID:	T00004
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	1000
Content:	Used Oil
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	1/1/1979
Date Removed:	8/10/1998
Date Last Used:	8/10/1998
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported

BLUE VELVET TRANSPORT, INC. (Continued) **U004085388**

Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Galvanized Steel
Piping Type: Pressure
Release Detection on Piping: Not reported

I30 **ROADWAY EXPRESS, INC.** **LUST U004099984**
West **4925 SOUTHWAY SW** **UST N/A**
1/4-1/2 **CANTON, OH 44706**
0.256 mi.
1352 ft. **Site 2 of 2 in cluster I**

Relative:
Higher

Actual:
1077 ft.

LUST:
Release Number: 76000419-N00001
Release Date: Not reported
Facility Status: **Inactive**
LTF Status: 1 SUS/CON from regulated UST
FR Status: **NFA: No Further Action**
Priority: 2
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76000419
Facility Type: Trucking/Transport
24 Hr Emergency Contact: Not reported
24 Hr Emergency Phone: Not reported
Number Of Tanks On Site: Not reported
Local Fire Department: Zero
Delegated Authority: No
Elig For Green Buckeye Award: Not reported
Active Release Site: No
Owner Id: W000069
Owner Name: ROADWAY EXPRESS, INC.
Owner Address: 1077 GORGE BLVD, DEPT A20
Owner City/State/Zip: AKRON, OH 44310
Owner Phone: (330) 384-2324

Inspection:
Facility Id: 76000419
Inspection Id: 8/18/97
Code: Not reported
Permit Number: P00001
Inspection Type: Final

UST:
Tank ID: T00001
Tank Status: **Removed**
Tank Type: Steel
Capacity: 10000
Content: Diesel
CAS #: 68334-30-5
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST

ROADWAY EXPRESS, INC. (Continued) **U004099984**

Installation Date:	5/1/1974
Date Removed:	8/18/1997
Date Last Used:	8/18/1997
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Suction: valve at tank
Release Detection on Piping:	Not reported

J31
SW
1/4-1/2
0.267 mi.
1409 ft.

Relative:
Higher

Actual:
1071 ft.

ZIEGLER BOLT & PARTS CO. **LUST U004105311**
4848 CORPORATE ST SW **UST N/A**
CANTON, OH 44710

Site 2 of 2 in cluster J

LUST:

Release Number:	76000490-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76000490
Facility Type:	Gas Station
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W004430
Owner Name:	ZIEGLER BOLT & PARTS CO.
Owner Address:	4848 CORPORATE ST SW
Owner City/State/Zip:	CANTON, OH 44710
Owner Phone:	(216) 478-2542

Inspection:

Facility Id:	76000490
Inspection Id:	3/29/96
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000490
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	7/15/1996
Lfd Permit Id:	Not reported

ZIEGLER BOLT & PARTS CO. (Continued) **U004105311**

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	2000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	8/1/1980
Date Removed:	3/29/1996
Date Last Used:	3/29/1996
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	2000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	8/1/1980
Date Removed:	3/29/1996
Date Last Used:	3/29/1996
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Galvanized Steel
Piping Type:	Not reported
Release Detection on Piping:	Not reported

K32 **CRAMERS, INC.** **LUST U004088489**
West **4926 SOUTHWAY SW** **UST N/A**
1/4-1/2 **CANTON, OH 44706**
0.280 mi.
1479 ft. **Site 1 of 2 in cluster K**

Relative:
Higher

Actual:
1074 ft.

LUST:

Release Number:	76000105-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3

CRAMERS, INC. (Continued) **U004088489**

Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:

Facility ID:	76000105
Facility Type:	Not reported
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W005651
Owner Name:	CRAMERS, INC.
Owner Address:	4944 SOUTHWAY SW
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	(216) 477-4571

Inspection:

Facility Id:	76000105
Inspection Id:	10/4/94
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76000105
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	1/20/1995
Lfd Permit Id:	Not reported

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	1000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	10/4/1994
Date Last Used:	1/1/1982
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown
Piping Type:	Suction: no valve at tank
Release Detection on Piping:	Not reported

33
SE
1/4-1/2
0.302 mi.
1597 ft.

FORMER MATLAK INC
4108 NAVARRE RD SW
CANTON, OH 44706

LUST U004091069
UST N/A

Relative:
Higher

Actual:
1078 ft.

LUST:
Release Number: 76010320-N00001
Release Date: 09/09/2005
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 10/11/2005
Class: Viable Responsible Party has been identified

Facility:

Facility ID:	76010320
Facility Type:	Not reported
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	CANTON TWP FIRE DEPARTMENT
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W022988
Owner Name:	KOLP REAL ESTATE
Owner Address:	326 CLEVELAND AVE NW
Owner City/State/Zip:	CANTON, OH 44702
Owner Phone:	(330)456-4739

Inspection:

Facility Id:	76010320
Inspection Id:	9/9/05
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76010320
Permit Id:	P00001
Permit Status:	Closed
Issued Date:	8/16/2005
Lfd Permit Id:	Not reported

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Bare Steel
Capacity:	4000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	UST
Installation Date:	Not reported

FORMER MATLAK INC (Continued) **U004091069**

Date Removed:	9/9/2005
Date Last Used:	1/1/1950
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	No Piping
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Bare Steel
Capacity:	4000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	9/9/2005
Date Last Used:	1/1/1950
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	No Piping
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00003
Tank Status:	**Removed**
Tank Type:	Bare Steel
Capacity:	1200
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	9/9/2005
Date Last Used:	1/1/1950
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Not reported
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00004
Tank Status:	**Removed**
Tank Type:	Bare Steel
Capacity:	2000
Content:	Gasoline

FORMER MATLAK INC (Continued) **U004091069**

CAS #:	8006-61-9
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	9/9/2005
Date Last Used:	1/1/1950
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Not reported
Release Detection on Piping:	Not reported

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34 **ROLLINS LEASING CORP. #208A** **LUST U004100109**
WSW **4884 CORPORATE SW** **UST N/A**
1/4-1/2 **CANTON, OH 44706**
0.305 mi.
1611 ft.

Relative:
Higher

Actual:
1083 ft.

LUST:

Release Number:	76000422-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76000422
Facility Type:	Commercial
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W000150
Owner Name:	ROLLINS LEASING CORP.
Owner Address:	1 ROLLINS PLAZA
Owner City/State/Zip:	WILMINGTON, DE 19803
Owner Phone:	(800) 752-2677

Inspection:

Facility Id:	76000422
Inspection Id:	11/17/97
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

ROLLINS LEASING CORP. #208A (Continued) **U004100109**

Facility Id: 76000422
Permit Id: P00001
Permit Status: Expired
Issued Date: 11/18/1997
Lfd Permit Id: Not reported

UST:
Tank ID: T00001
Tank Status: **Removed**
Tank Type: Fiberglass Reinforced Plastic
Capacity: 12000
Content: Diesel
CAS #: 68334-30-5
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 2/1/1982
Date Removed: 12/10/1997
Date Last Used: 12/10/1997
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Tnk Tightness Testing;Statistical Inventory Reconciliation
Corrosion Protection Piping: Not reported
Piping Material: Bare Steel
Piping Type: Pressure
Release Detection on Piping: Not reported

Tank ID: T00002
Tank Status: **Removed**
Tank Type: Fiberglass Reinforced Plastic
Capacity: 12000
Content: Diesel
CAS #: 68334-30-5
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 2/1/1982
Date Removed: 12/10/1997
Date Last Used: 12/10/1997
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Tnk Tightness Testing;Statistical Inventory Reconciliation
Corrosion Protection Piping: Not reported
Piping Material: Bare Steel
Piping Type: Pressure
Release Detection on Piping: Not reported

Tank ID: T00003
Tank Status: **Removed**
Tank Type: Steel
Capacity: 2000
Content: Unknown
CAS #: Not reported
Regulated: Yes
Overfill Device Installed: No

ROLLINS LEASING CORP. #208A (Continued) **U004100109**

Spill Device Installed:	No
AST/UST:	UST
Installation Date:	2/1/1982
Date Removed:	12/10/1997
Date Last Used:	12/10/1997
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Tnk Tightness Testing;Statistical Inventory Reconciliation
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Suction: valve at tank
Release Detection on Piping:	Not reported

Tank ID:	T00004
Tank Status:	**Removed**
Tank Type:	Steel
Capacity:	2000
Content:	Used Oil
CAS #:	Not reported
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	2/1/1982
Date Removed:	12/10/1997
Date Last Used:	12/10/1997
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Manual Tank Gauging;Tnk Tightness Testing
Corrosion Protection Piping:	Not reported
Piping Material:	Bare Steel
Piping Type:	Suction: valve at tank
Release Detection on Piping:	Not reported

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35 East 1/4-1/2 0.310 mi. 1636 ft.

MEREDITH ERECTORS, INC.
3926 SOUTHWAY SW
CANTON, OH 44706

LUST U004096088
UST N/A

Relative: Higher

Actual: 1089 ft.

LUST:

Release Number:	76003798-N00001
Release Date:	04/10/1995
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	08/25/2003
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76003798
Facility Type:	Commercial
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported

MEREDITH ERECTORS, INC. (Continued) **U004096088**

Local Fire Department: Zero
Delegated Authority: No
Elig For Green Buckeye Award: Not reported
Active Release Site: No
Owner Id: W002703
Owner Name: MEREDITH INVESTMENTS
Owner Address: 4448 SOUTHWAY SW
Owner City/State/Zip: CANTON, OH 44706
Owner Phone: (216) 477-1890

Inspection:
Facility Id: 76003798
Inspection Id: 4/10/95
Code: 103
Permit Number: P00001
Inspection Type: Final

Permit:
Facility Id: 76003798
Permit Id: P00001
Permit Status: Expired
Issued Date: 8/29/1995
Lfd Permit Id: Not reported

UST:
Tank ID: T00001
Tank Status: **Removed**
Tank Type: Steel
Capacity: 1000
Content: Gasoline
CAS #: 8006-61-9
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 9/1/1985
Date Removed: 4/10/1995
Date Last Used: 4/10/1995
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Unknown
Piping Type: Pressure
Release Detection on Piping: Not reported

Tank ID: T00002
Tank Status: **Removed**
Tank Type: Steel
Capacity: 1000
Content: Diesel
CAS #: 68334-30-5
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: 9/1/1985

MEREDITH ERECTORS, INC. (Continued) **U004096088**

Date Removed:	4/10/1995
Date Last Used:	4/10/1995
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Unknown
Piping Type:	Pressure
Release Detection on Piping:	Not reported

K36 **SAMPSEL PIPELINE CO.** **LUST U004100459**
West **4938 SOUTHWAY SW** **UST N/A**
1/4-1/2 **CANTON, OH 44706**
0.314 mi.
1656 ft. **Site 2 of 2 in cluster K**

Relative:
Higher

Actual:
1066 ft.

LUST:

Release Number:	76001026-N00002
Release Date:	01/27/1995
Facility Status:	**Active**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFC: No Further Action Data Cleaning**
Priority:	3
Review Date:	10/20/2010
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76001026
Facility Type:	Gas Station
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	Yes
Owner Id:	W003555
Owner Name:	SAMPSEL PIPELINE CO.
Owner Address:	4938 SOUTHWAY SW
Owner City/State/Zip:	CANTON, OH 44706
Owner Phone:	(216) 477-8363

Inspection:

Facility Id:	76001026
Inspection Id:	12/29/94
Code:	103
Permit Number:	P00001
Inspection Type:	Final

Permit:

Facility Id:	76001026
Permit Id:	P00001
Permit Status:	Expired
Issued Date:	1/3/1995
Lfd Permit Id:	Not reported

SAMPSEL PIPELINE CO. (Continued) **U004100459**

UST:

Tank ID:	T00001
Tank Status:	**Removed**
Tank Type:	Cathodically Protected Steel
Capacity:	6000
Content:	Gasoline
CAS #:	8006-61-9
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	12/29/1994
Date Last Used:	3/1/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Cathodically Protected
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	Cathodically Protected Steel
Capacity:	6000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	12/29/1994
Date Last Used:	3/1/1992
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Cathodically Protected
Piping Type:	Not reported
Release Detection on Piping:	Not reported

Tank ID:	T00003
Tank Status:	**Removed**
Tank Type:	Cathodically Protected Steel
Capacity:	6000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	12/29/1994
Date Last Used:	3/1/1992
Date Abandoned/Closed:	Not reported

SAMPSEL PIPELINE CO. (Continued) **U004100459**

Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Cathodically Protected
Piping Type:	Not reported
Release Detection on Piping:	Not reported

37
WSW
1/4-1/2
0.368 mi.
1943 ft.

YOUNG WHITE GMC TRUCK **LUST U004105244**
4970 SOUTHWAY ST SW **UST N/A**
CANTON, OH 44701

Relative:
Higher

Actual:
1090 ft.

LUST:

Release Number:	76009985-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76009985
Facility Type:	Not reported
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W019227
Owner Name:	YOUNG WHITE GMC TRUCK
Owner Address:	4970 SOUTHWAY ST SW
Owner City/State/Zip:	CANTON, OH 44701
Owner Phone:	Not reported

UST:

Tank ID:	Not reported
Tank Status:	**Not reported**
Tank Type:	Not reported
Capacity:	Not reported
Content:	Not reported
CAS #:	Not reported
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	Not reported
Installation Date:	Not reported
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported

YOUNG WHITE GMC TRUCK (Continued) **U004105244**

Piping Material: Not reported
Piping Type: Not reported
Release Detection on Piping: Not reported

38
West
1/4-1/2
0.372 mi.
1962 ft.

BUCKEYE CORP.
4969 SOUTHWAY AVE
CANTON, OH 44706

LUST U004086277
UST N/A

Relative:
Higher

Actual:
1072 ft.

LUST:
Release Number: 76003591-N00001
Release Date: Not reported
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76003591
Facility Type: Commercial
24 Hr Emergency Contact: Not reported
24 Hr Emergency Phone: Not reported
Number Of Tanks On Site: Not reported
Local Fire Department: Zero
Delegated Authority: No
Elig For Green Buckeye Award: Not reported
Active Release Site: No
Owner Id: W001090
Owner Name: BUCKEYE CORP.
Owner Address: 4969 SOUTHWAY AVE
Owner City/State/Zip: CANTON, OH 44706
Owner Phone: (216) 478-1493

UST:
Tank ID: T00001
Tank Status: Removed
Tank Type: STEEL
Capacity: 1000
Content: Gasoline
CAS #: 8006-61-9
Regulated: Yes
Overfill Device Installed: No
Spill Device Installed: No
AST/UST: UST
Installation Date: Not reported
Date Removed: 1/9/1992
Date Last Used: 6/30/1991
Date Abandoned/Closed: Not reported
Corrosion Protection Tank: Not reported
Release Detection on Tank: Not reported
Corrosion Protection Piping: Not reported
Piping Material: Double Walled
Piping Type: Not reported
Release Detection on Piping: Not reported

BUCKEYE CORP. (Continued) **U004086277**

Tank ID:	T00002
Tank Status:	**Removed**
Tank Type:	STEEL
Capacity:	1000
Content:	Diesel
CAS #:	68334-30-5
Regulated:	Yes
Overfill Device Installed:	No
Spill Device Installed:	No
AST/UST:	UST
Installation Date:	Not reported
Date Removed:	1/9/1992
Date Last Used:	6/30/1991
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Double Walled
Piping Type:	Not reported
Release Detection on Piping:	Not reported

L39
East
1/4-1/2
0.401 mi.
2116 ft.

SPEEDWAY 9400
3805 SOUTHWAY ST SW
CANTON, OH 44706

RCRA-CESQG **1004764818**
FINDS **OHD987005287**
LUST
SPILLS

Site 1 of 2 in cluster L

Relative:
Higher

Actual:
1090 ft.

RCRA-CESQG:

Date form received by agency:	02/15/2011
Facility name:	SPEEDWAY 9400
Facility address:	3825 SOUTHWAY ST SW CANTON, OH 44706
EPA ID:	OHD987005287
Mailing address:	PO BOX 1500 SPRINGFIELD, OH 45501
Contact:	CHARLES A BESSE
Contact address:	PO BOX 1500 SPRINGFIELD, OH 45501
Contact country:	US
Contact telephone:	(937) 863-6278
Contact email:	CABESSE@SSALLC.COM
EPA Region:	05
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

SPEEDWAY 9400 (Continued) **1004764818**

Owner/Operator Summary:
Owner/operator name: SPEEDWAY LLC
Owner/operator address: PO BOX 1500
SPRINGFIELD, OH 45501
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/2001
Owner/Op end date: Not reported

Owner/operator name: SPEEDWAY LLC
Owner/operator address: PO BOX 1500
SPRINGFIELD, OH 45501
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/2001
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 04/04/2005
Facility name: SPEEDWAY 9400
Classification: Conditionally Exempt Small Quantity Generator

Date form received by agency: 07/02/2002
Facility name: SPEEDWAY 9400
Site name: SPEEDWAY NO 9400
Classification: Conditionally Exempt Small Quantity Generator

Date form received by agency: 01/08/1998
Facility name: SPEEDWAY 9400
Site name: SPEEDWAY NO 9400
Classification: Conditionally Exempt Small Quantity Generator

Hazardous Waste Summary:
Waste code: D001

SPEEDWAY 9400 (Continued) **1004764818**

Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D018
Waste name: BENZENE

Violation Status: No violations found

FINDS:

Registry ID: 110009635706

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

LUST:
Release Number: 76000220-N00002
Release Date: 08/12/2002
Facility Status: **Inactive**
LTF Status: 1 SUS/CON from regulated UST
FR Status: **NFA: No Further Action**
Priority: 2
Review Date: 08/03/2005
Class: Viable Responsible Party has been identified

Release Number: 76000220-N00003
Release Date: 11/14/2005
Facility Status: **Inactive**
LTF Status: 6 Closure of regulated UST
FR Status: **NFA: No Further Action**
Priority: 3
Review Date: 11/21/2005
Class: Viable Responsible Party has been identified

Release Number: 76000220-N00004
Release Date: 08/31/2010
Facility Status: **Active**
LTF Status: 6 Closure of regulated UST
FR Status: **NFC: No Further Action Data Cleaning**

SPEEDWAY 9400 (Continued) **1004764818**

Priority: 3
Review Date: 08/31/2010
Class: Viable Responsible Party has been identified

SPILLS:
Spill No.: 9004-76-1666
Spill Year: 1990
Date Spill Reported: 04/06/1990
Spill Month: 4
Spill Number: 1666
Reporter Name: CO
Confidential: No
District Code: NE
Employee Number: Not reported
Lat/Long: Not reported
Product Spilled Name: DIESEL FUEL

L40 **SPEEDWAY** **UNREG LTANKS S100648569**
East **3805 SOUTHWAY ST SW** **SPILLS N/A**
1/4-1/2 **CANTON, OH 44701**
0.401 mi.
2116 ft. **Site 2 of 2 in cluster L**

Relative:
Higher

Actual:
1090 ft.

UNREG LTANKS:
Facility Status: **No Further Action letter issued**
Facility Id: 760220
Facility Track: 0
Report Number: 7600873
RP Status: Not reported
Inspector: Not reported
Revised Date: 10/18/90
Class: D
Vacant: Not reported
Emrgncy Resp: 2
Authorized By: ROE
Added Date: 04/10/90
Owner Name: EMRO
Owner Address: Not reported
Owner City,St,Zip: OH
Owner Phone: Not reported
Operator Name: EMRO
Operator Address: Not reported
Operator C,S,Z: OH
Operator Phone: Not reported
Remarks: 0
Summary: Not reported

Facility County #: 151
Facility Phone: Not reported
Incident Number: 760087300
RP Search Date: Not reported
Coordinator: NECA
Fiscal Tracking: F900
Priority: 2
Lust Trust Fund: 2
ER By: Not reported
Authorized Date: 10/12/90
Entry By: UNGER

SPILLS:
Spill No.: 9206-76-2730
Spill Year: 1992
Date Spill Reported: 06/27/1992
Spill Month: 6
Spill Number: 2730
Reporter Name: FD
Confidential: No
District Code: NE
Employee Number: Not reported

SPEEDWAY (Continued) **S100648569**

Lat/Long: Not reported
Product Spilled Name: DIESEL FUEL

M41 **REES PLATING SITE** **CERCLIS** **1014914963**
West **5020 SOUTHWAY ST. SW** **OHN000510550**
1/4-1/2 **CANTON, OH 44706**
0.438 mi.
2315 ft. **Site 1 of 2 in cluster M**

Relative:
Higher

Actual:
1072 ft.

CERCLIS:

Site ID:	0510550
EPA ID:	OHN000510550
Facility County:	STARK
Short Name:	REES PLATING SITE
Congressional District:	16
IFMS ID:	C501
SMSA Number:	Not reported
USGC Hydro Unit:	Not reported
Federal Facility:	Not a Federal Facility
DMNSN Number:	Not reported
Site Orphan Flag:	Not reported
RCRA ID:	Not reported
USGS Quadrangle:	Not reported
Site Init By Prog:	R
NFRAP Flag:	Not reported
Parent ID:	Not reported
RST Code:	Not reported
EPA Region:	05
Classification:	Not reported
Site Settings Code:	Not reported
NPL Status:	Not on the NPL
DMNSN Unit Code:	Not reported
RBRAC Code:	Not reported
RResp Fed Agency Code:	Not reported
Non NPL Status:	Removal Only Site (No Site Assessment Work Needed)
Non NPL Status Date:	20101208
Site Fips Code:	39151
CC Concurrence Date:	Not reported
CC Concurrence FY:	Not reported
Alias EPA ID:	Not reported
Site FUDS Flag:	Not reported

CERCLIS Site Contact Name(s):

Contact ID:	5270177.00000
Contact Name:	JOSEPH J. FREDLE
Contact Tel:	(440) 250-1740
Contact Title:	On-Scene Coordinator (OSC)
Contact Email:	Not reported

Alias Comments: Not reported
Site Description: Not reported

CERCLIS Assessment History:

Action Code:	001
Action:	REMOVAL
Date Started:	06/27/2011
Date Completed:	08/04/2011

REES PLATING SITE (Continued) **1014914963**

Priority Level:	Cleaned up
Operable Unit:	SITEWIDE
Primary Responsibility:	EPA Fund-Financed
Planning Status:	Approved
Urgency Indicator:	Time Critical
Action Anomaly:	Not reported

For detailed financial records, contact EDR for a Site Report.:

Click this hyperlink while viewing on your computer to access
13 additional US CERCLIS Financial: record(s) in the EDR Site Report.

M42
West
1/4-1/2
0.438 mi.
2315 ft.

REES PLATING CO INC
5020 SOUTHWAY ST SW
CANTON, OH 44706

Site 2 of 2 in cluster M

RCRA-TSDF 1000375440
RCRA-LQG OHD004463998
FINDS
LUST
FINANCIAL ASSURANCE

Relative:
Higher

Actual:
1072 ft.

RCRA-TSDF:

Date form received by agency:	10/23/2007
Facility name:	REES PLATING CO INC
Facility address:	5020 SOUTHWAY ST SW CANTON, OH 44706
EPA ID:	OHD004463998
Contact:	JOHN H WHITACRE
Contact address:	Not reported Not reported
Contact country:	Not reported
Contact telephone:	(330) 478-2561
Contact email:	Not reported
EPA Region:	05
Land type:	Private
Classification:	TSDF
Description:	Handler is engaged in the treatment, storage or disposal of hazardous waste
Classification:	Large Quantity Generator
Description:	Handler: generates 1,000 kg or more of hazardous waste during any calendar month; or generates more than 1 kg of acutely hazardous waste during any calendar month; or generates more than 100 kg of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month; or generates 1 kg or less of acutely hazardous waste during any calendar month, and accumulates more than 1 kg of acutely hazardous waste at any time; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates more than 100 kg of that material at any time

Owner/Operator Summary:

Owner/operator name:	REES PLATING CO INC
Owner/operator address:	5020 SOUTHWAY ST SW CANTON, OH 44706
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/21/1975

REES PLATING CO INC (Continued) **1000375440**

Owner/Op end date: Not reported

Owner/operator name: REES PLATING CO INC
Owner/operator address: 5020 SOUTHWAY ST SW
CANTON, OH 44706
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/21/1975
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 08/23/2006
Facility name: REES PLATING CO INC
Site name: REES PLATING COMPANY INC
Classification: Large Quantity Generator

Date form received by agency: 02/28/2006
Facility name: REES PLATING CO INC
Site name: REES PLATING COMPANY INC
Classification: Large Quantity Generator

Date form received by agency: 04/29/2003
Facility name: REES PLATING CO INC
Classification: Large Quantity Generator

Date form received by agency: 02/27/2002
Facility name: REES PLATING CO INC
Site name: REES PLATING COMPANY INC
Classification: Large Quantity Generator

Date form received by agency: 02/10/2000
Facility name: REES PLATING CO INC
Site name: REES PLATING COMPANY
Classification: Large Quantity Generator

Date form received by agency: 02/25/1998
Facility name: REES PLATING CO INC

REES PLATING CO INC (Continued) **1000375440**

Site name: REES PLATING COMPANY
Classification: Large Quantity Generator

Date form received by agency: 02/22/1996
Facility name: REES PLATING CO INC
Site name: REES PLATING COMPANY
Classification: Large Quantity Generator

Date form received by agency: 01/25/1994
Facility name: REES PLATING CO INC
Classification: Large Quantity Generator

Date form received by agency: 01/26/1993
Facility name: REES PLATING CO INC
Site name: REES PLATING CO
Classification: Large Quantity Generator

Date form received by agency: 02/06/1992
Facility name: REES PLATING CO INC
Classification: Large Quantity Generator

Date form received by agency: 08/13/1990
Facility name: REES PLATING CO INC
Site name: REES PLATING CO
Classification: Large Quantity Generator

Hazardous Waste Summary:
Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Waste code: D003
Waste name: A MATERIAL IS CONSIDERED TO BE A REACTIVE HAZARDOUS WASTE IF IT IS NORMALLY UNSTABLE, REACTS VIOLENTLY WITH WATER, GENERATES TOXIC GASES WHEN EXPOSED TO WATER OR CORROSIVE MATERIALS, OR IF IT IS CAPABLE OF DETONATION OR EXPLOSION WHEN EXPOSED TO HEAT OR A FLAME. ONE EXAMPLE OF SUCH WASTE WOULD BY WASTE GUNPOWDER.

Waste code: D004
Waste name: ARSENIC

Waste code: D006
Waste name: CADMIUM

Waste code: D007
Waste name: CHROMIUM

Waste code: D008
Waste name: LEAD

Waste code: D009
Waste name: MERCURY

REES PLATING CO INC (Continued) **1000375440**

Waste code: D011
Waste name: SILVER

Waste code: F006
Waste name: WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS EXCEPT FROM THE FOLLOWING PROCESSES: (1) SULFURIC ACID ANODIZING OF ALUMINUM; (2) TIN PLATING ON CARBON STEEL; (3) ZINC PLATING (SEGREGATED BASIS) ON CARBON STEEL; (4) ALUMINUM OR ZINC-ALUMINUM PLATING ON CARBON STEEL; (5) CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC AND ALUMINUM PLATING ON CARBON STEEL; AND (6) CHEMICAL ETCHING AND MILLING OF ALUMINUM.

Waste code: F009
Waste name: SPENT STRIPPING AND CLEANING BATH SOLUTIONS FROM ELECTROPLATING OPERATIONS WHERE CYANIDES ARE USED IN THE PROCESS.

Waste code: F019
Waste name: WASTEWATER TREATMENT SLUDGES FROM THE CHEMICAL CONVERSION COATING OF ALUMINUM EXCEPT FROM ZIRCONIUM PHOSPHATING IN ALUMINUM CAN WASHING WHEN SUCH PHOSPHATING IS AN EXCLUSIVE CONVERSION COATING PROCESS.

Facility Has Received Notices of Violations:
Regulation violated: Not reported
Area of violation: TSD - Financial Requirements
Date violation determined: 03/23/2010
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/09/2011
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Formal Enforcement Agreement or Order
Date violation determined: 03/23/2010
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/09/2011
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - Financial Requirements
Date violation determined: 03/23/2010
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/24/2010

REES PLATING CO INC (Continued) **1000375440**

Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Formal Enforcement Agreement or Order
Date violation determined: 03/23/2010
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/24/2010
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Formal Enforcement Agreement or Order
Date violation determined: 05/19/2009
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/11/2009
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Formal Enforcement Agreement or Order
Date violation determined: 05/19/2009
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/29/2009
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 05/12/2009
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/01/2009
Enf. disposition status: Not reported

REES PLATING CO INC (Continued) **1000375440**

Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 05/12/2009
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/29/2009
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 05/12/2009
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/11/2009
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 08/15/2008
Date achieved compliance: Not reported
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/15/2008
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - Records/Reporting
Date violation determined: 08/22/2007
Date achieved compliance: 10/26/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/11/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported

REES PLATING CO INC (Continued) **1000375440**

Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - Records/Reporting
Date violation determined: 08/22/2007
Date achieved compliance: 10/26/2007
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/22/2007
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - Records/Reporting
Date violation determined: 05/09/2006
Date achieved compliance: 08/23/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/27/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - Records/Reporting
Date violation determined: 05/09/2006
Date achieved compliance: 08/23/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/09/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - Records/Reporting
Date violation determined: 05/09/2006
Date achieved compliance: 08/23/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/27/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State

REES PLATING CO INC (Continued) **1000375440**

Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - Records/Reporting
Date violation determined: 05/09/2006
Date achieved compliance: 08/23/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/09/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - Records/Reporting
Date violation determined: 12/13/2005
Date achieved compliance: 03/01/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/13/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - Records/Reporting
Date violation determined: 09/13/2004
Date achieved compliance: 01/27/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 09/13/2004
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - Records/Reporting
Date violation determined: 09/13/2004
Date achieved compliance: 01/27/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/15/2004
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported

REES PLATING CO INC (Continued) **1000375440**

Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SS - 3734.02(E)&(F)
Area of violation: TSD - General
Date violation determined: 11/04/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/17/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SS - 3734.02(E)&(F)
Area of violation: TSD - General
Date violation determined: 11/04/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 12/29/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SS - 3734.02(E)&(F)
Area of violation: TSD - General
Date violation determined: 11/04/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/20/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-270-07
Area of violation: LDR - General
Date violation determined: 11/04/2003
Date achieved compliance: 07/09/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/20/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported

REES PLATING CO INC (Continued) **1000375440**

Paid penalty amount:	Not reported
Regulation violated:	SS - 3734.02(E)&(F)
Area of violation:	TSD - General
Date violation determined:	11/04/2003
Date achieved compliance:	12/09/2005
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/10/2004
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-66-74
Area of violation:	TSD - Container Use and Management
Date violation determined:	11/04/2003
Date achieved compliance:	05/27/2004
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	11/20/2003
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-66-73
Area of violation:	TSD - Container Use and Management
Date violation determined:	11/04/2003
Date achieved compliance:	06/09/2004
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	11/20/2003
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SS - 3734.02(E)&(F)
Area of violation:	TSD - General
Date violation determined:	11/04/2003
Date achieved compliance:	12/09/2005
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	12/29/2004
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

REES PLATING CO INC (Continued) **1000375440**

Regulation violated:	SR - 3745-270-07
Area of violation:	LDR - General
Date violation determined:	11/04/2003
Date achieved compliance:	07/09/2004
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/10/2004
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3745-52-34(A)(2)&(3)
Area of violation:	Generators - Pre-transport
Date violation determined:	11/04/2003
Date achieved compliance:	06/09/2004
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	11/20/2003
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3734.02(E)&(F)
Area of violation:	Generators - General
Date violation determined:	01/14/2003
Date achieved compliance:	12/09/2005
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/09/2003
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3734.02(E)&(F)
Area of violation:	Generators - General
Date violation determined:	01/14/2003
Date achieved compliance:	12/09/2005
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	04/23/2003
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3734.02(E)&(F)

REES PLATING CO INC (Continued) **1000375440**

Area of violation: Generators - General
Date violation determined: 01/14/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/29/2004
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3734.02(E)&(F)
Area of violation: Generators - General
Date violation determined: 01/14/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/20/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3734.02(E)&(F)
Area of violation: Generators - General
Date violation determined: 01/14/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/10/2004
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3734.02(E)&(F)
Area of violation: Generators - General
Date violation determined: 01/14/2003
Date achieved compliance: 12/09/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/17/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport

REES PLATING CO INC (Continued) **1000375440**

Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/20/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/20/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-73
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002

REES PLATING CO INC (Continued) **1000375440**

Date achieved compliance:	05/07/2003
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	11/01/2002
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3745-52-34(A)(2)&(3)
Area of violation:	Generators - Pre-transport
Date violation determined:	10/01/2002
Date achieved compliance:	05/07/2003
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	11/01/2002
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3745-52-34(A)(2)&(3)
Area of violation:	Generators - Pre-transport
Date violation determined:	10/01/2002
Date achieved compliance:	05/07/2003
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	01/06/2003
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3745-65-52 thru 65-56
Area of violation:	Generators - Pre-transport
Date violation determined:	10/01/2002
Date achieved compliance:	05/07/2003
Violation lead agency:	State
Enforcement action:	Not reported
Enforcement action date:	Not reported
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	Not reported
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	SR - 3745-52-11
Area of violation:	Generators - General
Date violation determined:	10/01/2002
Date achieved compliance:	02/28/2005

REES PLATING CO INC (Continued) **1000375440**

Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/09/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/10/2004
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-33
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 01/28/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/06/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-74
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 01/06/2003
Violation lead agency: State

REES PLATING CO INC (Continued) **1000375440**

Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-73
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/28/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/06/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-91 thru 66-991
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-52 thru 65-56
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL

REES PLATING CO INC (Continued) **1000375440**

Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-33
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 01/28/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/29/2004
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/28/2003

REES PLATING CO INC (Continued) **1000375440**

Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-52 thru 65-56
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-91 thru 66-991
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/06/2003
Enf. disposition status: Not reported

REES PLATING CO INC (Continued) **1000375440**

Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(2)&(3)
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/28/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(2)&(3)
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-31
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 01/28/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(2)&(3)
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported

REES PLATING CO INC (Continued) **1000375440**

Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-91 thru 66-991
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-91 thru 66-991
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/01/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-91 thru 66-991
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/28/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-73
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported

REES PLATING CO INC (Continued) **1000375440**

Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-52 thru 65-56
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/06/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-52 thru 65-56
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/28/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/09/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-31
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 01/28/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/06/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported

REES PLATING CO INC (Continued) **1000375440**

Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-73
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/07/2003
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-16
Area of violation: Generators - Pre-transport
Date violation determined: 10/01/2002
Date achieved compliance: 05/27/2004
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/06/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 10/01/2002
Date achieved compliance: 02/28/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/28/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-91(A)(B)(C)(D)
Area of violation: TSD - Tank System Standards
Date violation determined: 08/26/1996
Date achieved compliance: 12/24/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 09/11/1996
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported

REES PLATING CO INC (Continued) **1000375440**

Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(2)&(3)
Area of violation: Generators - Pre-transport
Date violation determined: 08/26/1996
Date achieved compliance: 10/21/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 09/11/1996
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-73(A)
Area of violation: Generators - Pre-transport
Date violation determined: 08/26/1996
Date achieved compliance: 10/21/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 09/11/1996
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - General
Date violation determined: 03/07/1985
Date achieved compliance: 03/18/1986
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/13/1985
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 06/09/2011
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Formal Enforcement Agreement or Order
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 06/09/2011
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: TSD - Financial Requirements
Date achieved compliance: Not reported
Evaluation lead agency: State

REES PLATING CO INC (Continued) **1000375440**

Evaluation date: 05/04/2010
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 03/23/2010
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Formal Enforcement Agreement or Order
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 03/23/2010
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: TSD - Financial Requirements
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/19/2009
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Formal Enforcement Agreement or Order
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/19/2009
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/12/2009
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 08/15/2008
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 10/26/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 08/22/2007
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Records/Reporting
Date achieved compliance: 10/26/2007
Evaluation lead agency: State

Evaluation date: 08/23/2006
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Not reported

REES PLATING CO INC (Continued) **1000375440**

Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/09/2006
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Records/Reporting
Date achieved compliance: 08/23/2006
Evaluation lead agency: State

Evaluation date: 12/29/2005
Evaluation: NOT A SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/13/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Records/Reporting
Date achieved compliance: 03/01/2006
Evaluation lead agency: State

Evaluation date: 02/28/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 02/28/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 09/13/2004
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Records/Reporting
Date achieved compliance: 01/27/2005
Evaluation lead agency: State

Evaluation date: 07/09/2004
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 07/09/2004
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 07/09/2004
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

REES PLATING CO INC (Continued) **1000375440**

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Container Use and Management
Date achieved compliance: 06/09/2004
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Container Use and Management
Date achieved compliance: 05/27/2004
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 07/09/2004
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/27/2004
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 06/09/2004
Evaluation lead agency: State

Evaluation date: 11/04/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 06/10/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 06/10/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General

REES PLATING CO INC (Continued) **1000375440**

Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 06/10/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: LDR - General
Date achieved compliance: 07/09/2004
Evaluation lead agency: State

Evaluation date: 06/10/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

Evaluation date: 06/09/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

Evaluation date: 06/09/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/27/2004
Evaluation lead agency: State

Evaluation date: 06/09/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 01/14/2003
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Generators - General
Date achieved compliance: 12/09/2005
Evaluation lead agency: State

Evaluation date: 12/23/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

Evaluation date: 12/23/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 01/28/2003
Evaluation lead agency: State

Evaluation date: 12/23/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/27/2004
Evaluation lead agency: State

REES PLATING CO INC (Continued) **1000375440**

Evaluation date: 12/23/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/07/2003
Evaluation lead agency: State

Evaluation date: 12/20/2002
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/07/2003
Evaluation lead agency: State

Evaluation date: 12/20/2002
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

Evaluation date: 12/20/2002
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/27/2004
Evaluation lead agency: State

Evaluation date: 10/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 02/28/2005
Evaluation lead agency: State

Evaluation date: 10/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/27/2004
Evaluation lead agency: State

Evaluation date: 10/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 01/06/2003
Evaluation lead agency: State

Evaluation date: 10/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/07/2003
Evaluation lead agency: State

Evaluation date: 10/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 01/28/2003
Evaluation lead agency: State

Evaluation date: 08/26/1996
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Generators - Pre-transport

REES PLATING CO INC (Continued) **1000375440**

Date achieved compliance: 10/21/1996
Evaluation lead agency: State

Evaluation date: 08/26/1996
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: TSD - Tank System Standards
Date achieved compliance: 12/24/1996
Evaluation lead agency: State

Evaluation date: 03/07/1985
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 03/18/1986
Evaluation lead agency: State

FINDS:

Registry ID: 110000893427

Environmental Interest/Information System

US EPA Enforcement Criminal Records Management System (ECRM), now called the Criminal Case Reporting System (CCRS), is the Criminal Investigation Division's (CID) "official record" of all criminal investigation activities. The system maintains and tracks case-specific program and investigative information on over 8,200 active and archived criminal cases. CCRS is an EPA-only system and data entry is performed directly by CID employees. The Public is allowed to obtain only select defendant data fields for closed, convicted cases via the Freedom of Information Act.

US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) is the Superfund database that is used to support management in all phases of the Superfund program. The system contains information on all aspects of hazardous waste sites, including an inventory of sites, planned and actual site activities, and financial information.

HAZARDOUS WASTE BIENNIAL REPORTER

The OH-CORE (Ohio - Core) database contains information commonly shared among the Ohio EPA environmental programs. The information is facility-based, general in nature, and used to support specific programmatic systems while simultaneously maintaining an inventory of common facility-related data. Specific programmatic details are maintained in programmatic databases.

REES PLATING CO INC (Continued) **1000375440**

LUST:
Release Number: 76001220-N00001
Release Date: Not reported
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

OH FINANCIAL ASSURANCE:
US EPAID: OHD004463998
FA Type: None
Liability Type: None
FA Instrument: None
Liability Instrument: None
Status: Closure

N43 **CONSUMER DIRECT** **LUST U004088269**
ENE **1400 RAFF RD** **UST N/A**
1/4-1/2 **CANTON, OH 44750**
0.473 mi.
2496 ft. **Site 1 of 2 in cluster N**

Relative:
Higher

Actual:
1099 ft.

LUST:
Release Number: 76010143-N00001
Release Date: Not reported
Facility Status: Inactive
LTF Status: 6 Closure of regulated UST
FR Status: NFA: No Further Action
Priority: 3
Review Date: 06/20/2000
Class: Viable Responsible Party has been identified

Facility:
Facility ID: 76010143
Facility Type: Not reported
24 Hr Emergency Contact: Not reported
24 Hr Emergency Phone: Not reported
Number Of Tanks On Site: Not reported
Local Fire Department: Zero
Delegated Authority: No
Elig For Green Buckeye Award: Not reported
Active Release Site: No
Owner Id: W019385
Owner Name: CONSUMER DIRECT
Owner Address: 1400 RAFF RD
Owner City/State/Zip: CANTON, OH 44750
Owner Phone: Not reported

UST:
Tank ID: Not reported
Tank Status: Not reported
Tank Type: Not reported
Capacity: Not reported
Content: Not reported
CAS #: Not reported

CONSUMER DIRECT (Continued) **U004088269**

Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported
AST/UST:	Not reported
Installation Date:	Not reported
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Not reported
Piping Type:	Not reported
Release Detection on Piping:	Not reported

N44 **CANTON INDUS PARK** **LUST U004086615**
ENE **1401 RAFF RD SW** **UST N/A**
1/4-1/2 **CANTON, OH 44710**
0.485 mi.
2562 ft. **Site 2 of 2 in cluster N**

Relative:
Higher

Actual:
1107 ft.

LUST:

Release Number:	76010019-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

Facility:

Facility ID:	76010019
Facility Type:	Not reported
24 Hr Emergency Contact:	Not reported
24 Hr Emergency Phone:	Not reported
Number Of Tanks On Site:	Not reported
Local Fire Department:	Zero
Delegated Authority:	No
Elig For Green Buckeye Award:	Not reported
Active Release Site:	No
Owner Id:	W019261
Owner Name:	CANTON INDUS PARK
Owner Address:	1401 RAFF RD SW
Owner City/State/Zip:	CANTON, OH 44710
Owner Phone:	Not reported

UST:

Tank ID:	Not reported
Tank Status:	**Not reported**
Tank Type:	Not reported
Capacity:	Not reported
Content:	Not reported
CAS #:	Not reported
Regulated:	Not reported
Overfill Device Installed:	Not reported
Spill Device Installed:	Not reported

CANTON INDUS PARK (Continued) **U004086615**

AST/UST:	Not reported
Installation Date:	Not reported
Date Removed:	Not reported
Date Last Used:	Not reported
Date Abandoned/Closed:	Not reported
Corrosion Protection Tank:	Not reported
Release Detection on Tank:	Not reported
Corrosion Protection Piping:	Not reported
Piping Material:	Not reported
Piping Type:	Not reported
Release Detection on Piping:	Not reported

45
SE
1/2-1
0.733 mi.
3870 ft.

ASHLAND PETROLEUM
2408 GAMBRINUS
CANTON, OH

DERR S105505998
LUST N/A
SPILLS
NPDES
AIRS

Relative:
Higher

Actual:
1073 ft.

DERR:

DERR ID:	276000065
District:	NEDO
Alias:	Not reported
Lat/Long:	40.7708 -81.4194
EPA ID:	OHD048107049
Program:	**Site Assessment**
Contact Phone:	(330) 963-1200

LUST:

Release Number:	76002241-N00001
Release Date:	Not reported
Facility Status:	**Inactive**
LTF Status:	6 Closure of regulated UST
FR Status:	**NFA: No Further Action**
Priority:	3
Review Date:	06/20/2000
Class:	Viable Responsible Party has been identified

SPILLS:

Spill No.:	9011-76-5214
Spill Year:	1990
Date Spill Reported:	11/05/1990
Spill Month:	11
Spill Number:	5214
Reporter Name:	CO
Confidential:	No
District Code:	NE
Employee Number:	Not reported
Lat/Long:	Not reported
Product Spilled Name:	SUSPENDED SOLIDS
Product Spilled Name:	OI GREASE

Spill No.:	9003-76-1368
Spill Year:	1990
Date Spill Reported:	03/19/1990
Spill Month:	3
Spill Number:	1368

ASHLAND PETROLEUM (Continued) **S105505998**

Reporter Name: CO
Confidential: No
District Code: NE
Employee Number: Not reported
Lat/Long: Not reported
Product Spilled Name: WASTE WATER

Spill No.: 9010-76-5130
Spill Year: 1990
Date Spill Reported: 10/31/1990
Spill Month: 10
Spill Number: 5130
Reporter Name: CO
Confidential: No
District Code: NE
Employee Number: Not reported
Lat/Long: Not reported
Product Spilled Name: SUSPENDED SOLIDS
Product Spilled Name: OIL AND GREASE

Spill No.: 9104-76-1230
Spill Year: 1991
Date Spill Reported: 03/14/1991
Spill Month: 4
Spill Number: 1230
Reporter Name: COMPANY
Confidential: No
District Code: NE
Employee Number: Not reported
Lat/Long: Not reported
Product Spilled Name: SO2

Spill No.: 9102-76-0606
Spill Year: 1991
Date Spill Reported: 02/27/1991
Spill Month: 2
Spill Number: 0606
Reporter Name: COMPANY
Confidential: No
District Code: NE
Employee Number: Not reported
Lat/Long: Not reported
Product Spilled Name: WASTE WATER

Click this hyperlink while viewing on your computer to access
32 additional OH SPILL: record(s) in the EDR Site Report.

OH NPDES:
Issue Date: 7/1/2010
Township: Canton
Facility Npdes Permit: 3GH00018*AG
Applicant Name: Marathon Petroleum Co LLC
Applicant Address: PO Box 8170, Canton, OH 44711

Issue Date: 6/19/2008
Township: Not reported
Facility Npdes Permit: 3GC03966*AG

ASHLAND PETROLEUM (Continued) **S105505998**

Applicant Name: MARATHON PETROLEUM CO LLC
Applicant Address: PO BOX 8170 CANTON, OH 44711

Issue Date: 8/26/2010
Township: Not reported
Facility Npdes Permit: 3GR01327*DG
Applicant Name: MARATHON PETROLEUM CO LLC
Applicant Address: PO BOX 8170 CANTON, OH 44711

AIRS:
Facility Id: 1576002006
Permit Classification: EX
Emission Units Meeting Def of Trivial Outlined in EngGuide62: 0
Insignificant Emission Units: 150
Significant Emission Units: 64
Contact First Name: William
Contact Last Name: Patrie
Mailing Address 1: 2408 Gambrinus Avenue SW
Mailing Address 2: Not reported
Mailing City/State/Zip: Canton, OH 44706
Contact Phone: 3304795670
Contact EMail: wppatrie@marathonpetroleum.com

Emissions:
Facility Id: 1576002006
Facility Name: Marathon Petroleum Company LP - Canton Refinery
Address1: 2408 Gambrinus Avenue SW
City/State/Zip: Canton, OH 44706
County Name: Stark
Lat/Long(d m s): 40 46 20 / -81 25 6
Group Id: Not reported
EPA EMU Id: B022
Design Capacity Unit: 136
Design Capacity: mmBTU/hr
Design Desc: Boiler/Heater
Install Date: 01-JUN-66 1
SCC Id: 30600104
Winter %Throughput Processed: 23
Spring %Throughput Processed: 26
Summer %Throughput Processed: 26
Fall %Throughput Processed: 25
Days Week: 7
Weeks Year: 52
Hours Day: 24
Hours Yr: 8760
Through Value: 347
Material Units: MILLION CUBIC FEET
Primary Material of Throughput: Natural Gas
Mat Act: Burned
Pollutant: Pb - Lead
Fugitives: 0
Stack: 0.0001
Total: 0.0001

Facility Id: 1576002006
Facility Name: Marathon Petroleum Company LP - Canton Refinery
Address1: 2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	1.93
Total:	1.93

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.93
Total:	0.93

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	10.58
Total:	10.58

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	12.6
Total:	12.6
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.39
Total:	1.39
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.72
Total:	0.72
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.24
Total:	0.24
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.24
Total:	0.24

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.24
Total:	0.24

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0001
Total:	0.0001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27
Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	1.44
Total:	1.44

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B023
Design Capacity Unit:	83
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	22
Spring %Throughput Processed:	27

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	27
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	259
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.69
Total:	0.69

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	10.85
Total:	10.85

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	12.92
Total:	12.92

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.42
Total:	1.42

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.74
Total:	0.74

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.25
Total:	0.25

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.25
Total:	0.25

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.25
Total:	0.25

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0001
Total:	0.0001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	1.48
Total:	1.48

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B027
Design Capacity Unit:	81
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-74 1
SCC Id:	10200701
Winter %Throughput Processed:	29
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	266
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.71
Total:	0.71

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0.22
Total:	0.22
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	4.22
Total:	4.22
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.15
Total:	1.15
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.6
Total:	0.6
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.2
Total:	0.2
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.2
Total:	0.2
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.2
Total:	0.2

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0001
Total:	0.0001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	0.96
Total:	0.96

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B028
Design Capacity Unit:	43
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	220
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.57
Total:	0.57

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	1.58
Total:	1.58

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	30.89
Total:	30.89

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	8.41
Total:	8.41

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	4.36
Total:	4.36

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	1.45
Total:	1.45

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	1.45
Total:	1.45

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	1.45
Total:	1.45

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0004
Total:	0.0004

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	7.06
Total:	7.06

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B029
Design Capacity Unit:	242
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-79 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	25
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1614
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	4.2
Total:	4.2
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	0.97
Total:	0.97
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	11.18
Total:	11.18
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	3.04
Total:	3.04
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	1.58
Total:	1.58

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.53
Total:	0.53

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.53
Total:	0.53

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.53
Total:	0.53

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0001
Total:	0.0001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1
SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	3.16
Total:	3.16

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B031
Design Capacity Unit:	250
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-MAR-08 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	10200701
Winter %Throughput Processed:	37
Spring %Throughput Processed:	28
Summer %Throughput Processed:	15
Fall %Throughput Processed:	20
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	570
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	1.52
Total:	1.52

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	0.17
Total:	0.17

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	1.09
Total:	1.09

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	0.42
Total:	0.42

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.22
Total:	0.22

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.07
Total:	0.07

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.07
Total:	0.07

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.07
Total:	0.07

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	0.44
Total:	0.44

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B033
Design Capacity Unit:	55
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-08 1
SCC Id:	30600104
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	40
Fall %Throughput Processed:	60
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	79
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0.21
Total:	0.21
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	Ammonia
Fugitives:	0
Stack:	0.22
Total:	0.22
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Processed
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	95.76
Total:	95.76
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	35.29
Total:	35.29
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.86
Total:	1.86

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	109.39
Total:	109.39

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	43.76
Total:	43.76

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	40.69
Total:	40.69

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	36.76
Total:	36.76

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1
SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	65.82
Total:	65.82

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P002
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-52 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600201
Winter %Throughput Processed:	25
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	7589
Material Units:	1000 BARRELS
Primary Material of Throughput:	Fresh Feed
Mat Act:	Processed
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	1.76
Total:	1.76

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	3.63
Total:	3.63

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	2.84
Total:	2.84

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	17.32
Total:	17.32

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.24
Total:	0.24

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.08
Total:	0.08

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.08
Total:	0.08

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.08
Total:	0.08

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	0.39
Total:	0.39

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P003
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	42232
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	5.74
Total:	5.74
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	0.94
Total:	0.94
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	0.76
Total:	0.76
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	12.18
Total:	12.18
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.06
Total:	0.06
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.02
Total:	0.02
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.02
Total:	0.02

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.02
Total:	0.02

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	1.624
Total:	1.624

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P004
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-86 1
SCC Id:	30600904
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21116
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	10.35
Total:	10.35

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600503
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Processed
Pollutant:	Ammonia
Fugitives:	0.001
Stack:	0
Total:	0.001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600503
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Processed
Pollutant:	Organic Compounds
Fugitives:	1.125
Stack:	0
Total:	1.125

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600503
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Processed
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.125
Stack:	0
Total:	1.125

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600508
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Processed
Pollutant:	Organic Compounds
Fugitives:	0.033
Stack:	0
Total:	0.033

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600508
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Processed
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.033
Stack:	0
Total:	0.033

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600516
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	Ammonia
Fugitives:	4.878
Stack:	0
Total:	4.878

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600516
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	9.975
Stack:	0
Total:	9.975

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600516
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	9.975
Stack:	0
Total:	9.975

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600517
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	Ammonia
Fugitives:	0.142
Stack:	0
Total:	0.142

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600517
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	0.536

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0
Total:	0.536
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600517
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.536
Stack:	0
Total:	0.536
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600519
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	0.014
Stack:	0
Total:	0.014
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600519
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.014
Stack:	0
Total:	0.014
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600520
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	Ammonia
Fugitives:	0.001
Stack:	0
Total:	0.001
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600520
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	0.059
Stack:	0
Total:	0.059
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P009
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-58 1
SCC Id:	30600520
Winter %Throughput Processed:	28
Spring %Throughput Processed:	27
Summer %Throughput Processed:	24
Fall %Throughput Processed:	21
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	543706.9
Material Units:	1000 GALLONS
Primary Material of Throughput:	Wastewater
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0.059
Stack:	0
Total:	0.059
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P023
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10091.52
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	Organic Compounds
Fugitives:	3.53
Stack:	0
Total:	3.53
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P023
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10091.52
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	22.33
Stack:	0
Total:	22.33

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P023
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10091.52
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	22.33
Stack:	0
Total:	22.33

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P023
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10091.52
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	22.33
Stack:	0
Total:	22.33

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P023
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10091.52
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	3
Stack:	0
Total:	3

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P024
Design Capacity Unit:	Not reported

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10932.48
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	Organic Compounds
Fugitives:	3.83
Stack:	0
Total:	3.83

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P024
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10932.48
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	27.32
Stack:	0
Total:	27.32

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	P024
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10932.48
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	27.32
Stack:	0
Total:	27.32

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P024
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10932.48
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	27.32
Stack:	0
Total:	27.32

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P024
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	30600701
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	10932.48
Material Units:	MILLION GALLONS
Primary Material of Throughput:	Cooling Water
Mat Act:	Circulated
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	3.25
Stack:	0
Total:	3.25

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P801
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600801
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	28859
Material Units:	1000 BARRELS
Primary Material of Throughput:	Refinery Feed
Mat Act:	Processed
Pollutant:	Organic Compounds
Fugitives:	53.488
Stack:	0
Total:	53.488

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	P801
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	30600801
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	28859
Material Units:	1000 BARRELS
Primary Material of Throughput:	Refinery Feed
Mat Act:	Processed
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	48.26
Stack:	0
Total:	48.26

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T028
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-47 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	19426
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	4.25

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0
Total:	4.25
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T028
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-47 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	19426
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	4.25
Stack:	0
Total:	4.25
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T030
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-51 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12665
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.06
Stack:	0
Total:	1.06
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T030
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-51 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12665
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.06
Stack:	0
Total:	1.06
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T033
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-02 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	3353
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.38
Stack:	0
Total:	1.38

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T033
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-02 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	3353
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.38
Stack:	0
Total:	1.38

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T036
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	15818
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.02
Stack:	0
Total:	1.02

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T036
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-55 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	15818
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.02
Stack:	0
Total:	1.02

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T037
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-08 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	20677
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.74
Stack:	0
Total:	1.74

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T037
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-08 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	20677
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.74
Stack:	0
Total:	1.74

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T038
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-56 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	40301117
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141573
Material Units:	1000 GALLONS
Primary Material of Throughput:	Crude Oil
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.17
Stack:	0
Total:	1.17

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T038
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-56 1
SCC Id:	40301117
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141573
Material Units:	1000 GALLONS
Primary Material of Throughput:	Crude Oil
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.17
Stack:	0
Total:	1.17

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T040
Design Capacity Unit:	Not reported

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-70 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12563
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.61
Stack:	0
Total:	1.61

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T040
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-70 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12563
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.61
Stack:	0
Total:	1.61

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	T041
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-70 1
SCC Id:	40301117
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	72121
Material Units:	1000 GALLONS
Primary Material of Throughput:	Crude Oil
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	2.4
Stack:	0
Total:	2.4

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T041
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-70 1
SCC Id:	40301117
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	72121
Material Units:	1000 GALLONS
Primary Material of Throughput:	Crude Oil
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	2.4
Stack:	0
Total:	2.4

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T043
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-64 1
SCC Id:	40301180
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141369
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	2.5
Stack:	0
Total:	2.5

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T043
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-64 1
SCC Id:	40301180
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141369
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	2.5
Stack:	0
Total:	2.5

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T046
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-51 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	188871
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	3.7
Stack:	0
Total:	3.7

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T046
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-51 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	188871
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	3.7

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0
Total:	3.7
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T050
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-74 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	19463
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.7
Stack:	0
Total:	1.7
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T050
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-74 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	19463
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.7
Stack:	0
Total:	1.7
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T067
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-57 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	5832
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.14
Stack:	0
Total:	1.14
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T067
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-57 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	5832
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.14
Stack:	0
Total:	1.14
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T082
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-74 1
SCC Id:	40301009
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	22903
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.06
Stack:	0
Total:	1.06
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T082
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-74 1
SCC Id:	40301009
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	22903
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.06
Stack:	0
Total:	1.06

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T083
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-10 1
SCC Id:	40301025
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	25939
Material Units:	1000 GALLON-YEARS
Primary Material of Throughput:	Residual Oil
Mat Act:	Storage Capacity
Pollutant:	Organic Compounds
Fugitives:	1.76
Stack:	0
Total:	1.76

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T083
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-10 1
SCC Id:	40301025
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	25939
Material Units:	1000 GALLON-YEARS
Primary Material of Throughput:	Residual Oil
Mat Act:	Storage Capacity
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.76
Stack:	0
Total:	1.76

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T093
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-10 1
SCC Id:	40301025
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21803
Material Units:	1000 GALLON-YEARS
Primary Material of Throughput:	Residual Oil
Mat Act:	Storage Capacity
Pollutant:	Organic Compounds
Fugitives:	1.52
Stack:	0
Total:	1.52

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T093
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JAN-10 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	40301025
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	21803
Material Units:	1000 GALLON-YEARS
Primary Material of Throughput:	Residual Oil
Mat Act:	Storage Capacity
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.52
Stack:	0
Total:	1.52

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T094
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-65 1
SCC Id:	40301023
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	96339
Material Units:	1000 GALLONS
Primary Material of Throughput:	Asphalt
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	4.18
Stack:	0
Total:	4.18

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T094
Design Capacity Unit:	Not reported

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-65 1
SCC Id:	40301023
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	96339
Material Units:	1000 GALLONS
Primary Material of Throughput:	Asphalt
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	4.18
Stack:	0
Total:	4.18

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T097
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	40301023
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	48871
Material Units:	1000 GALLONS
Primary Material of Throughput:	Asphalt
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	3.31
Stack:	0
Total:	3.31

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	T097
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-72 1
SCC Id:	40301023
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	48871
Material Units:	1000 GALLONS
Primary Material of Throughput:	Asphalt
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	3.31
Stack:	0
Total:	3.31

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T130
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-76 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	192587
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	2.205
Stack:	0
Total:	2.205

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T130
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-76 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	192587
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	2.205
Stack:	0
Total:	2.205

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T142
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-89 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	51781
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	2.06
Stack:	0
Total:	2.06

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T142
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-89 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	51781
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	2.06
Stack:	0
Total:	2.06

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T143
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-90 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	189679
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.5

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0
Total:	1.5
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T143
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-90 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	189679
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.5
Stack:	0
Total:	1.5
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T148
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-91 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12592
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.63
Stack:	0
Total:	1.63
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T148
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-91 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12592
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.63
Stack:	0
Total:	1.63
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T149
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-91 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	12289
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.63
Stack:	0
Total:	1.63

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T149
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-91 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	12289
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.63
Stack:	0
Total:	1.63

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T162
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-94 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	209578
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.58
Stack:	0
Total:	1.58

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T162
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-94 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	209578
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.58
Stack:	0
Total:	1.58

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T167
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-95 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	11357
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.52
Stack:	0
Total:	1.52

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T167
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-95 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	11357
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.52
Stack:	0
Total:	1.52

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T169
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-51 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	3419
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	Organic Compounds
Fugitives:	1.24
Stack:	0
Total:	1.24

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	T169
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not Applicable
Install Date:	01-JUN-51 1
SCC Id:	40301107
Winter %Throughput Processed:	25
Spring %Throughput Processed:	25
Summer %Throughput Processed:	25
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	3419
Material Units:	1000 GALLONS
Primary Material of Throughput:	Gasoline
Mat Act:	Throughput
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	1.24
Stack:	0
Total:	1.24

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.034
Total:	0.034

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.034
Total:	0.034

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.034
Total:	0.034

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.098
Total:	0.098

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.1
Total:	0.1

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	0.196
Total:	0.196

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	1.493
Total:	1.493

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	1.778
Total:	1.778
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	SRU #2, #3 TherOx
EPA EMU Id:	Not reported
Design Capacity Unit:	Not reported
Design Capacity:	Not reported
Design Desc:	Not reported
Install Date:	Not reported
SCC Id:	30609904
Winter %Throughput Processed:	0
Spring %Throughput Processed:	0
Summer %Throughput Processed:	0
Fall %Throughput Processed:	100
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	37
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Process Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	6.786
Total:	6.786
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	0.24
Total:	0.24
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	21.79
Total:	21.79
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	7.62
Total:	7.62
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	3.95
Total:	3.95
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	1.32
Total:	1.32
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	1.32
Total:	1.32
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	1.32
Total:	1.32

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0003
Total:	0.0003

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	7.92
Total:	7.92

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B015
Design Capacity Unit:	193
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-68 1
SCC Id:	30600104
Winter %Throughput Processed:	24
Spring %Throughput Processed:	27
Summer %Throughput Processed:	26
Fall %Throughput Processed:	23
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	1426
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	3.81
Total:	3.81

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	5.77
Total:	5.77

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	6.87
Total:	6.87

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	0.76
Total:	0.76

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.39
Total:	0.39

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.13
Total:	0.13

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.13
Total:	0.13

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.13
Total:	0.13

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0.78
Total:	0.78
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B016
Design Capacity Unit:	39
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	20
Spring %Throughput Processed:	26
Summer %Throughput Processed:	25
Fall %Throughput Processed:	29
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	141
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.38
Total:	0.38
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	6.67
Total:	6.67
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	14.53
Total:	14.53
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.6
Total:	1.6

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.83
Total:	0.83

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.28
Total:	0.28

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.28
Total:	0.28

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.28
Total:	0.28

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0001
Total:	0.0001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	1.66
Total:	1.66

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B019
Design Capacity Unit:	51
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-70 1
SCC Id:	30600104
Winter %Throughput Processed:	26
Spring %Throughput Processed:	23
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	299
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.8
Total:	0.8

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	0.23
Total:	0.23

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	131.52
Total:	131.52

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	2.715
Total:	2.715

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	1.41
Total:	1.41

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.469
Total:	0.469

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.469
Total:	0.469

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.469
Total:	0.469

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack:	0.0001
Total:	0.0001
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	2.82
Total:	2.82
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B020
Design Capacity Unit:	64
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-58 1
SCC Id:	30600104
Winter %Throughput Processed:	21
Spring %Throughput Processed:	26
Summer %Throughput Processed:	27
Fall %Throughput Processed:	26
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	508
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas

ASHLAND PETROLEUM (Continued) **S105505998**

Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	1.36
Total:	1.36
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	11.45
Total:	11.45
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760

ASHLAND PETROLEUM (Continued) **S105505998**

Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	13.63
Total:	13.63
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.5
Total:	1.5
Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7

ASHLAND PETROLEUM (Continued) **S105505998**

Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.78
Total:	0.78

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.26
Total:	0.26

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28

ASHLAND PETROLEUM (Continued) **S105505998**

Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.26
Total:	0.26

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0
Stack:	0.26
Total:	0.26

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1

ASHLAND PETROLEUM (Continued) **S105505998**

SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Pb - Lead
Fugitives:	0
Stack:	0.0001
Total:	0.0001

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	SO2 - Sulfur Dioxide
Fugitives:	0
Stack:	1.56
Total:	1.56

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B021
Design Capacity Unit:	50

ASHLAND PETROLEUM (Continued) **S105505998**

Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-64 1
SCC Id:	30600104
Winter %Throughput Processed:	19
Spring %Throughput Processed:	28
Summer %Throughput Processed:	29
Fall %Throughput Processed:	24
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	281
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	VOC - Volatile Organic Compounds
Fugitives:	0
Stack:	0.75
Total:	0.75

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	CO - Carbon Monoxide
Fugitives:	0
Stack:	3.43
Total:	3.43

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6

ASHLAND PETROLEUM (Continued) **S105505998**

Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	NOx - Nitrogen Oxides
Fugitives:	0
Stack:	13.1
Total:	13.1

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	Organic Compounds
Fugitives:	0
Stack:	1.85
Total:	1.85

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW

ASHLAND PETROLEUM (Continued) **S105505998**

City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Cond) - Primary PM Condensible Portion Only (All Less than 1 Micron)
Fugitives:	0
Stack:	0.96
Total:	0.96

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PE (Filt) - Primary PM, Filterable Portion Only
Fugitives:	0
Stack:	0.32
Total:	0.32

ASHLAND PETROLEUM (Continued) **S105505998**

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM10 (Filt) - Primary PM10, Filterable Portion Only
Fugitives:	0
Stack:	0.32
Total:	0.32

Facility Id:	1576002006
Facility Name:	Marathon Petroleum Company LP - Canton Refinery
Address1:	2408 Gambrinus Avenue SW
City/State/Zip:	Canton, OH 44706
County Name:	Stark
Lat/Long(d m s):	40 46 20 / -81 25 6
Group Id:	Not reported
EPA EMU Id:	B022
Design Capacity Unit:	136
Design Capacity:	mmBTU/hr
Design Desc:	Boiler/Heater
Install Date:	01-JUN-66 1
SCC Id:	30600104
Winter %Throughput Processed:	23
Spring %Throughput Processed:	26
Summer %Throughput Processed:	26
Fall %Throughput Processed:	25
Days Week:	7
Weeks Year:	52
Hours Day:	24
Hours Yr:	8760
Through Value:	347
Material Units:	MILLION CUBIC FEET
Primary Material of Throughput:	Natural Gas
Mat Act:	Burned
Pollutant:	PM2.5 (FILT) - Primary PM2.5, Filterable Portion Only
Fugitives:	0

ASHLAND PETROLEUM (Continued) **S105505998**

Stack: 0.32
Total: 0.32

Count: 20 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
CANTON	1003872351	CANTON WORKS DU PONT EI DE NEMOURS	ALLEN & 17TH STS	44708	CERCLIS-NFRAP,DERR
CANTON	1009519726	OHIO POWER CO. - CANTON SERVICE CT	5300 NAVARRE RD	44701	FTTS,HIST FTTS INSP
PERRY TWP	1010787762	ODOT HIGHWAY BRIDGE	STA SR 21 008.25 B#STA-21-12.R	44708	RCRA-LQG
CANTON	2011965675		2100 SHEPLER CHURCH AVENUE SW	44706	ERNS
CANTON	8860597		SOUTH CANTON SUBSTATION BRINKE		ERNS
CANTON	89106157		NEAR CANTON, OH; 1000' EAST OF		ERNS
CANTON	90163318		CANTON S SERVICE BLDG WACO POL		ERNS
CANTON	91228680		CANTON SOUTH SUBSTATION ON KIE		ERNS
CANTON	91240835		CANTON OHIO ALGERS INDUSTRIAL		ERNS
CANTON	94379264		CANTON YARD		ERNS
CANTON	97410528		CITY OF CANTON FIRE DEPT HAS C		ERNS
CANTON	S102600786	CANTON METAL RECYCLING	15TH & GEORGETOWN		SPILLS
CANTON	S102886929	CANTON SANITATION DEPT	30TH STREET		SPILLS
CANTON	S102890892	CASCADE PETROLEUM CO CANTON IND PA	2327 W. HUTTON RD W OF SR 83		SPILLS
CANTON	S102895297	CANTON STP	WESTBROOK PARK POND		SPILLS
CANTON	S102901984	CANTON WWTP	MONUMENT RD & PARK DR		SPILLS
CANTON	S103774467	CANTON WWTP	13TH & SUPERIOR ST		SPILLS
CANTON	S105484566	CANTON CITY	MT VERNON BLVD & OVERBROOK		SPILLS
CANTON	S105484604	CANTON AUTO REPAIR AND TOWING	32 ND ST MW @ OVERBROOK		SPILLS
CANTON	U004093371	HY-WAY INC STATION #671	5158 W TUSCARAWAS HWY	44708	LUST,UST

CDF013067

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 05/08/2012
Date Data Arrived at EDR: 05/10/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 5

Source: EPA
Telephone: N/A
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 03/30/2012
Date Data Arrived at EDR: 04/05/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/30/2012
Date Data Arrived at EDR: 04/05/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 12/27/2011
Date Data Arrived at EDR: 02/27/2012
Date Made Active in Reports: 03/12/2012
Number of Days to Update: 14

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 12/10/2010
Date Data Arrived at EDR: 01/11/2011
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 36

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 12/28/2011
Date Data Arrived at EDR: 02/27/2012
Date Made Active in Reports: 03/12/2012
Number of Days to Update: 14

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 07/05/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 08/19/2011
Date Data Arrived at EDR: 08/31/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 132

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/15/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/15/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/15/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/15/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/30/2011
Date Data Arrived at EDR: 12/30/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 11

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 06/11/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/30/2011
Date Data Arrived at EDR: 12/30/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 11

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 06/11/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 04/02/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 72

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: Ohio EPA
Telephone: 614-644-2924
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: N/A

DERR: Division of Emergency & Remedial Response's Database

The DERR listings contains sites from all of Ohio that are in the Division of Emergency and Remedial Response (DERR) database, which is an index of sites for which our district offices maintain files. The database is NOT a record of contaminated sites or sites suspected of contamination. Not all sites in the database are contaminated, and a site's absence from the database does not imply that it is uncontaminated.

Date of Government Version: 05/21/2012
Date Data Arrived at EDR: 05/23/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 34

Source: Ohio EPA, Div. of Emergency and Remedial Response
Telephone: 614-644-3538
Last EDR Contact: 05/21/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Semi-Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Licensed Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 04/16/2012
Date Made Active in Reports: 05/17/2012
Number of Days to Update: 31

Source: Ohio Environmental Protection Agency
Telephone: 614-644-2621
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Annually

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank File

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 04/27/2012
Date Data Arrived at EDR: 05/23/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 34

Source: Department of Commerce
Telephone: 614-752-8200
Last EDR Contact: 05/23/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Quarterly

UNREG LTANKS: Ohio Leaking UST File

A suspected or confirmed release of petroleum from a non-regulated UST.

Date of Government Version: 08/25/1999
Date Data Arrived at EDR: 08/19/2003
Date Made Active in Reports: 08/26/2003
Number of Days to Update: 7

Source: Department of Commerce
Telephone: 614-752-7938
Last EDR Contact: 08/01/2003
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 08/19/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 25

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 02/07/2012
Date Data Arrived at EDR: 02/17/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 88

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 04/23/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 05/09/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 62

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/01/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 05/07/2012
Date Data Arrived at EDR: 05/08/2012
Date Made Active in Reports: 07/10/2012
Number of Days to Update: 63

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 05/25/2012
Date Data Arrived at EDR: 05/25/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 12/14/2011
Date Data Arrived at EDR: 12/15/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 26

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

UST: Underground Storage Tank Tank File
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 01/25/2012
Date Data Arrived at EDR: 01/25/2012
Date Made Active in Reports: 03/14/2012
Number of Days to Update: 49

Source: Department of Commerce
Telephone: 614-752-8200
Last EDR Contact: 06/29/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/12/2012
Date Data Arrived at EDR: 05/02/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 75

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/01/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 08/19/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 25

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 05/07/2012
Date Data Arrived at EDR: 05/08/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 69

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Quarterly

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 12/14/2011
Date Data Arrived at EDR: 12/15/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 26

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/28/2012
Date Data Arrived at EDR: 02/29/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 76

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 11/28/2011
Date Data Arrived at EDR: 11/29/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 42

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Quarterly

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 02/07/2012
Date Data Arrived at EDR: 02/17/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 88

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/10/2011
Date Data Arrived at EDR: 05/11/2011
Date Made Active in Reports: 06/14/2011
Number of Days to Update: 34

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 04/23/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Semi-Annually

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/12/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

ENG CONTROLS: Sites with Engineering Controls

A database that tracks properties with engineering controls.

Date of Government Version: 05/15/2012
Date Data Arrived at EDR: 05/16/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 41

Source: Ohio EPA
Telephone: 614-644-2306
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Semi-Annually

INST CONTROL: Sites with Institutional Engineering Controls

A database that tracks properties with institutional controls.

Date of Government Version: 05/15/2012
Date Data Arrived at EDR: 05/16/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 41

Source: Ohio Environmental Protection Agency
Telephone: 614-644-2306
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Semi-Annually

HIST INST CONTROLS: Institutional Controls Database

"Institutional control" is a restriction that is recorded in the same manner as a deed which limits access to or use of the property such that exposure to hazardous substances or petroleum are effectively and reliably eliminated or mitigated. Examples of institutional controls include land and water use restrictions. This database is no longer updated or maintained by the state agency.

Date of Government Version: 05/10/2005
Date Data Arrived at EDR: 04/06/2006
Date Made Active in Reports: 05/04/2006
Number of Days to Update: 28

Source: Ohio EPA
Telephone: 614-644-2306
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

HIST ENG CONTROLS: Operation & Maintenance Agreements Database

Volunteers that complete a voluntary action that relies on the ongoing operation and maintenance (O&M) of an engineered control to make the site protective (e.g" cap systems and ground water treatment systems) must enter into a legally binding agreement with the Ohio EPA before the director issues a covenant not to sue. This O&M Agreement must describe how the remedy is constructed and how itwill be monitored, maintained and repaired. It also lays out inspection opportunities for the agency. Companies must document that they have the financial capability to operate any remedy relied on, before the agency will agree to enter into the O&M Agreement. The statute requires that the agency be notified of any change in ownership. This database is no longer updated or maintained by the state agency.

Date of Government Version: 05/10/2005
Date Data Arrived at EDR: 04/04/2006
Date Made Active in Reports: 05/04/2006
Number of Days to Update: 30

Source: Ohio EPA
Telephone: 614-644-2306
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

State and tribal voluntary cleanup sites

VCP: Voluntary Action Program Sites
Site involved in the Voluntary Action Program.

Date of Government Version: 05/15/2012
Date Data Arrived at EDR: 05/16/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 41

Source: Ohio EPA, Voluntary Action Program
Telephone: 614-728-1298
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Semi-Annually

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 02/17/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 42

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Ohio Brownfield Inventory
A statewide brownfields inventory. A brownfield is an abandoned, idled or under-used industrial or commercial property where expansion or redevelopment is complicated by known or potential releases of hazardous substances and/or petroleum.

Date of Government Version: 03/21/2012
Date Data Arrived at EDR: 03/22/2012
Date Made Active in Reports: 03/28/2012
Number of Days to Update: 6

Source: Ohio EPA
Telephone: 614-644-3748
Last EDR Contact: 06/20/2012
Next Scheduled EDR Contact: 10/01/2012
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/27/2011
Date Data Arrived at EDR: 06/27/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 06/25/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 07/03/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: No Update Planned

SWRCY: Recycling Facility Listing
A listing of recycling facility locations.

Date of Government Version: 04/16/2012
Date Data Arrived at EDR: 04/17/2012
Date Made Active in Reports: 05/11/2012
Number of Days to Update: 24

Source: Ohio EPA
Telephone: 614-728-5357
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

HIST LF: Old Solid Waste Landfill
A list of about 1200 old abandoned dumps or landfills. This database was developed from Ohio EPA staff notebooks and other information dating from the mid-1970s

Date of Government Version: 01/01/1980
Date Data Arrived at EDR: 07/01/2003
Date Made Active in Reports: 07/17/2003
Number of Days to Update: 16

Source: Ohio EPA
Telephone: 614-644-3749
Last EDR Contact: 06/26/2003
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 05/07/2012
Next Scheduled EDR Contact: 08/20/2012
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 03/16/2012
Date Data Arrived at EDR: 06/12/2012
Date Made Active in Reports: 07/16/2012
Number of Days to Update: 34

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 06/04/2012
Next Scheduled EDR Contact: 09/17/2012
Data Release Frequency: Quarterly

CDL: Clandestine Drug Lab Locations
A list of clandestine drug lab sites with environmental impact. This list is extracted from the SPILLS database based on the "product" type.

Date of Government Version: 06/07/2012
Date Data Arrived at EDR: 06/07/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 19

Source: Ohio EPA
Telephone: 614-644-2080
Last EDR Contact: 05/29/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Lists of Registered Storage Tanks

ARCHIVE UST: Archived Underground Storage Tank Sites
Underground storage tank records that have been removed from the Underground Storage Tank database.

Date of Government Version: 01/25/2012
Date Data Arrived at EDR: 01/25/2012
Date Made Active in Reports: 03/14/2012
Number of Days to Update: 49

Source: Department of Commerce, Division of State Fire Marshal
Telephone: 614-752-7938
Last EDR Contact: 06/29/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/16/2012
Date Data Arrived at EDR: 03/26/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 80

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

LUCIS: Land Use Control Information System
LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 05/21/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 04/01/2012
Date Data Arrived at EDR: 04/03/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 72

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Annually

SPILLS: Emergency Response Database
Incidents reported to the Emergency Response Unit. The focus of the ER program is to minimize the impact on the environment from accidental releases, spills, and unauthorized discharges from any fixed or mobile sources. Incidents involving petroleum products, hazardous materials, hazardous waste, abandoned drums, or other materials which may pose as a poliution threat to the state?s water, land, or air should be reported immediately. Not all incidents included in the database are actual SPILLS, they can simply be reported incidents.

Date of Government Version: 06/07/2012
Date Data Arrived at EDR: 06/07/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 19

Source: Ohio EPA
Telephone: 614-644-2084
Last EDR Contact: 05/29/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Varies

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/15/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/29/2011
Date Data Arrived at EDR: 08/09/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 94

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 05/08/2012
Next Scheduled EDR Contact: 08/20/2012
Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 04/16/2012
Next Scheduled EDR Contact: 07/30/2012
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites
The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 06/11/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/01/2011
Date Data Arrived at EDR: 01/25/2012
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 36

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 06/27/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 02/27/2012
Date Data Arrived at EDR: 03/14/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 92

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 06/13/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 05/29/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/18/2011
Date Data Arrived at EDR: 09/08/2011
Date Made Active in Reports: 09/29/2011
Number of Days to Update: 21

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 06/05/2012
Next Scheduled EDR Contact: 09/17/2012
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 09/01/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 131

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 05/29/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 06/29/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 05/23/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 05/23/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/30/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 06/21/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 11/01/2010
Date Data Arrived at EDR: 11/10/2010
Date Made Active in Reports: 02/16/2011
Number of Days to Update: 98

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 04/17/2012
Next Scheduled EDR Contact: 07/30/2012
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/21/2011
Date Data Arrived at EDR: 07/15/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 60

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 06/11/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 01/10/2012
Date Data Arrived at EDR: 01/12/2012
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 49

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/11/2012
Next Scheduled EDR Contact: 10/22/2012
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 10/23/2011
Date Data Arrived at EDR: 12/13/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 79

Source: EPA
Telephone: (312) 353-2000
Last EDR Contact: 06/12/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 03/01/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 62

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: 09/10/2012
Data Release Frequency: Biennially

TOWNGAS: DERR Towngas Database

The database includes 82 very old sites (circa 1895) which produced gas from coal for street lighting. Most visual evidence of these sites has disappeared, however the potential for buried coal tar remains. The database is no longer in active use.

Date of Government Version: 07/28/1992
Date Data Arrived at EDR: 02/21/2003
Date Made Active in Reports: 03/05/2003
Number of Days to Update: 12

Source: Ohio EPA
Telephone: 614-644-3749
Last EDR Contact: 02/12/2003
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

UIC: Underground Injection Wells Listing

A listing of underground injection well locations.

Date of Government Version: 02/21/2012
Date Data Arrived at EDR: 02/22/2012
Date Made Active in Reports: 03/30/2012
Number of Days to Update: 37

Source: Ohio EPA
Telephone: 614-644-2752
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Varies

DRYCLEANERS: Drycleaner Facility Listing

A listing of drycleaner facility locations.

Date of Government Version: 03/19/2012
Date Data Arrived at EDR: 03/22/2012
Date Made Active in Reports: 03/28/2012
Number of Days to Update: 6

Source: Ohio EPA
Telephone: 614-644-3469
Last EDR Contact: 06/18/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Varies

NPDES: NPDES General Permit List

General information regarding NPDES (National Pollutant Discharge Elimination System) permits.

Date of Government Version: 05/15/2012
Date Data Arrived at EDR: 05/16/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 41

Source: Ohio EPA
Telephone: 614-644-2031
Last EDR Contact: 05/16/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Semi-Annually

AIRS: Title V Permits Listing

A listing of Title V Permits issued by the Division of Air Pollution Control. It is a federal operating permit program adopted and implemented by the state. The basic program elements typically specify that major sources will submit an operating application to the specified state environmental regulatory agency according to a schedule.

Date of Government Version: 04/09/2012
Date Data Arrived at EDR: 04/10/2012
Date Made Active in Reports: 05/17/2012
Number of Days to Update: 37

Source: Ohio EPA
Telephone: 614-644-2270
Last EDR Contact: 06/22/2012
Next Scheduled EDR Contact: 10/08/2012
Data Release Frequency: Varies

USD: Urban Setting Designation Sites

A USD may be requested for properties participating in the VAP when there is no current or future use of the ground water by local residents for drinking, showering, bathing or cooking. In these areas, an approved USD would lower the cost of cleanup and promote economic redevelopment while still protecting public health and safety. If these USDs were to be approved, the ground water cleanup or response requirements for the areas could be lessened. The Ohio EPA director may approve a USD request based on a demonstration that the USD requirements are met and an evaluation of existing and future uses of ground water in the area. The Ohio EPA director's decision on approval or denial of the request is needed before cleanup requirements for the site can be determined.

Date of Government Version: 05/15/2012
Date Data Arrived at EDR: 05/16/2012
Date Made Active in Reports: 06/26/2012
Number of Days to Update: 41

Source: Ohio EPA
Telephone: 614-644-3749
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Varies

HIST USD: Urban Setting Designations Database

A USD may be requested for properties participating in the VAP when there is no current or future use of the ground water by local residents for drinking, showering, bathing or cooking. In these areas, an approved USD would lower the cost of cleanup and promote economic redevelopment while still protecting public health and safety. If these USDs were to be approved, the ground water cleanup or response requirements for the areas could be lessened. The Ohio EPA director may approve a USD request based on a demonstration that the USD requirements are met and an evaluation of existing and future uses of ground water in the area. The Ohio EPA director's decision on approval or denial of the request is needed before cleanup requirements for the site can be determined. This database is no longer updated or maintained by the state agency.

Date of Government Version: 05/10/2005
Date Data Arrived at EDR: 04/25/2006
Date Made Active in Reports: 05/11/2006
Number of Days to Update: 16

Source: Ohio EPA
Telephone: 614-644-3749
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 04/16/2012
Next Scheduled EDR Contact: 07/30/2012
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 04/23/2012
Next Scheduled EDR Contact: 08/06/2012
Data Release Frequency: Varies

FINANCIAL ASSURANCE: Financial Assurance Information Listing
Financial assurance information.

Date of Government Version: 01/17/2012
Date Data Arrived at EDR: 01/17/2012
Date Made Active in Reports: 01/30/2012
Number of Days to Update: 13

Source: Ohio EPA
Telephone: 614-644-2955
Last EDR Contact: 07/09/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Site Listing
A listing of coal ash disposal site locations.

Date of Government Version: 02/07/2012
Date Data Arrived at EDR: 02/17/2012
Date Made Active in Reports: 03/28/2012
Number of Days to Update: 40

Source: Ohio EPA
Telephone: 614-644-2134
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

CRO: Cessation of Regulated Operations Facility Listing
"Cessation of Regulated Operations" means the discontinuation or termination of regulated operations or the finalizing of any transaction or proceeding through which those operations are discontinued. "Regulated Operations" means the production, use, storage or handling of regulated substances.

Date of Government Version: 06/17/2011
Date Data Arrived at EDR: 08/23/2011
Date Made Active in Reports: 09/27/2011
Number of Days to Update: 35

Source: Ohio EPA
Telephone: 614-644-3065
Last EDR Contact: 05/18/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 07/16/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: Varies

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 02/27/2012
Date Data Arrived at EDR: 04/04/2012
Date Made Active in Reports: 05/15/2012
Number of Days to Update: 41

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 07/02/2012
Next Scheduled EDR Contact: 10/15/2012
Data Release Frequency: Quarterly

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 04/16/2012
Next Scheduled EDR Contact: 07/30/2012
Data Release Frequency: N/A

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 03/31/2012
Date Data Arrived at EDR: 05/17/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 28

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 05/15/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Quarterly

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 05/24/2012
Date Data Arrived at EDR: 06/05/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 9

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 05/21/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Quarterly

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 05/04/2012
Next Scheduled EDR Contact: 08/13/2012
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/12/2012
Next Scheduled EDR Contact: 09/24/2012
Data Release Frequency: Varies

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 05/18/2012
Next Scheduled EDR Contact: 08/27/2012
Data Release Frequency: Varies

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Historical Auto Stations: EDR Proprietary Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Historical Cleaners: EDR Proprietary Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 05/21/2012
Date Data Arrived at EDR: 05/22/2012
Date Made Active in Reports: 05/31/2012
Number of Days to Update: 9

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 05/22/2012
Next Scheduled EDR Contact: 09/03/2012
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 07/20/2011
Date Made Active in Reports: 08/11/2011
Number of Days to Update: 22

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 04/17/2012
Next Scheduled EDR Contact: 07/30/2012
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 05/01/2012
Date Data Arrived at EDR: 05/09/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 36

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 05/09/2012
Next Scheduled EDR Contact: 08/20/2012
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 04/27/2012
Date Made Active in Reports: 06/05/2012
Number of Days to Update: 39

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 04/23/2012
Next Scheduled EDR Contact: 08/06/2012
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 06/24/2011
Date Made Active in Reports: 06/30/2011
Number of Days to Update: 6

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 02/27/2012
Next Scheduled EDR Contact: 06/11/2012
Data Release Frequency: Annually

VT MANIFEST: Hazardous Waste Manifest Data
Hazardous waste manifest information.

Date of Government Version: 05/11/2012
Date Data Arrived at EDR: 05/24/2012
Date Made Active in Reports: 06/14/2012
Number of Days to Update: 21

Source: Department of Environmental Conservation
Telephone: 802-241-3443
Last EDR Contact: 04/23/2012
Next Scheduled EDR Contact: 08/06/2012
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2010
Date Data Arrived at EDR: 08/19/2011
Date Made Active in Reports: 09/15/2011
Number of Days to Update: 27

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 07/16/2012
Next Scheduled EDR Contact: 10/01/2012
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Child Day Care Facilities
Source: Department of Job & Family Services
Telephone: 614-466-6282

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Department of Natural Resources
Telephone: 614-265-1044

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

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GEOCHECK®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OH 44706

TARGET PROPERTY COORDINATES

Latitude (North):	40.7824 - 40° 46' 56.64"
Longitude (West):	81.4318 - 81° 25' 54.48"
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	463564.8
UTM Y (Meters):	4514480.0
Elevation:	1058 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	40081-G4 CANTON WEST, OH
Most Recent Revision:	1994

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

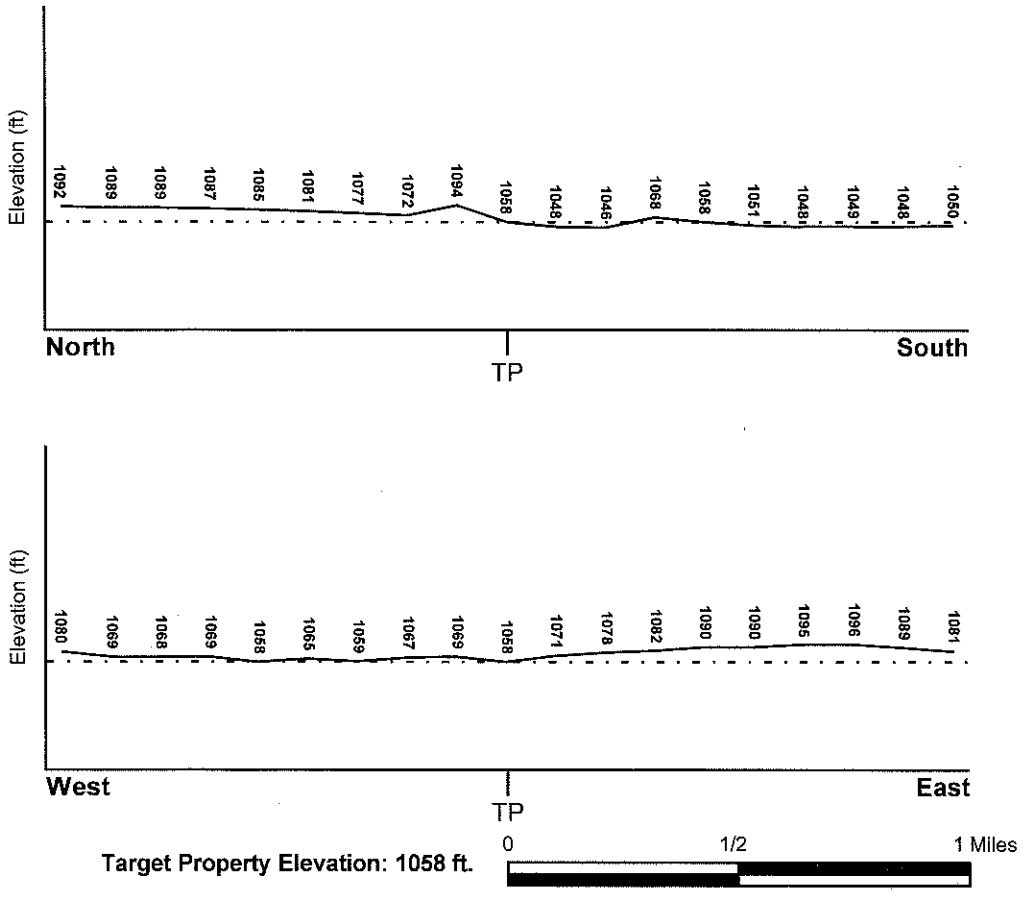
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General SSW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
STARK, OH	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property:	3907800100B - FEMA Q3 Flood data
Additional Panels in search area:	3905120005B - FEMA Q3 Flood data 3907800115B - FEMA Q3 Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
CANTON WEST	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era:	Paleozoic
System:	Pennsylvanian
Series:	Atokan and Morrowan Series
Code:	PP1 *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name:	CHILI
Soil Surface Texture:	loam
Hydrologic Group:	Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.
Soil Drainage Class:	Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel:	LOW
Depth to Bedrock Min:	> 60 inches
Depth to Bedrock Max:	> 60 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	9 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 2.00 Min: 0.60	Max: 7.30 Min: 4.50
2	9 inches	35 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 6.00 Min: 2.00	Max: 6.50 Min: 4.50
3	35 inches	54 inches	very gravelly - sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 6.00 Min: 2.00	Max: 6.50 Min: 5.10
4	54 inches	60 inches	stratified	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean Gravels, Well-graded gravel.	Max: 20.00 Min: 6.00	Max: 7.80 Min: 5.10

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: gravelly - loam
muck
silt loam

Surficial Soil Types: gravelly - loam
muck
silt loam

Shallow Soil Types: silty clay loam
silt loam
very gravelly - sandy loam

Deeper Soil Types: muck
loam
silt loam
gravelly - loamy sand
unweathered bedrock

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
D16	OH7607112	1/2 - 1 Mile SSE

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

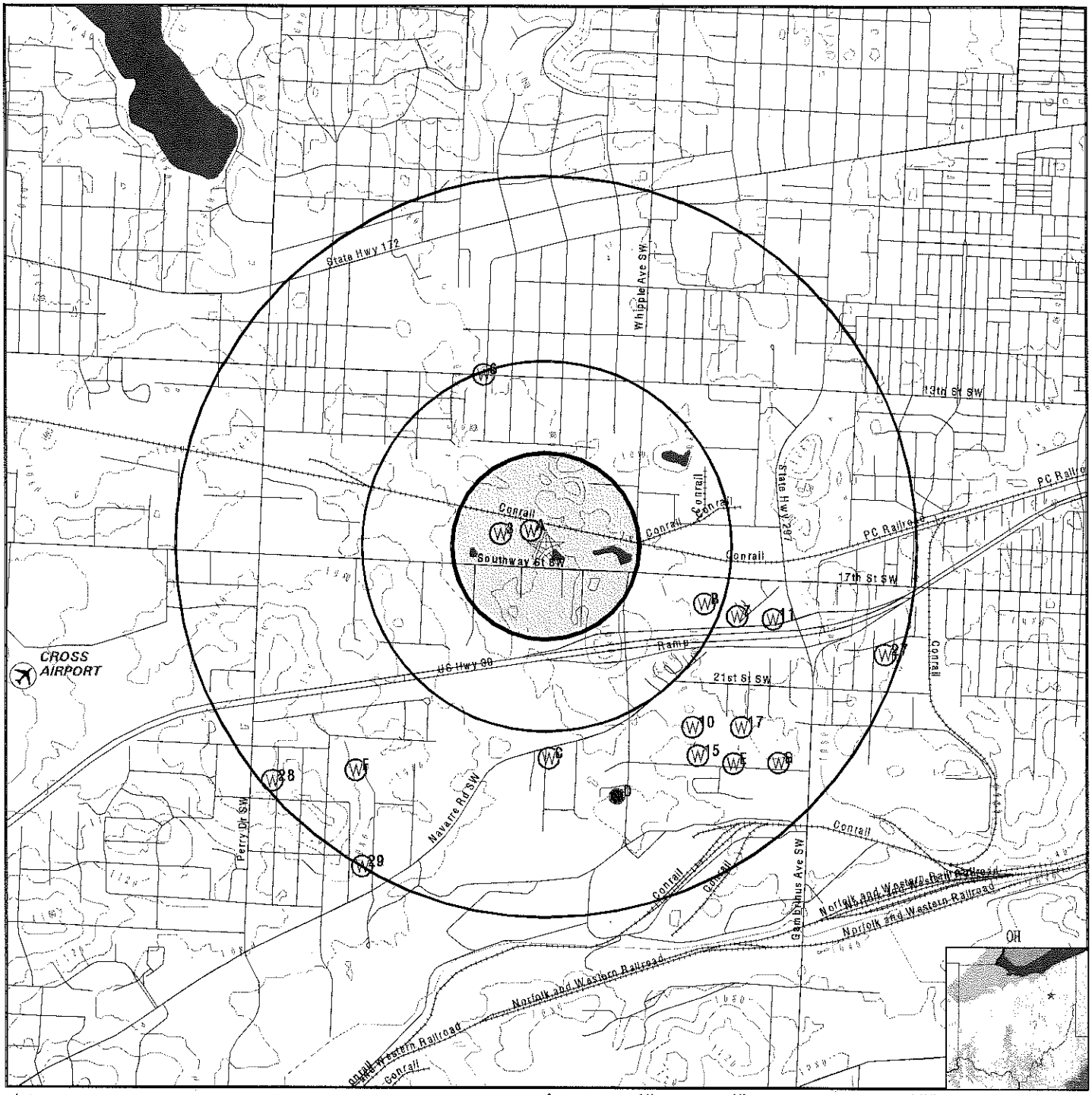
MAP ID	WELL ID	LOCATION FROM TP
A1	OHPW50000004181	0 - 1/8 Mile NW
A2	OHWT30000002650	0 - 1/8 Mile NW
3	OHPW50000004179	1/8 - 1/4 Mile WNW
B4	OHD500000815236	1/4 - 1/2 Mile ESE
B5	OHD500000815235	1/4 - 1/2 Mile ESE
6	OHD500000750581	1/4 - 1/2 Mile NNW
7	OHWT30000002622	1/2 - 1 Mile ESE
C8	OHWT30000002595	1/2 - 1 Mile South
C9	OHPW50000004103	1/2 - 1 Mile South
10	OHD500000807162	1/2 - 1 Mile SE
11	OHPW50000004142	1/2 - 1 Mile ESE
D12	OHPW50000004093	1/2 - 1 Mile SSE
D13	OHWT30000002587	1/2 - 1 Mile SSE
D14	OHPW50000004092	1/2 - 1 Mile SSE
15	OHD500000807161	1/2 - 1 Mile SE
17	OHD500000807160	1/2 - 1 Mile SE
D18	OHPW50000004086	1/2 - 1 Mile SSE
E19	OHD500000807159	1/2 - 1 Mile SE
E20	OHD500000763413	1/2 - 1 Mile SE
F21	OHWT30000002591	1/2 - 1 Mile SW

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
F22	OHPW50000004098	1/2 - 1 Mile SW
G23	OHD500000808358	1/2 - 1 Mile SE
G24	OHD500000808357	1/2 - 1 Mile SE
G25	OHD500000808359	1/2 - 1 Mile SE
G26	OHD500000808356	1/2 - 1 Mile SE
27	OHD500000805197	1/2 - 1 Mile ESE
28	OHD500000674528	1/2 - 1 Mile SW
29	OHD500000657244	1/2 - 1 Mile SSW

PHYSICAL SETTING SOURCE MAP - 3368308.2s



0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- Airports
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- Indeterminate Groundwater Flow at Location
- Groundwater Flow Varies at Location

SITE NAME:	Canton Drop Forge	CLIENT:	ENVIRON International Corporation
ADDRESS:	4575 Southway Street Canton OH 44706	CONTACT:	Meghna Nooyi
		INQUIRY #:	3368308.2s
LAT/LONG:	40.7824 / 81.4318	DATE:	July 16, 2012 7:41 pm

CDF013097

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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

	Database	EDR ID Number
A1 **NW** **0 - 1/8 Mile** **Higher**	**OH WELLS**	**OHPW50000004181**

Objectid:	5674		
County:	STARK	Pwsid:	OH7655412
Well num:	18609		
Well name:	CANTON DROP FORGE WELL 0002		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	09/25/2001
Wl status:	Active	Sys status:	Active
Sys name:	CANTON DROP FORGE	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.782974		
Longitude:	-81.432323		
Accuracy:	50		
Ll colmeth:	INTERPOLATION - PHOTO		
Hdatum:	NAD 83		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (OTHER)		
Site id:	OHPW50000004181		

A2 **NW** **0 - 1/8 Mile** **Higher**	**OH WELLS**	**OHWT30000002650**

County:	STARK	Pwsid:	OH7655412
Wtp num:	7726	Wtp name:	CANTON DROP FORGE STU 2
Tp avail:	PERMANENT	Wtr type:	ground water
Wtpdsn cap:	10850		
Notreat in:	Not Reported	Wtr body n:	Not Reported
Wtp status:	Active	Sys status:	Active
Sys name:	CANTON DROP FORGE	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water	First name:	KEITH J.
Last name:	HOUSEKNECHT	Title:	Not Reported
Address1:	4575 SOUTHWAY STREET SW		
Address2:	PO BOX 6902		
City:	CANTON	State:	OH
Zip:	44706-0902	Phone:	330-477-4511
Emg phone:	Not Reported		
Latitude:	40.783056		
Longitude:	-81.432778		
Accuracy:	25		
Ll colmeth:	INTERPOLATION - PHOTO		
Hdatum:	NAD 27		
Verify met:	VERIFIED, UNKNOWN METHOD		
Site id:	OHWT30000002650		

---

3 **WNW** **1/8 - 1/4 Mile** **Higher**	**OH WELLS**	**OHPW50000004179**

Objectid:	5673		
County:	STARK	Pwsid:	OH7655412
Well num:	18608		
Well name:	CANTON DROP FORGE WELL 0001		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	10/15/1999
Wl status:	Active	Sys status:	Active
Sys name:	CANTON DROP FORGE	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.782889		
Longitude:	-81.434105		
Accuracy:	50		
Ll colmeth:	INTERPOLATION - PHOTO		
Hdatum:	NAD 83		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (OTHER)		
Site id:	OHPW50000004179		

B4
ESE
1/4 - 1/2 Mile
Higher

OH WELLS **OHD500000815236**

Well log n:	2014766		
Well type :	W		
End user i:	795		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	VAN-KAY INC.
Drill type:	RO	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	4124		
St name:	SOUTHWAY	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Well Loc Desc:	MW-5		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.7802		
Longitude:	-81.42391		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	2		
Screen len:	10		

Total dept:	69		
Date of co:	01/07/2008	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	69		
Screened 1:	59		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000815236		

B5
ESE
1/4 - 1/2 Mile
Higher

OH WELLS **OHD500000815235**

Well log n:	2014765		
Well type :	W		
End user i:	795		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	VAN-KAY INC.
Drill type:	RO	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	4124		
St name:	SOUTHWAY	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Well Loc Desc:	MS-6		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		

Vert acc u:	Not Reported		
Latitude:	40.78		
Longitude:	-81.42373		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	10		
Total dept:	69		
Date of co:	01/07/2008	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	69		
Screened 1:	59		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000815235		

6
NNW
1/4 - 1/2 Mile
Higher

OH WELLS **OHD500000750581**

Well log n:	157475		
Well type :	W		
End user i:	2329		
Cnty code:	151	Twp code:	2175
Orig owner:	GUST	Orig own 1:	SCHWITZQABLE
Drill type:	Not Reported	Test type :	Not Reported
Well use c:	Not Reported	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	Not Reported		
St no:	4745		
St name:	13TH	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	Not Reported	State code:	OH
Zip:	Not Reported		

Zone code:	S		
Horiz x:	2294907.1		
Horiz y:	1017643.1		
Horiz datu:	NAD27		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	1080		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.78906		
Longitude:	-81.43511		
Source of :	GPS	Flowing we:	N
Test rate:	15		
Draw down:	0		
S water le:	31		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	0		
Total dept:	63		
Date of co:	07/16/1955	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	0		
Screened i:	0		
Screened 1:	0		
Sustained :	0		
Attatch st:	\\NRAS1\		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	1049		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000750581		

7
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHWT30000002622**

County:	STARK	Pwsid:	OH7646812
Wtp num:	7681	Wtp name:	MUSICAL INN
Tp avail:	PERMANENT	Wtr type:	ground water
Wtpdsn cap:	250		
Notreat in:	Not Reported	Wtr body n:	Not Reported
Wtp status:	Active	Sys status:	Active
Sys name:	MUSICAL INN	Sys type:	Transient Non-Community water systems
Src type:	ground water	First name:	LOUANN
Last name:	SMITH	Title:	OWNER
Address1:	4001 Navarre Rd SW		
Address2:	Not Reported		

City:	CANTON	State:	OH
Zip:	44706	Phone:	330-904-1853
Emg phone:	Not Reported		
Latitude:	40.779667		
Longitude:	-81.421981		
Accuracy:	1		
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED		
Hdatum:	NAD 27		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHWT30000002622		

C8
South
1/2 - 1 Mile
Lower

OH WELLS **OHWT30000002595**

County:	STARK	Pwsid:	OH7603412
Wtp num:	7564	Wtp name:	WHISPERING OAKS MHP
Tp avail:	PERMANENT	Wtr type:	ground water
Wtpdsn cap:	17100		
Notreat in:	Not Reported	Wtr body n:	Not Reported
Wtp status:	Active	Sys status:	Active
Sys name:	WHISPERING OAKS MHP	Sys type:	Community
Src type:	ground water	First name:	ALAINA
Last name:	WESTFALL	Title:	PARK MANAGER
Address1:	4516 Navarre Road SW		
Address2:	Not Reported		
City:	CANTON	State:	OH
Zip:	44706	Phone:	330-268-9458
Emg phone:	330-268-9458		
Latitude:	40.774178		
Longitude:	-81.432244		
Accuracy:	5		
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED		
Hdatum:	NAD 27		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHWT30000002595		

C9
South
1/2 - 1 Mile
Lower

OH WELLS **OHPW50000004103**

Objectid:	5511		
County:	STARK	Pwsid:	OH7603412
Well num:	18369		
Well name:	WHISPERING OAKS MHP WELL 0001		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	10/15/1999
Wl status:	Active	Sys status:	Active
Sys name:	WHISPERING OAKS MHP	Sys type:	Community
Src type:	ground water		
Latitude:	40.774039		
Longitude:	-81.431069		

Accuracy:	5
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED
Hdatum:	WGS 84
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)
Site id:	OHPW50000004103

10
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000807162**

Well log n:	1008764		
Well type :	W		
End user i:	4214		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	CEC
Drill type:	Not Reported	Test type :	Not Reported
Well use c:	M	Aquifer ty:	Not Reported
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	4015		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77528		
Longitude:	-81.42444		
Source of :	Not Reported	Flowing we:	Not Reported
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	15		
Total dept:	55		
Date of co:	02/01/2008	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	40		
Screened 1:	55		

Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000807162		

11
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHPW50000004142**

Objectid:	5720		
County:	STARK	Pwsid:	OH7664812
Well num:	18698		
Well name:	ELDORADO LANES WELL 0001		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	05/14/2009
Wl status:	Active	Sys status:	Active
Sys name:	ELDORADO LANES	Sys type:	Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.779565		
Longitude:	-81.420126		
Accuracy:	500		
Ll colmeth:	INTERPOLATION - MAP		
Hdatum:	NAD 27		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (OTHER)		
Site id:	OHPW50000004142		

D12
SSE
1/2 - 1 Mile
Higher

OH WELLS **OHPW50000004093**

Objectid:	5556		
County:	STARK	Pwsid:	OH7607112
Well num:	18424		
Well name:	DLH PROPERTIES WELL 0001		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	10/15/1999
Wl status:	Active	Sys status:	Active
Sys name:	DLH INDUSTRIES, INC.	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.772822		
Longitude:	-81.428		
Accuracy:	1		
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED		
Hdatum:	WGS 84		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHPW50000004093		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database | EDR ID Number

D13
SSE
1/2 - 1 Mile
Higher

OH WELLS **OHWT30000002587**

County:	STARK	Pwsid:	OH7607112
Wtp num:	7586	Wtp name:	DLH INDUSTRIES INC
Tp avail:	PERMANENT	Wtr type:	ground water
Wtpdsn cap:	8750		
Notreat in:	Not Reported	Wtr body n:	Not Reported
Wtp status:	Active	Sys status:	Active
Sys name:	DLH INDUSTRIES, INC.	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water	First name:	Not Reported
Last name:	Not Reported	Title:	Not Reported
Address1:	2422 Leo Avenue SW		
Address2:	Not Reported		
City:	CANTON	State:	OH
Zip:	44706	Phone:	Not Reported
Emg phone:	Not Reported		
Latitude:	40.772797		
Longitude:	-81.428008		
Accuracy:	1		
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED		
Hdatum:	NAD 27		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHWT30000002587		

D14
SSE
1/2 - 1 Mile
Higher

OH WELLS **OHPW50000004092**

Objectid:	5557		
County:	STARK	Pwsid:	OH7607112
Well num:	18425		
Well name:	DLH PROPERTIES WELL 0002		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	10/15/1999
Wl status:	Active	Sys status:	Active
Sys name:	DLH INDUSTRIES, INC.	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.772781		
Longitude:	-81.428053		
Accuracy:	1		
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED		
Hdatum:	WGS 84		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHPW50000004092		

15
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000807161**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Well log n:	1008765		
Well type :	W		
End user i:	4214		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	CEC
Drill type:	Not Reported	Test type :	Not Reported
Well use c:	M	Aquifer ty:	Not Reported
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	4015		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77417		
Longitude:	-81.42417		
Source of :	Not Reported	Flowing we:	Not Reported
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	15		
Total dept:	49		
Date of co:	02/01/2008	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	34		
Screened 1:	49		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		

Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000807161		

D16
SSE
1/2 - 1 Mile
Higher

FRDS PWS **OH7607112**

Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117996		
Facility name:	Dlh Properties WELL 0001		
Facility type:	Well	Treatment process:	hypochlorination, pre
Treatment objective:	disinfection		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		

Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117998		
Facility name:	Dlh Properties WELL 0002		
Facility type:	Well	Treatment process:	hypochlorination, pre
Treatment objective:	disinfection		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		

Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	118000		
Facility name:	DLH Industries, Inc. P01		
Facility type:	Sampling_station	Treatment process:	hypochlorination, pre
Treatment objective:	disinfection		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	144165		
Facility name:	DLH Industries Inc Well 0003		
Facility type:	Well	Treatment process:	hypochlorination, pre
Treatment objective:	disinfection		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	38446		
Facility name:	DLH Industries Inc		
Facility type:	Treatment_plant	Treatment process:	hypochlorination, pre
Treatment objective:	disinfection		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	72483		
Facility name:	DLH Industries, Inc. Distribution		
Facility type:	Distribution_system_zone	Treatment process:	hypochlorination, pre
Treatment objective:	disinfection		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117996		
Facility name:	Dlh Properties WELL 0001		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117998		
Facility name:	Dlh Properties WELL 0002		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	118000		
Facility name:	DLH Industries, Inc. P01		
Facility type:	Sampling_station	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	144165		
Facility name:	DLH Industries Inc Well 0003		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	38446		
Facility name:	DLH Industries Inc		
Facility type:	Treatment_plant	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	72483		
Facility name:	DLH Industries, Inc. Distribution		
Facility type:	Distribution_system_zone	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117996		
Facility name:	Dlh Properties WELL 0001		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117998		
Facility name:	Dlh Properties WELL 0002		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	118000		
Facility name:	DLH Industries, Inc. P01		
Facility type:	Sampling_station	Treatment process:	innovative
Treatment objective:	other		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	144165		
Facility name:	DLH Industries Inc Well 0003		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	38446		
Facility name:	DLH Industries Inc		
Facility type:	Treatment_plant	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	72483		
Facility name:	DLH Industries, Inc. Distribution		
Facility type:	Distribution_system_zone	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117996		
Facility name:	Dlh Properties WELL 0001		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117998		
Facility name:	Dlh Properties WELL 0002		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	118000		
Facility name:	DLH Industries, Inc. P01		
Facility type:	Sampling_station	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	144165		
Facility name:	DLH Industries Inc Well 0003		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	38446		
Facility name:	DLH Industries Inc		
Facility type:	Treatment_plant	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	72483		
Facility name:	DLH Industries, Inc. Distribution		
Facility type:	Distribution_system_zone	Treatment process:	innovative
Treatment objective:	other		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117996		
Facility name:	Dlh Properties WELL 0001		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117998		
Facility name:	Dlh Properties WELL 0002		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	118000		
Facility name:	DLH Industries, Inc. P01		
Facility type:	Sampling_station	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	144165		
Facility name:	DLH Industries Inc Well 0003		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	38446		
Facility name:	DLH Industries Inc		
Facility type:	Treatment_plant	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	72483		
Facility name:	DLH Industries, Inc. Distribution		
Facility type:	Distribution_system_zone	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117996		
Facility name:	Dlh Properties WELL 0001		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	117998		
Facility name:	Dlh Properties WELL 0002		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	118000		
Facility name:	DLH Industries, Inc. P01		
Facility type:	Sampling_station	Treatment process:	innovative
Treatment objective:	other		

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	144165		
Facility name:	DLH Industries Inc Well 0003		
Facility type:	Well	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	38446		
Facility name:	DLH Industries Inc		
Facility type:	Treatment_plant	Treatment process:	innovative
Treatment objective:	other		
Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		
Pwsid:	OH7607112	Epa region:	05
State:	OH	County:	Stark
Pws name:	DLH Industries, Inc.		
Population Served:	250	Pwssvcconn:	16
PWS Source:	Groundwater		
Pws type:	NTNCWS		
Status:	Active	Owner type:	Private
Facility id:	72483		
Facility name:	DLH Industries, Inc. Distribution		
Facility type:	Distribution_system_zone	Treatment process:	innovative
Treatment objective:	other		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Contact name:	Jim Mathie		
Original name:	DLH Industries, Inc.		
Contact phone:	Not Reported	Contact address1:	2422 Leo Avenue SW
Contact address2:	P O Box 6030		
Contact city:	Canton		
Contact zip:	44706		

PWS ID:	OH7607112		
Date Initiated:	Not Reported	Date Deactivated:	Not Reported
PWS Name:	DLH PROPERTIES MR LEE RANDOLPH 2422 LEO AVE SW,PO BOX 6030 CANTON, OH 44706		

Addressee / Facility:	Not Reported		
Facility Latitude:	40 46 21.0000	Facility Longitude:	81 25 42.0000
City Served:	Not Reported		
Treatment Class:	Treated	Population:	25

PWS currently has or had major violation(s) or enforcement: YES

VIOLATIONS INFORMATION:

Violation ID:	9400441	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	01/01/94	Vio. end Date:	01/31/94	Vio. Period:	001 Months
Num required Samples:	Not Reported	Number of Samples Taken:		Not Reported	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Routine Minor (TCR)				
Contaminant:	COLIFORM (TCR)				
Vio. Awareness Date:	Not Reported				

Violation ID:	9400201	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	12/01/93	Vio. end Date:	12/31/93	Vio. Period:	001 Months
Num required Samples:	Not Reported	Number of Samples Taken:		Not Reported	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	MCL, Acute (TCR)				
Contaminant:	COLIFORM (TCR)				
Vio. Awareness Date:	Not Reported				

Violation ID:	9400202	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	12/01/93	Vio. end Date:	12/31/93	Vio. Period:	001 Months
Num required Samples:	Not Reported	Number of Samples Taken:		Not Reported	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Repeat Minor (TCR)				
Contaminant:	COLIFORM (TCR)				
Vio. Awareness Date:	Not Reported				

Violation ID:	9224978	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	09/01/91	Vio. end Date:	11/30/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	8 REGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9224979	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	09/01/91	Vio. end Date:	11/30/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	15 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9224980	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	09/01/91	Vio. end Date:	11/30/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	36 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9224981	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	12/01/91	Vio. end Date:	02/29/92	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	8 REGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9224982	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	12/01/91	Vio. end Date:	02/29/92	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	15 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9224983	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	12/01/91	Vio. end Date:	02/29/92	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	36 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9124972	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	03/01/91	Vio. end Date:	05/31/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	8 REGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9124973	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	03/01/91	Vio. end Date:	05/31/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	15 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9124974	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	03/01/91	Vio. end Date:	05/31/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	36 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9124975	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	06/01/91	Vio. end Date:	08/31/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	8 REGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9124976	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	06/01/91	Vio. end Date:	08/31/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	15 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

Violation ID:	9124977	Source ID:	Not Reported	PWS Phone:	Not Reported
Vio. beginning Date:	06/01/91	Vio. end Date:	08/31/91	Vio. Period:	003 Months
Num required Samples:	000	Number of Samples Taken:		000	
Analysis Result:	Not Reported	Maximum Contaminant Level:		Not Reported	
Analysis Method:	Not Reported				
Violation Type:	Monitoring, Regular				
Contaminant:	36 UNREGULATED PHASE I VOCS				
Vio. Awareness Date:	Not Reported				

ENFORCEMENT INFORMATION:

Truedate:	03/31/2009	Pwsid:	OH7607112
Pwsname:	DLH INDUSTRIES, INC.		
Retpopsrvd:	234	Pwstypecod:	NTNC
Vioid:	1167901	Contaminant:	LEAD & COPPER RULE
Viol. Type:	Follow-up and Routine Tap Sampling		
Complperbe:	1/1/2001 0:00:00		
Complperen:	7/23/2002 0:00:00	Enfdate:	12/11/2001 0:00:00
Enf action:	State Violation/Reminder Notice		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	OH7607112
Pwsname:	DLH INDUSTRIES, INC.		
Retpopsrvd:	234	Pwstypecod:	NTNC
Vioid:	1167901	Contaminant:	LEAD & COPPER RULE
Viol. Type:	Follow-up and Routine Tap Sampling		
Complperbe:	1/1/2001 0:00:00		
Complperen:	7/23/2002 0:00:00	Enfdate:	12/11/2001 0:00:00
Enf action:	State Public Notif Requested		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	OH7607112
Pwsname:	DLH INDUSTRIES, INC.		
Retpopsrvd:	234	Pwstypecod:	NTNC
Vioid:	1167901	Contaminant:	LEAD & COPPER RULE
Viol. Type:	Follow-up and Routine Tap Sampling		
Complperbe:	1/1/2001 0:00:00		
Complperen:	7/23/2002 0:00:00	Enfdate:	4/20/2002 0:00:00
Enf action:	State Public Notif Received		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	OH7607112
Pwsname:	DLH INDUSTRIES, INC.		
Retpopsrvd:	234	Pwstypecod:	NTNC
Vioid:	1167901	Contaminant:	LEAD & COPPER RULE
Viol. Type:	Follow-up and Routine Tap Sampling		
Complperbe:	1/1/2001 0:00:00		
Complperen:	7/23/2002 0:00:00	Enfdate:	7/23/2002 0:00:00
Enf action:	State Compliance Achieved		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	OH7607112
Pwsname:	DLH INDUSTRIES, INC.		
Retpopsrvd:	234	Pwstypecod:	NTNC
Vioid:	9761400	Contaminant:	ASBESTOS
Viol. Type:	3		
Complperbe:	7/1/2000 0:00:00		
Complperen:	12/31/2000 0:00:00	Enfdate:	3/15/2001 0:00:00
Enf action:	State Violation/Reminder Notice		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	OH7607112
Pwsname:	DLH INDUSTRIES, INC.		
Retpopsrvd:	234	Pwstypecod:	NTNC
Vioid:	9761400	Contaminant:	ASBESTOS
Viol. Type:	3		
Complperbe:	7/1/2000 0:00:00		
Complperen:	12/31/2000 0:00:00	Enfdate:	3/15/2001 0:00:00
Enf action:	State Public Notif Requested		
Violmeasur:	Not Reported		

System Name:	DLH Industries, Inc.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	111679		
Enforcement Date:	4/20/2002 0:00:00	Enf. Action:	State Public Notif Received

ENFORCEMENT INFORMATION:

System Name:	DLH Industries, Inc.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	111679		
Enforcement Date:	7/23/2002 0:00:00	Enf. Action:	State Compliance Achieved
System Name:	DLH Industries, Inc.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	111679		
Enforcement Date:	12/11/2001 0:00:00	Enf. Action:	State Public Notif Requested
System Name:	DLH Industries, Inc.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	111679		
Enforcement Date:	12/11/2001 0:00:00	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH INDUSTRIES, INC.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	1167901		
Enforcement Date:	12/11/2001 0:00:00	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH INDUSTRIES, INC.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	1167901		
Enforcement Date:	12/11/2001 0:00:00	Enf. Action:	State Public Notif Requested
System Name:	DLH INDUSTRIES, INC.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	1167901		
Enforcement Date:	4/20/2002 0:00:00	Enf. Action:	State Public Notif Received
System Name:	DLH INDUSTRIES, INC.		
Violation Type:	Follow-up and Routine Tap Sampling		
Contaminant:	LEAD & COPPER RULE		
Compliance Period:	1/1/2001 0:00:00 - 7/23/2002 0:00:00		
Violation ID:	1167901		
Enforcement Date:	7/23/2002 0:00:00	Enf. Action:	State Compliance Achieved
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Minor (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1994-01-01 - 1994-01-31		
Violation ID:	9400441		
Enforcement Date:	1994-02-16	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Minor (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1994-01-01 - 1994-01-31		
Violation ID:	9400441		
Enforcement Date:	1994-02-16	Enf. Action:	State Public Notif Requested

ENFORCEMENT INFORMATION:

System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Minor (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1994-01-01 - 1994-01-31		
Violation ID:	9400441		
Enforcement Date:	1994-02-09	Enf. Action:	State Public Notif Received
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	1,2 DIBROMO-3-CHLOROPROPANE (DBCP)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593295		
Enforcement Date:	1995-06-02	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	1,2 DIBROMO-3-CHLOROPROPANE (DBCP)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593295		
Enforcement Date:	1995-06-02	Enf. Action:	State Public Notif Requested
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	1,2 DIBROMO-3-CHLOROPROPANE (DBCP)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593295		
Enforcement Date:	1995-08-15	Enf. Action:	State Public Notif Received
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	1,2 DIBROMO-3-CHLOROPROPANE (DBCP)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593295		
Enforcement Date:	1995-06-06	Enf. Action:	State Compliance Achieved
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	ETHYLENE DIBROMIDE (EDB)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593296		
Enforcement Date:	1995-06-02	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	ETHYLENE DIBROMIDE (EDB)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593296		
Enforcement Date:	1995-06-02	Enf. Action:	State Public Notif Requested
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	ETHYLENE DIBROMIDE (EDB)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593296		
Enforcement Date:	1995-08-15	Enf. Action:	State Public Notif Received
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Regular		
Contaminant:	ETHYLENE DIBROMIDE (EDB)		
Compliance Period:	1995-01-01 - 1995-03-31		
Violation ID:	9593296		
Enforcement Date:	1995-06-06	Enf. Action:	State Compliance Achieved

ENFORCEMENT INFORMATION:

System Name:	DLH Industries, Inc.		
Violation Type:	3		
Contaminant:	ASBESTOS		
Compliance Period:	7/1/2000 0:00:00 - 12/31/2000 0:00:00		
Violation ID:	97614		
Enforcement Date:	3/15/2001 0:00:00	Enf. Action:	State Public Notif Requested
System Name:	DLH Industries, Inc.		
Violation Type:	3		
Contaminant:	ASBESTOS		
Compliance Period:	7/1/2000 0:00:00 - 12/31/2000 0:00:00		
Violation ID:	97614		
Enforcement Date:	3/15/2001 0:00:00	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH INDUSTRIES, INC.		
Violation Type:	3		
Contaminant:	ASBESTOS		
Compliance Period:	7/1/2000 0:00:00 - 12/31/2000 0:00:00		
Violation ID:	9761400		
Enforcement Date:	3/15/2001 0:00:00	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH INDUSTRIES, INC.		
Violation Type:	3		
Contaminant:	ASBESTOS		
Compliance Period:	7/1/2000 0:00:00 - 12/31/2000 0:00:00		
Violation ID:	9761400		
Enforcement Date:	3/15/2001 0:00:00	Enf. Action:	State Public Notif Requested
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Minor (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1998-05-01 - 1998-05-31		
Violation ID:	98014430		
Enforcement Date:	1998-06-25 S	Enf. Action:	IA
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Minor (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1998-05-01 - 1998-05-31		
Violation ID:	98014430		
Enforcement Date:	1998-06-25 S	Enf. Action:	IE
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Minor (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1998-05-01 - 1998-05-31		
Violation ID:	98014430		
Enforcement Date:	1998-06-29 S	Enf. Action:	IF
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1998-12-01 - 1998-12-31		
Violation ID:	99015517		
Enforcement Date:	1999-01-25	Enf. Action:	State Violation/Reminder Notice
System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1998-12-01 - 1998-12-31		
Violation ID:	99015517		
Enforcement Date:	1999-01-25	Enf. Action:	State Public Notif Requested

ENFORCEMENT INFORMATION:

System Name:	DLH PROPERTIES		
Violation Type:	Monitoring, Routine Major (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	1998-12-01 - 1998-12-31		
Violation ID:	99015517		
Enforcement Date:	1999-02-01	Enf. Action:	State Public Notif Received

CONTACT INFORMATION:

Name:	DLH INDUSTRIES, INC.	Population:	234
Contact:	DLH INDUSTRIES, INC.	Phone:	Not Reported
Address:	2422 Leo Avenue SW		
Address 2:	CANTON		
	OH, 44 330-4		

17
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000807160**

Well log n:	1008766		
Well type :	W		
End user i:	4214		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	CEC
Drill type:	Not Reported	Test type :	Not Reported
Well use c:	M	Aquifer ty:	Not Reported
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	4015		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77528		
Longitude:	-81.42194		
Source of :	Not Reported	Flowing we:	Not Reported
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	15		

Total dept:	49		
Date of co:	02/01/2008	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	34		
Screened 1:	49		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000807160		

D18
SSE
1/2 - 1 Mile
Higher

OH WELLS **OHPW50000004086**

Objectid:	5555		
County:	STARK	Pwsid:	OH7607112
Well num:	18423		
Well name:	DLH INDUSTRIES INC WELL 0003		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	11/26/2001
Wl status:	Active	Sys status:	Active
Sys name:	DLH INDUSTRIES, INC.	Sys type:	Non-Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.772231		
Longitude:	-81.428688		
Accuracy:	25		
Ll colmeth:	INTERPOLATION - PHOTO		
Hdatum:	NAD 83		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHPW50000004086		

E19
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000807159**

Well log n:	1010031		
Well type :	W		
End user i:	4214		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	CEC
Drill type:	Not Reported	Test type :	Not Reported
Well use c:	M	Aquifer ty:	Not Reported
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported

Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	4015		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77417		
Longitude:	-81.42222		
Source of :	Not Reported	Flowing we:	Not Reported
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	15		
Total dept:	49		
Date of co:	02/01/2008	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	34		
Screened 1:	49		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000807159		

E20
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000763413**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Well log n:	2013424		
Well type :	W		
End user i:	795		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	MARATHON PETROLEUM COMPANY
Drill type:	CT	Test type :	B
Well use c:	COM	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	Not Reported		
St no:	0		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	Not Reported		
Well Loc Desc:	WELL #9 REPLACEMENT		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77355		
Longitude:	-81.422467		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	100		
Draw down:	0		
S water le:	42		
S water me:	T	S water 1:	10/18/2007
Cas ht:	0		
Screen len:	20		
Total dept:	117		
Date of co:	10/18/2007	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.095		
Screened i:	115		
Screened 1:	95		
Sustained :	100		
Attatch st:	Not Reported		
Screen dia:	16		
Screen typ:	CONTINOUS WIRE WOUND	Screen mat:	STAINLESS STEEL
Pump type:	TURBINE		
Pump capac:	600		
Pump set a:	85		
Pitless ty:	Not Reported	Pump inst :	FRONTZ DRILLING, INC.
Elev sourc:	Not Reported		
Water leve:	0		

Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000763413		

F21
SW
1/2 - 1 Mile
Higher

OH WELLS **OHWT30000002591**

County:	STARK	Pwsid:	OH7643212
Wtp num:	7663	Wtp name:	CHILDRENS TOY FUND
Tp avail:	PERMANENT	Wtr type:	ground water
Wtpdsn cap:	1000		
Notreat in:	Not Reported	Wtr body n:	Not Reported
Wtp status:	Active	Sys status:	Active
Sys name:	CHILDRENS TOY FUND	Sys type:	Transient Non-Community water systems
Src type:	ground water	First name:	CATHI
Last name:	BOGOVICH	Title:	Not Reported
Address1:	2401 SWISS AVENUE SW		
Address2:	Not Reported		
City:	CANTON	State:	OH
Zip:	44706	Phone:	330-479-5393
Emg phone:	330-418-3222		
Latitude:	40.773561		
Longitude:	-81.441503		
Accuracy:	1		
Ll colmeth:	GPS CODE MEASUREMENTS (PSEUDO RANGE) DIFFERENTIALLY CORRECTED		
Hdatum:	NAD 27		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHWT30000002591		

F22
SW
1/2 - 1 Mile
Higher

OH WELLS **OHPW50000004098**

Objectid:	5627		
County:	STARK	Pwsid:	OH7643212
Well num:	18535		
Well name:	KEN MAR HALL INC WELL 0001		
Dnr wl log:	Not Reported		
Wl avail:	PERMANENT	Act date:	10/15/1999
Wl status:	Active	Sys status:	Active
Sys name:	CHILDRENS TOY FUND	Sys type:	Transient Non-Community water systems
Src type:	ground water		
Latitude:	40.773716		
Longitude:	-81.441835		
Accuracy:	25		
Ll colmeth:	INTERPOLATION - PHOTO		
Hdatum:	NAD 83		
Verify met:	VERIFIED RELATIVE TO MAP FEATURES (1:24,000)		
Site id:	OHPW50000004098		

G23
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000808358**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Well log n:	2017023		
Well type :	W		
End user i:	4221		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	ASHLAND OIL
Drill type:	A	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	3801		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706-2311		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	NAD83		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77403		
Longitude:	-81.41997		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	10		
Total dept:	25		
Date of co:	04/17/2008	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	25		
Screened 1:	15		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		

Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000808358		

G24
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000808357**

Well log n:	2017022		
Well type :	W		
End user i:	4221		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	ASHLAND OIL
Drill type:	A	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	3801		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706-2311		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	NAD83		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77385		
Longitude:	-81.42013		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	10		
Total dept:	27		
Date of co:	04/17/2008	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	27		
Screened 1:	17		

Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000808357		

G25
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000808359**

Well log n:	2017024		
Well type :	W		
End user i:	4221		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	ASHLAND OIL
Drill type:	A	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	3801		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706-2311		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	NAD83		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77409		
Longitude:	-81.41966		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	10		

Total dept:	27		
Date of co:	04/18/2008	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	27		
Screened 1:	17		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000808359		

G26
SE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000808356**

Well log n:	2017021		
Well type :	W		
End user i:	4221		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	ASHLAND OIL
Drill type:	A	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	3801		
St name:	23RD	St type co:	ST
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706-2311		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	NAD83		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	0		
Vert acc:	0		

Vert acc u:	Not Reported		
Latitude:	40.77383		
Longitude:	-81.41964		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	0		
Screen len:	10		
Total dept:	27		
Date of co:	04/16/2008	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.01		
Screened i:	27		
Screened 1:	17		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000808356		

27
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHD500000805197**

Well log n:	2021620		
Well type :	W		
End user i:	795		
Cnty code:	151	Twp code:	475
Orig owner:	Not Reported	Orig own 1:	MARATHON PETROLEUM COMPANY
Drill type:	A	Test type :	Not Reported
Well use c:	M	Aquifer ty:	SGR
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	Not Reported
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	2408		
St name:	GAMBRINUS	St type co:	AVE
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44711		

Well Loc Desc:	90-82R NORTH AREA MIDDLE OF LOT		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	NAD83		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	1086		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.77818		
Longitude:	-81.41434		
Source of :	GLOBAL POSITION SYSTEM	Flowing we:	N
Test rate:	0		
Draw down:	0		
S water le:	0		
S water me:	Not Reported	S water 1:	Not Reported
Cas ht:	2		
Screen len:	15		
Total dept:	30		
Date of co:	02/26/2009	Located in:	Not Reported
Assoc rpt :	N		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	.02		
Screened i:	30		
Screened 1:	15		
Sustained :	0		
Attatch st:	Not Reported		
Screen dia:	2		
Screen typ:	MACHINE SLOTTED	Screen mat:	PVC
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	GLOBAL POSITION SYSTEM		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000805197		

28
SW
1/2 - 1 Mile
Higher

OH WELLS **OHD500000674528**

Well log n:	955284		
Well type :	W		
End user i:	833		
Cnty code:	151	Twp code:	2175
Orig owner:	ANTHONY	Orig own 1:	DEURIO
Drill type:	R	Test type :	O
Well use c:	Not Reported	Aquifer ty:	MUD
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported

Sub no:	Not Reported	Permit no:	20972
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	0		
St dir cod:	SW		
St no:	2347		
St name:	DELAWARE	St type co:	AVE
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Zone code:	Not Reported		
Horiz x:	0		
Horiz y:	0		
Horiz datu:	Not Reported		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	1120		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.773166		
Longitude:	-81.446066		
Source of :	Not Reported	Flowing we:	Not Reported
Test rate:	10		
Draw down:	100		
S water le:	80		
S water me:	G	S water 1:	08/23/2003
Cas ht:	2		
Screen len:	0		
Total dept:	210		
Date of co:	08/23/2003	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	0		
Screened i:	0		
Screened 1:	0		
Sustained :	10		
Attatch st:	Not Reported		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		
Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000674528		

29
SSW
1/2 - 1 Mile
Higher

OH WELLS **OHD500000657244**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Well log n:	952175		
Well type :	W		
End user i:	640		
Cnty code:	151	Twp code:	2175
Orig owner:	ALICE	Orig own 1:	BAKER
Drill type:	CT	Test type :	B
Well use c:	D	Aquifer ty:	SHA
Loc map ye:	Not Reported	Loc area:	Not Reported
Loc no:	0		
Sub name:	Not Reported	Sub map ye:	Not Reported
Sub no:	Not Reported	Permit no:	20748
Sec owner :	Not Reported	Lot no:	Not Reported
Sect no:	32		
St dir cod:	SW		
St no:	2580		
St name:	SWISS	St type co:	AVE
Sec add:	Not Reported		
Sec add no:	0		
City:	CANTON	State code:	OH
Zip:	44706		
Zone code:	S		
Horiz x:	2293219.6		
Horiz y:	1010615.04		
Horiz datu:	NAD27		
Horiz acc :	0		
Horiz acc1:	0		
Horiz ac 1:	Not Reported		
Vert loc:	1064		
Vert acc:	0		
Vert acc u:	Not Reported		
Latitude:	40.76983		
Longitude:	-81.4415		
Source of :	GPS	Flowing we:	Not Reported
Test rate:	15		
Draw down:	5		
S water le:	30		
S water me:	G	S water 1:	03/22/2003
Cas ht:	1		
Screen len:	0		
Total dept:	85		
Date of co:	03/22/2003	Located in:	Not Reported
Assoc rpt :	Not Reported		
Depth to b:	0		
Drill year:	Not Reported		
Well seal :	0		
Screen slo:	0		
Screened i:	0		
Screened 1:	0		
Sustained :	15		
Attatch st:	Not Reported		
Screen dia:	0		
Screen typ:	Not Reported	Screen mat:	Not Reported
Pump type:	Not Reported		
Pump capac:	0		
Pump set a:	0		
Pitless ty:	Not Reported	Pump inst :	Not Reported
Elev sourc:	Not Reported		
Water leve:	0		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Well drill:	Not Reported	Subcon odh:	Not Reported
Site id:	OHD500000657244		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: OH Radon

Radon Test Results

Zipcode	Num Tests	Maximum	Minimum	Arith Mean	Geo Mean
44706	54	23.3	0.1	5.08	3.77

Federal EPA Radon Zone for STARK County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 44706

Number of sites tested: 6

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	Not Reported	Not Reported	Not Reported	Not Reported
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	7.367 pCi/L	50%	33%	17%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Department of Natural Resources
Telephone: 614-265-1044

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Public Water System Data
Source: Ohio Environmental Protection Agency
Telephone: 614-644-2752
The database includes community, transient noncommunity and nontransient noncommunity water wells; and source treatment unit locations.

Water Well Database
Source: Department of Natural Resources
Telephone: 614-265-6740

OTHER STATE DATABASE INFORMATION

RADON

State Database: OH Radon
Source: Department of Health
Telephone: 614-644-2727
Radon Statistics for Zip Code Areas

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

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Appendix C

Historical Reference Sources

Appendix C.1

Topographic Maps

Canton Drop Forge
4575 Southway Street
Canton, OH 44706

Inquiry Number: 3368308.4
July 17, 2012

EDR Historical Topographic Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report AS IS. Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

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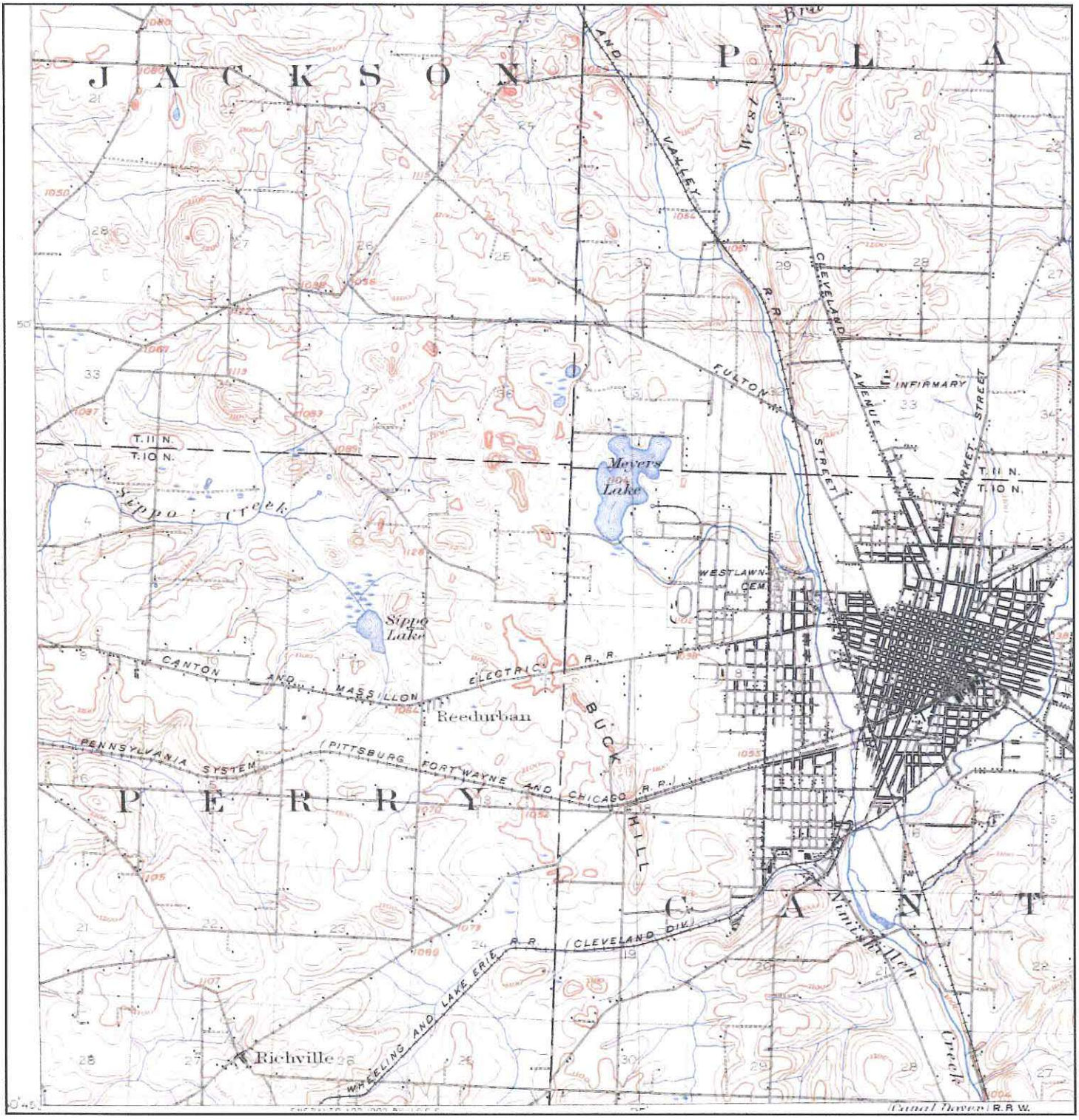
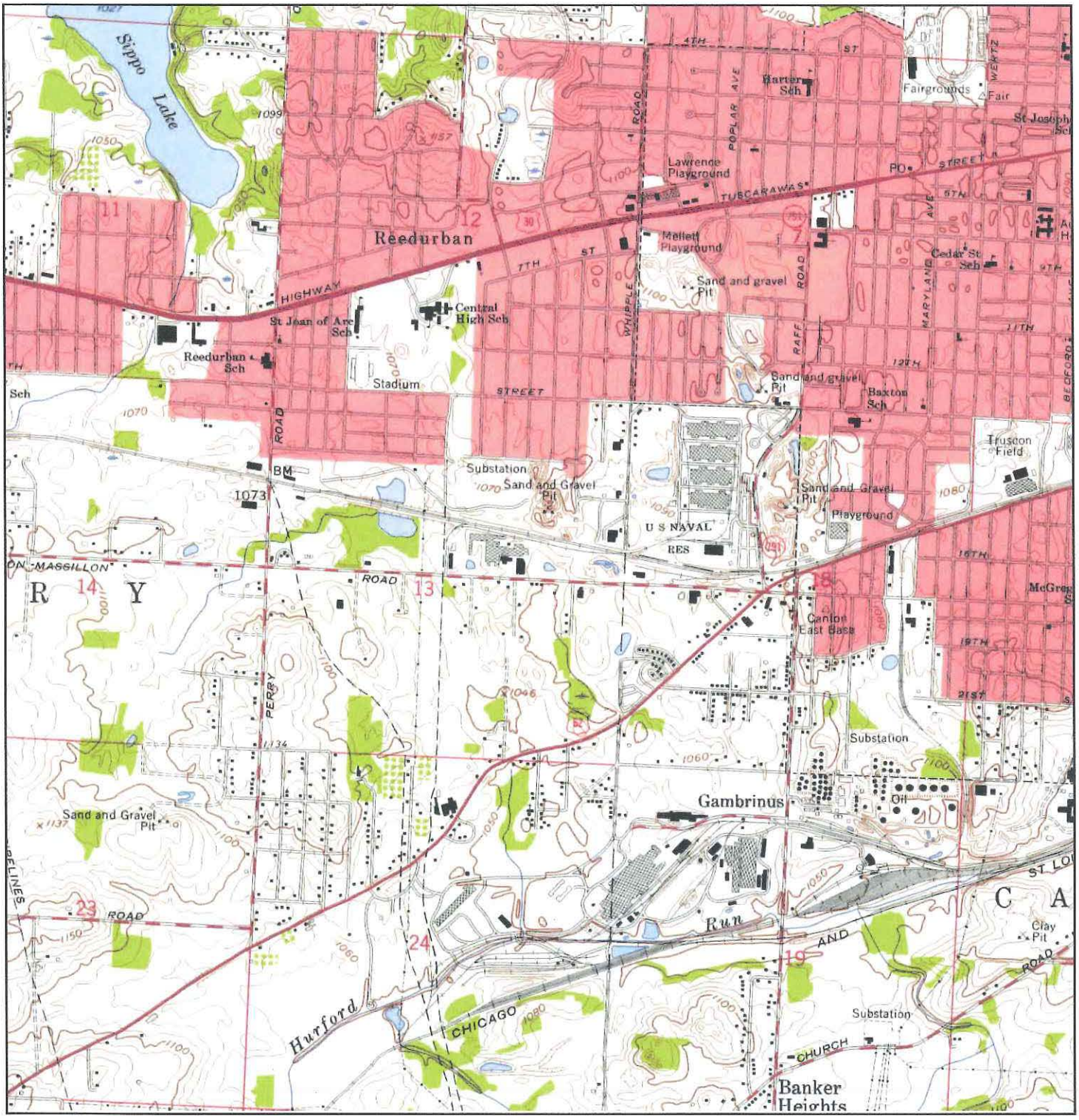
Historical Topographic Map



N	TARGET QUAD NAME: CANTON MAP YEAR: 1903 SERIES: 15 SCALE: 1:62500	SITE NAME: Canton Drop Forge ADDRESS: 4575 Southway Street Canton, OH 44706 LAT/LONG: 40.7824 / -81.4318	CLIENT: ENVIRON International Corporation CONTACT: Meghna Nooyi INQUIRY#: 3368308.4 RESEARCH DATE: 07/17/2012

CDF013149

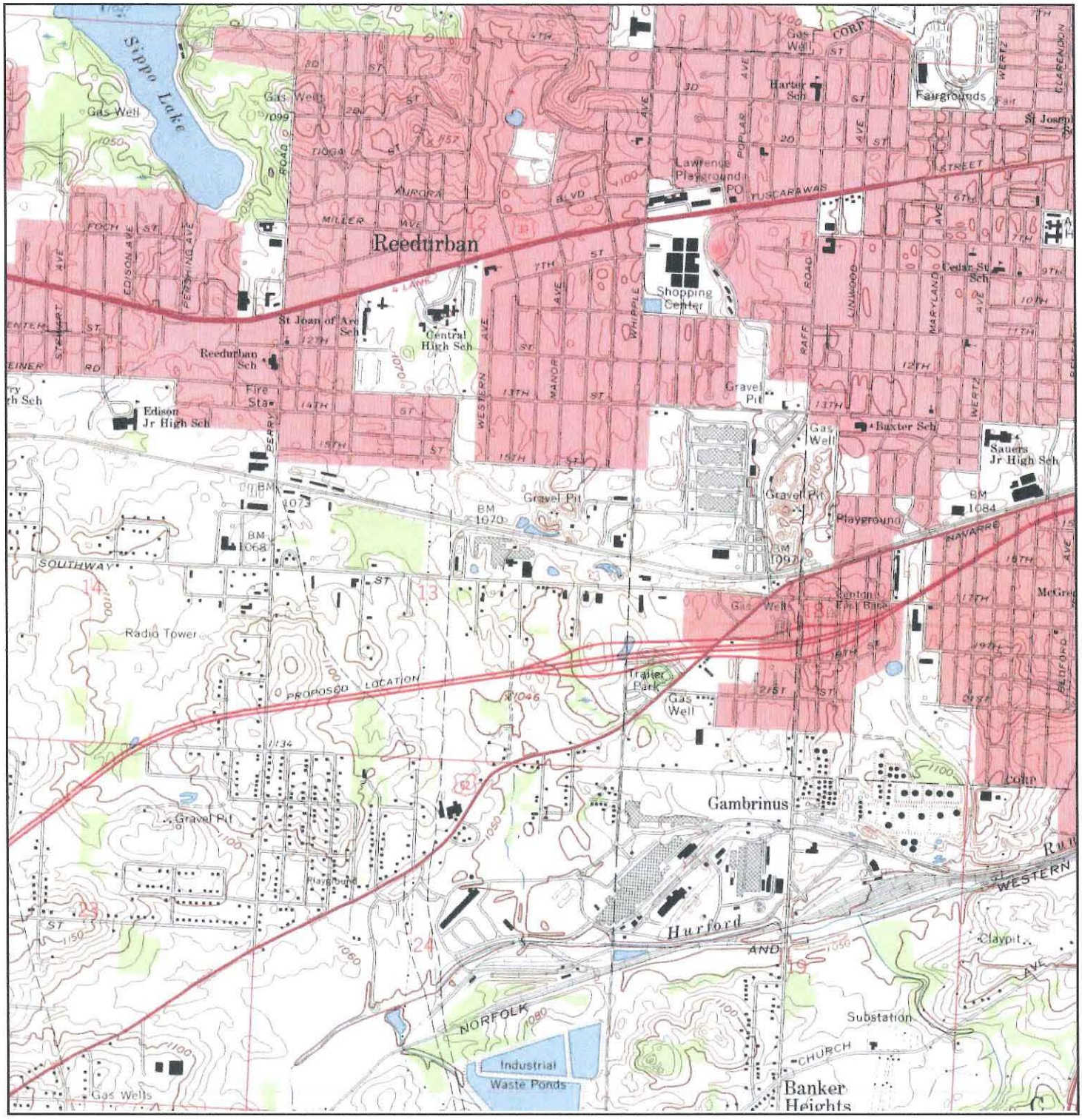
Historical Topographic Map



N	TARGET QUAD NAME: CANTON WEST MAP YEAR: 1958 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Canton Drop Forge ADDRESS: 4575 Southway Street Canton, OH 44706 LAT/LONG: 40.7824 / -81.4318	CLIENT: ENVIRON International Corporation CONTACT: Meghna Nooyi INQUIRY#: 3368308.4 RESEARCH DATE: 07/17/2012

CDF013150

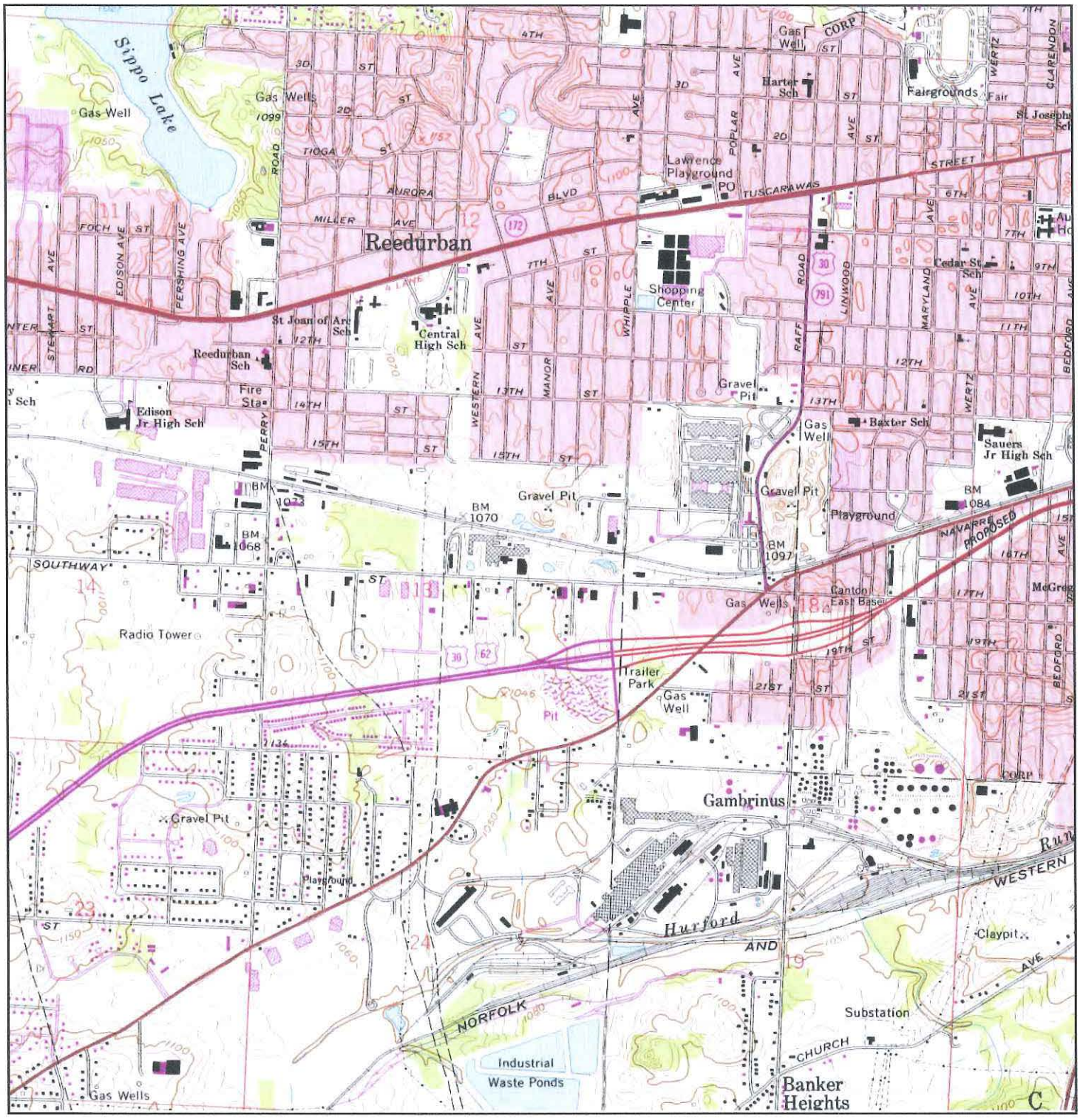
Historical Topographic Map



N	TARGET QUAD		SITE NAME:	Canton Drop Forge	CLIENT:	ENVIRON International Corporation
	NAME:	CANTON WEST	ADDRESS:	4575 Southway Street	CONTACT:	Meghna Nooyi
	MAP YEAR:	1967		Canton, OH 44706	INQUIRY#:	3368308.4
	SERIES:	7.5	LAT/LONG:	40.7824 / -81.4318	RESEARCH DATE:	07/17/2012
	SCALE:	1:24000				

CDF013151

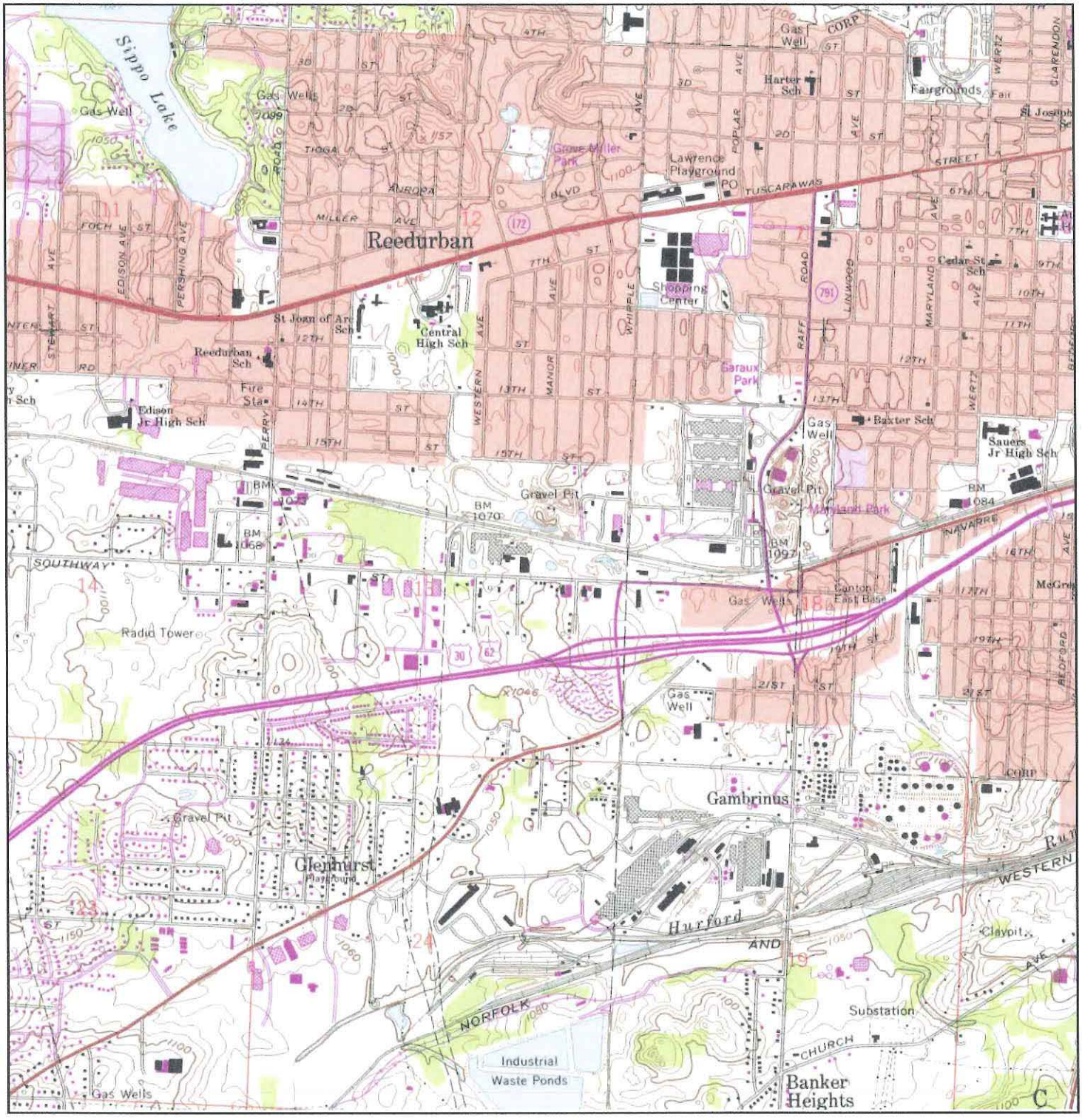
Historical Topographic Map



N	TARGET QUAD NAME: CANTON WEST MAP YEAR: 1978 PHOTOREVISED FROM :1967 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Canton Drop Forge ADDRESS: 4575 Southway Street Canton, OH 44706 LAT/LONG: 40.7824 / -81.4318	CLIENT: ENVIRON International Corporation CONTACT: Meghna Nooyi INQUIRY#: 3368308.4 RESEARCH DATE: 07/17/2012

CDF013152

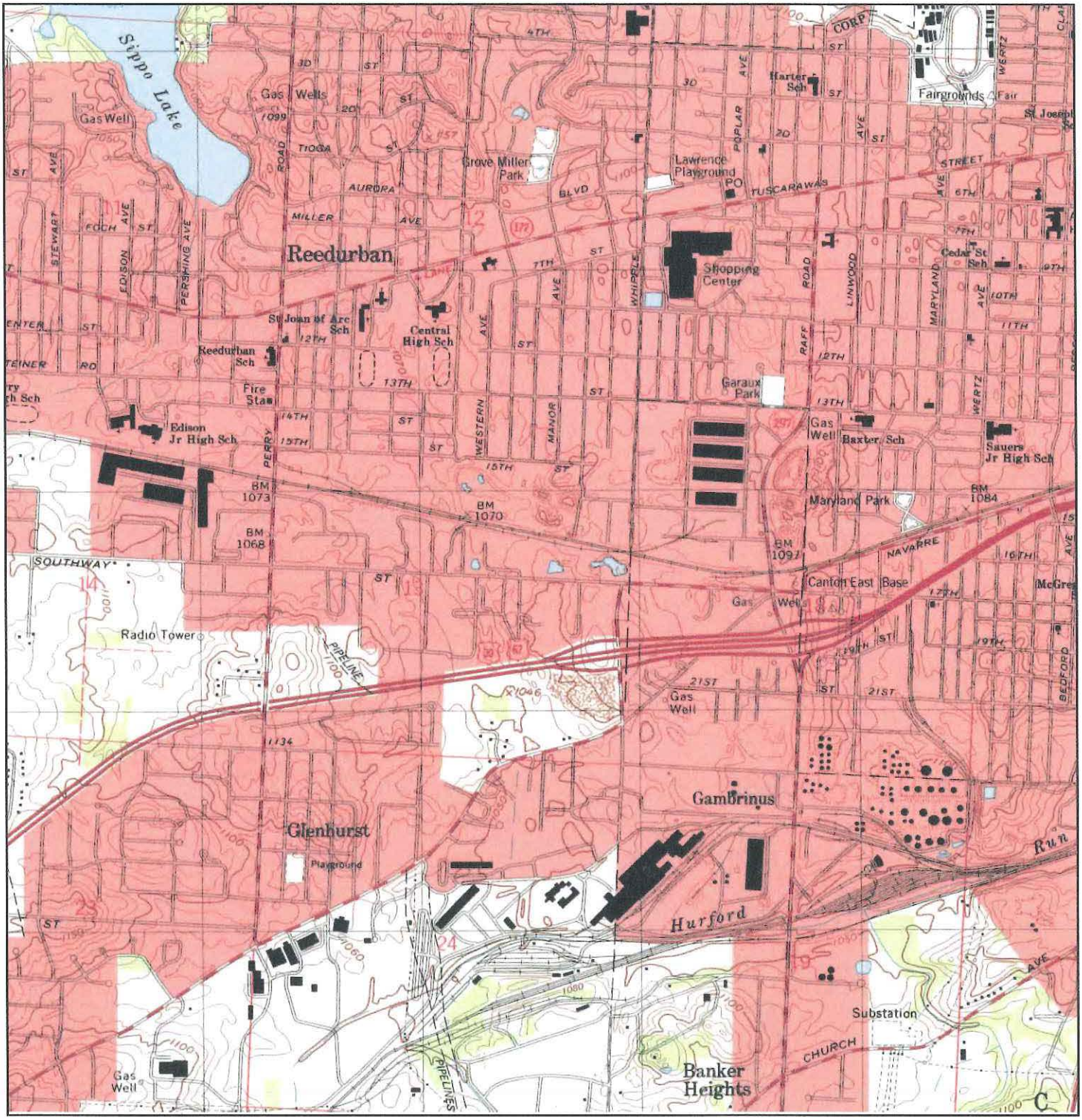
Historical Topographic Map



N	TARGET QUAD NAME: CANTON WEST MAP YEAR: 1985 PHOTOREVISED FROM :1967 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Canton Drop Forge ADDRESS: 4575 Southway Street Canton, OH 44706 LAT/LONG: 40.7824 / -81.4318	CLIENT: ENVIRON International Corporation CONTACT: Meghna Nooyi INQUIRY#: 3368308.4 RESEARCH DATE: 07/17/2012

CDF013153

Historical Topographic Map



N	TARGET QUAD NAME: CANTON WEST MAP YEAR: 1994 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Canton Drop Forge ADDRESS: 4575 Southway Street Canton, OH 44706 LAT/LONG: 40.7824 / -81.4318	CLIENT: ENVIRON International Corporation CONTACT: Meghna Nooyi INQUIRY#: 3368308.4 RESEARCH DATE: 07/17/2012

CDF013154

Appendix C.2

Aerial Photographs

Canton Drop Forge
4575 Southway Street
Canton, OH 44706

Inquiry Number: 3368308.5
July 17, 2012

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
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Date EDR Searched Historical Sources:

Aerial Photography July 17, 2012

Target Property:

4575 Southway Street

Canton, OH 44706

Year	*Scale*	*Details*	*Source*
1952	Aerial Photograph. Scale: 1"=500'	Panel #: 40081-G4, Canton West, OH;/Flight Date: March 30, 1952	EDR
1957	Aerial Photograph. Scale: 1"=1000'	Panel #: 40081-G4, Canton West, OH;/Flight Date: May 07, 1957	EDR
1960	Aerial Photograph. Scale: 1"=1000'	Panel #: 40081-G4, Canton West, OH;/Flight Date: June 06, 1960	EDR
1967	Aerial Photograph. Scale: 1"=500'	Panel #: 40081-G4, Canton West, OH;/Flight Date: November 29, 1967	EDR
1971	Aerial Photograph. Scale: 1"=1000'	Panel #: 40081-G4, Canton West, OH;/Flight Date: April 16, 1971	EDR
1976	Aerial Photograph. Scale: 1"=1000'	Panel #: 40081-G4, Canton West, OH;/Flight Date: April 03, 1976	EDR
1982	Aerial Photograph. Scale: 1"=1000'	Panel #: 40081-G4, Canton West, OH;/Flight Date: April 29, 1982	EDR
1991	Aerial Photograph. Scale: 1"=750'	Panel #: 40081-G4, Canton West, OH;/Flight Date: April 18, 1991	EDR
1994	Aerial Photograph. Scale: 1"=500'	Panel #: 40081-G4, Canton West, OH;/Composite DOQQ - acquisition dates: April 21, 1994,April 14, 1994	EDR
2005	Aerial Photograph. Scale: 1"=500'	Panel #: 40081-G4, Canton West, OH;/Flight Year: 2005	EDR
2006	Aerial Photograph. Scale: 1"=500'	Panel #: 40081-G4, Canton West, OH;/Flight Year: 2006	EDR

INQUIRY #: 3368308.5

YEAR: 1952

= 500'

N

CDF013159

INQUIRY #: 3368308.5

YEAR: 1957

= 1000'

N

CDF013160

INQUIRY #: 3368308.5

YEAR: 1960

= 1000'

N

CDF013161

INQUIRY #: 3368308.5

YEAR: 1967

= 500'

N

CDF013162

INQUIRY #: 3368308.5

YEAR: 1971

= 1000'

N

CDF013163

INQUIRY #: 3368308.5

YEAR: 1976

= 1000'

N

CDF013164

INQUIRY #: 3368308.5

YEAR: 1982

= 1000'

N

CDF013165

INQUIRY #: 3368308.5

YEAR: 1991

= 750'

N

CDF013166

INQUIRY #: 3368308.5

YEAR: 1994

= 500'

N

CDF013167

INQUIRY #: 3368308.5

YEAR: 2005

= 500'

N

CDF013168

INQUIRY #: 3368308.5

YEAR: 2006

= 500'

N

CDF013169

Appendix C.3

Abstract of City Directories

Canton Drop Forge
4575 Southway Street SW
Canton, OH 44706

Inquiry Number: 3368308.6
July 17, 2012

The EDR-City Directory Abstract

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

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City Directory Images

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.'s (EDR) City Directory Abstract is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's City Directory Abstract includes a search and abstract of available city directory data. For each address, the directory lists the name of the corresponding occupant at five year intervals.

Business directories including city, cross reference and telephone directories were reviewed, if available, at approximately five year intervals for the years spanning 1921 through 2002. This report compiles information gathered in this review by geocoding the latitude and longitude of properties identified and gathering information about properties within 660 feet of the target property.

A summary of the information obtained is provided in the text of this report.

RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. An "X" indicates where information was identified in the source and provided in this report.

Year	Source	TP	Adjoining	Text Abstract	Source Image
2002	Haines Company	X	X	X	-
	Haines & Company	X	X	X	-
1995	R.L. Polk Co. Publishers	X	X	X	-
1990	R.L. POLK & CO. PUBLISHERS	-	-	-	-
1986	OHIO BELL - AN AMERITECH COMPANY	-	-	-	-
1981	THE OHIO BELL TELEPHONE COMPANY	X	X	X	-
1976	THE OHIO BELL TELEPHONE COMPANY	-	-	-	-
1970	THE BURCH DIRECTORY	-	-	-	-
1966	THE BURCH DIRECTORY	-	-	-	-
1960	THE BURCH DIRECTORY CO.	-	-	-	-
1954	THE BURCH DIRECTORY CO.	-	-	-	-
1948	THE BURCH DIRECTORY CO.	-	-	-	-
1942	THE BURCH DIRECTORY CO.	-	-	-	-
1936	THE BURCH DIRECTORY CO.	-	-	-	-
1931	THE BURCH DIRECTORY CO.	-	-	-	-
1926	THE BURCH DIRECTORY CO.	-	-	-	-
1921	THE BURCH DIRECTORY CO.	-	-	-	-

FINDINGS

TARGET PROPERTY INFORMATION

ADDRESS

4575 Southway Street SW
Canton, OH 44706

FINDINGS DETAIL

Target Property research detail.

SOUTHWAY SW

4575 SOUTHWAY SW

Year	*Uses*	*Source*
2002	CANTON DROP FORGE	Haines Company
1981	Canton Drop Forging & Mfg Co	THE OHIO BELL TELEPHONE COMPANY

SOUTHWAY ST SW

4575 SOUTHWAY ST SW

Year	*Uses*	*Source*
1995	CANTON DROP FORGE MFG	R.L. Polk Co. Publishers

FINDINGS

ADJOINING PROPERTY DETAIL

The following Adjoining Property addresses were researched for this report. Detailed findings are provided for each address.

NEVADA AVE SW

1841 NEVADA AVE SW

Year	Uses	Source
2002	OYODERBeli	Haines Company
	OYODERBeli	Haines & Company

1856 NEVADA AVE SW

Year	Uses	Source
2002	PERRY LSD	Haines & Company
	PERRY TWP	Haines & Company

1911 NEVADA AVE SW

Year	Uses	Source
2002	XXXX	Haines Company
	XXXX	Haines & Company

SOUTHWAY SW

4520 SOUTHWAY SW

Year	Uses	Source
2002	CNDMACHINC	Haines Company
1981	OHIO STEEL SLITTERS INC	THE OHIO BELL TELEPHONE COMPANY
	Plant 1	THE OHIO BELL TELEPHONE COMPANY

4528 SOUTHWAY SW

Year	Uses	Source
2002	STANTON Jessica L	Haines Company
	FULLER Tuesday	Haines Company
	RICHARDSJ	Haines Company
	WOOD Sam R	Haines Company
1981	W & W Auto Sales	THE OHIO BELL TELEPHONE COMPANY

4552 SOUTHWAY SW

Year	Uses	Source
2002	SPRAGUE Donald E	Haines Company

FINDINGS

4556 SOUTHWAY SW

Year	Uses	Source
2002	ANDERSON Mark	Haines Company
	HOUT T	Haines Company

4580 SOUTHWAY SW

Year	Uses	Source
2002	00 TSON Michael H	Haines Company

4606 SOUTHWAY SW

Year	Uses	Source
2002	STARK BATTERY 1 NC	Haines Company
	NORTHN MBL ELEC INC	Haines Company
	MOUNTCASTLE Peggy	Haines Company
1981	H & N Serv Center	THE OHIO BELL TELEPHONE COMPANY

4622 SOUTHWAY SW

Year	Uses	Source
2002	XXXX	Haines Company

4624 SOUTHWAY SW

Year	Uses	Source
2002	XXXX	Haines Company

4650 SOUTHWAY SW

Year	Uses	Source
1981	BEAVER EXCAVATING CO THE	THE OHIO BELL TELEPHONE COMPANY
	Quality Asphalt Paving Co	THE OHIO BELL TELEPHONE COMPANY

SOUTHWAY ST SW

4520 SOUTHWAY ST SW

Year	Uses	Source
1995	C N D MACHINE INC mach shop	R.L. Polk Co. Publishers

4528 SOUTHWAY ST SW

Year	Uses	Source
1995	Preacher Thomas E	R.L. Polk Co. Publishers
	Sledel Rose A	R.L. Polk Co. Publishers
	Burkhart Brett A & Christina R	R.L. Polk Co. Publishers
	Burkhart Christina R	R.L. Polk Co. Publishers
	Welrath Wayne & Valerie	R.L. Polk Co. Publishers

FINDINGS

Year	Uses	Source
1995	Welrath Valerie	R.L. Polk Co. Publishers
	Apartments	R.L. Polk Co. Publishers
	Steed Harry E Jr & Frances M	R.L. Polk Co. Publishers
	Wood Sam R & Delores	R.L. Polk Co. Publishers

4532 SOUTHWAY ST SW

Year	Uses	Source
1995	W & W AUTO SALES used auto sis	R.L. Polk Co. Publishers

4552 SOUTHWAY ST SW

Year	Uses	Source
1995	Sprague Donald E	R.L. Polk Co. Publishers

4556 SOUTHWAY ST SW

Year	Uses	Source
1995	Me Courry Mike J	R.L. Polk Co. Publishers

4560 SOUTHWAY ST SW

Year	Uses	Source
1995	Vacant	R.L. Polk Co. Publishers

4606 SOUTHWAY ST SW

Year	Uses	Source
1995	NORTHERN MOBILE ELECTRIC INC parts sis & serv	R.L. Polk Co. Publishers

4650 SOUTHWAY ST SW

Year	Uses	Source
1995	BEAVER EXCAVATING INC excavators	R.L. Polk Co. Publishers

FINDINGS

TARGET PROPERTY: ADDRESS NOT IDENTIFIED IN RESEARCH SOURCE

The following Target Property addresses were researched for this report, and the addresses were not identified in the research source.

Address Researched	Address Not Identified in Research Source
4575 Southway Street SW	1990, 1986, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921

ADJOINING PROPERTY: ADDRESSES NOT IDENTIFIED IN RESEARCH SOURCE

The following Adjoining Property addresses were researched for this report, and the addresses were not identified in research source.

Address Researched	Address Not Identified in Research Source
1841 NEVADA AVE SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
1856 NEVADA AVE SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
1911 NEVADA AVE SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4520 SOUTHWAY SW	1995, 1990, 1986, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4520 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4528 SOUTHWAY SW	1995, 1990, 1986, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4528 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4532 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4552 SOUTHWAY SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4552 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4556 SOUTHWAY SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4556 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4560 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4580 SOUTHWAY SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4606 SOUTHWAY SW	1995, 1990, 1986, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4606 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4622 SOUTHWAY SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921

FINDINGS

Address Researched	Address Not Identified in Research Source
4624 SOUTHWAY SW	1995, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4650 SOUTHWAY SW	2002, 1995, 1990, 1986, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921
4650 SOUTHWAY ST SW	2002, 1990, 1986, 1981, 1976, 1970, 1966, 1960, 1954, 1948, 1942, 1936, 1931, 1926, 1921

Appendix C.4

Historical Fire Insurance Maps

Canton Drop Forge
4575 Southway Street
Canton, OH 44706

Inquiry Number: 3368308.3
July 16, 2012

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

7/16/12

Site Name:
Canton Drop Forge
4575 Southway Street
Canton, OH 44706

Client Name:
ENVIRON International
5747 Perimeter Drive
Dublin, OH 43017

EDR Inquiry # 3368308.3

Contact: Meghna Nooyi

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by ENVIRON International Corporation were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name: Canton Drop Forge
Address: 4575 Southway Street
City, State, Zip: Canton, OH 44706
Cross Street:
P.O. # NA
Project: Canton Drop Forge
Certification # 67C6-4D74-A718

Sanborn® Library search results
Certification # 67C6-4D74-A718

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ☑ Library of Congress
- ☑ University Publications of America
- ☑ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Appendix D

Qualifications of Environmental Professional

ENVIRON

Ashish P. Deshmukh, PhD | Manager

Columbus, Ohio
+ 1 614 766 5990 | adeshmukhrharris@environcorp.com

Ashish Deshmukh has over 13 years of experience in the environmental and chemical sciences, with particular emphasis in the areas of product safety, chemical regulatory compliance, due diligence, environmental, health and safety (EHS) regulatory compliance and natural organic matter chemistry. Specific areas of expertise include evaluating products for food contact use, and providing global regulatory approval support to chemical and packaging material manufacturers. This work has involved identifying appropriate regulatory strategies for products; performing regulatory reviews, hazard analyses, preliminary exposure assessments and gap analyses of components of adhesives, inks and coatings used for food applications; designing protocols for extraction and migration studies, and evaluating and interpreting results; performing safety and suitability assessments; and preparing submissions for regulatory agencies.

EDUCATION

2005 Post-doctoral Scholar, Environmental Geochemistry, Princeton University

2003 PhD, Environmental Chemistry, The Ohio State University

1993 MS, Organic Chemistry, Purdue University

1990 BSc, Chemistry, University of Mumbai, India

EXPERIENCE

Product Safety and Regulatory Support

- Responsible for evaluating products for food contact use, and for providing global regulatory approval support for a major chemical manufacturer. Responsibilities include:
  - Identifying appropriate regulatory strategies for products
  - Performing regulatory reviews, hazard analyses, preliminary exposure assessments, and gap analyses of components of adhesives, inks, and coatings used for food contact applications
  - Designing protocols for extraction and migration studies and evaluating and interpreting results
  - Performing safety and suitability assessments of products
  - Preparing submissions for regulatory agencies
- Evaluated the safety of a dry-strength agent used in the manufacture of packaging paper for use in food contact applications and prepared a Food Contact Notification for FDA submission
- Assessed the safety of a tape handle product in food contact applications for a leading manufacturer of tape products
- Participated in a FIFRA regulatory compliance review for a leading manufacturer of lawn care products
- Performed a cGMP audit of a leading manufacturer of PVC tubing that are used in manufacturing medical devices, as a first step towards switching to a safer plasticizer

Chemical Regulatory Compliance

- Advised chemical manufacturers for achieving compliance with TSCA regulations

- Prepared Pre-Manufacture Notifications (PMNs) for submission to the EPA for manufacture and import of new chemicals
- Prepared New Substance Notifications (NSNs) for submission to Environment Canada for manufacture and import of new chemicals into Canada
- Advised clients on applicability of exemptions to the PMN requirement for manufacture or import of new chemical products (e.g., polymer exemption, low volume exemption, etc.)
- Evaluated the chemistry and use of a limescale remover used for cleaning coffee-brewing equipment for a leading company in the food service business
- Investigated the chemistry occurring on the surface of a catalyst used for scavenging reduced sulfur compounds from sour gas in a petroleum refinery in order to mitigate odor issues

Phase I Environmental Assessments and Environmental Due Diligence

- Conducted and directed Phase I environmental assessments of over three hundred properties, including automotive parts manufacturing facilities; plastic processing facilities; chemical and pharmaceutical manufacturing and distribution facilities; printing facilities; equipment manufacturing facilities; and various other manufacturing facilities
- Performed Phase I ESAs under the Voluntary Action Program (VAP) of Ohio EPA and obtained "No Further Action" (NFA) letters
- Conducted Phase II environmental assessments, including soil, groundwater, and soil vapor sampling at manufacturing facilities to identify and quantify known or suspected environmental contamination of soil or ground water

EHS Regulatory Compliance

- Performed EHS regulatory compliance and risk-based assessments of a wide range of industrial facilities while assisting clients in meeting regulatory compliance requirements at the local, state, national, and regional levels, and implementing EHS risk management programs

Natural Organic Matter Chemistry

- Investigated molecular-level interactions of pollutants with soil organic matter (SOM) and evaluated the role of SOM structure in the natural attenuation of pollutants using multi-dimensional NMR Spectroscopy
- Evaluated the structure of stable organic matter in soils using advanced analytical methods, which is critical to understanding sequestration of carbon in soils
- Determined structure and origin of naturally occurring organochlorine molecules in weathering plant material and soils using X-Ray Absorption Spectroscopy, High Resolution ESI-MS and LC-MS/MS

Prior to joining ENVIRON, Ashish Deshmukh held the following positions:

- 2003-2005: Post-Doctoral Research Associate, Department of Geosciences, Princeton University
- 1998-2003: Graduate Research Associate, Department of Chemistry, OSU
- 1993-1998: Business Development Manager, Varun Polymol Organics Ltd., Mumbai, India
- 1990-1993: Teaching Assistant, Department of Chemistry, Purdue University

Ashish P. Deshmukh, PhD

CREDENTIALS

Professional Affiliations and Activities

Member, American Chemical Society

Member, The Honor Society of Phi Kappa Phi

Member, Sigma Xi Scientific Research Society

PUBLICATIONS & PRESENTATIONS

Deshmukh A.P., C. Pacheco, M. Hay, and S.C.B. Myneni. 2007. Structural environments of carboxyl groups in natural organic molecules from terrestrial systems. Part 2: 2D NMR Spectroscopy. Geochimica et Cosmochimica Acta, 71: 3533-3544.

Deshmukh A.P., A.J. Simpson, C.M. Hadad, and P.G. Hatcher. 2005. Insights into the structure of cutin and cutan from Agave americana leaf cuticle using HR-MAS NMR spectroscopy. Organic Geochemistry, 36: 1072-1085.

Salloum M.J., B. Chefetz, A.P. Deshmukh, and P.G. Hatcher. 2005. Comparison of polycyclic aromatic hydrocarbon distribution and sedimentary organic matter characteristics in contaminated, coastal sediments from Pensacola Bay, Florida. Marine Environmental Research, 59: 139-163.

Sachleben J.R., B. Chefetz, A.P. Deshmukh, and P.G. Hatcher. 2004. Solid-state NMR characterization of pollutant-soil organic matter interactions: Pyrene sorption to cuticular materials Envi. Sci. Technol. 38 (16): 4369-4376.

Deshmukh A.P., A.J. Simpson, and P.G. Hatcher. 2003. Evidence for cross-linking in tomato cutin using HR-MAS NMR spectroscopy. Phytochemistry, 64 (6): 1163-1170.

Chefetz B., J. Tarchitzky, A.P. Deshmukh, P.G. Hatcher, and Y. Chen. 2002. Structural characterization of soil organic matter and humic substances in particle-size fractions of an agricultural soil. Soil Sci. Soc. Am. J. 66 (1): 129-141.

Chefetz B., M.J. Salloum, A.P. Deshmukh, and P.G. Hatcher. 2002. Structural components of humic acids as determined by chemical modifications and 13C NMR, pyrolysis- and thermochemolysis-GC/MS. Soil Sci. Soc. Am. J. 66 (4): 1159-1171.

Deshmukh A.P., B. Chefetz, and P.G. Hatcher. 2001. Characterization of organic matter in pristine and contaminated coastal marine sediments using solid-state 13C NMR, pyrolytic and thermochemolytic methods: a case study in the San Diego Harbor area. Chemosphere, 45 (6/7): 1007-1022.

Deshmukh A.P. and W.J. Mitsch. 2000. Hydric soil development in the Olentangy River Experimental Wetlands after five years of inundation. Olentangy River Wetland Research Park at the Ohio State University: Annual Report 1999. pp 113-120.

Chefetz B., A.P. Deshmukh, E.A. Guthrie. and P.G. Hatcher. 2000. Pyrene sorption by natural organic matter. Envi. Sci. Technol. 34 (14): 2925-2930.

Deshmukh A. P., S. Kim, R.P. Rodgers, A.G. Marshall, and S.C.B. Myneni. Lichens, not humans, are major sources of organochlorines in soils (in preparation).

Myneni S.C.B., M. Hay, D. Edwards, A.P. Deshmukh, T. Strathmann. 2008. X-Ray, vibrational and NMR spectroscopic investigations of natural organic molecules and their complexes: Applications and limitations. AGU Fall Meeting, San Francisco, CA.

Deshmukh A.P. 2008. Perspectives on Environmental Consulting. Seminar Series, Environmental Science Graduate Program, The Ohio State University, Columbus, Ohio.

Pacheco C., A.P. Deshmukh, M.B. Hay, and S.C.B. Myneni. 2007. Structural environments of carboxyl groups in natural organic molecules from terrestrial systems: NMR Spectroscopy. EUROMAR 2007 Magnetic Resonance Meeting. Palau Firal I de Congresso de Tarragona. Tarragona, Spain.

Hatcher P.G. and A.P. Deshmukh. 2006. Understanding the chemistry of crystalline polymethylenic carbon in soils as sinks for hydrophobic contaminants. 18th World Congress of Soil Science, Philadelphia, PA.

Myneni S.C.B., A.P. Deshmukh, and M.B. Hay. 2006. Reactive carboxylic acids of decaying biomacromolecules in the environment. 2nd Annual Meeting of the Stanford EMSI, Palo Alto, CA.

Hatcher P.G. and A.P. Deshmukh. 2006. Evaluating the sorption interaction of a common environmental contaminant, phenanthrene, with plant cuticular material typically found in soil using solid-state 13C NMR. 48th Rocky Mountain Conference on Analytical Chemistry, Breckenridge, CO.

Myneni S.C.B., A.C. Leri, A.P. Deshmukh, J.A. Hakala, and R. Zwillinger. 2006. Halogen Cycle in the Environment. 233rd American Chemical Society (ACS) National Meeting, Division of Geochemistry, San Francisco, CA.

Deshmukh A.P., S. Kim, A.G. Marshall, and S.C.B. Myneni. 2005. Organohalogens in soils: Anthropogenic or natural? 230th ACS National Meeting, Division of Environmental Chemistry, Washington, DC.

Deshmukh A.P., M.B. Hay, C.R. Pacheco, and S.C.B. Myneni. 2005. Carboxyl structures in humic substances. 230th ACS National Meeting, Division of Geochemistry, Washington, DC.

Deshmukh, A.P. 2005. Sequestration of phenanthrene in aliphatic soil organic matter. Exxon-Mobil Biomedical Sciences, Inc., Annandale, NJ.

Hay M.B., A.P. Deshmukh, and S.C.B. Myneni. 2005. Local structure of carboxylic acid groups in natural organics. 15th Annual Goldschmidt Conference, Moscow, ID.

Sachleben, J.R., K. Kramer, D. See, B. Chefetz, A.P. Deshmukh, and P.G. Hatcher. 2004. Solid-State NMR characterization of pyrene sorption to cuticular materials. 46th Rocky Mountain Conference on Analytical Chemistry, Denver, CO.

Deshmukh A.P., S. Pilkenton, J.R. Sachleben, M. Simpson, and P.G. Hatcher. 2003. Sorption and sequestration of phenanthrene in polymethylenic plant biopolymers: Proxies for soil organic matter. 2nd Annual Meeting of the EMSI at OSU, Columbus, OH.

Deshmukh A.P. and P.G. Hatcher. 2003. Role of polymethylenic carbon in the sorption and sequestration of hydrophobic organic contaminants in natural organic matter. Environmental Geology and Geochemistry Seminars, Princeton University, Princeton, NJ.

Deshmukh A.P. and P.G. Hatcher. 2003. Role of polymethylenic carbon in the sorption and sequestration of hydrophobic organic contaminants in natural organic matter. Department of Civil Engineering and Environmental Science, University of Oklahoma, Norman, OK.

Gregory T., B. Chefetz, A.P. Deshmukh, P.G. Hatcher, and E. Nichols. 2003. Influence of Vegetation on PAH bioavailability. USEPA International Applied Phytotechnologies Conference, Chicago, IL.

Deshmukh A.P., A. Simpson, J.R. Sachleben, M.J. Salloum, and P.G. Hatcher. 2002. Sorption of phenanthrene to aliphatic plant biopolymers as proxies for soil organic matter. 1st Annual Meeting of the EMSI at OSU, Columbus, OH.

Grasham A., P.G. Hatcher, M. Salloum, A.P. Deshmukh, and E. Guthrie. 2002. 13C Pyrene fate in marine sediments. 223rd ACS National Meeting, Division of Chemical Education, Orlando, FL.

Sachleben J.R., B. Chefetz, A.P. Deshmukh, and P.G. Hatcher. 2002. Solid-State NMR characterization of pyrene sorption to cuticular materials. 44th Rocky Mountain Conference on Analytical Chemistry, Symposium on NMR, Denver, CO.

Deshmukh A.P., M.J. Salloum, J.R. Sachleben, and P.G. Hatcher. 2001. Sorption of phenanthrene to components of plant cuticles. 221st ACS National Meeting, Division of Geochemistry, San Diego, CA.

Sachleben J.R., B. Chefetz, A.P. Deshmukh, and P.G. Hatcher. 2001. Solid-State NMR characterization of pollutant-soil organic matter interactions: Pyrene sorption to cuticular materials. 221st ACS National Meeting, Division of Geochemistry, San Diego, CA.

Chefetz, B., A.P. Deshmukh, E.A. Guthrie, and P.G. Hatcher. 2000. Pyrene Sorption by Natural Organic Matter. 1st North Central Regional Symposium on Natural Organic Matter, Minneapolis, MN.

Chefetz, B., Tarchitzky, G., Deshmukh, A.P., Chen, Y., and Hatcher, P.G. (2000). Structural characterization of humic substances in particle size fraction of agricultural soil. 10th International Meeting of the International Humic Substances Society, Toulouse, France.

Chefetz B., Salloum, M.J., Deshmukh A.P., and Hatcher P.G. (2000). Pyrene sorption by natural organic matter. 220th ACS National Meeting, Division of Environmental Chemistry, Washington, DC.

DISSERTATIONS AND THESES

Deshmukh, A.P. 2003. Sorption and sequestration of phenanthrene in polymethylenic plant biopolymers: Proxies for soil and sedimentary organic matter. Dissertation (Ph.D.), The Ohio State University, Columbus, OH, USA.

Deshmukh, A.P. 1993. Studies directed toward the enantioselective synthesis of L-gulose. Thesis (M.S.), Purdue University, West Lafayette, IN, USA.

ENVIRON

Jeanne M. Tarvin, PG, CPG | Principal

Milwaukee, Wisconsin
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Jeanne Tarvin is a certified professional geologist with more than 26 years of consulting experience. Her project experience includes directing and managing transaction due diligence work, hydrogeologic studies, remedial investigations, landfill studies, feasibility studies, remedial designs and remedial actions under CERCLA, RCRA, TSCA and state led programs. Responsible for technical quality, project execution, strategic direction and resource management, her practice focuses on remediation and redevelopment of environmentally impaired properties, solid and hazardous waste management, environmental, health and safety due diligence for mergers and acquisitions, and contaminated sediment issues. Jeanne is currently a Gubernatorial Appointee to the Technical Advisory Committee for the Wisconsin Drycleaners Environmental Reimbursement Fund (DERF).

EDUCATION

1984	BS, Engineering Geophysics, Michigan Technological University
1985-87	Post-Graduate Studies, Hydrogeology, University of Wisconsin-Milwaukee

EXPERIENCE

- Served as Project Environmental Principal for confidential railroad derailment site in Illinois. Provided operation and maintenance services and developed a closure strategy on a groundwater pump and treatment system/bentonite containment wall installed in response to a release of 30,000 gallons of tetrachloroethene. In addition, performed a hydrogeologic evaluation and risk assessment of the remedial system performance to develop a closure strategy for the site.
- Functioned as Project Manager for a pre-design study, remedial design and remedial action for two multi-million dollar Superfund NPL projects in Central Wisconsin. Directly responsible for USEPA Region 5 and WDNR negotiations, project scheduling and budgeting, development of project work plans, technical direction of NCP level field and laboratory testing program, regulatory liaison and preparation and review of technical work plans and reports.
- Performed as Project Principal on M&A projects involving portfolios of sites ranging from two sites to upwards of 100 sites. Responsible for directing project teams on quick turn projects and providing technical review. Developed and implemented probabilistic cost modeling on numerous sites for estimating environmental liabilities for clients and their environmental counsel. Strategies used for reducing liability risks have included Voluntary Party Liability Exemption tools in Minnesota, Wisconsin, New Jersey, Illinois and Michigan.
- Served as Project Principal on Remedial Action Dredging Project for the Fox River Operable Unit One cleanup in Little Lake Butte Des Morts for a pulp and paper client. Responsible for developing remedial action work plans and overseeing remedial action as oversight engineer.
- Functioned as Project Principal on a RCRA 3013 Order for investigation at a steel manufacturing facility in Indiana. Responsible for negotiations with USEPA Region 5 and IDEM for development of a scope of work for investigation. Performed further investigation in an attempt to avoid a Corrective Action on the majority of the site. Corrective Action is proposed on the former Coke Plant location within the site.
- Responsible for negotiating Administrative Orders on Consent and Consent Decrees with state and federal regulatory agencies on Superfund, RCRA and state-led remediation projects.

- Performed as Project Principal on a RCRA Part B Permit Modification for a hazardous waste kiln in Missouri. Project included USEPA Region 3 negotiations, design plans and specifications and preparation of the permit modification.
- Served as Project Principal for development of a Remedial Action Work Plan for dredging at the Great Lakes Naval Station in Illinois. Negotiated dredging strategy with USEPA Region 5 and IEPA.
- Functioned as Project Manager for a RFI at an industrial facility in Little Rock, Arkansas. Negotiated a scope of work with the ADEQ and USEPA Region 6. The work is being completed under the USEPA Region 6 Corrective Action Strategy (CAS) Pilot Program.
- Prepared siting studies, feasibility studies, hydrogeologic studies and facility designs for industrial and municipal landfills, including permitting.
- Served as Lead Auditor for a comprehensive environmental compliance audit for a large manufacturing facility. The audit addressed handling and storage of hazardous materials, storage and disposal of hazardous and special waste, spill response and spill containment, storm water regulations, wastewater permits and air emissions. The final report included an air emissions inventory and recommendations for a spill response plan, as well as improvements in hazardous waste stream management.
- Performed as Project Manager for a RCRA Part B closure of four cupola sludge lagoons at an iron works foundry. Duties included a RFI and preparation and implementation of the closure plan. As part of the closure plan, a confirmation of removal of hazardous soils was performed and a groundwater monitoring system was installed.
- Functioned as Project Manager for preparation and negotiation of a RCRA Facility Investigation Work Plan at a solvent recovery facility in Wisconsin which contains nine SWMUs.
- Investigated and closed industrial and commercial sites with chlorinated VOC impacts using natural attenuation and risk based evaluation. Successfully closed site using natural attenuation that were slated for active remediation by the WDNR.
- Managed compliance audits and environmental permitting at several industrial sites and power plants.
- Served as Project Principal on RI/FS and remediation for four Manufactured Gas Plant Sites in Wisconsin. Former member of MGP Advisory Committee for major utility in Midwest.
- Performed as Project Manager for a Superfund NPL site in Central Wisconsin. Negotiated a Record of Decision Amendment to delete an Alternative Water Supply as part of the final remedy. This Amendment saved the client millions of dollars over projected remedial action costs.
- Managed and performed numerous environmental site assessments for property transfer including preparation of work plans for soil and groundwater sampling, soil gas surveying, interpretation of chemical analysis, development of remedial action plans and final report preparation.
- Functioned as Project Manager on a Superfund site in Wisconsin. Negotiated a Record of Decision Amendment to remove the requirement for an active groundwater pump and treat system. Performed a corrective action on a failed landfill cover in 2009. The original design by another consultant was flawed. The new innovative cover was the largest application of a geoweb cover system in the Midwest.
- Performed geophysical surveys including seismic refraction, thermography, electromagnetics, electrical resistivity, downhole bore logging and subsurface interface radar for contamination assessments; development of groundwater monitoring plans, hydrogeologic analysis and engineering design of drilling activities for major exploration programs.

- Provided expert and fact witness testimony on contested cases involving hydrogeologic characterization, sediment costs and landfill design and operation.
- Presented technical data/interpretation at public meetings on behalf of responsible parties.

CREDENTIALS

Registrations and Certifications

Professional Geologist: Wisconsin

Certified Professional Geologist

NR 712 Wisconsin Certified Hydrogeologist

FRA Railroad Workplace Safety (49 CFR 214 Subpart C)

HAZWOPER 40-Hour and 8-Hour Supervisor Safety Training

Professional Affiliations and Activities

American Institute of Professional Geologists

National Water Well Association

Federation of Environmental Technologists

Honors and Awards

Recipient of Supply Chain Award of Excellence for 1996 and 1997 from Wisconsin Electric

BT1 Client Service A-team's roster in 1996 for delivering truly superior client services

Gubernatorial Appointment to the Technical Advisory Committee for the Drycleaners Environmental Reimbursement Fund (DERF) - current

PUBLICATIONS & PRESENTATIONS

"Cost Effectiveness of the Horizontal Biosparge Well Application for Aerobic Co-Metabolic Groundwater Remediation," 2005 NGWA Remediation Conference, November 2005.

"Application of Horizontal Biosparge Wells for Aerobic Co-metabolic Groundwater Remediation," Eighth International In-Situ and On-Site Bioremediation Symposium, June 2005.

"Avoiding RCRA and CERCLA Liabilities," Client Training Seminar, 2002.

"Waste Management, Risks and Liabilities," Client Training Seminar, 2001.

"Brownfields From a Technical Standpoint," Brownfields Development in Wisconsin Seminar, 2000.

"Mergers and Acquisitions: Audits and Due Diligence Strategies," STS Client Seminar, 1999.

"Drycleaner Cleanup Rules Legislative Update," Wisconsin Fabricare Institute, September 1998.

"Spill Response Awareness Training," Client Training Seminar, 1998.

"Remediation: A Case Study," Client Training Seminar, 1997.

"Strategic Regulatory Negotiations," Client Seminar, 1996.

"Comparison of Sludge Lagoon Covers," TAPPI Conference Proceedings, 1995.

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

March 22, 2013

Donald A. Fay, CP
Vice President
TRC Environmental Corporation
11231Cornell Park Drive
Cincinnati, OH 45242

and

Sean Denman
Health & Safety Director
Canton Drop Forge, Inc.
4575 Southway Street, SW
Canton, OH 44707

Re: Canton Drop Forge Southway Property, RCRA and VAP MOA Track Project, No. 276-000130-002 - Ohio EPA's Eligibility Review

Dear Mr. Fay and Mr. Denman:

This letter provides a legal review of the Initial Eligibility Determination dated November 1, 2012 and other information that evaluates the VAP eligibility of the property known as the Canton Drop Forge Southway Property, 4575 Southway Street SW, Canton, in Stark County (the "Property").

TRC Environmental Corporation ("TRC") submitted the Initial Eligibility Determination on behalf of Canton Drop Forge, Inc. ("CDF" or the "Volunteer"), under the RCRA and Voluntary Action Program Memorandum of Agreement Track (the "MOA Track"). The submission also contained the Volunteer's Agreement to Comply form signed by CDF's representative on September 26, 2012.

On September 5, 2012, Ohio EPA's Northeast District Office received your "Notice of Entry into the RCRA and VAP MOA Track" for the approximately 33-acre Property. On September 24, 2012, Kevin Palombo, a project coordinator with Ohio EPA's Division of Environmental Response and Revitalization, provided you with a letter acknowledging the Property's entry into the MOA Track.

Following my November assignment to the project I reviewed the site information to evaluate the Property's eligibility under the Ohio EPA and USEPA agreement effective November 8, 2007, which governs MOA Track eligibility. My review also considered eligibility for "classic VAP" participation, based on Ohio Administrative Code (OAC) 3745-300-02. As described below, Property appears ineligible under the MOA Track or OAC 3745-300-02 at this time.

Review of Initial Eligibility Determination

The Initial Eligibility Determination addresses determinations related to petroleum underground storage tank (UST) system closure and corrective action events and historical disposal or placement of waste materials.

Regarding petroleum UST system assessment, removal or remediation.

The Initial Eligibility Determination contains a BUSTR determination dated January 23, 1992 related to incident #7600833-00, stating that BUSTR is not requiring further corrective action for the petroleum UST release incident. Also it documents that BUSTR issued a no further action determination dated May 24, 1999 for closure requirements related to incident #7600833-01.

Regarding solid or hazardous waste closure requirements.

The Initial Eligibility Determination indicates that that the on-site landfill closed in 1979 because it had reached its capacity. Zone A was closed in October 1978, Zone B in 1979. On October 15, 1981 the Ohio EPA director granted an exemption from solid waste facility permit requirements (for wooden pallets as a solid waste) and an authorization for additional disposal of the wooden pallets as well as demolition-generated brickbats and concrete.

The Initial Eligibility Determination also includes a USEPA screening site inspection report. Report pages 2-3 to 2-4, indicating that Stark County licensed the landfill in 1976. Zone A was used for the disposal of all wastes generated on-site, and included oil sludge, waste oil, slag, ashes, lime/soda softener sludge, floor sweepings, trash and rags. The report indicates that disposal continued in zone B as of late 1981. It states that in 1981 wastes generated on-site were transported off-site for disposal. The report, page 2-4, indicates the cover material for the landfill included slag, ash, lime/soda softener sludge, and demolition wastes. The Initial Eligibility Determination, attachment 3, contains analytical results from an April 2011 sampling event. The samples consisted of deposited fly ash, "waste refractory," "lime cake," and "floor scrappings", which analyzed for all TCLP metals, showed no concentration in any sample that exceeded TCLP.

The Initial Eligibility Determination does not address the issue of generator closure. Ohio EPA records indicate the CDF facility has been a large quantity generator (LQG)

of hazardous waste. Ohio EPA records indicate that CDF has generated hazardous waste in amounts which would designate it as an LQG. If CDF accumulated the hazardous waste on-site, it would be subject to the hazardous waste generator closure requirements for all areas where hazardous waste was accumulated. The Initial Eligibility Determination, form 7, question 8g, does not indicate LQG status. US EPA's inspection report, page 3, provides that the hazardous waste is generated when CDF uses an acid to clean the furnace seals of scale. The report says it last happened in 2007 yet Ohio EPA records indicate the waste was sent to Envirite in 2009 and 2011. With form 7 question 8.g answered correctly as "yes", responses to questions 8.h. and 8.i would express whether the waste was accumulated, to assess generator closure obligations.

Review of January 2013 NOV and February 2013 Response

This review considered other potential state and federal regulatory program involvement related to the Property. As you know, USEPA's hazardous waste program issued a notice of violation (NOV) dated January 22, 2013. The NOV refers to site circumstances that involve potential regulatory obligations under RCRA, namely for two on-site surface impoundments known as Pond 1 and Pond 2. CDF provided its February 20, 2013 response to the NOV to provide the requested documentation.

Evaluation of Eligibility

The MOA effective November 8, 2007 governing the MOA Track, states in pertinent part at Section I.B.2, page 2, that the MOA does not apply to sites or facilities that are:

- Subject to hazardous waste closure requirements...under RCRA or ORC Chapter 3734 and rules adopted thereunder... [See also OAC 3745-300-02(B)(5)(b).]

- The subject of federal enforcement or response action under RCRA... [See also OAC 3745-300-02(B)(4).]

- Subject to solid waste closure requirements under ORC Chapter 3734 and rules adopted thereunder... [See also OAC 3745-300-02(B)(5)(a).]

- Subject to petroleum UST and hazardous substance storage tank system assessment, removal or remediation under ORC Chapter 3737 and rules adopted thereunder... [See also OAC 3745-300-02(B)(6).]

See paragraphs a, d, f, g of the MOA, Section I.B.2; OAC 3745-300-02(B)(4)-(6).

Neither the MOA nor OAC 3745-300-02(B)(6) eligibility criteria pose a bar to the Property's eligibility based on the past UST release incidents addressed under the BUSTR NFA determinations.

In contrast, the site circumstances noted by the NOV and response letter have not yet been fully evaluated or resolved; these may encompass RCRA closure obligations. The routine furnace cleaning events may encompass closure obligations and likewise require evaluation. The Property areas that are subject to closure obligations based on state or federal law are considered ineligible for the MOA Track until the obligations have been completed under the applicable regulating program. The Property may also be subject to federal enforcement under RCRA given the NOV matters.

Given these circumstances Ohio EPA may not conclude the Property is MOA Track eligible. A specific VAP-eligibility determination may be made for the Property once the regulatory program obligations become understood.

In general, any areas of the Property that do not require closure nor are the subject of a federal enforcement action may participate in the VAP in accordance with the MOA Track procedures for participation. The Property areas subject to closure or the subject of federal enforcement, where applicable, would become VAP-eligible once the regulatory obligations are completed.

This letter determination is not a final action of the director and therefore not subject to appeal.

If you have any questions related to this review you can feel free to contact Mr. Palombo at 330-963-1292 or kevin.palombo@epa.state.oh.us, or me at 614-644-2849 or sue.kroeger@epa.state.oh.us.

Sincerely,

Sue Kroeger
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Food, Agricultural and Biological Engineering

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Stark County Water Resources

AEX-480.76

Ernest F. Oelker
Kristina M. Boone
Larry C. Brown

Water is a resource often taken for granted. In recent years, water availability and quality have become important public concerns in Stark County. The county's population of 367,585 (1990 census data) is predominantly urban, and about 93 percent of all households rely on ground water for their water supply. By understanding where water is obtained and how it is used in the county, residents can gain a better appreciation for their water. Providing a brief overview of Stark County's water resources, this fact sheet is intended to help increase public awareness and understanding of water resources. Water resources terminology used in this publication is included in *Surface and Ground Water Terminology*, Fact Sheet AEX 460, which provides a listing of generally accepted water resource definitions. Ohio State University Extension publications are available through all Ohio county Extension offices.

Precipitation

An average of approximately 37 inches of precipitation falls on Stark County annually. Figure 1 illustrates the average monthly precipitation for the county (averaged over three collection site) for the period 1961 to 1990. Based on this 30-year record, the average precipitation is 3.1 inches per month, with January (2.1 inches) typically being the driest month, and July (4.2 inches) the wettest. There can be, however, extreme variations in some years and in certain months within a year. Such seasonal and yearly extremes, which may have serious consequences, often are not apparent from the long-term precipitation information.

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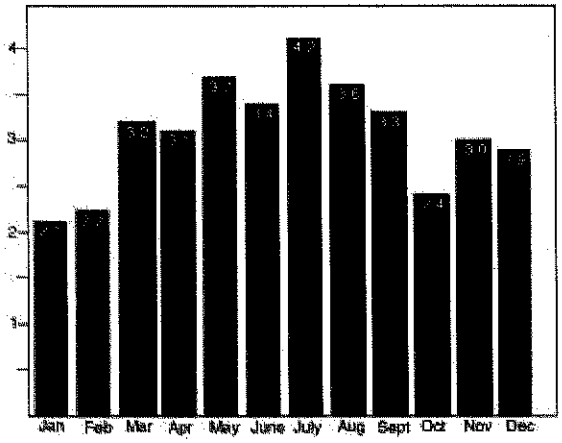

Figure 1. Average monthly precipitation (in inches) in Stark County, Ohio (1961-1990); Data collected at Akron-Canton, Beach City Lake, and Louisville.

Surface-Water Resources

A small section of Marlboro and Lake Townships drains into the Upper Cuyahoga River Basin, which leads to Lake Erie at Cleveland. All of Lexington, and parts of Marlboro, Nimishillen and Washington townships drain into the Mahoning River, which eventually empties into the Ohio River near Beaver, Pennsylvania. The remainder of the county is drained by the Sandy Creek, Sugar Creek, and Tuscarawas River basins, which are all parts of the Muskingum River basin that eventually moves to the Ohio River at Marietta (in Washington County). A generalized surface-water map of Stark County is given in Figure 2.

Surface waters are affected by the soil type and topography of the land adjacent to them, and the way humans use the land. Land use, such as residential development, construction, and agricultural production, can increase the amount of sediment entering a body of water. The type of soils in an area also influences surface water because of the soil's infiltration capacity. With some soils, rainfall is more likely to run off, while other soils allow water to infiltrate more readily.

Stark County contains approximately 366,720 land acres, of which 43 percent is farmland. Forty-nine different soil types are present within the county, the majority of which are silt loams with moderately poor drainage. The county water acreage consists of about 2,112 acres of lakes, including Dale Walburn Reservoir (670), Deer Creek Reservoir (313 acres), Lake Cable (152), Sippo Lake (88 acres), Alpine Village Development (70 acres) and Lake Brewster (36 acres). Most of the water acreage is now used for recreational and waste disposal purposes. Approximately 548 linear miles of streams and rivers course through Stark County (estimated from ODNR Div. of Water river basin maps). This availability lends itself to many uses by both communities and individuals.

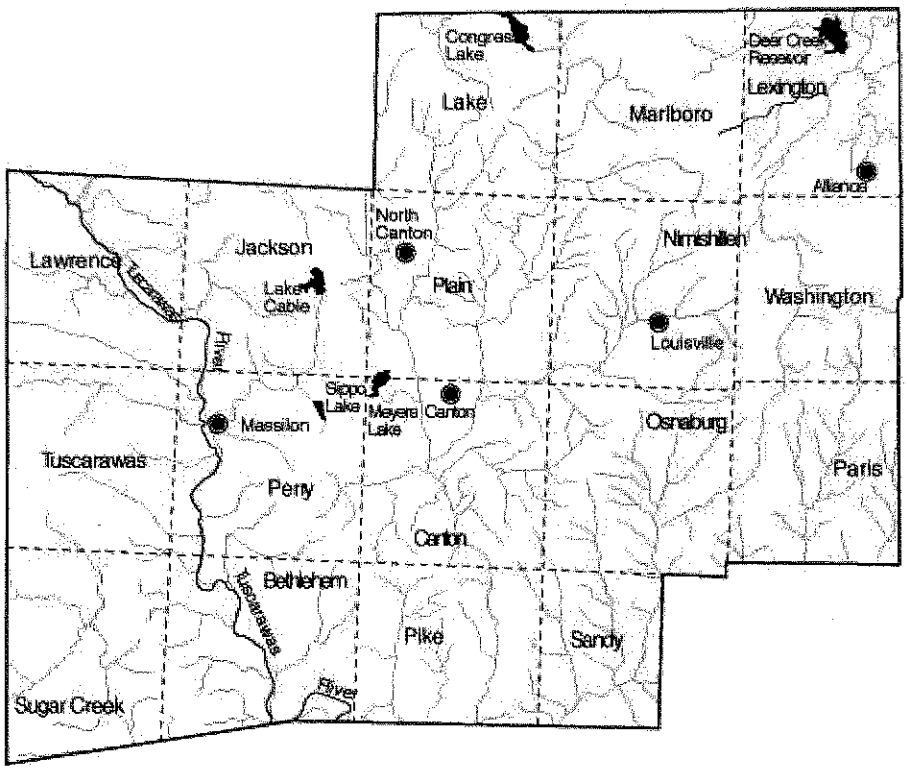

Figure 2. Surface-water resources in Stark County, Ohio (adapted from ODNR Div. of Water river basin maps by R.A. Roberts).

Ground-Water Resources

Stark County's primary ground-water resources are sand and gravel deposits and sandstones. The southeastern two-thirds of the county draws its ground water from sandstones and sandy shales, with maximum well yields of up to 25 gallons per minute (gpm). This area also contains areas of overlying discontinuous, unconsolidated glacial deposits of sand and gravel of varying thickness which may yield 10 to 30 gpm. Most of the northwestern third of the county obtains ground water from interbedded and interlensed sand, gravel, silt and clay deposits or the underlying Pottsville sandstone. Wells in these areas range from 100 to 300 feet deep and yield 50 to 100 gpm.

Areas underlying Hartville, North Canton, Canton, Canal Fulton, Massillon and Navarre have the best ground-water supplies in the county. These aquifers are deep deposits of permeable sand and gravel, which yield between 500 and 2,000 gpm in many wells. The deep sand and gravel aquifer underlying Massillon and Navarre is susceptible to infiltration of chlorides, requiring careful control of well spacing and pumping rates. Ground-water supplies, whether they are developed from bedrock or glacial deposits, have a high natural mineral content resulting in hard water. This water usually requires treatment for domestic use. Varying amounts of iron are found in the county. An overview of the ground-water resources in the county is given in *Stark County Ground-Water Resources*, AEX-490.76.

The yield of a well will vary considerably depending on the age and depth of the well, well construction, the diameter of the casing, pump capacity and age, and more importantly, properties of the geologic formation. Specific information on ground-water availability and wells can be obtained by contacting the Ohio Department of Natural Resources (ODNR), Div. of Water.

Where Does the Water Go?

Based on long-term weather records, Ohio receives an average of 38 inches of precipitation per year. These 38 inches move through a complex path called the hydrologic cycle. Of these 38 inches, about 10 inches (26 percent) become runoff, which moves immediately to surface-water bodies like streams and lakes. Two inches are retained at the ground surface and evaporate back into the atmosphere in a relatively short period of time. Twenty-six of the 38 total inches enter the soil surface through infiltration. Twenty of these 26 inches go into soil storage and later are returned to the atmosphere by the combination of evaporation and transpiration (evapotranspiration). The remaining 6 inches of precipitation (16 percent of the total) have the potential to recharge the ground-water supply. Two of these 6 inches eventually move to springs, lakes, or streams as ground-water discharge. The remaining 4 inches either return to the atmosphere by evapotranspiration or are withdrawn to supply water needs. For further reading, refer to *Ohio's Hydrologic Cycle*, AEX 461.

Statewide averages applied to the county's average annual precipitation provide a rough estimate of how many inches will result in runoff and how many inches have the potential to reach aquifers. Based on statewide averages of runoff and ground-water recharge, Stark County's 37 inches of average annual precipitation result in about 9.5 inches of runoff to streams and lakes, and about 6 inches have the potential to recharge aquifers, annually. Values for particular locations will differ according to local conditions.

Water Use

Water use for each of Stark County's public water-supply systems is given in Table 1. For each water system, this table presents an estimate of the population served, water source, estimated daily usage and treatment plant capacity. The county's largest public-water system is Canton, which uses ground water for its supply. Alliance, Louisville, Minerva, Navarre, North Canton and Massillon use ground water, as well.

Ground water is the major water source for rural households in Stark County. Approximately 26 percent of all households obtain their water from private wells. Based on an estimated usage of 102 gallons per person per day, 9.8 million gallons per day (gpd) from private wells is used. Additional private water uses include industry (16.3 million gpd), golf course and crop irrigation (0.5 million gpd), and livestock use (0.6 million gpd), mostly from ground-water supplies. The remaining 74 percent of households use public-water supplies with ground or surface water as the source, as identified in Table 1.

Some water users in Ohio must register their withdrawals with the ODNR Div. of Water. Through the Water Withdrawal Facility Registration Program, owners of facilities that could withdraw 100,000 gpd (70 gpm) or more must register those facilities. Information collected through this program includes withdrawal capacity, ground- or surface-water sources, location and type of water use, and location of discharge points. The program is for registration only, and not for allocation or permission. Registered withdrawers file annual reports of their water use. This information helps planners at ODNR determine the availability of water for projected needs and better manage and protect Ohio's water resources. Documenting water use also provides official records for individual uses. For more information, contact ODNR, Div. of Water.

Stark County also has 68 non-transient non-community public water supplies. Non-transient non-community systems are small public supplies, such as some schools and businesses, that serve more than 25 of same people for six months of the year. In Stark County, 20,647 people are served by non-transient non-community systems and the total usage is 416,765 gpd.

Table 1. Water Use in Stark County, Ohio.[1]

Public Water System	Population Served	Primary Water Source	Water Usage (GPD)[2]	Treatment Plant Capacity (GPD)
Alliance City	25,000	Surface Water	5,530,000	11,000,000
Beach City	1,138	Ground Water	114,000	250,000
Brewster	2,300	Ground Water	340,000	864,000
Canal Fulton	4,157	Ground Water	444,000	360,000
Canton	140,000	Ground Water	25,510,000	27,000,000
East Canton[3]	1,750	Ground Water	175,000	576,000
East Sparta	750	Ground Water	130,000	338,000
Lake Township[4]	225	Ground Water	36,000	0
Louisville	9,000	Ground Water	862,000	1,000,000
Magnolia	925	Ground Water	75,000	540,000
Massillon/Ohio Water S.	53,308	Ground Water	7,190,000	11,200,000
Minerva	4,900	Ground Water	763,000	2,000,000
Navarre	2,200	Ground Water	501,000	864,000
North Canton	17,000	Ground Water	2,400,000	6,000,000
Waynesburg	1,068	Ground Water	145,000	500,000
Wilmot	363	Ground Water	33,000	120,000
Other[5]	8,131	Ground Water	1,039,350	684,000
1 Estimates from Ohio EPA using 1993 data, adjusted by Leonard Black, ODNR Div. of Water.				
2 GPD = gallons per day.				
3 Water supplied by Canton.				
4 Water supplied by North Canton.				
5 Other - includes Apple Grove Water Association and approximately 44 other public and private water systems.				

Water Quality

Natural processes and human activities affect the quality of our water supplies. Throughout Ohio, human activities contribute to nonpoint source pollution, through which a major portion of the sediment, nutrients, acids and salts, heavy metals, toxic chemicals and pathogens enter the state's water resources. Nonpoint source pollution is the introduction of impurities into a surface-water body or an aquifer, usually through a non-direct route and from sources that are "diffuse" in nature. This type of pollution affects both ground and surface water. Examples include automobile emissions, runoff from parking lots, runoff and drainage from agricultural fields, feedlots, and home gardens, and runoff and drainage from construction, mining and logging.

Ground Water

As water moves through the permeable sand and gravel underlying Stark County, it dissolves and carries

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in solution minerals contained in these deposits. AEX-490.76 summarizes some of the county's natural ground-water quality aspects.

Human activities, such as agricultural production, domestic waste disposal, and lawn and turf care, may have some influence on the county's ground-water quality. In a 1989 study by Heidelberg College, 564 wells in the county were sampled for nitrate content, of which 485 (86 percent) contained nitrate-nitrogen concentrations in the range of 0 to 0.3 parts-per-million (ppm). This range is assumed to represent natural background levels. Forty-five wells (8 percent) were tested in the range of 0.3 to 3.0 ppm; these values may or may not indicate human influence. The 29 wells (5.1 percent) that tested in the range of 3.0 to 10 ppm, may indicate elevated concentrations resulting from human activities. Only 5 wells (0.9 percent) tested at over 10 ppm nitrate-nitrogen, which exceeds the safe drinking-water standard. The average test value for the 564 wells tested was 0.53 ppm. Design, location, and condition of a well, as well as the characteristics of the soils and geologic formations in which the well is constructed, influence the potential for pollutants to enter the well. Bacterial counts are another indicator of ground-water quality. For interested citizens, the Stark County Health Department tests water samples for bacterial counts.

Ground-water contamination by volatile organic compounds, VOCs, is a concern in certain areas of the county, in particular, wells in the Uniontown area. An Ohio Environmental Protection Agency (Ohio EPA) study indicated that between November 1990 and June 1991, 94 residential wells in the Uniontown area were sampled and analyzed for VOCs. One or more of the following compounds were found in 26 of the wells sampled: Tetra-chloroethene (11 wells), Trichloroethane (9), Trichloroethene (1), Trichlorobenzene (1), Toluene (1), Chloroform (4), Styrene (1), Chloromethane (1) and Trichlorofluoromethane (1). In samples from two wells, more than one compound was detected. No compound was detected at a concentration greater than its specific Maximum Contaminant Levels (MCL) established by the U.S. Environmental Protection Agency (U.S. EPA). However, in eight instances the Proposed MCL for tetrachloroethene (5 micro-grams per liter) was exceeded. In several instances, well equipment or the recent shock chlorination of wells in the area was suspected as the source of contamination. The Ohio EPA study suggested that the Uniontown area well contamination was an isolated problem related to the physical characteristics of the unconfined sand and gravel aquifer and human activities. The results of this study point out the great susceptibility of the sand and gravel aquifer and underlying sandstone/shale bedrock to contamination from both domestic septic systems and past surface disposal practices.

Surface Water

Runoff and sediment from residential development, construction sites and agricultural lands may enter the county's streams and lakes. Also, runoff may carry other pollutants, such as lawn and agricultural chemicals (pesticides and fertilizers), effluent from septic systems, oil and gas from spills, and industrial wastes. Through a cooperative program between the State of Ohio and the U.S. Geological Survey (USGS), sediment discharges have been measured at stream gauges on the Muskingum River at Dresden and McConnellsville. The two stations give sediment discharge figures for the continuous period from October 1952 to the present. Measurements from these gauges, plus calculations of sediment retained by the 15 reservoirs in the Muskingum River basin result in estimates of about 4.6 tons per acre per year of gross erosion in the Muskingum River basin.

Through the Ohio Nonpoint Source Assessment and Water Resources Inventory, Ohio EPA and ODNR have found that 13,000 stream miles in Ohio have been affected by nonpoint source pollution. Stark County contains portions of several streams and their tributaries that have been classified by the Assessment as being affected by nonpoint source pollution. Based on the findings of the Assessment and Inventory, the Ohio Nonpoint Source Management Plan has been implemented to help improve the

quality of the state's waters. For specific information on results of the Assessment and details of the Management Plan for the county, contact the Ohio EPA Northeast District Office (2110 E. Aurora Rd., Twinsburg, OH 44087). Overall, Stark County has a safe supply of water. County citizens have a major challenge to protect water resources from pollutants that could affect the quality of the water supply. For more information about nonpoint source pollution, refer to Nonpoint Source Pollution: Water Primer, AEX 465, available from your county Extension office.

Summary

Water availability and quality are important public concerns. Water problems can be both costly and inconvenient. While the present and future availability of water is good for Stark County, water is a precious resource that must be conserved and protected. We must all work together to maintain an adequate supply of good quality water.

This fact sheet provided information on water facts for Stark County. For more information on water resources and drinking-water quality in the county, contact the Stark/Summit Regional Office of Ohio State University Extension. In addition, the following agencies may be able to provide information on other water resources topics in the county: Stark Soil and Water Conservation District; Stark County Health Department; ODNR Div. of Water (Fountain Square, Col., OH 43224); USGS, Ohio District (975 W. Third Ave., Col., OH 43212); Ohio EPA (1800 WaterMark Dr., Col., OH 43266); and Ohio Department of Health (PO Box 118, Col., OH 43226).

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Evaluation of Background Metal Concentrations in Ohio Soils

June 21, 1996

Submitted to:

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Columbus, Ohio 43266-0149

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ENVIRONMENTAL SERVICES

Introduction

Soils contaminated by metals are common at many industrial sites in Ohio and across the country. The mere presence of metals in soils, however, does not necessarily indicate contamination because all soils naturally contain at least trace levels of metals (U.S. EPA, 1992a). The presence, nature, and extent of soil contamination by metals is commonly determined through comparisons of samples from "affected" locations to those from "unaffected" locations at or near the site, or to published regional metal concentrations. These "unaffected" concentrations are commonly referred to as background. Background concentrations for naturally occurring constituents are used not only to determine the presence, nature, and extent of contamination but also are used to aid in the establishment of soil remediation goals. Such background-related evaluations are often required under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In most cases, a direct statistical comparison to background data collected at a site is preferable over comparison to regionally derived background levels. Site-specific background data are preferred because the concentration of metals in unaffected soil varies from location to location, depending not only on the geology of the parent material from which the soil was derived, but also on climatic conditions and local land use patterns. Despite the obvious advantages of direct statistical comparison to site specific background data, a simple comparison or, in some cases, a statistical comparison to regionally derived background data may be appropriate or even preferable in some situations. For example, the lack of time or funding may prevent collection and analysis of sufficient background data. In other cases, it may be impossible to collect representative background data at an industrial facility due to limited space or the lack of an area unaffected by waste handling.

Published background metal concentrations in soils are available on a nation-wide level. Commonly cited references on this subject include Shacklette and Boerngen (1984), and Holmgren and others (1993). Whereas background soil data of this sort may be useful for making general comparisons from one state or region to another, localized databases are preferable for focusing on environmental objectives such as determining whether or not a release has occurred or in developing remediation goals. Logan and Miller published background levels for cadmium, chromium, copper, lead, nickel, and zinc from farm soil in seven counties in Ohio (Logan and Miller, 1983). While providing a reasonable estimate of background metal concentrations for each of the seven counties, the limited spatial variability of the data prevent adequate characterization of background for the state as a whole. Utilization of the Logan and Miller data is also limited by the number of metals characterized. Clearly, a more comprehensive data set is required to adequately characterize the variation of background metal concentrations across the state.

The primary objective of this study is to provide a state-wide statistical evaluation of background metal concentrations in Ohio soils, for use by industry, regulatory agencies, consultants and the general public. This study utilizes background data collected from environmental investigations

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across the state, and provides state-wide background concentrations for 20 metals. The assembled data set is from 64 sites in 36 of Ohio's 88 counties. Due to the individual nature of the environmental reports used throughout the study, many of the sites do not include analyses for all 20 metals.

This study was conducted in association with the Ohio Environmental Protection Agency (Ohio EPA) Division of Hazardous Waste Management. Involvement of the Ohio EPA in the project does not imply endorsement of the findings of the study by Ohio EPA nor should this report be construed as Ohio EPA guidance. No source of outside funding was used in the development of this report.

Metals in Background Soil

Nearly all of today's soils have been affected to some extent by anthropogenic processes. Farm soil, for instance, may contain heavy metals associated with sewage sludge application (Logan and Miller, 1983) and/or the direct application of fertilizers containing metals such as manganese, copper, zinc, boron, and potassium (Ohio Agricultural Guide, 1988). Soils in urban settings often contain elevated levels of metals related to fallout associated with the burning of fossil fuels and refuse for the generation of heat and power, or from other industrial sources. In addition, elevated concentrations of lead have been documented along roadways (Holmgren, et.al., 1983).

As a result, soils used to characterize background within Ohio may have a subtle overprint of these and other anthropogenic sources. This generalization certainly is true for background data collected from areas within or surrounding industrial facilities. However, as demonstrated by this study, background data affected by industrial activities (termed industrially-impacted soil) in many cases can be separated from those background data that represent soil conditions present throughout much of the state.

Background Data Set

Data used in this evaluation of background metal concentrations in Ohio soils were compiled from public Ohio EPA files for RCRA closure, RCRA Corrective Action, and CERCLA projects. Ohio EPA Division of Hazardous Waste Management, Central Office coordinated the selection of the reports to be included in the study. All of the reports that contained background metals data were considered for inclusion in the database. In several cases, specific sites were removed from the database at the request of Ohio EPA District Offices based on the location of the background samples. Background data from 64 environmental projects conducted between 1984 and 1994 were used in the study. A list of the sites and the associated metals utilized in the study is provided in Table 1. A total of 36 of the 88 counties in Ohio are represented in the study (Figure 1).

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Data Entry

Metal concentration data were entered into a relational database using a database application designed specifically for this project. Because metal concentrations in soil may be dependent on a number of variables (i.e., the local setting, the parent geologic material, depth, and land use history), the database file structure was designed so that evaluation by a number of criteria could be made easily. The criteria include geologic setting (DRASTIC hydrogeologic settings of Aller ,et al., 1987), grain size description, sample depth, Unified Soil Classification Scheme, United States Soil Conservation Service classification, Standard Industrial Classifications (SIC) Codes, and geographic setting (state, county, latitude and longitude). The available data entry fields associated with the database are summarized on Table 2. Due to insufficient detail in many of the data reports, much of this information was not available.

To aid the data entry process, real-time error checking on such items as U.S. EPA facility identification number, facility name, address, SIC Codes, analyte names and concentration units were provided in the form of lookup tables. This consideration minimized data entry errors and reduced the database review time. In addition, an audit trail was developed that tied each analytical result to the report from which it was taken. The audit trail enabled a check of the database entries against the source data, and will be useful for future workers who may wish to review source documents in detail concerning a particular site or metal.

All of these considerations were met through the commercially available relational database program Paradox for DOS® (Version 4.0). The application developed was written in the Paradox Application Language (PAL®). Data tables are easily exported to other popular software formats (dBASE®, Lotus 123®, and Quattro®), or as ASCII files.

Data Review and Preparation

Following data entry, the database was checked against the source documents for completeness and accuracy. The database files were then copied prior to data reduction and statistical analysis. This ensured that the original database would remain intact. The following steps were taken to prepare the data for statistical analysis:

1) Censored data (non-detects) that did not include a detection limit were removed from the database. It was not possible to substitute values for these censored data via generally accepted statistical techniques because the metal-specific detection limits that were reported varied widely within the database. Generally accepted statistical techniques that allow replacement of censored data assume that the data are from the same site, same sampling episode and/or have a constant detection limit.

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2) Censored data for which specific detection limits were reported were replaced by one half their respective detection limits and carried through the statistical analysis. This method of manipulating censored data is a generally accepted practice and is the only practical method to deal with the numerous detection limits reported for each metal. In addition, the authors believed this approach to be more conservative than simply replacing the censored data point concentration by the reported detection limit.

3) The facility count for each metal (i.e. the number of facilities at which a specific metal was analyzed) was then reviewed (Table 3). Boron, lithium, molybdenum, silicon, and tin, which were analytes at less than three separate sites, were not considered for further analysis in this study. It was felt that the current data sets for these metals lack the desired spatial variability for this study.

4) The percentage of censored data associated with each metal was computed and is presented also in Table 3. Because many statistical techniques are inappropriate for data sets with a high percentage of censored data (U.S. EPA, 1992b; Gilbert, 1987; and Gibbons, 1994), metals with greater than 60% censored data were not considered for statistical analysis. Statistical methods that compensate for high percentages of censored data were not utilized in this study because of the wide range of detection limits reported per analyte. Metals screened from further statistical analysis due to a high percentage of censored data included antimony (97% censored data), selenium (78% censored data), silver (72% censored data), and thallium (73% censored data). Limited information, such as the range of detections, are provided for these metals in summary tables (Table 5).

5) Metals that were not screened out include aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, vanadium and zinc. The database then was queried by metal and subjected to statistical analysis.

Statistical Approach

Metal-specific data sets used in this study consist of hundreds of sample results, many times larger than those of the typical environmental background study which usually contain less than ten sample results. In addition, because the sample results in this evaluation are from a variety of locations across the state the authors were working under the assumption that any data set could contain multiple populations, either as a result of geologic variability or as a result of anthropogenic sources. To effectively handle the large data sets and meet the assumption of multiple populations, the authors used an iterative approach to statistical analysis which combined visual inspection through the use of probability plots, statistical analysis, and statistical modeling. These procedures are discussed below.

Visual Inspection - Probability Plots

Probability plots are an effective means of visually evaluating the normality of large data sets such as those presented in this report. On a probability plot, a normally distributed data set will form a straight line. Probability plots can also be used to evaluate transformed data sets. For example, log-normally distributed data sets will plot as a straight line after they have been log-transformed. Procedures for construction of probability plots are provided by Gilbert (1987).

In addition to evaluating normality and log-normality, probability plots also have been used to evaluate the presence of multiple populations within data sets. This method has been used successfully for many years in geochemical exploration to locate ore bodies (Parslow, 1974; Sinclair, 1974 and 1976), and more recently to formulate cleanup standards for contaminated soils (Fleischhauer and Korte, 1990). Multiple populations will form distinct straight-line segments on a probability plot provided each population is normally distributed. Where two populations overlap, an inflection point will form. This point, referred to as the "threshold point" by Fleischhauer and Korte (1990), represents the separation point between two populations. Through this method, populations can be identified and segregated from one another for further analysis. Segregation of the data will be partial where overlap exists; however, the statistical bias probably will remain small (Fleischhauer and Korte, 1990).

Upon initial inspection, it appeared that the data for barium, cadmium, chromium, copper, lead, mercury and zinc contained two distinct populations. It was assumed that the two populations represent background and industrially-impacted soils rather than natural variation within the background population due to such things as parent material or sample depth. This assumption is supported by sample descriptions which describe the presence of man-made fill materials and the relatively high concentrations detected in the industrially-impacted soils population. In addition, the two populations would be expected in soils collected at industrial facilities.

To illustrate the use of probability plots, two normally distributed data sets are presented as frequency distributions on Figure 2a. The data are plotted on a probability plot in Figure 2b. In this case, Population A may represent background conditions and Population B may represent industrially-impacted soils. An inflection point between the two populations represents the threshold point separating the two populations. For comparison, Figure 2c is the frequency distribution of the zinc data set from this study. Figure 2d is the probability plot for zinc. The two populations are easily discernable.

Metal-specific data sets that demonstrated characteristics of multiple populations were divided into two subsets for further analysis. The threshold values (Table 4) were used as the divider. The populations that contained the higher concentrations were assumed to belong to the industrially-impacted soils population. The remaining data were considered to represent background.

Statistical Analysis

Once the data sets were evaluated visually and segregated as necessary, they were subjected to statistical analysis to identify outliers, further assess their distribution and develop summary statistics. Outliers were identified using the box-plot method (Iglewicz and Hoaglin, 1993). To identify outliers by this method, data sets were ranked and the quartiles Q_1 and Q_3 determined. Upper and lower fences "U" and "L", respectively were then defined as:

$$U = Q_3 + k(Q_3-Q_1) \text{ and } L = Q_1 - k(Q_3-Q_1).$$

Values that fell outside the fences were identified as outliers. The value for the constant "k" used in this study was 2.3, as recommended by Iglewicz and Hoaglin (1993) for larger data sets.

Following outlier identification, the data sets for each metal were analyzed to determine if they were normally or log-normally distributed by determining its probability plot correlation coefficient (Filliben, 1975). The correlation coefficient can range between 0 and 1, with 1 being a perfect correlation. As data sets become larger the critical values generated by Filliben approach unity and the method becomes very sensitive to the presence of outliers and censored data. To assess the sensitivity of the method to outliers, normality testing was completed on the data sets before and after outlier removal as suggested by Barnett and Lewis (1978) and Iglewicz and Hoaglin (1993).

Current U.S. EPA (1992b) guidance for statistical analysis cautions against the removal of outliers. This is a response, in part, to the small size of most background data sets where the removal of one or two data points could constitute the removal of as much as 25% of the data. In large data sets, where the expected percentage of outliers is 10% or greater, the removal of identified outliers is an acceptable practice (David Hoaglin, personal communication, 1996). Sensitivity analyses performed on the data sets containing outliers indicated that they should be removed from the data sets prior to statistical analysis. Removal of the outliers, which typically represented less than 3% of the data set, improved the normality of the data sets, reduced the standard deviation and had little to no affect on the mean or median.

Standard statistical methods were then used to determine the median, mean, minimum, maximum, range, count (number of observation), variance, coefficient of variance, sample standard deviation, skewness, and kurtosis for each population. Once the statistical evaluation was completed, an inverse log-transformation was applied to the mean for the log-normally distributed metals to provide an untransformed value. In this study, the inverse log-transformed mean also is referred to as the geometric mean.

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Statistical Modeling

A statistical modeling technique was used by the authors to visually compare the goodness-of-fit between observed data sets and modeled data sets. The modeled data sets were generated using the same mean, standard deviation and number of observations as that of the observed data. Once the modeled data set was generated, it was plotted on the probability plot along with the observed data and the degree to which the sets matched was evaluated visually. This method was especially useful in evaluating how well the calculated statistics (mean and standard deviation) characterized the observed data in those data sets that contained outliers and/or a large percentage of censored data.

In situations where multiple populations were identified, the statistical modeling technique was used also to refine the determination of the threshold point. Following an initial segregation and statistical analysis of the background and industrially-impacted soil data for a specific metal, the two modeled data sets were added together, plotted on probability paper along side the original data and compared. Then a new threshold point was determined and the statistical analysis, modeling, and visual inspection repeated until the best curve match was obtained.

Data Presentation

Probability plots for aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, vanadium and zinc are presented on Figures 3 through 18. These figures represent as many as three probability plots for each metal. The first plot in each case is of the raw (untransformed) data; the second is of the natural log-transformed data, and, where appropriate, the third plot represents the natural log-transformed data that has been corrected for outliers. Outliers and threshold points have been identified on the plots. Except for aluminum, each of these metals is log-normally distributed. Aluminum appears to be normally distributed. Data sets for barium, cadmium, chromium, copper, lead, mercury, and zinc were determined to contain two populations.

The results of the statistical evaluations of background soils for Ohio are presented in Table 5 and those for industrially-impacted soil are presented in Table 6. The results are provided on a metal by metal basis. The tables include the following information for each of the metals: count (number of data points), minimum and maximum concentration, range, variance, coefficient of variance, standard deviation, standard error, skewness, kurtosis, mean, median and geometric mean. A summary of statistical results is provided also on the probability plots (Figures 3 through 18). The statistical summaries for industrially-impacted soil have been presented in this report because: 1) they were identified as separate and distinct populations not related to background and 2) to document the statistical approach used in this study. Because the focus of the investigations that generated the data used in this study was to evaluate background conditions (not industrially-impacted conditions), the authors caution against the use of the industrially-impacted soil statistical summaries.

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Because of the log-normal distribution of the data, mean values are provided as geometric means for all metals with the exception of aluminum. The arithmetic mean is used for aluminum. Shacklette and Boerngen (1984) note that trace metals tend to have positively skewed frequency distributions, and thus the geometric mean is the more proper measure of central tendency for most elements in soils. Shacklette and Boerngen (1984) also note that the frequency distribution for aluminum usually is normal if the data are not log-transformed and the mean is expressed as the arithmetic mean.

Discussion of Results

The results of the statistical evaluation of background metal concentrations for soils in the state of Ohio are discussed below, in alphabetical order. The discussion is limited to state-wide occurrences of metals in background and, where appropriate, in industrially-impacted soil. In addition, where possible, the results determined in this study are compared (Table 7) to those of previous investigators including Brooks (1972), Logan and Miller (1983), Shacklette and Boerngen (1984), and Holmgren and others (1993). The statistical results developed by Logan and Miller (1983) and Holmgren and others (1993) are for Ohio, whereas those from the Shacklette and Boerngen (1984), and Brooks (1972) are for the eastern United States (east of the 96th meridian), and the United States, respectively.

Aluminum

A total of 136 aluminum determinations associated with four sites in four counties exist in the current database. None of these determinations were reported as being below the detection limit (Table 3). The data were found to be normally distributed with a single background population (Figure 3). The background aluminum values range from 2,000 to 16,100 mg/kg, with a median of 7,685 mg/kg and an arithmetic mean of 8,180 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 33,000 mg/kg and a range of 7,000 mg/kg to 100,000 mg/kg for soils of the eastern United States.

Antimony

A total of 285 antimony determinations associated with 10 sites in nine counties exist in the current database. Of these, 276 (97%) were reported as being below the detection limit (Table 3). Due to the large amount of censored data, antimony data were not evaluated statistically. Detected levels of antimony range from 0.97 to 92 mg/kg (Table 5). Detection limits range from 0.30 to 15 mg/kg. The most frequently occurring detection limit was 5 mg/kg. At these detection limits, it appears that antimony is not typically detected in Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 0.52 mg/kg and a range of <1 mg/kg to 8.8 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 0.5 mg/kg for U.S. soils.

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Arsenic

A total of 693 arsenic determinations associated with 32 sites in 22 counties exist in the current database. Of these, 46 (7%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 4). Outlier testing indicated that the data set contains seven outliers. After the removal of three high value and four low value outliers, the data set ranges from 0.50 mg/kg to 56 mg/kg, with a median of 5.80 and a geometric mean of 5.72 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 4.8 mg/kg and a range of <0.1 mg/kg to 73 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 5 mg/kg for U.S. soils.

Barium

A total of 742 barium determinations associated with 37 sites in 24 counties exist in the current database. Of these, 4 (0.5%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 5). Outlier testing indicated that the data set contains seven low value outliers. Statistical modeling indicated that the natural log of the threshold value which separates the populations to be 5.80. This value equates to 330 mg/kg (Table 4).

The background data set contains 710 observations. The background values range from 9.3 mg/kg to 323 mg/kg with a median of 63.2 and a geometric mean of 63.4 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 290 mg/kg and a range of 10 mg/kg to 1,500 mg/kg for U.S. soils. Brooks (1972) reports an average of 500 mg/kg for U.S. soils.

The industrially-impacted soil data set contains 25 observations with values ranging from 331 mg/kg to 7,790 mg/kg with a median of 660 mg/kg and a geometric mean of 838 mg/kg (Table 6).

Beryllium

A total of 322 beryllium determinations associated with eight sites in seven counties exist in the current database. Of these, 115 (36%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 6). The values range from 0.10 mg/kg to 3.15 mg/kg with a median of 0.450 mg/kg and a geometric mean of 0.377 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 0.55 mg/kg and a range of <1 mg/kg to 7 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 6 mg/kg for U.S. soils.

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Cadmium

A total of 768 cadmium determinations associated with 44 sites in 28 counties exist in the current database. Of these, 397 (52%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 7). Outlier testing indicates that the data set contains three low value outliers. Statistical modeling indicates that the natural log of the threshold value which separates the populations is 1.5. This value equates to 4.5 mg/kg (Table 4).

The background data set contains 706 observations. The background values range from 0.07 to 4.4 mg/kg with a median of 0.480 and a geometric mean of 0.507 mg/kg (Table 5). Logan and Miller (1983) report a mean of 0.2 mg/kg and a range of below detection to 2.9 mg/kg. Holmgren and others (1993) reports a geometric mean of 0.357 mg/kg for Ohio soils.

The industrially-impacted soil data set contains 59 observations with values ranging from 4.50 mg/kg to 362 mg/kg with a median of 12.0 and a geometric mean of 13.0 mg/kg (Table 6).

Chromium

A total of 972 chromium determinations associated with 50 sites in 31 counties exist in the current database. Of these, 23 (3%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 8). Outlier testing indicates that the data set contains 15 low value outliers. Statistical modeling indicates that the natural log of the threshold value which separates the populations is 4.4. This value equates to 81 mg/kg (Table 4).

The background data set contains 925 observations. The background values range from 2.0 to 80.5 mg/kg with a median of 12.0 mg/kg and a geometric mean of 12.1 mg/kg (Table 5). Logan and Miller (1983) report a mean of 12 mg/kg and a range of 4 to 23 mg/kg for Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 33 mg/kg and a range of 1 to 1,000 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 200 mg/kg for U.S. soils.

The industrially-impacted soil data set contains 32 observations with values ranging from 83.2 mg/kg to 2,340 mg/kg with a median of 200 mg/kg and a geometric mean of 260 mg/kg (Table 6).

Cobalt

A total of 320 cobalt determinations associated with seven sites in six counties exist in the current database. Of these, 24 (8%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 9). Outlier testing indicates that the data set contains three low value outliers. The background values range

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from 1.0 to 53.6 mg/kg with a median of 7.25 mg/kg and a geometric mean of 6.42 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 5.9 mg/kg and a range of <0.3 mg/kg to 70 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 10 mg/kg for U.S. soils.

Copper

A total of 392 copper determinations associated with 13 sites in 12 counties exist in the current database. Of these, 2 (0.5%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 10). Outlier testing indicates that the data set contains one low value outlier. Statistical modeling indicates that the natural log of the threshold value which separates the populations is 4.1. This value equates to 60 mg/kg (Table 4).

The background data set contains 357 observations. The background values range from 2.2 mg/kg to 58 mg/kg with a median of 12.0 mg/kg and a geometric mean of 11.8 mg/kg (Table 5). Logan and Miller (1983) report a mean of 19 mg/kg and a range of 11 to 37 mg/kg for Ohio soils. Holmgren and others (1993) reports a geometric mean of 26.2 mg/kg for Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 13 mg/kg and a range of <1 mg/kg to 700 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 20 mg/kg for U.S. soils.

The industrially-impacted soil data set contains 34 observations with values ranging from 66 mg/kg to 1,420 mg/kg with a median of 236 and a geometric mean of 233 mg/kg (Table 6).

Iron

A total of 156 iron determinations associated with four sites in four counties exist in the current database. Of these, 0 (0%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 11). Outlier testing indicates that the data set contains one low value outlier. The background values range from 5,150 to 100,000 mg/kg with a median of 17,300 mg/kg and a geometric mean of 18,400 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 14,000 mg/kg and a range of 100 to 100,000 mg/kg for soils of the eastern United States. Brooks (1972) reports a range of 10,000 to 50,000 mg/kg for U.S. soils.

Lead

A total of 1,019 lead determinations associated with 56 sites in 32 counties exist in the current database. Of these, 76 (7%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 12). Outlier testing indicates that the data set contains four low

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value outliers. Statistical modeling indicates that the natural log of the threshold value which separates the populations is 5.0. This value equates to 148 mg/kg (Table 4).

The background data set contains 929 observations. The background values range from 1.0 mg/kg to 147 mg/kg with a median of 14.3 and a geometric mean of 16.2 mg/kg (Table 5). Logan and Miller (1983) report a mean of 19 mg/kg and a range of 9 to 39 mg/kg for Ohio soils. Holmgren and others (1993) reports a geometric mean of 18.2 mg/kg for Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 14 mg/kg and a range of <10 mg/kg to 300 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 10 mg/kg for U.S. soils.

The industrially-impacted soil data set contains 86 observations with values ranging from 152 mg/kg to 10,500 mg/kg with a median of 558 and a geometric mean of 633 mg/kg (Table 6).

Manganese

A total of 124 manganese determinations associated with three sites in three counties exist in the current database. Of these, 0 (0%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 13). Outlier testing indicates that the data set contains three low value outliers and one high value outlier. Background values range from 59 to 1,750 mg/kg with a median of 476 mg/kg and a geometric mean of 459 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 260 mg/kg and a range of <2 to 7,000 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 850 mg/kg for U.S. soils.

Mercury

A total of 580 mercury determinations associated with 29 sites in 20 counties exist in the current database. Of these, 331 (57%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 14). Outlier testing indicates that the data set contains 22 low value outliers. Statistical modeling indicates that the natural log of the threshold value which separates the populations is 0.5. This value equates to 1.6 mg/kg (Table 4).

The background data set contains 514 observations. The values range from 0.010 mg/kg to 1.6 mg/kg with a median of 0.060 mg/kg and a geometric mean of 0.081 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 0.081 mg/kg and a range of 0.01 to 3.4 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 0.01 mg/kg for U.S. soils.

The industrially-impacted soil data set contains 44 observations with values ranging from 1.8 to 96 mg/kg with a median of 18.8 mg/kg and a geometric mean of 10.7 mg/kg (Table 6).

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Nickel

A total of 555 nickel determinations associated with 20 sites in 17 counties exist in the current database. Of these, 28 (5%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a background population (Figure 15). Outlier testing indicates that the data set contains four low value outliers and three high value outliers. The background values range from 2.0 mg/kg to 110 mg/kg with a median of 14.7 and a geometric mean of 14.4 mg/kg (Table 5). Logan and Miller (1983) report a mean of 18 mg/kg and a range of 9 mg/kg to 38 mg/kg for Ohio soils. Holmgren and others (1993) report a geometric mean of 27.1 mg/kg for Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 11 mg/kg and a range of <5 to 700 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 40 mg/kg for U.S. soils.

Potassium

A total of 145 potassium determinations associated with four sites in four counties exist in the current database. Of these, 8 (6%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 16). The values range from 230 to 2,180 mg/kg with a median of 720 mg/kg and a geometric mean of 709 mg/kg (Table 5). Shacklette and Boerngen (1984) report an arithmetic mean of 12,000 mg/kg and a range of 50 to 37,000 mg/kg for soils of the eastern United States.

Selenium

A total of 480 selenium determinations associated with 23 sites in 18 counties exist in the current database. Of these, 376 (78%) were reported as being below the detection limit (Table 3). Due to large amount of censored data, these data were not evaluated statistically. Detected values range from 0.2 to 35 mg/kg (Table 5). Detection limits for selenium range from 0.003 mg/kg to 5 mg/kg. The most frequently occurring detection limit is 0.25 mg/kg. At these detection limits it appears that selenium is not typically detected in Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 0.30 mg/kg and a range of <0.1 to 3.9 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 0.5 mg/kg for U.S. soils.

Silver

A total of 433 silver determinations associated with 20 sites in 17 counties exist in the current database. Of these, 313 (72%) were reported as being below the detection limit (Table 3). Due to large amount of censored data, these data were not evaluated statistically. Detected values range from 0.2 to 14.8 mg/kg (Table 5). Detection limits for silver range from 0.03 to 2.5 mg/kg. The most frequently occurring detection limit is 0.25 mg/kg. At these detection limits it appears that silver is not typically detected in Ohio soils. Limited published background data for silver are

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available. U.S. EPA (1983) cite a common range of 0.01 to 5 mg/kg and an average of 0.05 mg/kg for U.S. soils.

Thallium

A total of 276 thallium determinations associated with six sites in six counties exist in the current database. Of these, 201 (73%) were reported as being below the detection limit (Table 3). Due to the large amount of censored data, these data were not evaluated statistically. Detected values range from 0.17 to 0.59 mg/kg (Table 5). Detection limits for thallium range from 0.16 to 2.5 mg/kg. The most frequent detection limit is 2.5 mg/kg. At these detection limits it appears that thallium is not typically detected in Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 7.7 mg/kg and a range of 2.2 to 23 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 13 mg/kg for U.S. soils.

Vanadium

A total of 367 vanadium determinations associated with nine sites in eight counties exist in the current database. Of these, 0 (0%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed within a single background population (Figure 17). The values range from 4.6 to 71 mg/kg with a median of 17.8 mg/kg and a geometric mean of 17.4 mg/kg (Table 5). Shacklette and Boerngen (1984) report a geometric mean of 43 mg/kg and a range of <7 mg/kg to 300 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 100 mg/kg for U.S. soils.

Zinc

A total of 472 zinc determinations associated with 17 sites in 16 counties exist in the current database. Of these, 9 (2%) were reported as being below the detection limit (Table 3). The data were found to be log-normally distributed with both a background population and an industrially-impacted soil population (Figure 18). Outlier testing indicates that the data set contains one low value outlier and two high value outliers. Statistical modeling indicates that the natural log of the threshold value which separates the populations is 5.30. This value equates to 200 mg/kg (Table 4).

The background data set contains 434 observations. The background values range from 7.5 mg/kg to 190 mg/kg with a median of 43.0 mg/kg and a geometric mean of 42.7 mg/kg (Table 5). Logan and Miller (1983) report a mean of 75 mg/kg and a range of 47 mg/kg to 138 mg/kg for Ohio soils. Holmgren and others (1993) report a geometric mean of 82.1 mg/kg for Ohio soils. Shacklette and Boerngen (1984) report a geometric mean of 40 mg/kg and a range of <5 to 2,900 mg/kg for soils of the eastern United States. Brooks (1972) reports an average of 50 mg/kg for U.S. soils.

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The industrially-impacted soil data set contains 35 observations with values ranging from 210 to 3,940 mg/kg with a median of 600 mg/kg and a geometric mean of 564 mg/kg (Table 6).

Conclusions

Background soil data from environmental investigations at 64 facilities in 36 of Ohio's 88 counties were used to assess the distribution of background metal concentrations in soils. The resulting database, which contains over 10,000 separate analytical results for 20 metals, provides the most comprehensive collection of background soil quality data ever assembled for the state of Ohio.

Through the use of probability plots, statistical analysis and statistical modeling it was determined that, with the exception of aluminum, all of the metal concentrations in background soils evaluated are log-normally distributed. Aluminum concentrations were found to be normally distributed. These findings agree with those of earlier investigators including Shacklette and Boerngen (1984) and Holmgren and others (1993). Multiple populations representing background and industrially-impacted soils were identified through the use of probability plots. Threshold values separating the two populations were determined through statistical modeling.

Aluminum, arsenic, beryllium, cobalt, iron, manganese, nickel, potassium, and vanadium concentrations were determined to belong to a single background population. However, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc concentrations were determined to belong to two populations: background and industrially-impacted soil. Statistical summaries for industrially-impacted soil have been presented in this report because: 1) they were identified as separate and distinct populations not related to background and 2) to document the statistical approach used in this study. Because the focus of the investigations that generated the data used in this study was to evaluate background conditions (not industrially-impacted conditions), the authors caution against the use of the industrially-impacted soil statistical summaries.

The analytical results for antimony, selenium, silver, and thallium contained such a high percentage of censored data that the data could not be evaluated using standard parametric methods. The general lack of detectable concentrations does indicate, however, that these analytes are not commonly detected in Ohio soils.

Within the two major populations (background and industrially-impacted soil) it is possible that other, more subtle populations (i.e., those related to regional geological variability) may be present. Initially, it was hoped that these minor populations could be identified and characterized by soil type, DRASTIC hydrogeologic settings, glaciated versus non-glaciated locations, and/or grain size. However, such detail was not presented in many of the data reports utilized in this evaluation. For that reason, it was decided that background information would be provided on a state-wide basis for each of the two major populations. In the future, as more data are included in the database, it is

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anticipated that an increase in sample-specific detail will permit a statistical separation of specific geologic settings.

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Table 1. Facilities and Metals Used in the Evaluation of Background Metal Concentration in Ohio Soils.

Facility Name	County	EPA ID Number	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron
7 7, Inc.	Wayne	OHD982075343			¤	¤		
A. Shulman, Inc.	Summit	OHD155913114			¤	¤		
ACI Standard	Jefferson	OHD986981650						
AT&T Long Lines	Paulding	OHT400015020						
Albright & Wilson, Inc., Fernald Plant	Hamilton	OHD071267090			¤			
Alsco Amerimark	Tuscarawas	OHD057243610						
American Carco Corp.	Montgomery	OHD004277687				¤		
American Steel And Wire Corp.	Cuyahoga	OHD004220810						
American Steel And Wire Corp.	Cuyahoga	OHD000821496			¤	¤		
American Steel Foundries	Stark	OHD981090418				¤		
Aristech Chem Corp.	Scioto	OHD005108477			¤	¤		
Ashland Chemical Company	Franklin	OHD042311209			¤	¤		
Associated Materials, Inc.	Summit	OHD004163549			¤	¤		
Athens City	Athens	OHD987002052						
Avondale Industries, Inc.	Cuyahoga	OHD064095102				¤		
BP Oil Toledo Refinery	Lucas	OHD005057542		¤	¤	¤	¤	
Beazer East Inc.	Wayne	OHD068911494			¤	¤		
Bechtel-Mclaughlin, Inc.	Erie	OHD004182614						
Borden Chem Printing Ink Div.	Hamilton	OHD068932011						
Brush Wellman Inc.	Ottawa	OHD004212999		¤	¤	¤	¤	
Burnham Corp., Foundry Div.	Muskingum	OHD004282158						
Cecos International, Inc.	Clermont	OHD087433744		¤	¤	¤	¤	
Chemical Waste Management, Inc.	Clark	OHD000724161			¤	¤		
Chevron USA, Inc.	Hamilton	OHD004254132		¤	¤	¤	¤	
Cleveland Industrial Drum Service, Inc.	Cuyahoga	OHD017781352			¤	¤		
Cold Metal Products Co., Inc.	Mahoning	OHD039461314						
Copperweld Steel Company	Trumbull	OHD061731857						
Cyclops Corp., El Wing Smith Div.	Guernsey	OHD058842501			¤	¤		
Dana Corp Weatherhead Div.	Paulding	OHD005039730			¤			
Davey Compressor Corp.	Hamilton	OHD072867450			¤	¤		
Dayton Paint and Coatings, Inc.	Montgomery	OHD108575184			¤	¤		
Du Pont	Pickaway	OHD004287322		¤	¤	¤		
Envirosafe	Lucas	OHD000721423			¤	¤		
Federal Mogul Corp.	Van Wert	OHD005049184			¤	¤		
Fort Recovery Industries, Inc.	Mercer	OHD005046149				¤		
Fulton Industries, Inc.	Fulton	OHD094810736						
GMC Chevrolet Moraine Assembly Plant	Montgomery	OHD041063074				¤		
GMC Inland Div., Vandalia Plant	Darke	OHD052151701				¤		
GSX Chemical Services of Ohio, Inc.	Cuyahoga	OHD980569438			¤	¤		
General American Transportation Corp.	Trumbull	OHD004224085			¤	¤		
General Electric Co.	Trumbull	OHD004224960						
General Electric Co., Ohio Lamp Plant	Trumbull	OHD066052804						
Getman Bros Mfg. Co.	Marion	OHD986967768				¤		
Handy and Harman Automotive	Fulton	OHD051633113			¤	¤		
Koppers Company, Inc.	Lucas	OHD000817114						
Kornylak Corp.	Hamilton	OHD004252011						
Laminated Panel Products, Inc.	Lorain	OHD982071045						
Metal Coatings International, Inc.	Geauga	OHD068897586			¤	¤		
Multi-Color Corporation	Hamilton	OHD004251930						
Orsynex Corp	Franklin	OHD000721803				¤		
Owens-Corning Fiberglas Tech Ctr.	Licking	OHD039992516		¤	¤		¤	
PPG Industries, Inc.	Cuyahoga	OHD004446143				¤		
Papps Body Shop, Inc.	Cuyahoga	OHD047738711				¤		
Perfection Finishers Incorporated	Fulton	OHD005041405			¤			
Phillips Display Components Co.	Putnam	OHD038703484						
Po Box 2461	Mahoning	OHD004169488						
Queen City Barrel Company	Hamilton	OHD004477634						
River Smelting and Refining Co.	Cuyahoga	OHD004187035			¤			
Russell, Burdsall & Ward Corp.	Portage	OHD004196614						
South Point Plant (Ashland Oil)	Lawrence	OHD071650592	¤	¤	¤	¤	¤	
Stolle Corporation	Shelby	OHD004239000	¤					
The Goodyear Tire & Rubber Company	Jackson	OHD000817379		¤	¤	¤		
US Doe Portsmouth Gaseous Diffusion Plant	Pike	OH7890008983	¤	¤	¤	¤	¤	
US Doe-Feed Materials Production Center	Hamilton	OH6890008976	¤	¤	¤	¤	¤	¤

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Table 1. Facilities and Metals Used in the Evaluation of Background Metal Concentration in Ohio Soils.

Facility Name	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Mercury
7 7, Inc.						¤			
A. Shulman, Inc.	¤	¤				¤			¤
ACI Standard						¤			
AT&T Long Lines						¤			
Albright & Wilson, Inc., Fernald Plant									
Alsco Amerimark		¤				¤			
American Carco Corp.	¤	¤				¤			
American Steel And Wire Corp.		¤				¤			
American Steel And Wire Corp.	¤	¤				¤			¤
American Steel Foundries	¤	¤				¤			
Aristech Chem Corp.	¤	¤				¤			
Ashland Chemical Company		¤				¤			¤
Associated Materials, Inc.	¤	¤				¤			
Athens City						¤			
Avondale Industries, Inc.	¤	¤				¤			
BP Oil Toledo Refinery	¤	¤	¤			¤			¤
Beazer East Inc.	¤	¤				¤			¤
Bechtel-Mclaughlin, Inc.	¤	¤		¤					
Borden Chem Printing Ink Div.						¤			
Brush Wellman Inc.	¤	¤	¤	¤		¤			¤
Burnham Corp., Foundry Div.	¤					¤			
Cecos International, Inc.	¤	¤	¤	¤		¤			¤
Chemical Waste Management, Inc.	¤	¤							¤
Chevron USA, Inc.	¤	¤	¤			¤			¤
Cleveland Industrial Drum Service, Inc.	¤	¤		¤	¤	¤			¤
Cold Metal Products Co., Inc.	¤	¤				¤			
Copperweld Steel Company	¤	¤				¤			
Cyclops Corp., El Wing Smith Div.	¤	¤				¤			¤
Dana Corp Weatherhead Div.	¤	¤		¤		¤			
Davey Compressor Corp.	¤	¤				¤			¤
Dayton Paint and Coatings, Inc.	¤	¤				¤			¤
Du Pont	¤	¤				¤			¤
Envirosafe	¤	¤		¤		¤			¤
Federal Mogul Corp.	¤			¤		¤			¤
Fort Recovery Industries, Inc.		¤		¤		¤			
Fulton Industries, Inc.	¤	¤							
GMC Chevrolet Moraine Assembly Plant		¤				¤			
GMC Inland Div., Vandalia Plant		¤				¤			
GSX Chemical Services of Ohio, Inc.	¤	¤		¤		¤			¤
General American Transportation Corp.	¤	¤				¤			¤
General Electric Co.									¤
General Electric Co., Ohio Lamp Plant									¤
Getman Bros Mfg. Co.									
Handy and Harman Automotive	¤					¤			¤
Koppers Company, Inc.						¤			
Kornylak Corp.	¤	¤				¤			
Laminated Panel Products, Inc.		¤				¤			
Metal Coatings International, Inc.	¤	¤				¤			¤
Multi-Color Corporation		¤				¤			
Orsynex Corp		¤				¤			¤
Owens-Corning Fiberglas Tech Ctr.	¤	¤		¤		¤			¤
PPG Industries, Inc.	¤	¤				¤			
Papps Body Shop, Inc.	¤	¤				¤			
Perfection Finishers Incorporated	¤					¤			
Phillips Display Components Co.	¤	¤				¤			
Po Box 2461		¤				¤			
Queen City Barrel Company	¤	¤				¤			¤
River Smelting and Refining Co.	¤	¤				¤			
Russell, Burdsall & Ward Corp.	¤	¤							
South Point Plant (Ashland Oil)	¤	¤	¤	¤	¤	¤		¤	¤
Stolle Corporation	¤	¤				¤			
The Goodyear Tire & Rubber Company	¤	¤				¤			¤
US Doe Portsmouth Gaseous Diffusion Plant	¤	¤	¤	¤	¤	¤	¤	¤	¤
US Doe-Feed Materials Production Center	¤	¤	¤	¤	¤	¤		¤	¤

Table 1. Facilities and Metals Used in the Evaluation of Background Metal Concentration in Ohio Soils.

Facility Name	Molybdenum	Nickel	Potassium	Selenium	Silicon	Silver	Thallium	Tin	Vanadium	Zinc
7 7, Inc.										
A. Shulman, Inc.				¤		¤				¤
ACI Standard						¤				
AT&T Long Lines										
Albright & Wilson, Inc., Fernald Plant										
Alsco Amerimark										
American Carco Corp.										
American Steel And Wire Corp.										
American Steel And Wire Corp.				¤		¤				
American Steel Foundries										
Aristech Chem Corp.		¤							¤	¤
Ashland Chemical Company										
Associated Materials, Inc.										
Athens City										
Avondale Industries, Inc.										
BP Oil Toledo Refinery		¤		¤					¤	
Beazer East Inc.				¤		¤				
Bechtel-Mclaughlin, Inc.		¤								¤
Borden Chem Printing Ink Div.										
Brush Wellman Inc.		¤		¤		¤	¤	¤	¤	¤
Burnham Corp., Foundry Div.										
Cecos International, Inc.		¤		¤		¤	¤	¤	¤	¤
Chemical Waste Management, Inc.				¤						
Chevron USA, Inc.		¤		¤					¤	
Cleveland Industrial Drum Service, Inc.		¤		¤		¤				¤
Cold Metal Products Co., Inc.		¤								¤
Copperweld Steel Company										
Cyclops Corp., El Wing Smith Div.		¤		¤		¤				¤
Dana Corp Weatherhead Div.		¤								
Davey Compressor Corp.				¤		¤				
Dayton Paint and Coatings, Inc.				¤		¤				
Du Pont										
Envirosafe		¤		¤		¤				¤
Federal Mogul Corp.		¤		¤						¤
Fort Recovery Industries, Inc.		¤								¤
Fulton Industries, Inc.		¤								
GMC Chevrolet Moraine Assembly Plant										
GMC Inland Div., Vandalia Plant										
GSX Chemical Services of Ohio, Inc.		¤	¤	¤		¤			¤	¤
General American Transportation Corp.				¤		¤				
General Electric Co.										
General Electric Co., Ohio Lamp Plant										
Getman Bros Mfg. Co.										
Handy and Harman Automotive				¤		¤				
Koppers Company, Inc.										
Kornylak Corp.										
Laminated Panel Products, Inc.										
Metal Coatings International, Inc.				¤		¤				
Multi-Color Corporation										
Orsynex Corp										
Owens-Corning Fiberglas Tech Ctr.		¤		¤		¤	¤			¤
PPG Industries, Inc.										
Papps Body Shop, Inc.										
Perfection Finishers Incorporated										
Phillips Display Components Co.										
Po Box 2461										
Queen City Barrel Company										
River Smelting and Refining Co.										
Russell, Burdsall & Ward Corp.										
South Point Plant (Ashland Oil)		¤	¤	¤		¤	¤		¤	¤
Stolle Corporation		¤								¤
The Goodyear Tire & Rubber Company				¤		¤				
US Doe Portsmouth Gaseous Diffusion Plant		¤	¤	¤		¤	¤		¤	¤
US Doe-Feed Materials Production Center	¤	¤	¤	¤	¤	¤	¤		¤	¤

Table 2. Ohio Background Soil Metals Database Structure

SITES.DB

Field Name	Field Type	Description	Comments
Epaid	A12	U.S. EPA Facility ID Number	User Provided, Closure Report
Name	A40	Facility Name	System Provided, RCRIS List
Locstrt	A30	Street Address	System Provided, RCRIS List
Loccity	A25	City	System Provided, RCRIS List
Loczip	A9	Zip Code	System Provided, RCRIS List
County	A25	County Name	System Provided, RCRIS List
Oh_id	A8	Ohio EPA ID, if Assigned	System Provided, RCRIS List
Lat	A8	Lattitude of the Site	System Provided, RCRIS List
Long	A8	Longitude of the Site	System Provided, RCRIS List
SIC_Code	S	SIC Code	System Provided, RCRIS List
SIC_Type	A150	Industry Type	System Provided, Lookup Table

SAMPLES.DB

Field Name	Field Type	Description	Comments
Epaid	A12	U.S. EPA Facility ID Number	System Provided, SITES.DB
Sample	A30	Sample Identifier	User Provided, Closure Report
Date	D	Sample Collection Date	User Provided, Closure Report
Type*	A15	Sample Type (Grab or Composite)	User Provided, Closure Report
Depth	A15	Sample Depth Interval	User Provided, Closure Report
Report	A255	Closure Report Name	User Provided, Closure Report
Rept_Date	A15	Closure Report Date	User Provided, Closure Report
Author	A35	Closure Report Author	User Provided, Closure Report
Entry_Chem	A3	Person Entering Chemical Data	User Provided
Entry_Geo	A3	Person Entering Geologic Data	User Provided

RESULTS.DB

Field Name	Field Type	Description	Comments
Epaid	A12	U.S. EPA Facility ID Number	System Provided, SITES.DB
Sample	A30	Sample Identifier	System Provided, SAMPLES.DB
Date	D	Sample Collection Date	System Provided, SAMPLES.DB
Concentration Units*	A15	Concentration Units	User Provided, Closure Report
Compound**	A30	Analyte	User Provided, Closure Report
Value	N	Analyte Concentration or Detection Limit	User Provided, Closure Report
Qualifier*	A5	Qualifier Flag (<, ND, etc.)	User Provided, Closure Report
Validated*	A3	Validadation Flag (Yes, No, Unk[nown])	User Provided, Closure Report
Method	A15	Laboratory Method	User Provided, Closure Report
Laboratory	A25	Analyzing Laboratory	User Provided, Closure Report

GEO.DB

Field Name	Field Type	Description	Comments
Epaid	A12	U.S. EPA Facility ID Number	System Provided, SITES.DB
Sample	A30	Sample Identifier	System Provided, SAMPLES.DB
Date	D	Sample Collection Date	System Provided, SAMPLES.DB
Drastic #*	A5	DRASTIC Mapping System Designation	User Provided, Closure Report
Soil_Con	A25	Soil Conservation Service Designation	User Provided, Closure Report
Grain-Size	A25	Soil Grain-size (Gravel, Sand, Silt, etc.)	User Provided, Closure Report
USCS*	A10	United Soil Classification System Designation	User Provided, Closure Report
Hydrogeologic Setting	A100	Description of Hydrogeologic Setting	User Provided, Closure Report

NOTEBOOK.DB

Field Name	Field Type	Description	Comments
Date	D	Date of Edit Session	System Provided
User	A25	Person Making Entries or Edits	User Provided
Log	M100	Description of Activities	User Provided

Notes:

* These fields are checked against lookup table values during entry to assure that they are acceptable values (real-time error Checking).

** In addition to real-time error checking, the compound names can be provided by the system.

Field type designations: A# - Alphanumeric with number of characters; D - Date; N - Numeric; S - Short numeric; M - Memo field.

Shading indicates linked fields between database files.

Table 3. Metal-Specific Site Count and Percentage of Non-Detects.

Metal	Site Count	Percentage of Non-Detects
Aluminum	4	0%
Antimony*	10	97%
Arsenic	32	7%
Barium	37	0.5%
Beryllium	8	36%
Boron	1	3%
Cadmium	44	52%
Chromium	50	3%
Cobalt	7	8%
Copper	13	0.5%
Iron	4	0%
Lead	56	7%
Lithium	1	81%
Manganese	3	0%
Mercury	29	57%
Molybdenum	1	0%
Nickel	20	5%
Potassium	4	6%
Selenium*	23	78%
Silicon	1	0%
Silver*	20	72%
Thallium*	6	73%
Tin	2	83%
Vanadium	9	0%
Zinc	17	2%

Notes:

* Statistical analysis was not conducted in this evaluation due to >60% non-detects.
Shaded metals were screened out of this evaluation due to limited spatial variability.

Table 4. Threshold Values Determined through Statistical Modeling of Probability Plots

Metal	Natural Log of Threshold Value Concentration (mg/kg)	Threshold Value (mg/kg)
Barium	5.8	330
Cadmium	1.5	4.5
Chromium	4.4	81
Copper	4.1	60
Lead	5.0	148
Mercury	0.5	1.6
Zinc	5.3	200

Table 5. Statistical Summary of Background Metal Concentrations in Ohio Soils.

Metals	Count^	Outliers	Minimum (mg/kg)	Maximum (mg/kg)	Range (mg/kg)	*Statistical Results on Natural Log-Transformed Data Set** Variance	Coefficient of Variance	Standard Deviation	Standard Error	Skewness	Kurtosis	Median	Mean	Median (mg/kg)	Geometric Mean** (mg/kg)
Aluminum	136		2,000	16,100	14,100	*9.54E+06*	*3.78E+01*	*3090*	*2.65E+02*	*0.494*	*-0.295*	***7685****	***8180****		
Antimony****	285		0.97	92	91.03	Statistical analysis was not conducted on Antimony due to >70% censored data.									
Arsenic	686	7 (1%)	0.50	56	55.5	0.717	4.86E-01	0.847	8.47E-01	-0.457	0.832	1.76	1.74	5.80	5.72
Barium	710	7 (1%)	9.3	323	313.7	0.351	1.43E-01	0.592	5.92E-01	-0.344	0.589	4.15	4.15	63.2	63.4
Beryllium	322		0.10	3.15	3.05	0.442	-6.82E+01	0.665	6.65E-01	-0.222	-0.223	-0.799	-0.976	0.450	0.377
Cadmium	706	3 (0.5%)	0.07	4.4	4.34	0.678	-1.21E+00	0.823	8.23E-01	0.593	-0.318	-0.734	-0.679	0.480	0.507
Chromium	925	15 (2%)	2.0	80.5	78.5	0.353	2.38E-01	0.594	5.94E-01	0.338	0.832	2.48	2.49	12.0	12.1
Cobalt	316	4 (1%)	1.0	53.6	52.6	0.459	3.64E-01	0.677	6.77E-01	-0.665	0.450	1.98	1.86	7.25	6.42
Copper	357	1 (0.3%)	2.2	58	55.8	0.353	2.40E-01	0.594	5.94E-01	-0.273	0.011	2.48	2.47	12.0	11.8
Iron	155	1 (0.6%)	5,150	100,000	94,850	0.232	4.91E-02	0.482	4.82E-01	0.598	0.729	9.76	9.82	17300	18400
Lead	929	4 (0.4%)	1.0	147	146	0.698	3.00E-01	0.835	8.35E-01	0.224	0.366	2.66	2.79	14.3	16.2
Manganese	120	4 (3%)	59	1,750	1691	0.460	1.11E-01	0.678	6.78E-01	-0.672	0.749	6.17	6.13	476	459
Mercury	514	22 (4%)	0.010	1.6	1.59	0.698	-3.33E-01	0.835	8.35E-01	0.356	0.861	-2.81	-2.51	0.060	0.081
Nickel	548	7 (1%)	2.0	110	108	0.468	2.56E-01	0.684	6.84E-01	-0.318	0.732	2.69	2.67	14.7	14.4
Potassium	145		230	2,180	1,950	0.239	7.45E-02	0.489	4.89E-01	0.147	-0.390	6.58	6.56	720	709
Selenium****	480		0.20	35	34.8	Statistical analysis was not conducted on Selenium due to >70% censored data.									
Silver****	433		0.20	14.8	14.6	Statistical analysis was not conducted on Silver due to >70% censored data.									
Thallium****	276		0.17	0.59	0.42	Statistical analysis was not conducted on Thallium due to >70% censored data.									
Vanadium	367		4.6	71	66.4	0.244	1.73E+01	0.494	2.58E-02	0.044	-0.071	2.88	2.85	17.8	17.4
Zinc	434	1 (0.2%)	7.5	190	182.5	0.346	1.57E-01	0.588	2.82E-02	-0.246	0.189	3.76	3.75	43.0	42.7

Notes:

* Aluminum did not require transformation, the statistics presented are based on the raw data set.

** The geometric mean in this study was calculated by taking the antilog of the mean of the log-transformed data set. The median is the antilog of the median of the log-transformed data set (including outliers).

*** Aluminum did not require transformation, the median and arithmetic mean are presented.

**** The minimum, maximum and range for Antimony, Selenium, Silver and Thallium are detected values.

^ Adjusted for outliers

CDF013230

Table 6. Statistical Summary of Industrially-Impacted Soil Metal Concentrations in Ohio.

Metals	Count^	Outliers	Minimum (mg/kg)	Maximum (mg/kg)	Range (mg/kg)	*Statistical Results on Natural Log-Transformed Data Set*								Median*	Geometric Mean* (mg/kg)
						Variance	Coefficient of Variance	Standard Deviation	Standard Error	Skewness	Kurtosis	Median	Mean		
Barium	25		331	7790	7459	0.794	1.32E-01	0.891	1.78E-01	1.15	0.713	6.49	6.73	660	838
Cadmium	59		4.5	362	357.5	0.779	3.44E-01	0.882	1.15E-01	1.11	2.06	2.48	2.56	12.0	13.0
Chromium	32		83.2	2340	2256.8	1.00	1.80E-01	1.00	1.77E-01	0.837	-0.386	5.30	5.56	200	260
Copper	34		66	1420	1354	0.689	1.52E-01	0.830	1.42E-01	0.195	-0.644	5.47	5.45	236	233
Lead	86		152	10500	10348	1.09	1.62E-01	1.05	1.13E-01	0.633	-0.216	6.32	6.45	558	633
Mercury	44		1.8	96	94.2	1.28	4.79E-01	1.13	1.71E-01	-0.207	-1.35	2.94	2.37	18.8	10.7
Zinc	35	2 (5%)	210	3940	3730	0.384	9.77E-02	0.619	1.05E-01	0.767	1.61	6.40	6.34	600	564

Notes:

* The geometric mean in this study was calculated by taking the antilog of the mean of the log-transformed data set. The median is the antilog of the median of the log-transformed data set (including outliers).

^ After adjustment for outliers.

CDF013231

Table 7. Comparison of Background Metal Concentrations in Ohio Soils with Results of Previous Investigators.

	This Report		Logan & Miller (1983)		Holgren and others (1993)		Shacklette & Boerngen (1984)		Brooks (1972)	
Metals	Geo. Mean	Range	Mean (Ohio)	Range (Ohio)	Geo. Mean (Ohio)	Range (U.S.)	Geo. Mean (Eastern U.S)	Range (Eastern U.S)	Mean (U.S.)	Range (U.S.)
Aluminum	8,180*	2,000 - 16,100					33,000	7,000 - 10,000		
Antimony		0.97 - 92.0					0.52	<1 - 8.8	0.5	
Arsenic	5.72	0.50 - 56					4.8	<0.1 - 73	5	
Barium	63.4	9.3 - 323					290	10 - 1,500	500	
Beryllium	0.377	0.10 - 3.15					0.55	<1 - 7	6	
Cadmium	0.507	0.07 - 4.40	0.20	BDL - 2.9	0.357	<0.010 - 2.0				
Chromium	12.1	2.00 - 80.5	12.00	4 - 23			33	1 - 1,000	200	
Cobalt	6.42	1.0 - 53.6					5.9	<3 - 70	10	
Copper	11.8	1.20 - 58	19.00	11-37	26.2	<0.6 - 495	13	<1 - 700	20	
Iron	18,400	5,150 - 100,000					14,000	100 - >100,000		10,000 - 50,000
Lead	16.2	1.0 - 147	19.00	9 - 39	18.2	<1.0 - 135	14	<10 - 300	10	
Manganese	459	59.0 - 1,750					260	<2 - 7,000	850	
Mercury	0.081	0.01 - 1.60					0.081	0.01 - 3.4	0.01	
Nickel	14.4	2.00 - 110	18.00	9 - 38	27.1	0.7 - 269	11	<5 - 700	40	
Potassium	709	230 - 2,180					12,000	50 - 37,000		
Selenium		0.20 - 35.0					0.3	<0.1 - 3.9	0.5	
Silver		0.20 - 14.8								
Thallium		0.17 - 0.59					7.7	2.2 - 23	13	
Vanadium	17.4	4.60 - 71.0					43	<7 - 300	100	
Zinc	42.7	7.50 - 190	75.00	47 - 138	82.1	<3.0 - 264	40	<5 - 2,900	50	

Notes: All values in mg/kg
BDL=Below Detection
* Arithmetic mean

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Figure 1. Ohio Counties used in the Evaluation of Background Metal Concentrations by Logan and Miller (1983) and in this study.

Logan and Miller, 1983

Cox and Colvin, 1996

Cox-Colvin & Associates, Inc.

CDF013233

Figure 2a. Frequency Diagram of a Data Set with Two Populations.

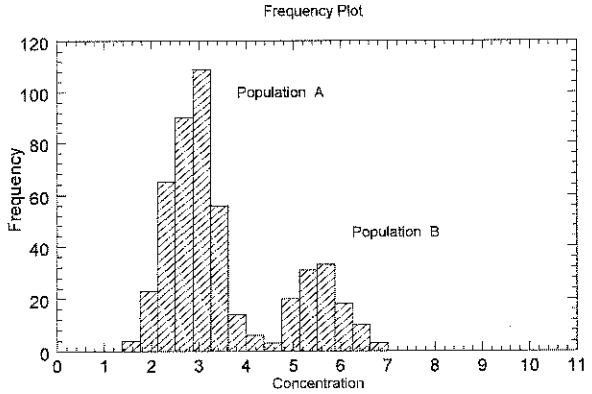


Figure 2b. Probability Plot of the Two Population Data Set in Figure 2a.

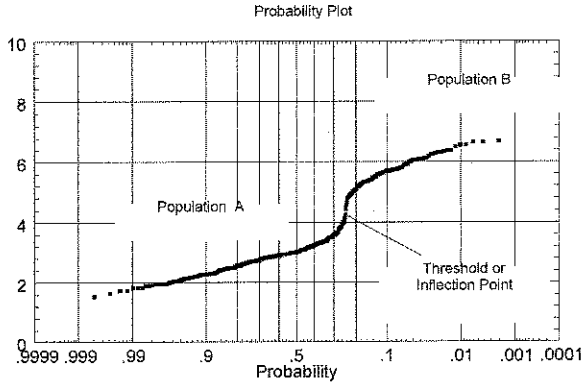


Figure 2c. Frequency Diagram of the Zinc Data Set.

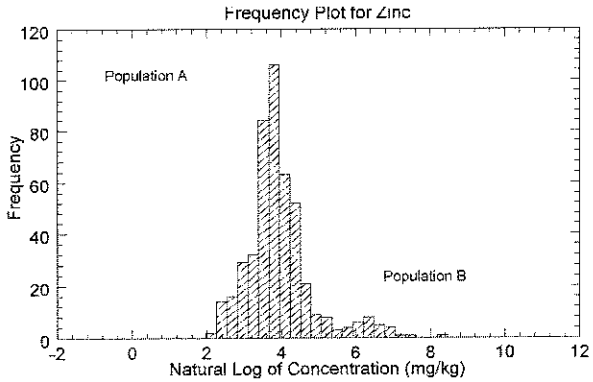
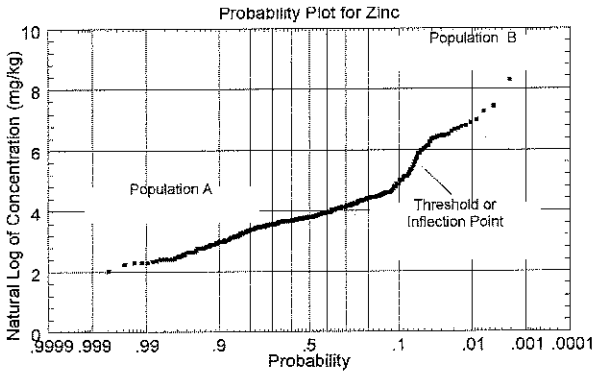
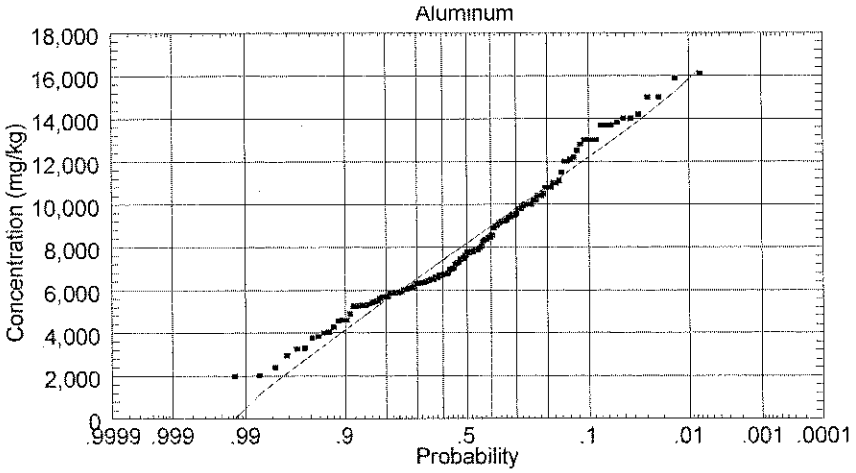


Figure 2d. Probability Plot of the Zinc Data Set in Figure 2c.



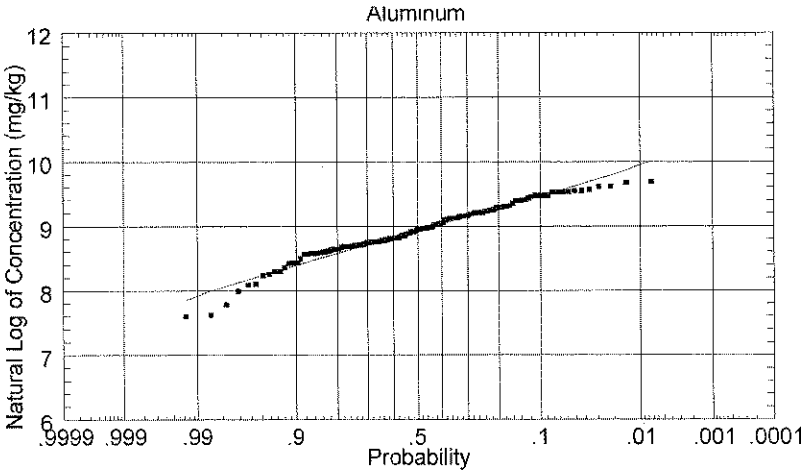
CDF013234

Figure 3. Probability Plots for Aluminum



Plot of Raw Data

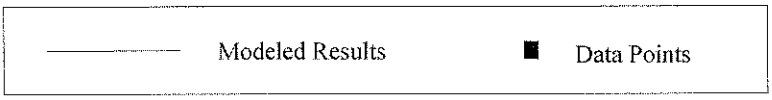
Normality testing and statistical modeling of raw data indicates that the data set is normally distributed with a single population.



Plot of Natural Log-Transformed Data

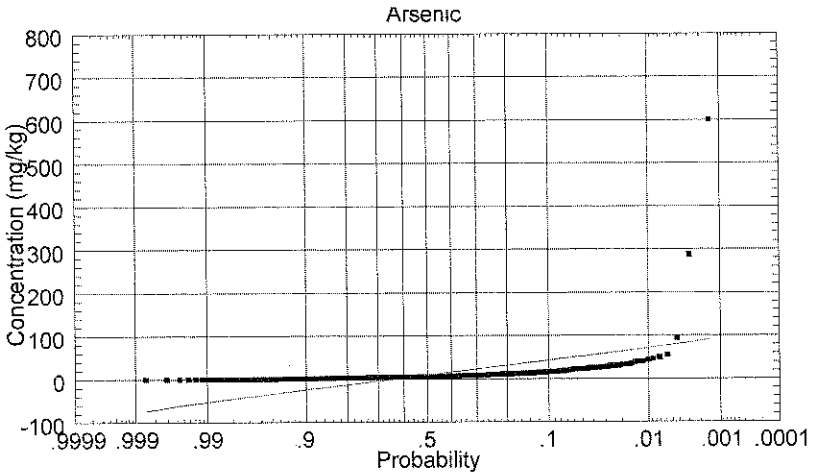
Statistical Summary

Single Background Population
Data Points = 136
Minimum Value = 2,000 mg/kg
Maximum Value = 16,100 mg/kg
Mean = 8,180 mg/kg



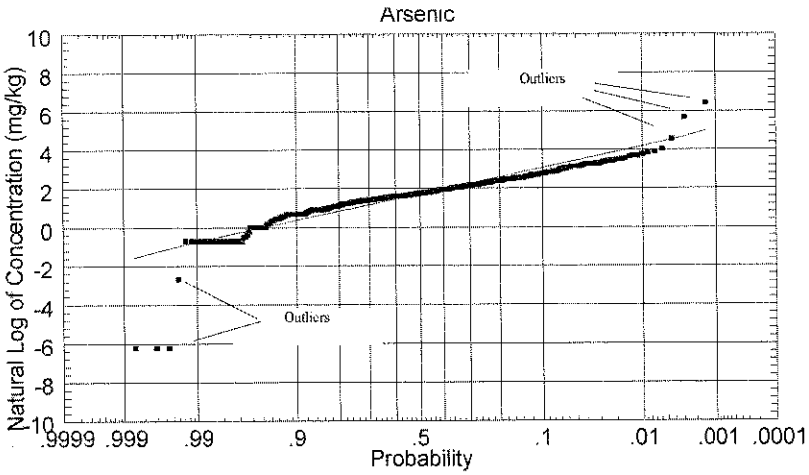
Cox-Colvin & Associates, Inc.

Figure 4. Probability Plots for Arsenic



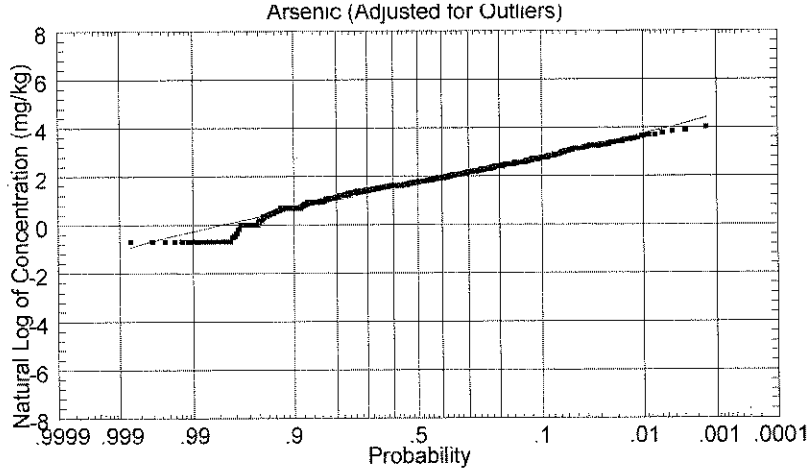
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.

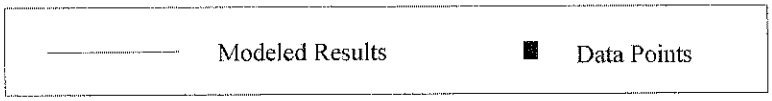


Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that the data set contains 7 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.



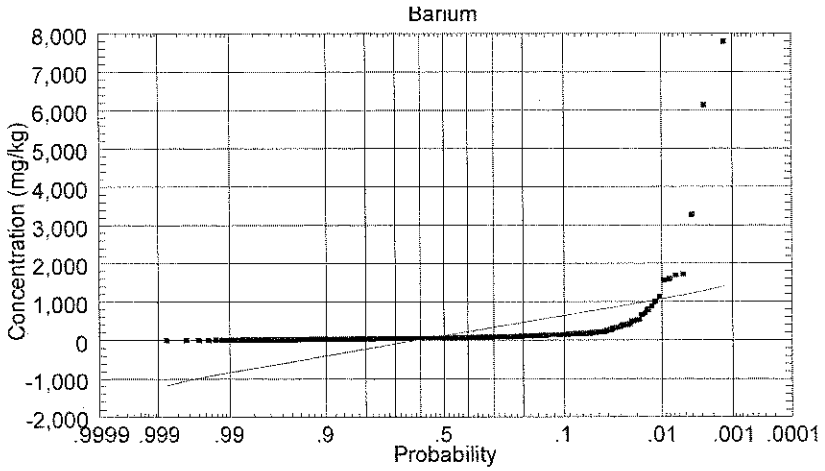
Statistical Summary

Single Background Population
Data Points = 686*
Minimum Value = 0.5 mg/kg*
Maximum Value = 56 mg/kg*
Geometric Mean = 5.72 mg/kg*

***After adjustment for outliers.**

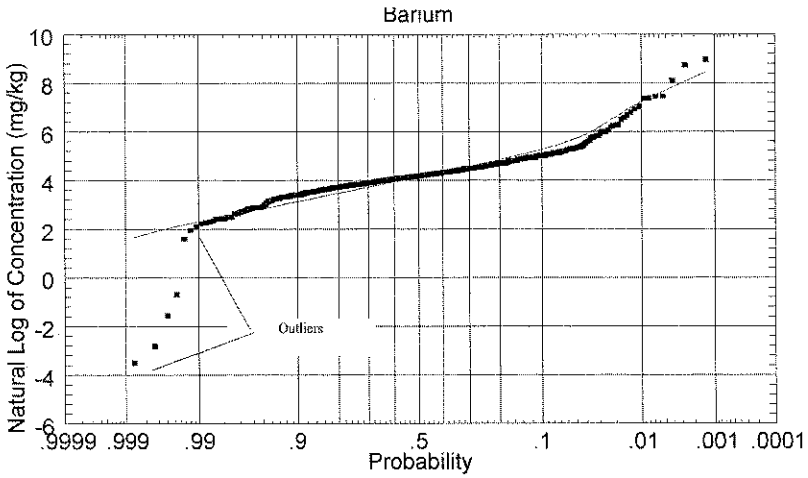
Cox-Colvin & Associates,

Figure 5. Probability Plots for Barium



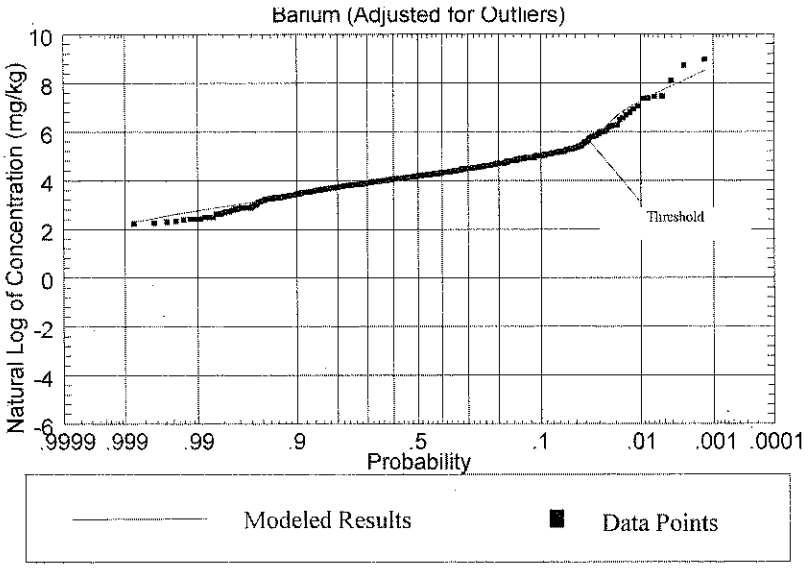
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 7 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

Statistical Summary

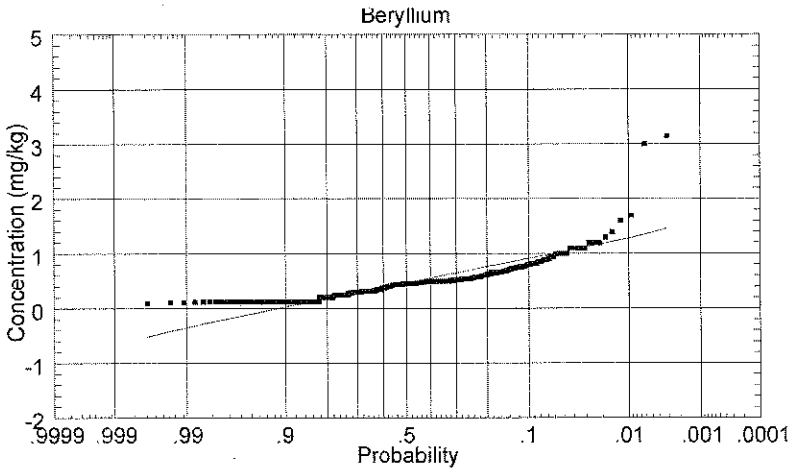
Two Populations
- **Ln of Threshold Value = 5.8**

Background Population
- **Data Points = 710***
- **Minimum Value = 9.3 mg/kg***
- **Maximum Value = 323 mg/kg**
- **Geometric Mean = 63.4 mg/kg***

Industrially-Impacted Soil
- **Data Points = 25**
- **Minimum Value = 331 mg/kg**
- **Maximum Value = 7,750 mg/kg**
- **Geometric Mean = 838 mg/kg**

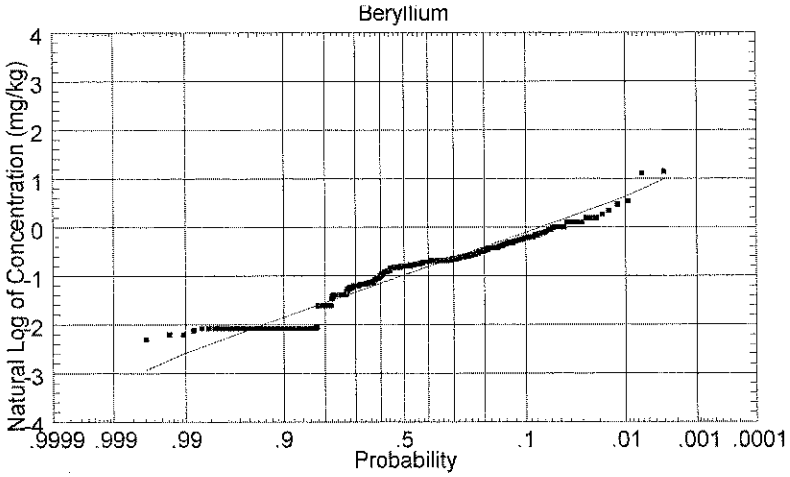
Cox-Colvin & Associates,

Figure 6. Probability Plots for Beryllium



Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that the data set contains no outliers.

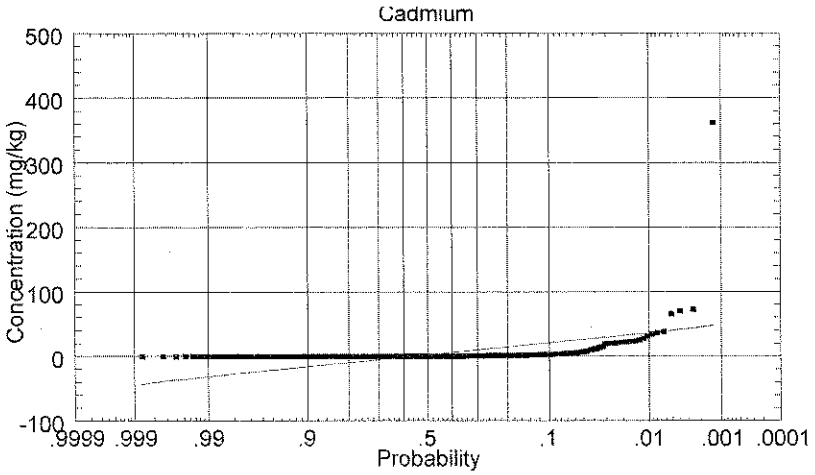
Statistical Summary

Single Background Population
Data Points = 322
Minimum Value = 0.1 mg/kg
Maximum Value = 3.15 mg/kg
Geometric Mean = 0.377 mg/kg

Modeled Results ■ Data Points

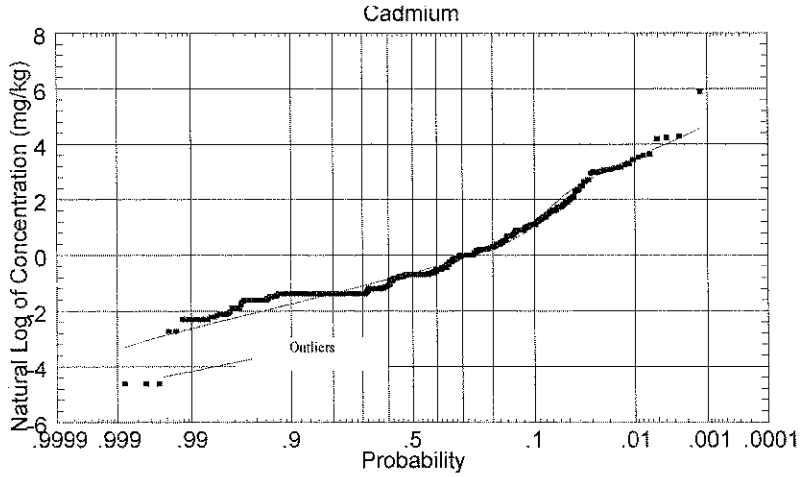
Cox-Colvin & Associates,

Figure 7. Probability Plots for Cadmium



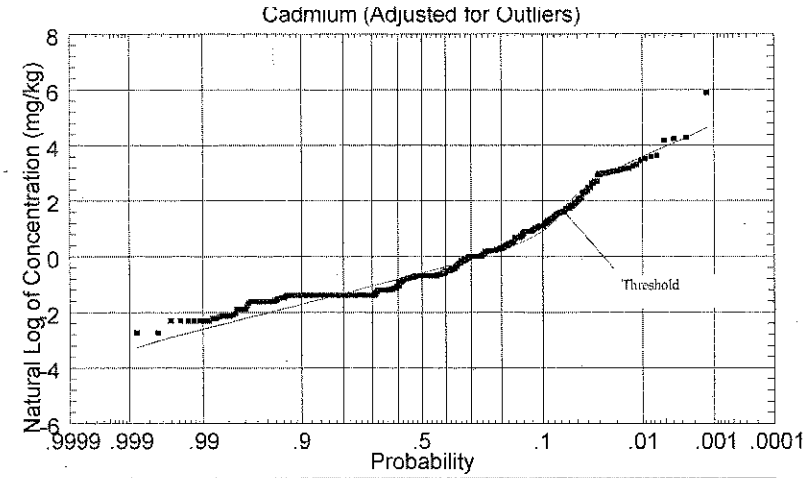
Plot of Raw Data

Normality testing and statistical normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

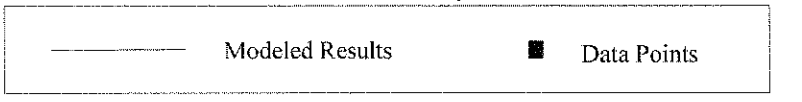
Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 3 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

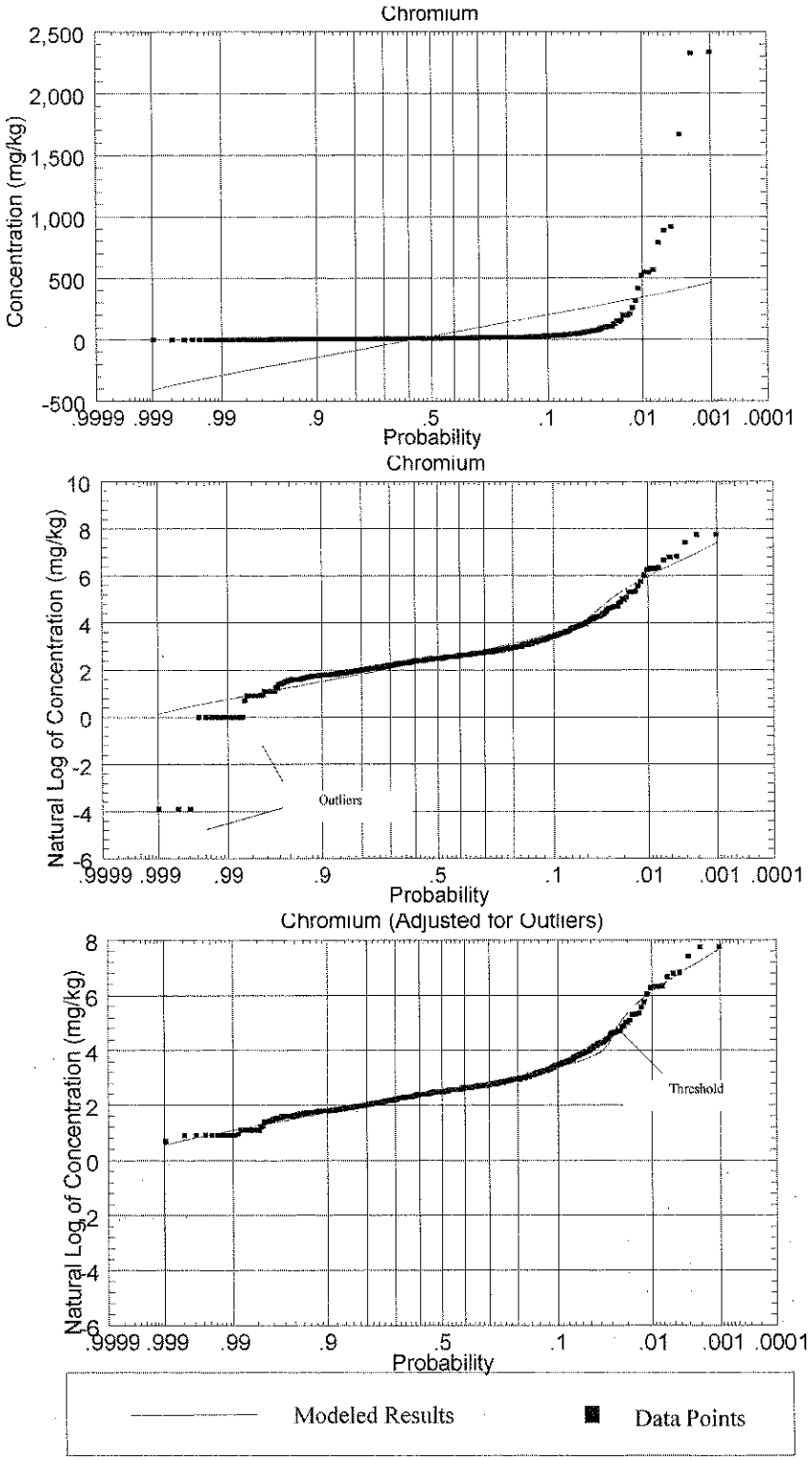
Statistical Summary

Two Populations
- **LN of Threshold Value = 1.5**
- **Background Population**
  - **Data Points = 706***
  - **Minimum Value = 0.07 mg/kg***
  - **Maximum Value = 4.4 mg/kg**
  - **Geometric Mean = 0.507 mg/kg***
- **Industrially-Impacted Soil**
  - **Data Points = 59**
  - **Minimum Value = 4.5 mg/kg**
  - **Maximum Value = 362 mg/kg**
  - **Geometric Mean = 15.0 mg/kg**



Cox-Colvin & Associates,

Figure 8. Probability Plots for Chromium



Plot of Raw Data

Modeling of raw data indicates that the data set is not normally distributed.

Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outli testing indicates that the data set contains 15 outliers

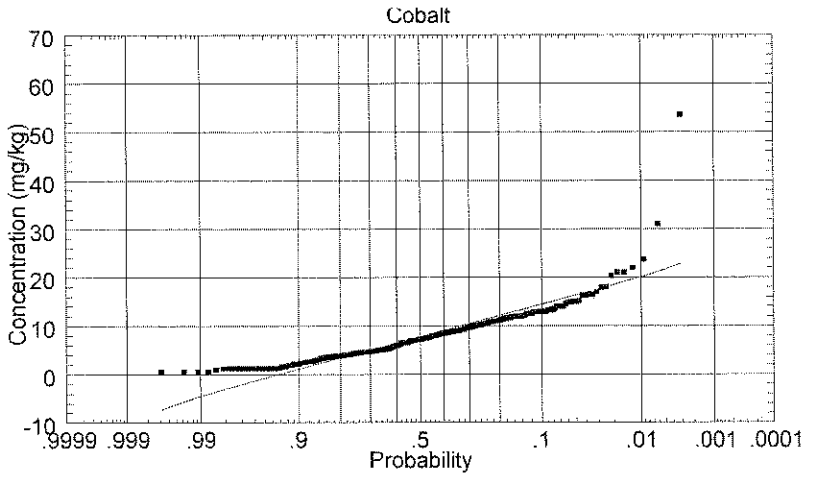
Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

Statistical Summary

Two Populations
Ln of Threshold Value = 4.4
Background Population
Data Points = 925*
Minimum Value = 2.0 mg/kg*
Maximum Value = 80.5 mg/kg
Geometric Mean = 12.1 mg/kg*
Industrially Impacted Soil
Data Points = 32
Minimum Value = 83.2 mg/kg
Maximum Value = 2,340 mg/kg
Geometric Mean = 260 mg/kg

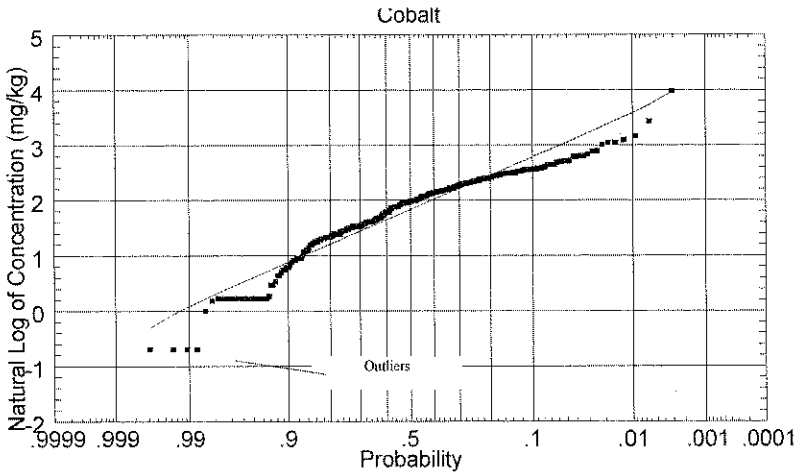
Cox-Colvin & Associates,

Figure 9. Probability Plots for Cobalt



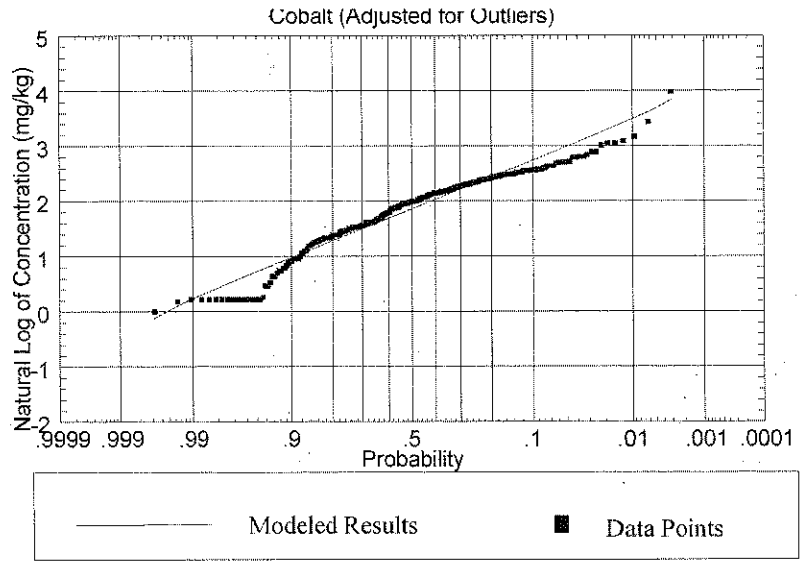
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that the data set contains 4 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

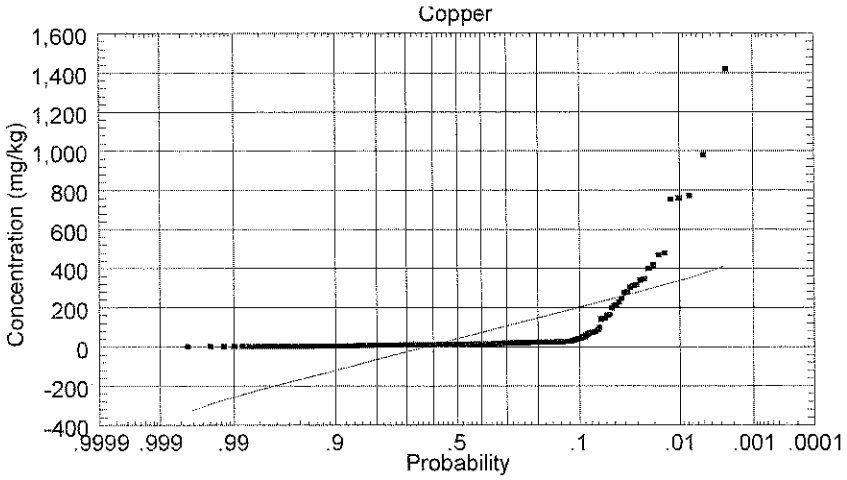
Statistical Summary

Single Background Population
Data Points = 316*
Minimum Value = 1.0 mg/kg*
Maximum Value = 53.6 mg/kg
Geometric Mean = 6.42 mg/kg*

*** After adjustment for outliers.**

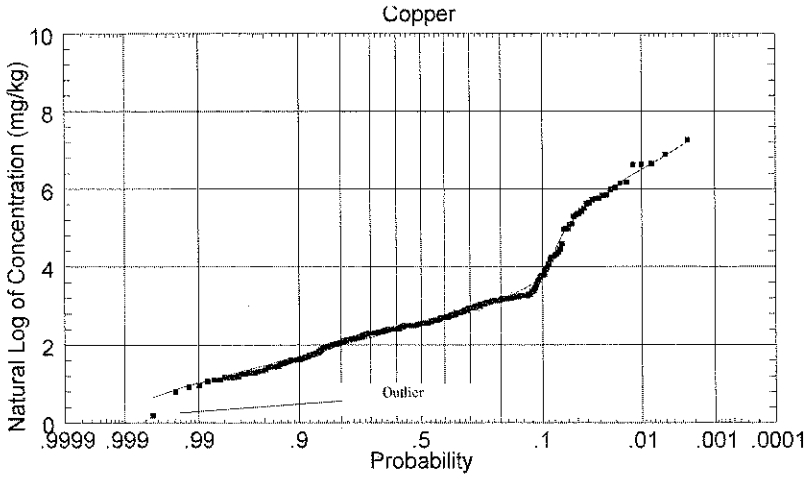
Cox-Colvin & Associates,

Figure 10. Probability Plots for Copper



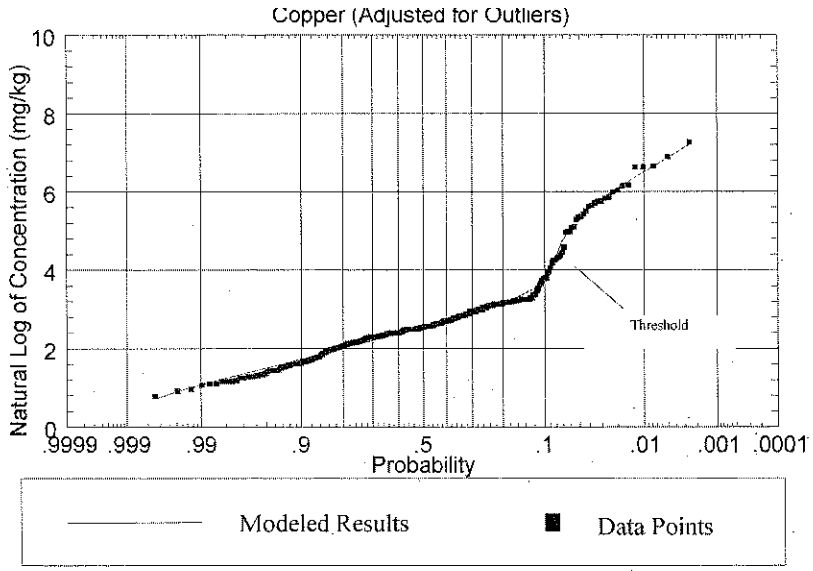
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 1 outlier.



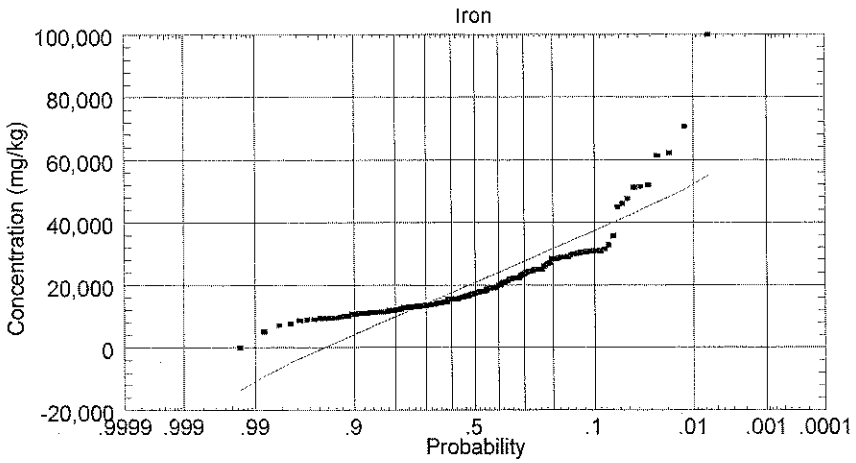
Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

Statistical Summary

Two Populations
- **Ln of Threshold Value = 4.1**
- **Background Population**
  - **Data Points = 357[a]**
  - **Minimum Value = 2.2 mg/kg[a]**
  - **Maximum Value = 58 mg/kg**
  - **Geometric Mean = 11.8 mg/kg[a]**
- **Industrially-Impacted Soil**
  - **Data Points = 34**
  - **Minimum Value = 66 mg/kg**
  - **Maximum Value = 1,420 mg/kg**
  - **Geometric Mean = 233 mg/kg**

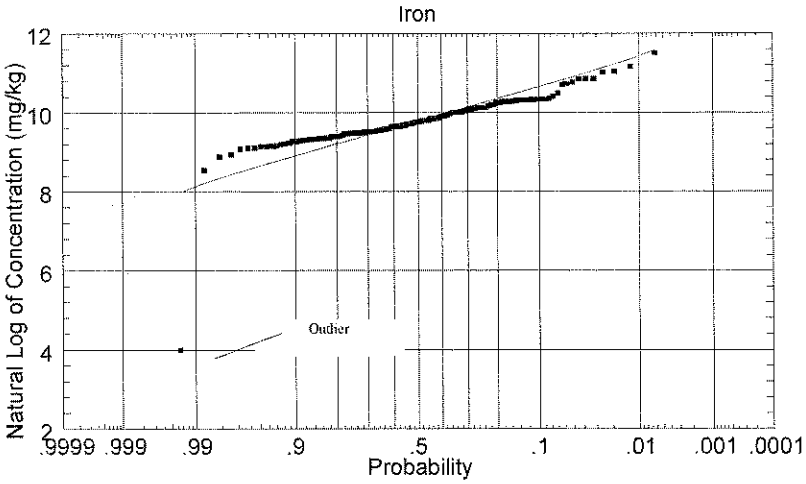
Cox-Colvin & Associates,

Figure 11. Probability Plots for Iron



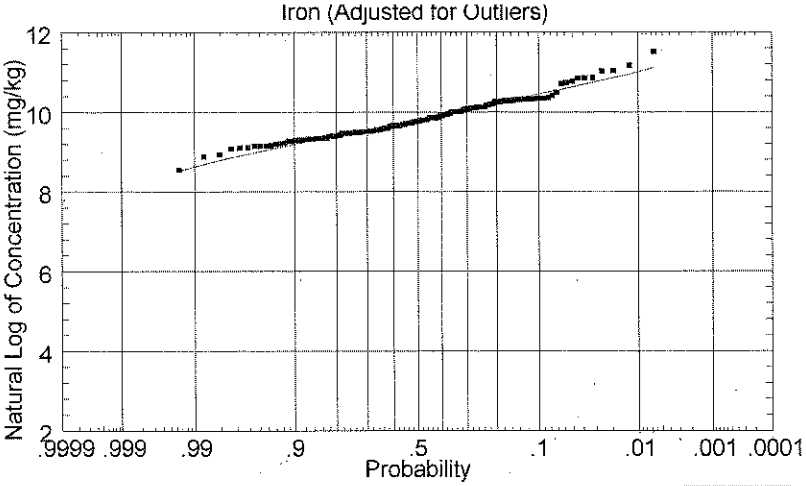
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.

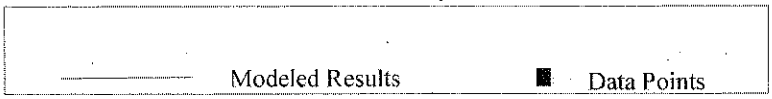


Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 1 outlier.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.



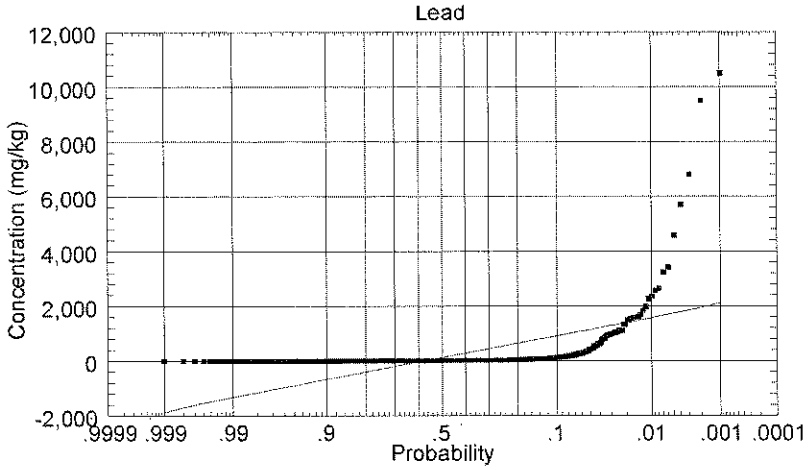
Statistical Summary

Single Background Population
Data Points = 155*
Minimum Value = 5,150 mg/kg*
Maximum Value = 100,000 mg/kg
Geometric Mean = 18,400 mg/kg*

***After adjustment for outliers.**

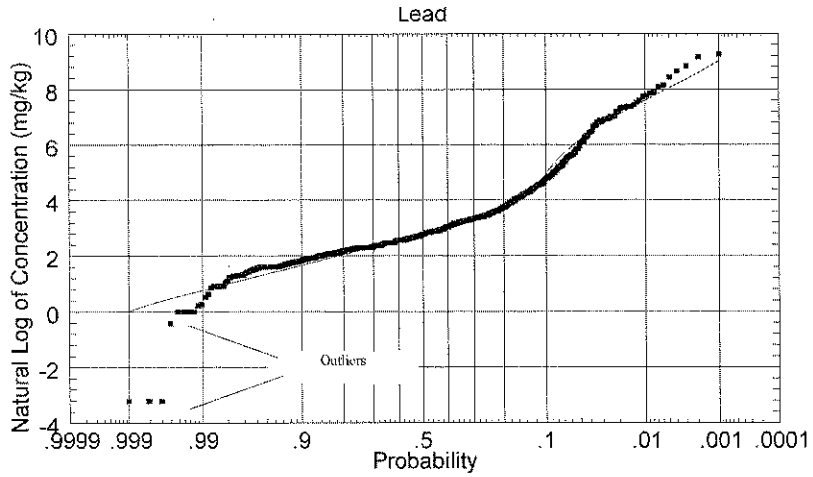
Cox-Colvin & Associates,

Figure 12. Probability Plots for Lead



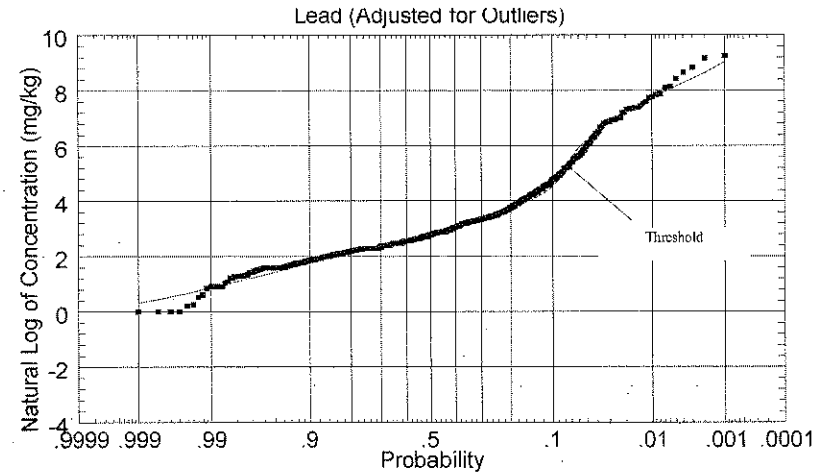
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.

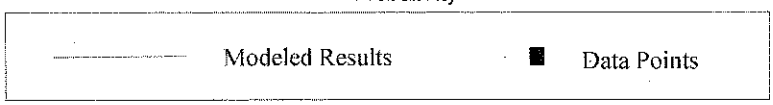


Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 4 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

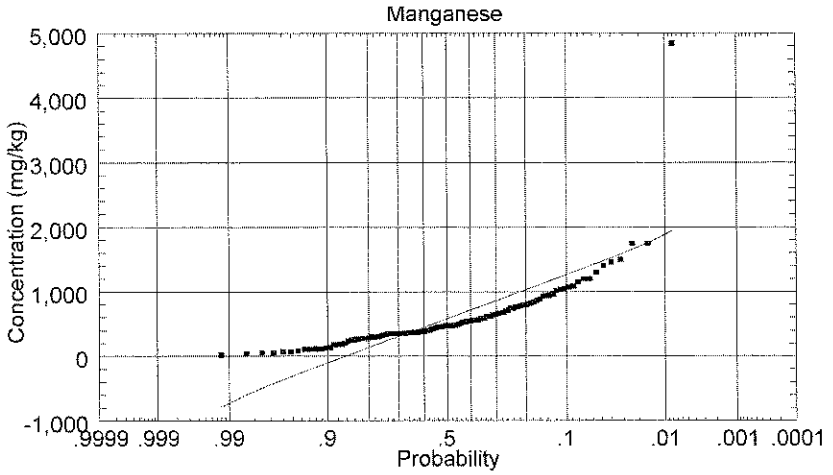


Statistical Summary

Two Populations
Ln of Threshold Value = 5.0
Background Population
Data Points = 929*
Minimum Value = 1.0 mg/kg*
Maximum Value = 147 mg/kg
Geometric Mean = 16.2 mg/kg*
Industrially-Impacted Soil
Data Points = 96
Minimum Value = 152 mg/kg
Maximum Value = 10,500 mg/kg
Geometric Mean = 633 mg/kg

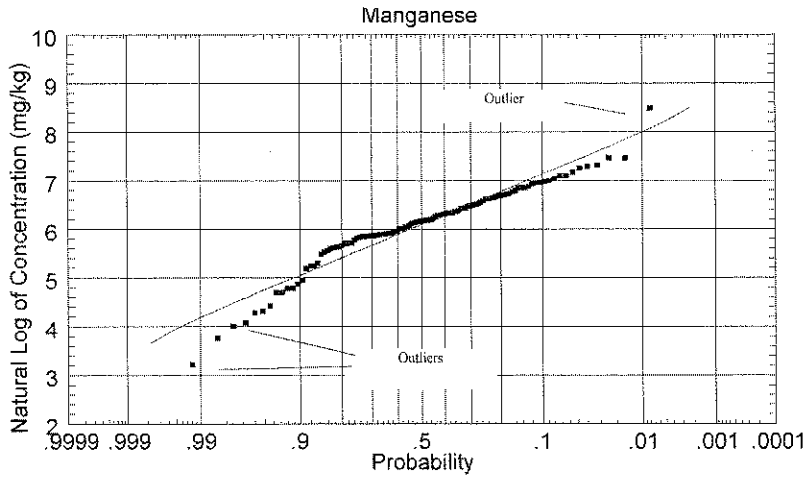
Cox-Colvin & Associates,

Figure 13. Probability Plots for Manganese



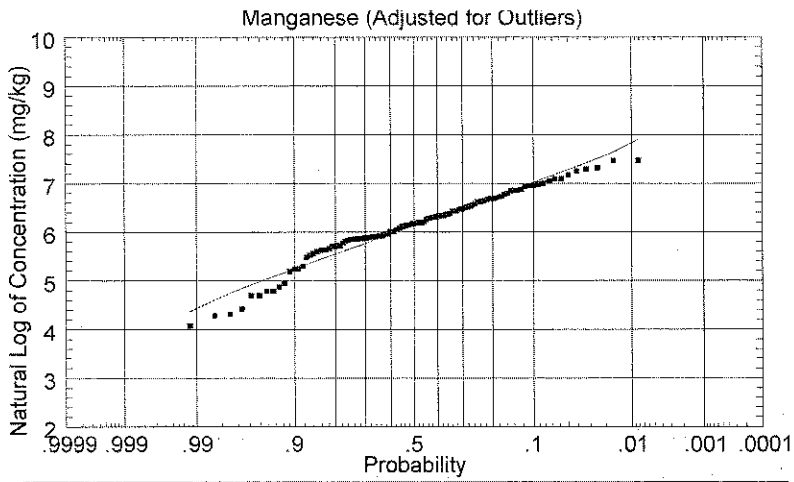
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that the data set contains 4 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

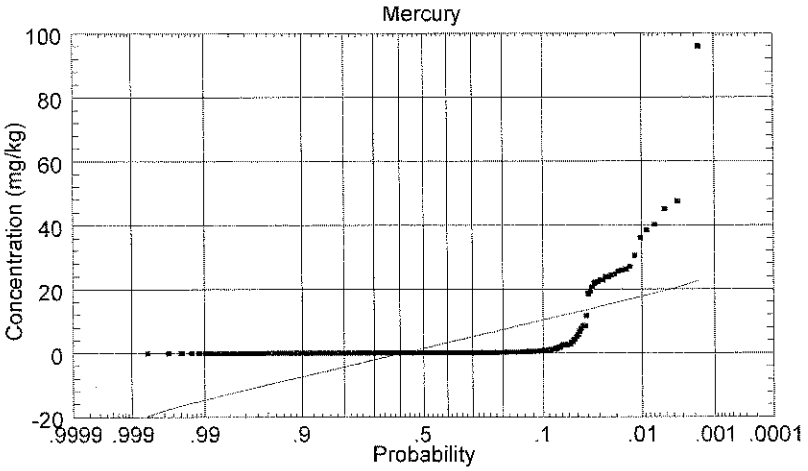
Statistical Summary

Single Background Population
Data Points = 120*
Minimum Value = 59 mg/kg*
Maximum Value = 1,750 mg/kg*
Geometric Mean = 459 mg/kg*

***After adjustment for outliers.**

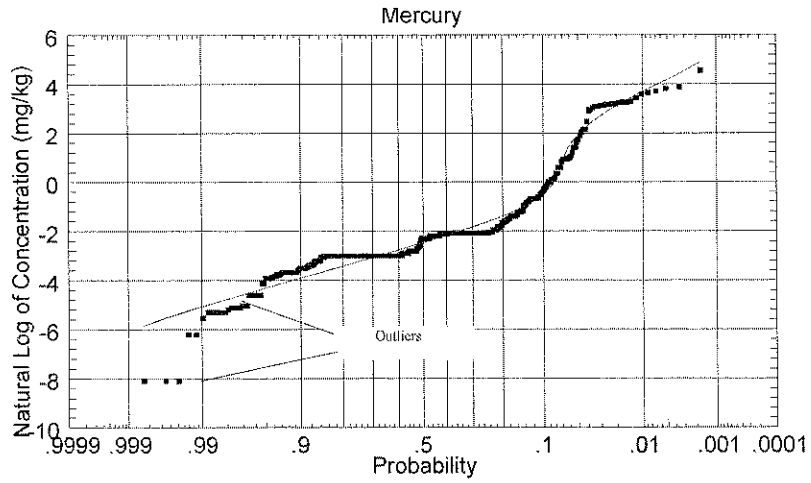
Cox-Colvin & Associates,

Figure 14. Probability Plots for Mercury



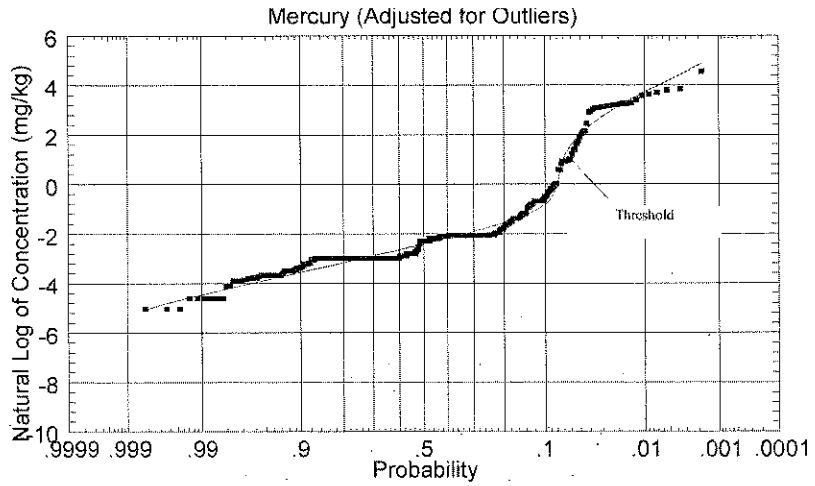
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 22 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

Statistical Summary

Two Populations
- **Ln of Threshold Value = 0.5**

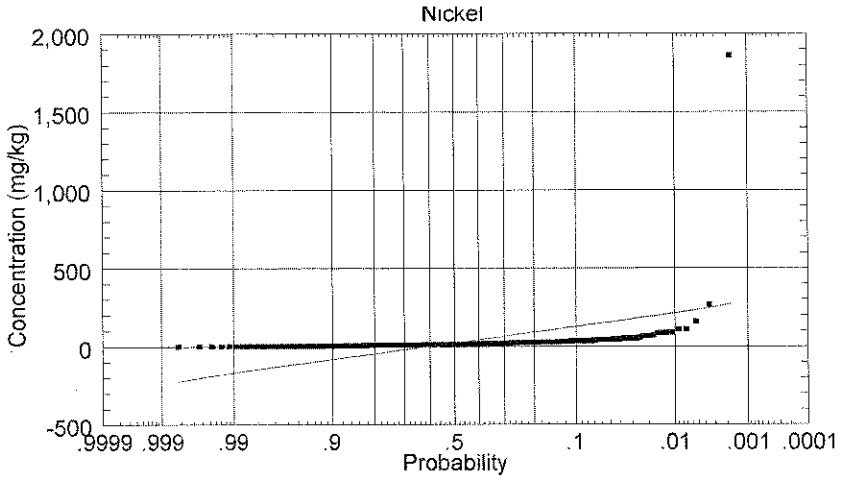
Background Population
- **Data Points = 514***
- **Minimum Value = 0.01 mg/kg***
- **Maximum Value = 1.6 mg/kg**
- **Geometric Mean = 0.081 mg/kg***

Industrially-Impacted Soil
- **Data Points = 44**
- **Minimum Value = 1.8 mg/kg**
- **Maximum Value = 96 mg/kg**
- **Geometric Mean = 10.7 mg/kg**

Modeled Results ■ Data Points

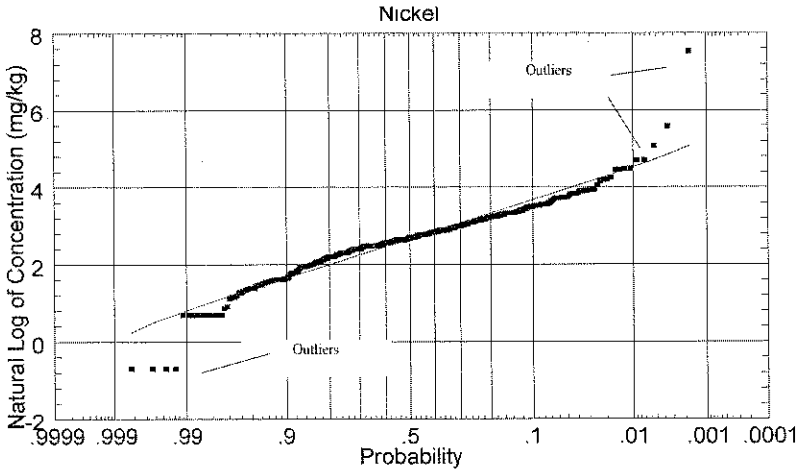
Cox-Colvin & Associates,

Figure 15. Probability Plots for Nickel



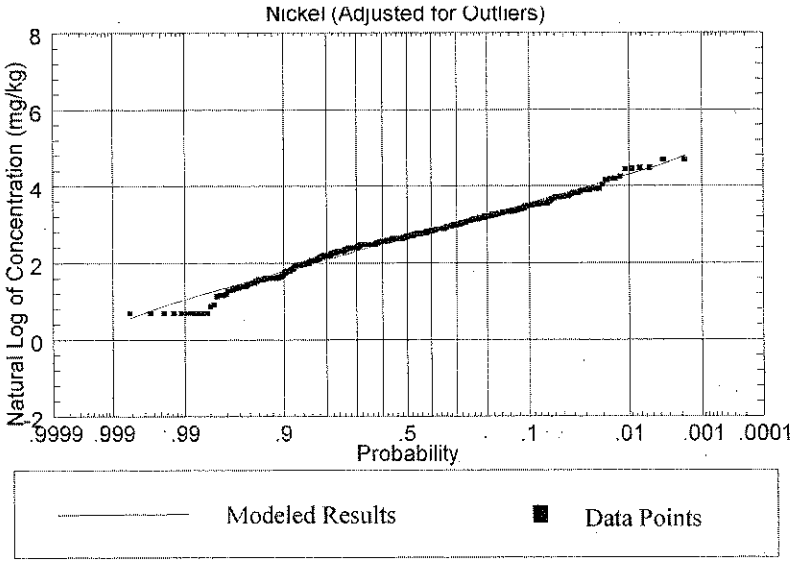
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that the data set contains 7 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

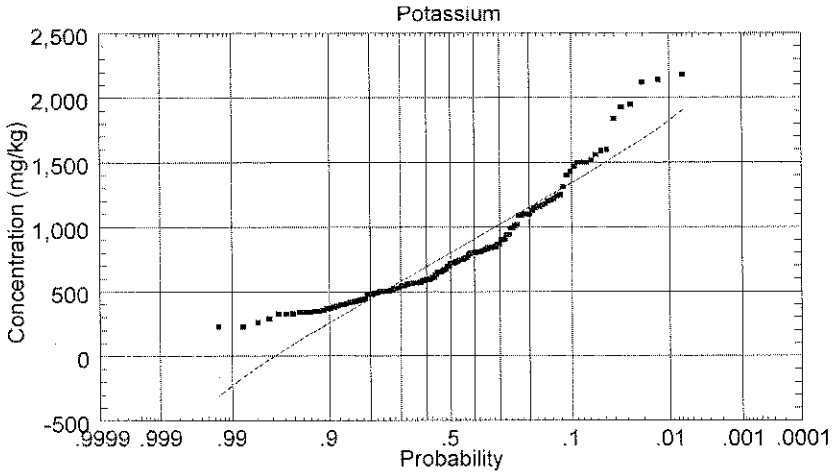
Statistical Summary

Single Background Population
Data Points = 548*
Minimum Value = 2.0 mg/kg*
Maximum Value = 110 mg/kg*
Geometric Mean = 14.4 mg/kg*

***After adjustment for outliers.**

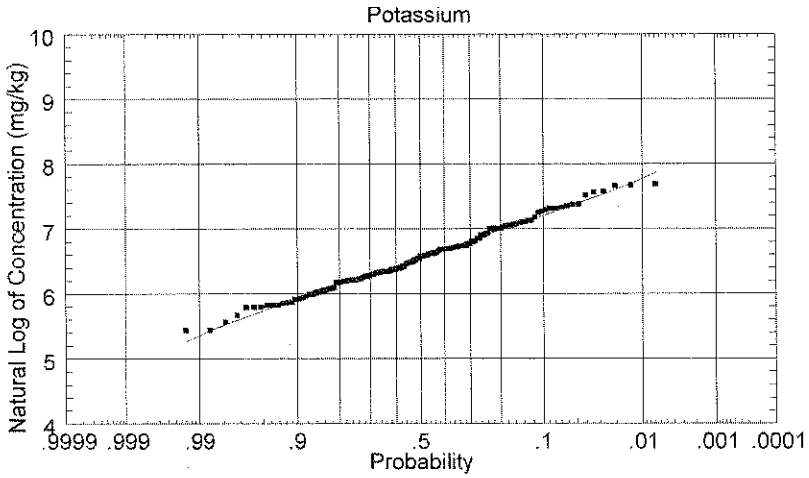
Cox-Colvin & Associates,

Figure 16. Probability Plots for Potassium



Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that there are no outliers.

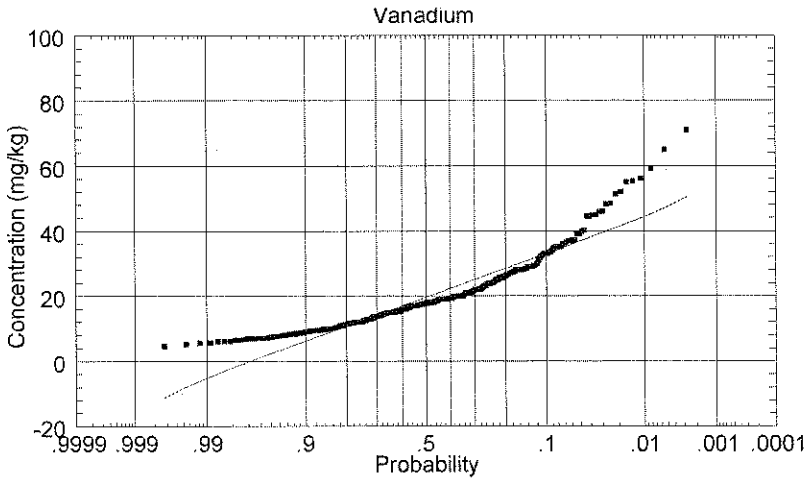
Statistical Summary

Single Background Population
Data Points = 145
Minimum Value = 230 mg/kg
Maximum Value = 2,180 mg/kg
Geometric Mean = 709 mg/kg

Modeled Results ■ Data Points

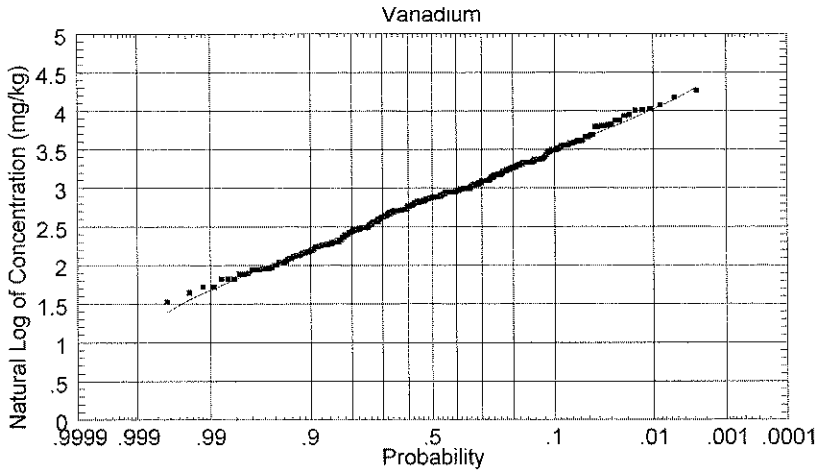
Cox-Colvin & Associates,

Figure 17. Probability Plots for Vanadium



Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with a single population. Outlier testing indicates that there are no outliers.

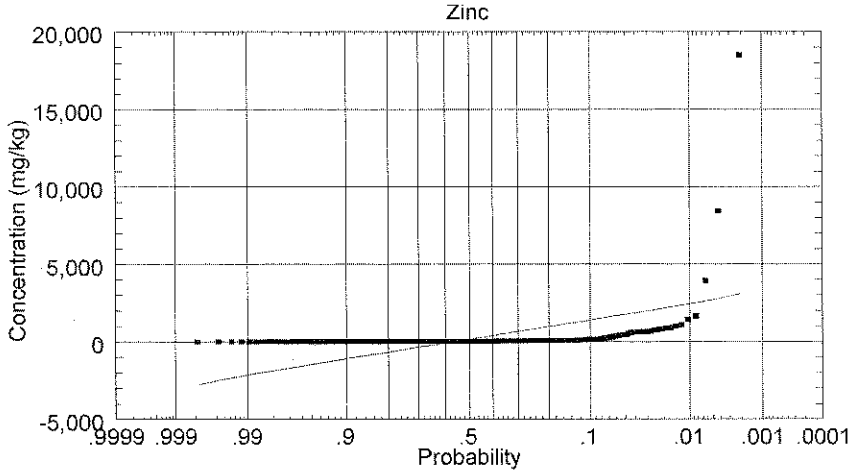
Statistical Summary

Single Background Population
Data Points = 367
Minimum Value = 4.6 mg/kg
Maximum Value = 71 mg/kg
Geometric Mean = 17.4 mg/kg

Modeled Results ■ Data Points

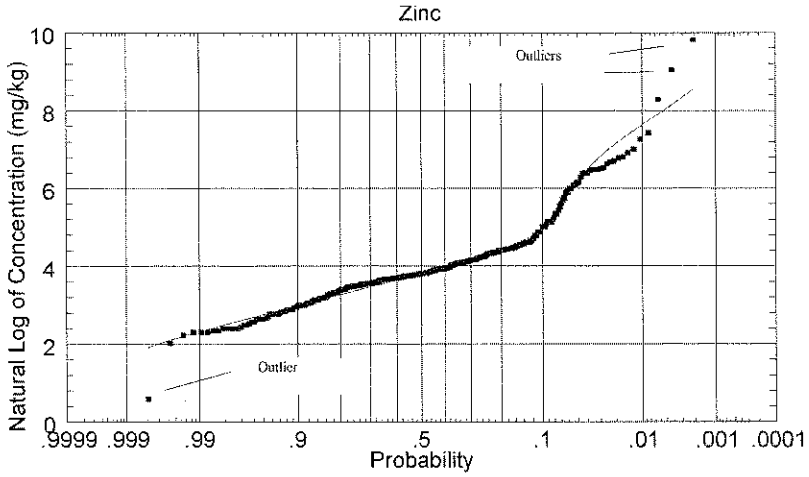
Cox-Colvin & Associates,

Figure 18. Probability Plots for Zinc



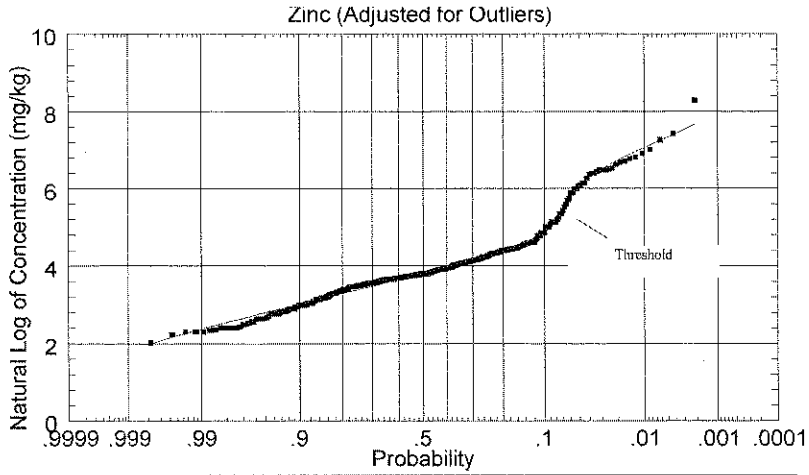
Plot of Raw Data

Normality testing and statistical modeling of raw data indicates that the data set is not normally distributed.



Plot of Natural Log-Transformed Data

Normality testing and statistical normality testing and statistical modeling of log-transformed data indicates that the data set is log-normally distributed with two populations. Outlier testing indicates that the data set contains 3 outliers.



Adjusting for outliers improves the normality test results as well as the visual match between the statistical modeling results and the log-transformed data.

Statistical Summary

Two Populations
- **Ln of Threshold Value = 5.3**
- **Background Population**
  - **Data Points = 434***
  - **Minimum Value = 7.5 mg/kg***
  - **Maximum Value = 190 mg/kg**
  - **Geometric Mean = 42.7 mg/kg***
- **Industrially-Impacted Soil**
  - **Data Points = 35***
  - **Minimum Value = 210 mg/kg**
  - **Maximum Value = 9,940 mg/kg***
  - **Geometric Mean = 564 mg/kg***

*** After adjustment for outliers.**

Cox-Colvin & Associates,

PARSONS ENGINEERING SCIENCE, INC.
A UNIT OF PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.
19101 Villaview Road, Suite 301 • Cleveland, Ohio 44119 • (216) 486-9005 • Fax (216) 486-0119
PARESCL/597/Dee/EJK7-7

15 May 1997

Mr. Keith Houseknecht
CANTON DROP FORGE, INC.
4575 Southway Street
Canton, Ohio 44706

Reference: Canton Drop Forge, Inc. Lagoon #1 Re-construction and Biocell Disposal

Dear Mr. Houseknecht:

In accordance with our Scope of Work for the above-referenced project, Parsons Engineering Science, Inc. (Parsons ES) respectfully submits to Canton Drop Forge, Inc. (CDF) our report of progress completed to-date. In particular, the enclosed report summarizes the results of environmental and geotechnical analyses completed, feasibility analyses of several alternative approaches considered, and the conceptual design, budgetary cost estimate and preliminary schedule for implementing the recommended option for addressing these issues.

It is intended that the accompanying draft report will be reviewed with CDF engineering, management and legal staff during our meeting scheduled for Friday, 16 May 1997. After this meeting, Parsons ES will revise the report, as appropriate, reflecting the comments received in a final version of the report within two weeks of the meeting.

We look forward to providing continued environmental and process engineering support to Canton Drop Forge in this and other matters under consideration. Please contact either Mr. Gordon Melle or me at (216) 486-9005 for questions or additional information regarding this effort.

Very truly yours,

PARSONS ENGINEERING SCIENCE, INC.

Edward J Karkalik

Edward J. Karkalik, PE
Project Manager

EJK/dee
cc: File 73139701000

PARSONS

DRAFT

CANTON DROP FORGE, INC.
LAGOON #1 RE-CONSTRUCTION/BIOCELL DISPOSAL
SUMMARY REPORT OF FEASIBILITY ANALYSES

Based on our Scope of Work for the entitled project, Parsons Engineering Science, Inc. (Parsons ES) respectfully submits to Canton Drop Forge, Inc. (CDF) this report. In the sections which follow, we summarize the results of the environmental and geotechnical analyses completed, the feasibility of several alternative approaches considered, and the conceptual design, budgetary cost estimate and preliminary schedule for implementing the recommended option for addressing the re-construction of Lagoon #1 and disposition of the biocell material.

SUMMARY OF CURRENT CONDITIONS

Sampling and Analysis Plan

Prior to sampling, a square grid pattern was lain over a copy of the map of the area which contained the material removed from Lagoon #1, i.e., the biocell (see Figure 1). The area of each grid section was 900 square feet (30 feet by 30 feet). A discrete number was given to each of the grid intersections (there are 77 intersection). A random number generator was then used to pick ten (10) grid intersection points which were then sampled in the field and submitted for analytical/environmental analysis. The samples were labeled CDF-1 through CDF-10. In addition, seven discrete sampling locations inside various grids were sampled and composited for geotechnical analysis. The sampling locations were labeled Geotech-1 through Geotech-7.

Samples which were obtained for analytical/environmental analyses were collected via hand at each selected sampling grid location. Samples were collected from approximately 0.5 feet below grade at each sample location. Sample material was placed directly into laboratory grade jars, sealed with screw-on Teflon-lined lids, place on ice in a cooler and transported to the laboratory. The samples were transported under chain-of-custody procedures to GeoAnalytical, Inc. laboratories in Twinsburg, Ohio for environmental and chemical analyses. Soil samples were analyzed following the Voluntary Action Program (VAP) protocol for total petroleum hydrocarbons, middle range organics (TPH-MRO, EPA method SW846-4015A (modified)), total petroleum hydrocarbons heavy range organics (TPH-HRO, EPA method SW846-4015A (modified)), TPH (EPA method 418.1), and semi-volatile organic compounds (SVOCs, EPA method SW846-8270B). Table 1 summarizes the analytical methods used for this effort.

The soil sample obtained for geotechnical analyses represented a composite of seven sampling locations (e.g., Geotech-1 through Geotech-7). Samples were collected from approximately 0.5 feet below grade at each sample location and placed in a 5-gallon bucket with a sealed lid. The sample material was transported to Applied Construction Technologies, Inc. (ACT) in Cleveland, Ohio for analysis and treatability testing. The composited sample material was mixed with varying amounts of lime and fly ash and subjected to the California Bearing Ratio test (ASTM D1883) to determine the resulting materials' relative bearing capacities. Four test runs were made, one each for the following soil, lime and fly ash mixtures:

- Biocell material with no lime and no fly ash;
- Biocell material with 2% lime and 10% fly ash;
- Biocell material with 6% lime and 22.5% fly ash; and
- Biocell material with 10% lime and 35% fly ash.

Results of Analyses

Table 2 presents the results of analytical and environmental testing for the soil samples collected for chemical analysis. Table 2 only summarizes compounds which were detected during analysis. The complete analytical reports received from GeoAnalytical, Inc. have been included as Appendix A. Please note that the "VAP Limits for Industrial Use Properties" displayed in Table 2 may only be used if the biocell material is deposited between two confining clay layers with vertical hydraulic conductivity of less than 10^{-5} cm/sec. If the biocell materials are enplaced in any other configuration, more conservative VAP limits will apply. It should also be noted that the oily nature of the sampled material caused matrix interference in the laboratory, producing elevated detection limits for SVOCs.

Results of geotechnical analyses and treatability testing are summarized in the table contained in Appendix B. These indicate that, for the soil, lime and fly ash mixtures tested, the second case (i.e., with 2% lime and 10% fly ash) produced the most desirable results. Please note that this mixture is not necessarily the ***optimal*** result; subsequent discussions with the laboratory have indicated that slightly lower additions of lime and fly ash may produce a mixture with an adequate bearing capacity.

Implications of Analytical Results

Implications of the environmental and chemical analytical results are such that the material contained in the biocell should be suitable for application following the guidance of the VAP regulations. There are no compounds, which are required to be analyzed under VAP, with values exceeding the limits provided in VAP's Generic Numerical Standards for industrial use properties [OAC 3745-300-08]. To apply these limits, CDF must agree to maintain this property in industrial use in perpetuity. Also, in the future, should CDF decide to obtain closure of this property (or the portion being addressed in this project), the entire VAP protocol must be completed, resulting in issuance of a No Further Action (NFA) Letter by a Certified Professional and, if desired, a Covenant Not To Sue (CNS) by Ohio EPA.

Implications of the geotechnical analytical and treatability testing results are that, in order to maintain structural integrity in future applications (see specifically options b, c, and f below), stabilization with lime and fly ash is required. Please note that the long-term effects of certain applications, i.e., specifically as wearing surfaces in track or roadway and parking applications, have not been tested and are difficult to predict. For example, CDF should be aware that exposure to traffic and the elements (e.g., sunlight, precipitation, etc.) may result in physical or chemical changes in the stabilized soil mixture, resulting in potentially undesirable effects.

RCRA characterization testing (previously completed by Hammontree & Associates, prior to removal of the biocell material from Lagoon #1) indicated that the material was non-hazardous. Hence, the options presented below are considered feasible without the need for pretreatment for environmental risk reduction (i.e., fixation to prevent leaching should not be required).

FEASIBILITY ANALYSES

FOIA Review for VAP Applicability

Based on information from Mr. Richard Zollinger, Esq. of CDF, the Freedom of Information Act (FOIA) searches conducted at Twinsburg (Ohio EPA, Northeast Ohio District), Columbus (Ohio EPA, Headquarters) and Chicago (US EPA, Region V) produced no information that would prohibit use of a VAP approach for disposition of biocell material and/or re-construction of Lagoon #1. Consequently, based on the results of the FOIA searches and the

environmental sampling and analyses summarized above, it has been determined that application of the VAP regulatory framework should provide guidance, which is acceptable to the major stakeholders (i.e., Ohio EPA, CDF), for this project.

Further review of CDF's operating and regulatory history has indicated that, at one time or another (but not necessarily currently), other regulatory frameworks may have been applicable. For instance, the underground storage tanks (USTs), at least one (of three) has since been removed, are operated under the jurisdiction of the Bureau of Underground Storage Tank Regulations (BUSTR). Also, the landfill, which was located in the vicinity of the biocell and has since been closed, was possibly regulated under the Resource Conservation and Recovery Act (RCRA). Additionally, the Ohio EPA's Master Sites List (MSL) includes the CDF property (EPA ID no. OHD004465142) as a "low priority" site, included in the MSL since 1985 due to an "oily wastes" problem. In any case, even with these additional regulatory considerations in the background, it appears reasonable to follow VAP guidance for the current project. It should be noted, however, that several additional steps, i.e., Phase I property assessment, NFA Letter, etc., are required before the Lagoon #1 and biocell areas of the CDF property can be considered "closed" under VAP guidance. In other words, completion of these actions will not result in a regulatory closure of this portion of the CDF property. These proposed actions have been developed consistent with the requirements of VAP, should CDF choose to seek closure in the future.

Alternative Approaches

In view of the potentially appropriate alternatives for the disposal of material contained in the biocell and concurrent re-construction of Lagoon #1, Parsons ES has considered the following approaches:

a) transportation to and disposal of the biocell material in an appropriately licensed off-site landfill;

b) stabilization, as described above for structural integrity, and deposition in an on-site area, which will later be re-surfaced with asphalt for parking;

c) stabilization, as described above for structural integrity, and deposition in an on-site area, which will be used as a track or roadway around the inside perimeter of the property;

d) transportation and sale to Ashland's Refinery in Canton for use as a feed-stock;

e) transportation and sale to a local asphalt plant for use as a feed-stock; and

f) stabilization, as described above for structural integrity, and deposition in an appropriate manner (see following section) in Lagoon #1 as part of the back-fill required to reduce the pond's capacity to that required for storm water management.

It should be noted that, in re-constructing Lagoon #1 for alternatives a, b, c, d, and e above, additional volumes of clean fill material (beyond that which may be required for option f), will be required in lieu of the volume of biocell material which is being used or disposed elsewhere and of the clay used to provide a lining under the layer of biocell material (enplaced in option f). Also, in all cases, a small, incremental volume of oil-impacted soil and water in Lagoon #1 must be removed prior to initiating any re-construction activities. Parsons ES proposes that, subject to CDF approval and subsequent to recovery of any free oil, the additional oily soil and water be transferred to the biocell and Lagoon #2, respectively. Finally, except for the nature of an internal layer of biocell material (as in option f), the emplacement sequence for re-construction of Lagoon #1 would be similar for all options listed above:

- clay layer;
- biocell material (option f only);

- clay layer (option f only);
- HDPE liner (optional, if required); and
- stabilization layer (optional, if required).

Please note that for options a through e, clean fill may be substituted for the lower clay layer indicated above.

Screening Criteria

As indicated in our Scope of Work, the following criteria were used to screen the alternatives listed previously: economic impact (i.e., overall costs); scheduling impact; technical feasibility (i.e., implementability); stakeholder (i.e., regulatory agency, customer, neighbor, stockholder) acceptability; and permitting requirements. Table 3 provides a summary of the screening criteria definitions (see footnotes). Additional details concerning the definitions of the screening criteria and their application are contained in Appendix C.

Results of Screening

After applying the screening criteria to the alternative approaches considered, Parsons ES identified a recommended option for further analysis. Table 3 provides the results of the alternatives screening exercise. The **recommended option**, as a result of the screening effort, is option f, the stabilization and transfer of biocell material for use in re-construction of Lagoon #1. This option is preferred because it is:

- cost-effective (minimizing costs of transporting soil in comparison to options a, d and e, which involve off-site shipment of biocell material and hauling of an equivalent volume of clean fill from off-site to the CDF property);
- time-efficient (reducing risks of scheduling impacts potentially caused by others, as in options a, d and e);
- technically feasible (e.g., and readily implementable, in comparison with options b, c, d and e, for which ease of implementation is either uncertain or perceived to be more difficult);
- acceptable to the primary stakeholders (e.g., the risk takers, including regulatory agencies and CDF, in comparison with options a, d and e for which future control cannot be assured); and
- low risk with respect to permitting (in comparison with options a, c and d, which may require "permits" for off-site transportation of the biocell material).

A conceptual description, cost estimate and preliminary schedule for this option are provided in the following section. Please note that, for the sake of comparison only, costing and scheduling information were developed and are provided for the off-site landfill disposal option. The off-site landfill disposal option is being used as the "base case" in this comparison with the preferred option.

RECOMMENDED OPTION

Conceptual Design

The conceptual design for the preferred option includes implementation of the following steps. Figure 2 provides a profile view of the resulting conceptual design. To implement this design, we recommend that CDF plan to:

- remove any residual oily soil which remains in Lagoon #1 and transfer it to the biocell;
- re-grade Lagoon #1, as necessary, to assure that the side-walls are stable;
- place and compact a 12-inch layer of clay, in two 6-inch lifts, to provide an impermeable lining in the Lagoon #1 excavation;
- in the biocell, add and mix 2% lime and 10% fly ash with the oily soil to stabilize it;
- transfer the stabilized mixture from the biocell to Lagoon #1;
- place and compact the stabilized biocell material in Lagoon #1; and
- place and compact one additional 6-inch layer of clay to cap and seal the surface of Lagoon #1.

Depending on the final size of Lagoon #1, excess stabilized biocell material may be available. Drainage and traffic considerations must be taken into account for the possible locations for on-site placement and compaction of this material. Appropriate consideration of these factors will preclude future erosion of this material from the property.

Budgetary Cost Estimate

Parsons ES has developed, working in conjunction with Beaver Excavating Company, a budgetary cost estimate (i.e., within +/- 30%) of $150,000 for the recommended option. This estimate is based on the assumptions that:

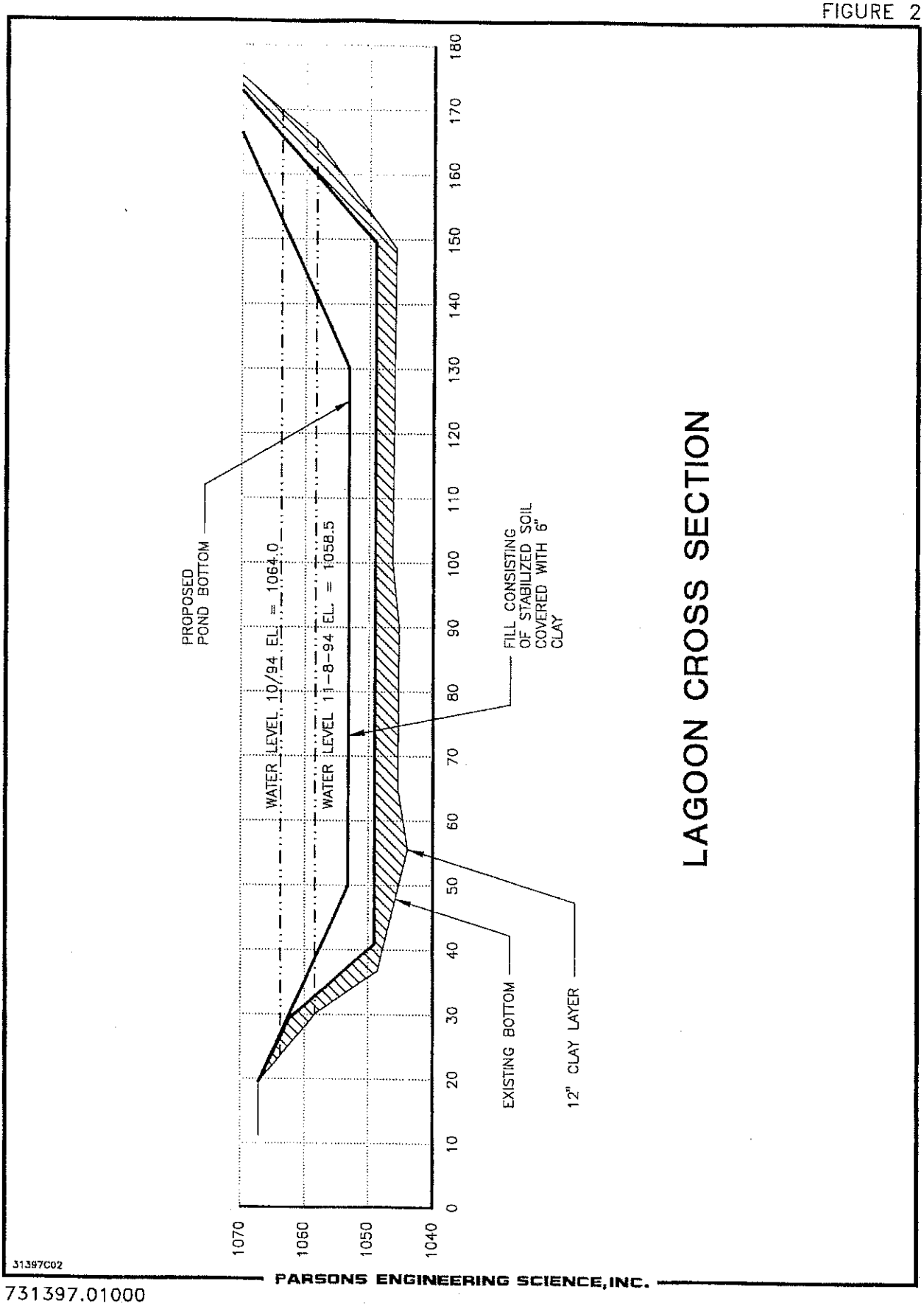
- about 3000 cubic yards of oily soil are available for stabilization in the biocell; and
- about 600 cubic yards of clay will be required for the upper and lower layers lining the re-constructed Lagoon #1.

Table 4 contains the cost estimate, provided by major cost category.

Preliminary Schedule

It is projected that this recommended option, for re-constructing Lagoon #1 and addressing the disposition of the biocell material concurrently, can be accomplished within 9 to 10 weeks after CDF's issuance of an order to proceed. In particular, the final design for Lagoon #1 can be completed within 3-4 weeks. The construction phase of the project is anticipated to require about six (6) weeks.

FIGURE 2



PARSONS ENGINEERING SCIENCE, INC.

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TABLE 1

ANALYTICAL PROCEDURES - SOIL
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

18 April 1997

Analyte	Method
Total Petroleum Hydrocarbons - Middle Range Organics	EPA Method SW846-8015A (modified)
Total Petroleum Hydrocarbons - Heavy Range Organics	EPA Method SW846-8015A (modified)
Total Petroleum Hydrocarbons	EPA Method 418.1
Semi-Volatile Organic Compounds	EPA Method SW846-8270B

TABLE 2

RESULTS OF LABORATORY ANALYSIS - SOIL
CANTON DROP FORGE
4575 SOUTHWAY STREET
CANTON, OHIO

18 April 1997

Sample ID	Middle Range Organics (ppm)	Heavy Range Organics (ppm)	TPH-418.1 (ppm)	Pyrene (ppm)	Chrysene (ppm)
CDF-1	19.0	671	36,900	<20	<20
CDF-2	42.3	893	46,900	<20	<20
CDF-3	94.8	1,620	92,600	<20	<20
CDF-4	59.4	593	72,700	<20	<20
CDF-5	118	1,090	104,000	<20	<20
CDF-6	101	1,080	89,600	<20	<20
CDF-7	101	1,170	93,800	25.2	22.5
CDF-8	147	1,270	95,000	20.5	25.8
CDF-9	196	1,100	135,000	22.5	22.1
CDF-10	32.6	580	57,200	<20	<20
VAP Limits for Industrial Use Properties	20,000	40,000	NA	8,900	3,100

NA - Not applicable.

TABLE 3
CANTON DROP FORGE, INC. PLANT, CANTON, OHIO
LAGOON #1 RE-CONSTRUCTION / BIOCELL DISPOSITION OPTIONS

Indicator	Description of Options	Subjective Evaluation (1-5, with 5= best)					
		Objective Economic Impact[1]	Objective Scheduling Impact[2]	Subjective Technical Feasibility[3]	Subjective Stakeholder Acceptance[4]	Subjective Permitting Req'ments[5]	Overall Rating
A	Disposal in off-site landfill[6]	1 (3)	4	4	3	3	15 (17)
B	Stabilization in on-site parking area[6] (to be covered with asphalt)	2	4	4	3	5	18
C	Stabilization in on-site track or roadway area[6] (not covered)	2	4	3	2	5	16
D	Transport to Ashland's Canton Refinery for feed-stock[6]	3	2	1	3	3	12
E	Transport to asphalt plant for feed-stock[6]	4	2	3	3	3	15
F	Stabilization and use in conjunction with clay layers[6]	3	4	4	4	5	20

see appendix 2 for criteria

Notes:

1) Economic Impact = 1 for options ≥ $50/tn and = 5 for options ≤ $10/tn.
2) Scheduling Impact = 1 for options ≥ 8 months and = 5 for options ≤ 2 months.
3) Technical Feasibility = 1 for impractical / very difficult options and = 5 for easily implemented options.
4) Stakeholder Acceptance = 1 for options meeting substantial / insurmountable objections and = 5 for fully acceptable options.
5) Permitting Requirements = 1 for substantial / difficult requirements and = 5 for no permits required.
6) Options A-E include transport, placement and compaction of clean fill in Lagoon #1.

CDF013260

TABLE 4

BUDGETARY COST ESTIMATE
CANTON DROP FORGE, INC.
RECONSTRUCTION OF LAGOON #1 AND BIOCELL DISPOSITION

Task Description	Cost Estimate
Conduct detailed design and construction review	$15,000
Pump out Lagoon #1	1,000
Remove oily soil from Lagoon #1	2,000
Re-grade Lagoon #1	2,000
Place and compact clay lining in Lagoon #1	10,000
Stabilize oily soil material in the biocell	75,000
Place and compact stabilized soil in Lagoon #1	30,000
Place and compact final clay layer	5,000
General conditions	10,000
TOTAL	**$150,000**

— $40/yd^3$

100,000 / 200,000

Option A = $151,000 estimate.
from bid on moving & disposing of material = ± 15%

APPENDIX A:

RESULTS OF ENVIRONMENTAL ANALYSES FROM GEOANALYTICAL, INC.

FOR

CANTON DROP FORGE, INC.
CANTON, OHIO

APRIL/MAY 1997

G E O A n a l y t i c a l , I n c .

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job# 9704102(A) Project Number: 731397.01000
Matrix Type: Soil
Samples Received: 04/22/97 Project Name: Canton Drop Forge
Date Analyzed: 04/25-26/97
Analysis Reported: 04/29/97

NONHALOGENATED VOLATILE ORGANICS IN SOIL

Lab #	Date	Station Location	Middle Range Organics	Heavy Range Organics	Reporting Limit
1995	04/18/97	CDF-1	19.0	671	4.0
1996	04/18/97	CDF-2	42.3	893	4.0
1997	04/18/97	CDF-3	94.8	1,620	4.0
1998	04/18/97	CDF-4	59.4	593	4.0
1999	04/18/97	CDF-5	118	1,090	4.0
2000	04/18/97	CDF-6	101	1,080	4.0
2001	04/18/97	CDF-7	101	1,170	4.0
2002	04/18/97	CDF-8	147	1,270	4.0
2003	04/18/97	CDF-9	196	1,100	4.0
2004	04/18/97	CDF-10	32.6	580	4.0
			mg/Kg	mg/Kg	mg/Kg

Analytical Methodology Information

EPA Method SW846-8015A(Modified), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Middle Range Organics calculated from Heptane (C7) to Hexadecane (C16).

Heavy Range Organics calculated from Hexadecane (C16) to Dotriacontane (C32).

Samples may contain compounds with higher molecular weights than Dotriacontane (C32) which are not calculated in the Total Petroleum Hydrocarbons number reported.

These petroleum fractions are found in Rule 3746 of the OAC Section 3745-300-08 of the Generic Numeric Standards.

Initial Calibration Date: 05/20/96-01/09/97
Continuing Calibration Date: 04/25-26/97
Analyst: M. Darsot - C. Lang

ANALYSIS REVIEWED AND APPROVED BY Christa Thaxton

GEO Analytical, Inc.

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job# 9704102(B)
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/25-28/97
Analysis Reported: 04/29/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

PETROLEUM HYDROCARBONS, TOTAL RECOVERABLE IN SOIL

Lab #	Date	Station Location	Result	Reporting Limit
1995	04/18/97	CDF-1	36,900	2,000
1996	04/18/97	CDF-2	46,900	4,000
1997	04/18/97	CDF-3	92,600	4,000
1998	04/18/97	CDF-4	72,700	2,000
1999	04/18/97	CDF-5	104,000	4,000
2000	04/18/97	CDF-6	89,600	4,000
2001	04/18/97	CDF-7	93,800	4,000
2002	04/18/97	CDF-8	95,000	4,000
2003	04/18/97	CDF-9	135,000	2,000
2004	04/18/97	CDF-10	57,200	2,000
			mg/Kg	mg/Kg

Analytical Methodology Information

EPA Method 418.1, "Methods for Chemical Analysis of Water and Wastes"

Initial Calibration Date: 04/25-28/97
Continuing Calibration Date: 04/25-28/97
Analyst: J. Woodall

ANALYSIS REVIEWED AND APPROVED BY Christa Pearson

G E O A n a l y t i c a l , I n c

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#	9704102(M)-2005	Project Number:	731397.01000
Matrix Type:	Water		
Samples Received:	04/22/97	Project Name:	Canton Drop Forge
Date Analyzed:	04/23/97		
Analysis Reported:	04/24/97		

Sample Date: 04/16/97
Sample Description: Trip Blank

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN WATER

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 25.0	25.0
Phenol	< 5.0	5.0
2-Chlorophenol	< 5.0	5.0
bis(2-Chloroethyl)ether	< 5.0	5.0
1,3-Dichlorobenzene	< 5.0	5.0
1,4-Dichlorobenzene	< 5.0	5.0
1,2-Dichlorobenzene	< 5.0	5.0
2-Methylphenol	< 5.0	5.0
bis(2-Chloroisopropyl)ether	< 5.0	5.0
4-Methylphenol	< 5.0	5.0
Hexachloroethane	< 5.0	5.0
N-Nitroso-di-n-propylamine	< 25.0	25.0
Nitrobenzene	< 5.0	5.0
Isophorone	< 5.0	5.0
2-Nitrophenol	< 5.0	5.0
2,4-Dimethylphenol	< 5.0	5.0
bis(2-Chloroethoxy)methane	< 5.0	5.0
2,4-Dichlorophenol	< 5.0	5.0
1,2,4-Trichlorobenzene	< 5.0	5.0
Naphthalene	< 5.0	5.0
4-Chloroanaline	< 5.0	5.0
Hexachlorobutadiene	< 5.0	5.0
4-Chloro-3-methylphenol	< 5.0	5.0
2-Methylnaphthalene	< 5.0	5.0
Hexachlorocyclopentadiene	< 5.0	5.0
2,4,5-Trichlorophenol	< 5.0	5.0
2,4,6-Trichlorophenol	< 5.0	5.0
2-Chloronaphthalene	< 5.0	5.0
2-Nitroanaline	< 5.0	5.0
Acenaphthylene	< 5.0	5.0
Dimethyl phthalate	< 5.0	5.0
2,6-Dinitrotoluene	< 5.0	5.0
3-Nitroanaline	< 5.0	5.0
Acenaphthene	< 5.0	5.0
2,4-Dinitrophenol	< 25.0	25.0
4-Nitrophenol	< 5.0	5.0
Dibenzofuran	< 5.0	5.0
2,4-Dinitrotoluene	< 5.0	5.0
	ug/L	ug/L

G E O A n a l y t i c a l , I n c

GEO Job# :9704102(M)-2005
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 5.0	5.0
Fluorene	< 5.0	5.0
4-Chlorophenylphenyl ether	< 5.0	5.0
4-Nitroanaline	< 5.0	5.0
2-Methyl-4,6-dinitrophenol	< 25.0	25.0
N-Nitrosodiphenylamine	< 5.0	5.0
4-Bromphenylphenyl ether	< 5.0	5.0
Hexachlorobenzene	< 5.0	5.0
Pentachlorophenol	< 5.0	5.0
Phenanthrene	< 5.0	5.0
Anthracene	< 5.0	5.0
Carbazole	< 5.0	5.0
Di-n-butyl phthalate	< 5.0	5.0
Fluoranthene	< 5.0	5.0
Pyrene	< 5.0	5.0
Butyl benzyl phthalate	< 5.0	5.0
Benzo(a)anthracene	< 5.0	5.0
3,3'-Dichlorobenzidine	< 25.0	25.0
Chrysene	< 5.0	5.0
bis(2-Ethylhexyl) phthalate	< 5.0	5.0
Di-n-octyl phthalate	< 5.0	5.0
Benzo(b)fluoranthene	< 5.0	5.0
Benzo(k)fluoranthene	< 5.0	5.0
Benzo(a)pyrene	< 2.0	2.0
Indeno(1,2,3-cd)pyrene	< 5.0	5.0
Dibenzo(a,h)anthracene	< 5.0	5.0
Benzo(ghi)perylene	< 5.0	5.0
	ug/L	ug/L

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	50	35-110
Phenol d5	27	10-110
Nitrobenzene d5	68	35-114
2-Fluorobiphenyl	72	43-116
2,4,6-Tribromophenol	89	10-123
Terphenyl d14	72	33-141

* indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97
Continuing Calibration Date: 04/23/97
Analyst: T. Lang

ANALYSIS REVIEWED AND APPROVED BY Christy Pearson

G E O . A n a l y t i c a l , I n c

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(C)-1995
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/02/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-1

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O Analytical, Inc

GEO Job# 9704102(C)-1995
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	91	33 - 144
Phenol d5	78	62 - 120
Nitrobenzene d5	100	80 - 132
2-Fluorobiphenyl	99	67 - 105
2,4,6-Tribromophenol	92	24 - 135
Terphenyl d14	82	46 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/02/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christie Thaxton

G E O Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job# 9704102(D)-1996
Matrix Type: Soil
Samples Received: 04/22/97
Data Analyzed: 04/30-05/02/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-2

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

GEO Analytical, Inc

GEO Job# 9704102(D)-1998
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroaniline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	92	33 - 144
Phenol d5	82	62 - 120
Nitrobenzene d5	102	80 - 132
2-Fluorobiphenyl	69	67 - 105
2,4,6-Tribromophenol	95	24 - 135
Terphenyl d14	94	49 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/02/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christie Thomas

G E O Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(E)-1997
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/02/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-3

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O A n a l y t i c a l, I n c

GEO Job# 9704102(E)-1997
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	88	33 - 144
Phenol d5	78	62 - 120
Nitrobenzene d5	93	80 - 132
2-Fluorobiphenyl	74	67 - 105
2,4,6-Tribromophenol	101	24 - 135
Terphenyl d14	80	49 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/02/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christie Traxim

G E O Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job# 9704102(F)-1998
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/02/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-4

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroaniline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroaniline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroaniline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O A n a l y t i c a l, I n c

GEO Job# 9704102(F)-1998
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	82	33 - 144
Phenol d5	72	62 - 120
Nitrobenzene d5	86	80 - 132
2-Fluorobiphenyl	95	67 - 105
2,4,6-Tribromophenol	92	24 - 135
Terphenyl d14	79	49 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/02/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christi Thomm

9263 Ravenna Rd. • Suite A-7 - Twinsburg, Ohio 44087 • Phone 216 963 6990 • Fax 216 963 697

G E O Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119.

GEO Job#: 9704102(G)-1999
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/03/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-5

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O Analytical, Inc

GEO Job# : 9704102(G)-1999
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COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	80	33 - 144
Phenol d5	71	62 - 120
Nitrobenzene d5	91	80 - 132
2-Fluorobiphenyl	101	67 - 105
2,4,6-Tribromophenol	94	24 - 135
Terphenyl d14	84	49 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/03/97
Analyst: T. Lang

REVIEWED AND APPROVED BY: Christie Thorson

G E O Analytical Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(H)-2000
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/03/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/16/97
Sample Description: CDF-6

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O Analytical, Inc

GEO Job# 9704102(H)-2000
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	86	33 - 144
Phenol d5	75	62 - 120
Nitrobenzene d5	84	80 - 132
2-Fluorobiphenyl	98	67 - 105
2,4,6-Tribromophenol	88	24 - 135
Terphenyl d14	89	49 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/03/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christy Traxler

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G E O Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(I)-2001
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/05/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-7

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroaniline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroaniline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroaniline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

GEO Analytical, Inc

GEO Job# 9704102(I)-2001
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	25.2	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	22.5	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	92	33 - 144
Phenol d5	84	62 - 120
Nitrobenzene d5	75*	80 - 132
2-Fluorobiphenyl	74	67 - 105
2,4,6-Tribromophenol	87	24 - 135
Terphenyl d14	100	49 - 141

* Indicates surrogate recovery outside of acceptable range.
***Analytical results for this sample are estimated concentration due to low surrogate recovery.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 04/17/97-05/01/97
Continuing Calibration Date: 04/30-05/05/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christie Thorum

G E O Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(J)-2002
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 05/02-05/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-8

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O . A n a l y t i c a l , I n c

GEO Job# 9704102(J)-2002

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	20.5	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	25.8	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	75	33 - 144
Phenol d5	59*	62 - 120
Nitrobenzene d5	72*	80 - 132
2-Fluorobiphenyl	102	67 - 105
2,4,6-Tribromophenol	85	24 - 135
Terphenyl d14	92	49 - 141

* Indicates surrogate recovery outside of acceptable range.
***Analytical results for this sample are estimated concentration due to low surrogate recovery.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 05/01/97
Continuing Calibration Date: 05/02-05/97
Analyst: T. Lang

REVIEWED AND APPROVED BY: Christie Thaxton

9263 Ravenna Rd. • Suite A-7 • Twinsburg, Ohio 44087 • Phone 216 963 6990 • Fax 216 963 6975

G E O A n a l y t i c a l , I n c

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#	9704102(K)-2003	Project Number:	731397.01000
Matrix Type:	Soil		
Samples Received:	04/22/97	Project Name:	Canton Drop Forge
Date Analyzed:	05/02-05/97		
Analysis Reported:	05/06/97		

Sample Date: 04/18/97
Sample Description: CDF-9

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

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CDF013283

G E O A n a l y t i c a l , I n c

GEO Job#: 9704102(K)-2003
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroaniline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	22.5	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	22.1	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	80	33 - 144
Phenol d5	60*	62 - 120
Nitrobenzene d5	78*	80 - 132
2-Fluorobiphenyl	92	67 - 105
2,4,6-Tribromophenol	71	24 - 135
Terphenyl d14	94	49 - 141

* Indicates surrogate recovery outside of acceptable range.
***Analytical results for this sample are estimated concentration due to low surrogate recovery.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Initial Calibration Date: 05/01/97
Continuing Calibration Date: 05/02-05/97
Analyst: T. Lang

REVIEWED AND APPROVED BY Christie Thoxton

GEO Analytical, Inc

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(L)-2004
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 05/02/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-10

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroaniline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroaniline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroaniline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

G E O A n a l y t i c a l, I n c

GEO Job# · 9704102(L)-2004
Page 2 of 2

COMPOUNDS	RESULTS	REPORTING LIMIT
Diethyl phthalate	< 20.0	20.0
Fluorene	< 20.0	20.0
4-Chlorophenylphenyl ether	< 20.0	20.0
4-Nitroanaline	< 20.0	20.0
2-Methyl-4,6-dinitrophenol	< 100	100
N-Nitrosodiphenylamine	< 20.0	20.0
4-Bromphenylphenyl ether	< 20.0	20.0
Hexachlorobenzene	< 20.0	20.0
Pentachlorophenol	< 20.0	20.0
Phenanthrene	< 20.0	20.0
Anthracene	< 20.0	20.0
Carbazole	< 20.0	20.0
Di-n-butyl phthalate	< 20.0	20.0
Fluoranthene	< 20.0	20.0
Pyrene	< 20.0	20.0
Butyl benzyl phthalate	< 20.0	20.0
Benzo(a)anthracene	< 20.0	20.0
3,3'-Dichlorobenzidine	< 100	100
Chrysene	< 20.0	20.0
bis(2-Ethylhexyl) phthalate	< 20.0	20.0
Di-n-octyl phthalate	< 20.0	20.0
Benzo(b)fluoranthene	< 20.0	20.0
Benzo(k)fluoranthene	< 20.0	20.0
Benzo(a)pyrene	< 20.0	20.0
Indeno(1,2,3-cd)pyrene	< 20.0	20.0
Dibenzo(a,h)anthracene	< 20.0	20.0
Benzo(ghi)perylene	< 20.0	20.0
	mg/Kg	mg/Kg.

COMPOUND	% SURROGATE RECOVERY	ACCEPTABLE RANGE
2-Fluorophenol	88	33 - 144
Phenol d5	76	62 - 120
Nitrobenzene d5	90	80 - 132
2-Fluorobiphenyl	98	67 - 105
2,4,6-Tribromophenol	98	24 - 135
Terphenyl d14	82	49 - 141

* Indicates surrogate recovery outside of acceptable range.

Analytical Methodology Information

EPA Method SW846-8270B, "Test Methods for Evaluating Solid Waste; Physical/Chemical Methods"

Initial Calibration Date: 05/01/97
Continuing Calibration Date: 05/02/97
Analyst: T. Lang

REVIEWED AND APPROVED BY: Christie Thomson

G E O . A n a l y t i c a l , I n c

Report Issued To: Parsons Engineering Science
19101 Villaview Road, Suite 300
Cleveland, Ohio 44119

GEO Job#: 9704102(C)-1995
Matrix Type: Soil
Samples Received: 04/22/97
Date Analyzed: 04/30-05/02/97
Analysis Reported: 05/06/97

Project Number: 731397.01000
Project Name: Canton Drop Forge

Sample Date: 04/18/97
Sample Description: CDF-1

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMI-VOLATILE ORGANICS IN SOIL

COMPOUNDS	RESULTS	REPORTING LIMIT
N-Nitrosodimethylamine	< 100	100
Phenol	< 20.0	20.0
2-Chlorophenol	< 20.0	20.0
bis(2-Chloroethyl)ether	< 20.0	20.0
1,3-Dichlorobenzene	< 20.0	20.0
1,4-Dichlorobenzene	< 20.0	20.0
1,2-Dichlorobenzene	< 20.0	20.0
2-Methylphenol	< 20.0	20.0
bis(2-Chloroisopropyl)ether	< 20.0	20.0
4-Methylphenol	< 20.0	20.0
Hexachloroethane	< 20.0	20.0
N-Nitroso-di-n-propylamine	< 100	100
Nitrobenzene	< 20.0	20.0
Isophorone	< 20.0	20.0
2-Nitrophenol	< 20.0	20.0
2,4-Dimethylphenol	< 20.0	20.0
bis(2-Chloroethoxy)methane	< 20.0	20.0
2,4-Dichlorophenol	< 20.0	20.0
1,2,4-Trichlorobenzene	< 20.0	20.0
Naphthalene	< 20.0	20.0
4-Chloroanaline	< 20.0	20.0
Hexachlorobutadiene	< 20.0	20.0
4-Chloro-3-methylphenol	< 20.0	20.0
2-Methylnaphthalene	< 20.0	20.0
Hexachlorocyclopentadiene	< 20.0	20.0
2,4,5-Trichlorophenol	< 20.0	20.0
2,4,6-Trichlorophenol	< 20.0	20.0
2-Chloronaphthalene	< 20.0	20.0
2-Nitroanaline	< 20.0	20.0
Acenaphthylene	< 20.0	20.0
Dimethyl phthalate	< 20.0	20.0
2,6-Dinitrotoluene	< 20.0	20.0
3-Nitroanaline	< 20.0	20.0
Acenaphthene	< 20.0	20.0
2,4-Dinitrophenol	< 100	100
4-Nitrophenol	< 20.0	20.0
Dibenzofuran	< 20.0	20.0
2,4-Dinitrotoluene	< 20.0	20.0
	mg/Kg	mg/Kg

APPENDIX B:

RESULTS OF GEOTECHNICAL ANALYSES AND STABILITY TESTING FROM APPLIED CONSTRUCTION TECHNOLOGIES, INC.

FOR

CANTON DROP FORGE, INC.
CANTON, OHIO

MAY 1997

ENGINEERING • TESTING • INSPECTION

APPLIED CONSTRUCTION TECHNOLOGIES, INC.

210 HAYES DRIVE • SUITE C • CLEVELAND, OHIO 44131 • (216) 459-TEST • FAX (216) 459-8954
478 E. EXCHANGE ST. • SUITE 202 • AKRON, OHIO 44304 • (216) 253-TEST • FAX (216) 253-3462

May 12, 1997

Parsons Engineering Science, Inc.
19101 Villaview Road, Suite 301
Cleveland, Ohio 44119

Attention: Mr. Rick Volpi

SUBJECT: LABORATORY TEST RESULTS
OILY CLAYEY GRAVEL AND SAND FROM
CANTON DROP FORGE

ACT PROJECT NO. 9705.08

Enclosed are the laboratory test results which have been completed on the sample of black oily clayey gravel and sand which was submitted to us on April 18, 1997. Reportedly the material is from Canton Drop Forge and the material is to be placed within a clay lined and capped cell for biological treatment.

It is our understanding that in its present condition the material is very difficult to work with and is not expected to be stable enough to construct a compacted clay cap over it. To improve its stability, we mixed various mixtures of lime and fly ash into the oily waste material. The granular nature of the material made it unsuitable for compression testing; therefore, the stability of the oily waste and the various mixtures of lime, fly ash, and waste were determined by conducting California Bearing Ratio tests (ASTM D1883). The test results are summarized below:

	Compacted Density	CBR
Oily Waste without Lime and Fly Ash	127.8 pcf	2.7
Oily Waste with 2 % Lime and 10% Fly Ash	120.9 pcf	10.4
Oily Waste with 6 % Lime and 22.5 % Fly Ash	115.5 pcf	10.0
Oily Waste with 10 % Lime and 35 % Fly Ash	108.4 pcf	9.3

The test results indicate that the stability of the material can be greatly improved with the addition of minor amounts of lime and fly ash. The stability of the mixture did not improve when larger amounts of lime and fly ash were used.

Based on the test results, a properly blended mixture of the oily waste with 2 % lime and 10 % fly ash would be expected to compact readily and be stable under normal construction equipment.

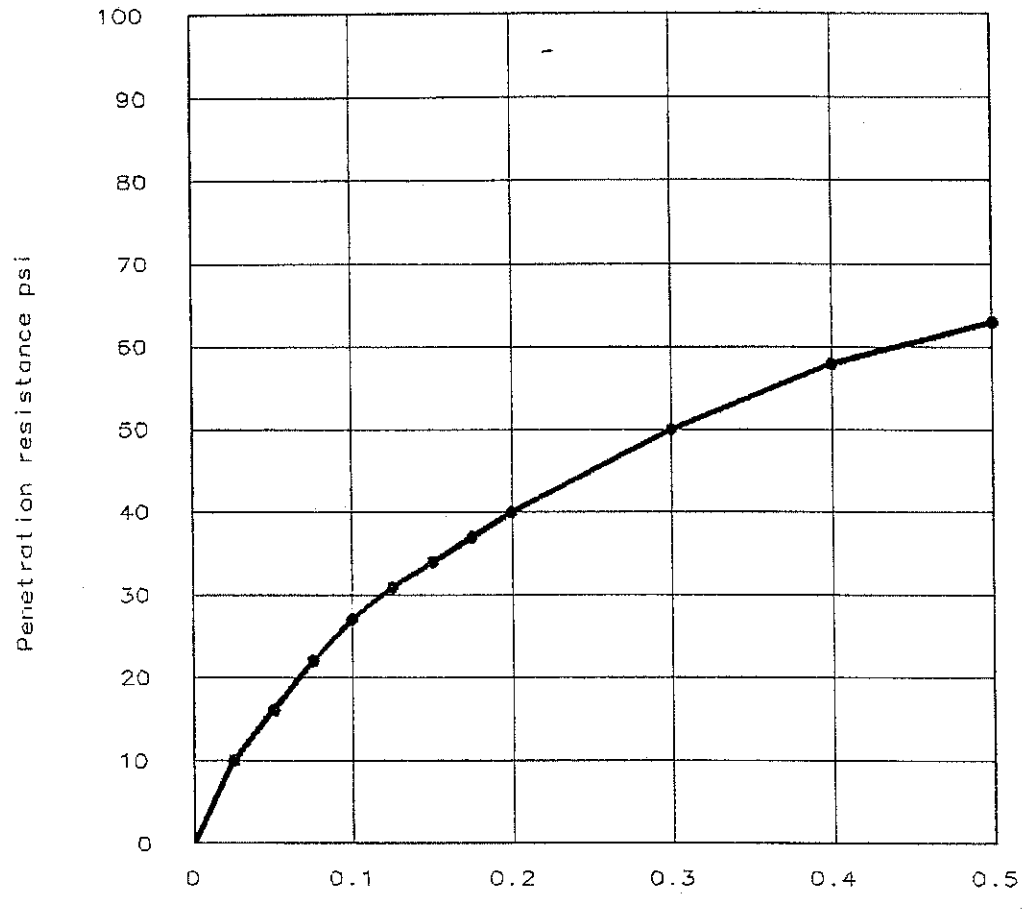
Should you have any questions concerning these test results, please do not hesitate to contact us.

APPLIED CONSTRUCTION TECHNOLOGIES, INC.
by:

Lynton L. Price, P.E.
Director of Engineering

CDF013290

BEARING RATIO TEST REPORT



	Molded			Soaked			CBR (%)		Penet.	Swel
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"	Surcharge	%
1 ●	127.8		3.5%	128.1		4.7%	2.7	2.7	14.93 lbs.	0.0
2 ▲										
3 ■										

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
OILY, CLAYEY GRAVEL & SAND					

Project No: 9705.08
Project: CANTON DROP FORGE
Location: BIOCELL
CLIENT: PARSONS ENGINEERING SCIENCE,INC.
Date: 5/6/97

BEARING RATIO TEST REPORT

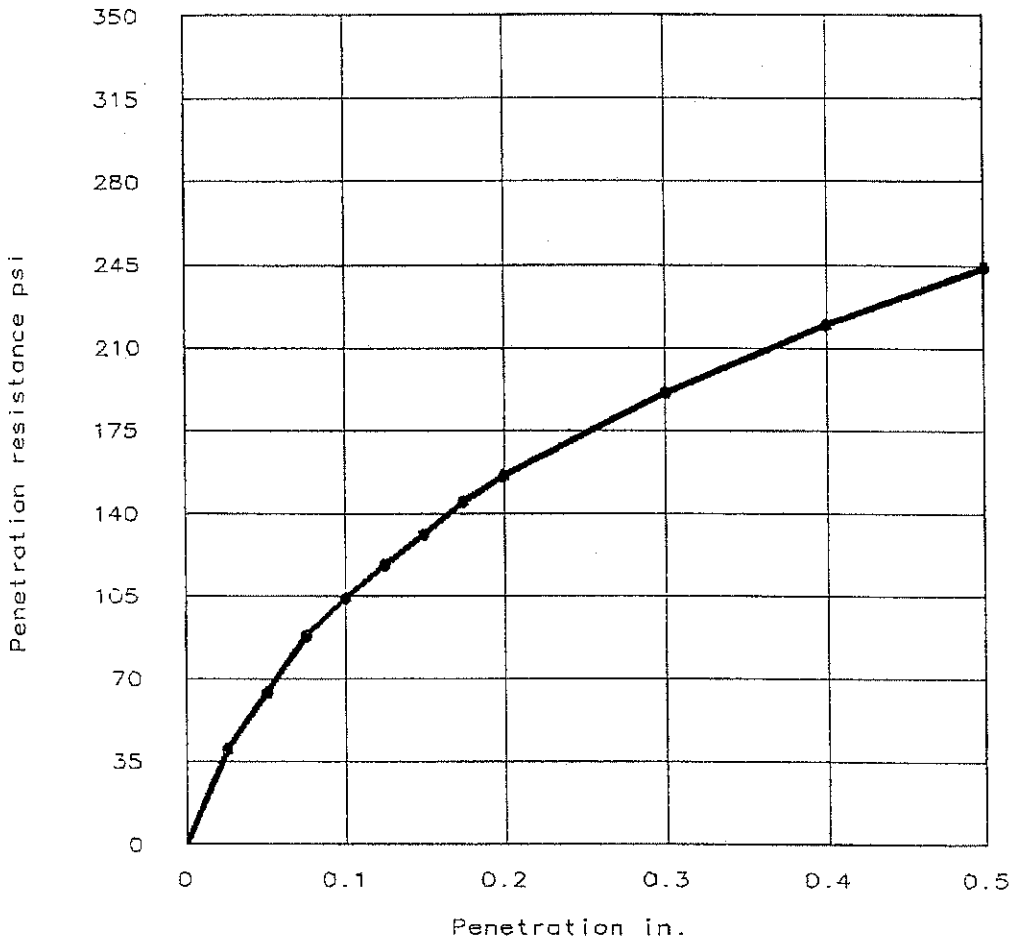
APPLIED CONSTRUCTION TECHNOLOGIES, INC.

Test Descr./Remarks:

BULK SAMPLE
SUBMITTED TO US BY
PARSONS ENGINEERING
SCIENCE ON 4-18-97

Fig. No.

BEARING RATIO TEST REPORT



	Molded			Soaked			CBR (%)		Penet.	Swel
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"	Surcharge	%
1 ●	120.9		5.4%	120.9		7.6%	10.4	10.4	15.07 lbs.	0.4
2 ▲										
3 ■										

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
OILY,CLAYEY GRAVEL&SAND,WTH 10%FLYASH,2%LIME					

Project No: 9705.08
Project: CANTON DROP FORGE
Location: BIOCELL
CLIENT: PARSONS ENGINEERING SCIENCE,INC.
Date: 5-9-97

BEARING RATIO TEST REPORT

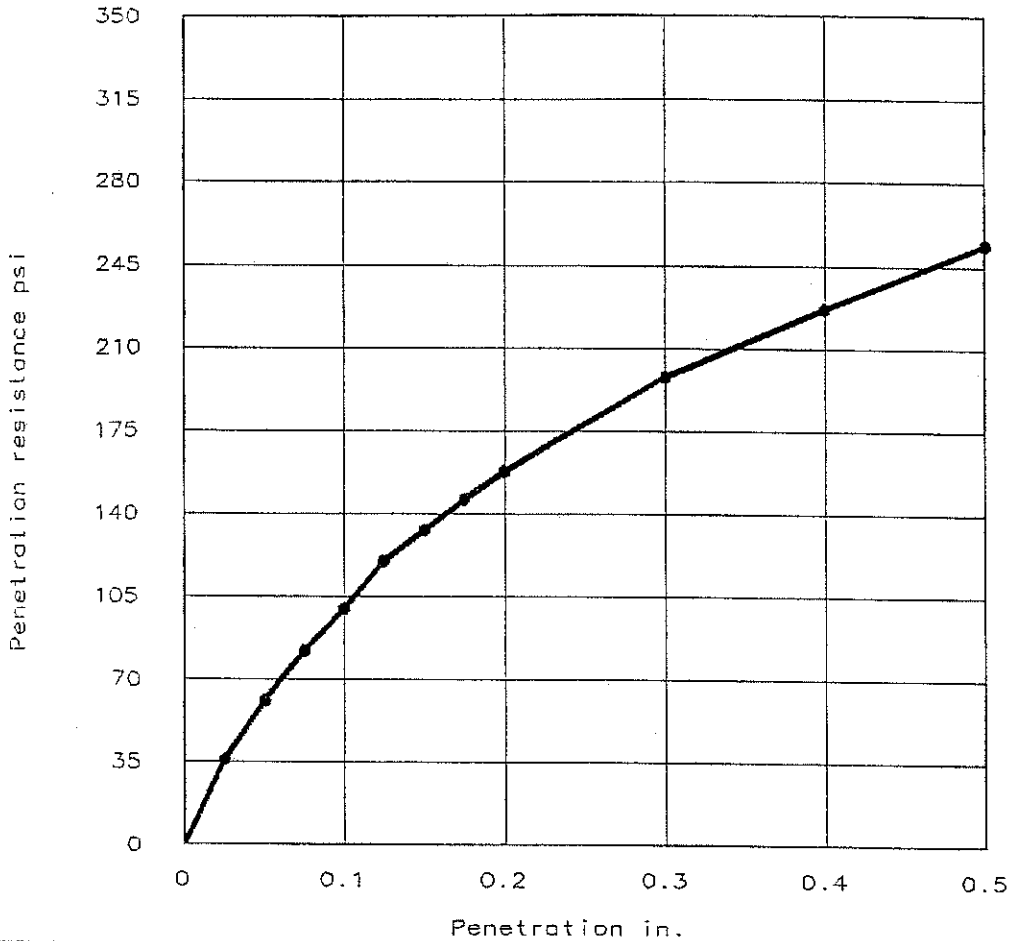
APPLIED CONSTRUCTION TECHNOLOGIES, INC.

Test Descr./Remarks:
ASTM-D 1883

BULK SAMPLE
SUBMITTED TO US BY
PARSONS ENGINEERING
SCIENCE ON 4-18-97

Fig. No.

BEARING RATIO TEST REPORT



	Molded			Soaked			CBR (%)		Penet.	Swel
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"	Surcharge	%
1 ●	115.5		3.2%	114.5		10.1%	10.0	10.5	15.01 lbs.	0.9
2 ▲										
3 ■										

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
OILY,CLAYEY GRAVEL&SAND,WTH22.5%FLYASH6%LIME					

Project No: 9705.08
Project: CANTON DROP FORGE
Location: BIOCELL
CLIENT: PARSONS ENGINEERING SCIENCE,INC.
Date: 5-9-97

BEARING RATIO TEST REPORT

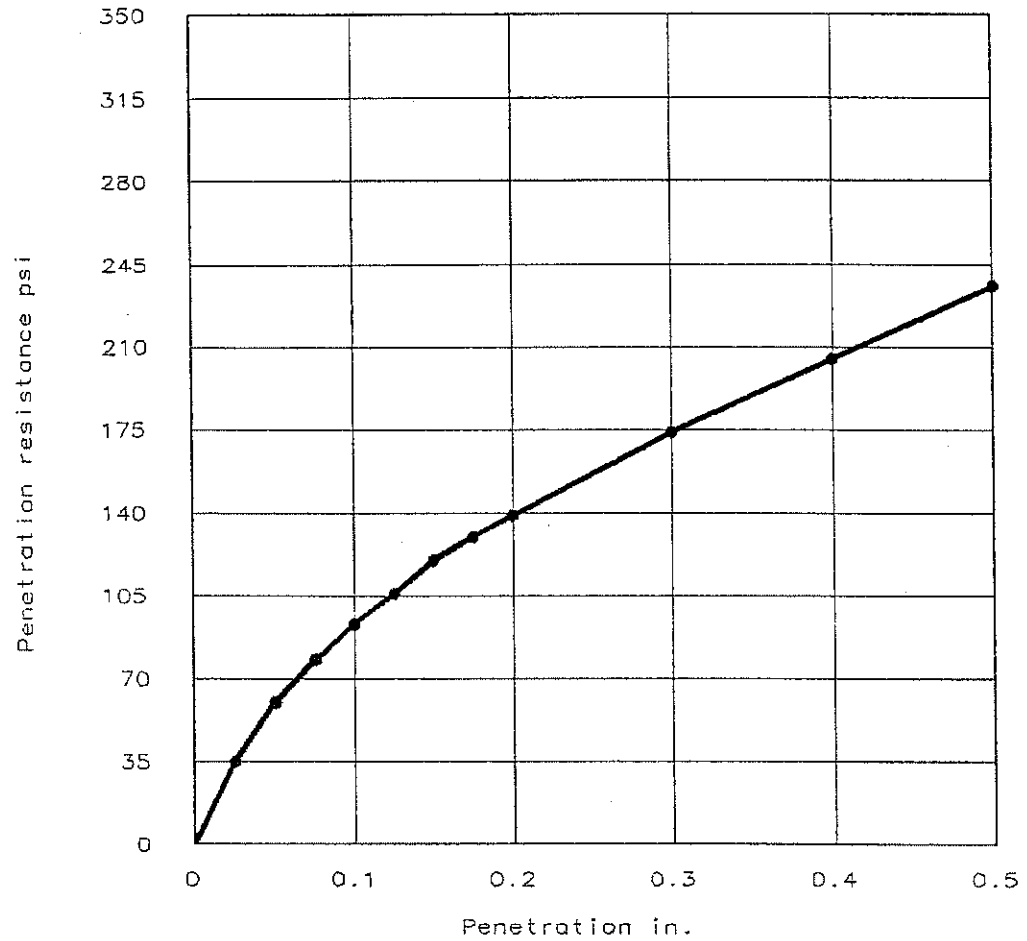
APPLIED CONSTRUCTION TECHNOLOGIES, INC.

Test Descr./Remarks:
ASTM-D 1883

BULK SAMPLE
SUBMITTED BY PARSONS
ENGINEERING SCIENCE
ON 4-18-97

Fig. No.

BEARING RATIO TEST REPORT



	Molded			Soaked			CBR (%)		Penet.	Swel
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"	Surcharge	%
1 ●	108.4		4.1%	107.5		14.1%	9.3	9.3	15.07 lbs.	0.9
2 ▲										
3 ■										

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
OILY,CLAYEY GRAVEL&SAND WTH 35%FLYASH10%LIME					

Project No: 9705.08
Project: CANTON DROP FORGE
Location: BIOCELL
CLIENT: PARSONS ENGINEERING SCIENCE,INC.
Date: 5-9-97

BEARING RATIO TEST REPORT

APPLIED CONSTRUCTION TECHNOLOGIES, INC.

Test Descr./Remarks:
ASTM-D 1883

BULK SAMPLE
SUBMITTED BY PARSONS
ENGINEERING SCIENCE
ON 4-18-97

Fig. No.

APPENDIX C:

CRITERIA FOR SCREENING ALTERNATIVES FOR CANTON DROP FORGE, INC. LAGOON #1 RE-CONSTRUCTION AND BIOCELL DISPOSAL PROJECT

CRITERIA FOR SCREENING ALTERNATIVES FOR CANTON DROP FORGE, INC. LAGOON #1 RE-CONSTRUCTION AND BIOCELL DISPOSAL PROJECT

Described below are the criteria used for screening the six (6) alternatives considered for the CDF Lagoon #1 re-construction and biocell disposal project and their applications in evaluating these options.

Economic Impact

This criterion considers budget-level unit costs of implementing the six alternatives. These analyses take into account the total costs for addressing the Lagoon #1 re-construction and disposal of biocell material, divided by the estimated volume of the biocell (i.e., about 4,500 tons). The calculation also takes into account any credits which may be realized for re-use of the biocell material.

Rating structure
1 is > $50 / ton
2 is $33 to $50 / ton
3 is $25 to $35 / ton
4 is $10 to $25 / ton
5 is $10 / ton

In Option a, costs to test, load, transport, dump (including excise taxes) the biocell material are projected at over $40/ton. Additional expenses are required to reconstruct Lagoon #1, estimated at over $15/ton. (**Note**: this estimate will also be used for Lagoon #1 re-construction in Options b, c, d and e), resulting in a total of over $55/ton.

In Options d and e, costs to test, screen, fluidize (optional only), load, transport and transfer the material are partial offset by the value the receiving facility placed on it. About $40/ton in total costs (including those for Lagoon #1) are partial offset by credits of about $5/ton for recovered hydrocarbon value in Option d and about $15/ton for displaced raw materials needed in Option e.

Please refer to Table 4 for costs estimated for Option f (about $33/ton).

Schedule Impact

This criterion considers the total time, commencing from CDF's authorization, to complete engineering, procurement, permitting (or other third-party approvals), implementation and closure of the alternatives.

Rating structure
1 is > 8 / months
2 is 6 to 8 months
3 is 4 to 6 months
4 is 2 to 4 months
5 is <2 months

It is envisaged that, since Options b, c and f are largely within CDF's control and for Option a significant delays are not anticipated getting landfill approval for disposal of this (previously characterized) non-hazardous material, these actions can be completed within 2 to 4 months. Options d and e are anticipated to require longer periods of time to test, verify quality, get third-party approvals (i.e., from Ashland or asphalt plant) and to fit within their operating schedules. To avoid subsequent re-handling of the material, direct feed to their presses will be required, causing delays in completion.

Technical Feasibility

Technical feasibility takes into account the implementability of the proposed options. The rating is entirely subjective with factors identified regarding the ease or difficulty anticipated.

Rating structure
1 is very difficult to implement
2 is somewhat difficult to implement
3 has neutral difficulty for implementation
4 is reasonably easy to implement
5 is most easily implemented

It is anticipated that Options a, b and f will be reasonably easy to implement. Although there are small risks of failure, these approaches has been completed many times without significant problems. Options c and e have also been attempted before, but the risks of failure (from experience) are higher. For Option c, long-term degradation of the stabilized material may produce undesired results (i.e., leaching and/or structural failure), due to exposure to traffic and the elements. For Option e, difficulty in maintaining stability of the subject material has not been tested and, hence, is uncertain. Option d poses the greatest risks of potential failure, primarily due to the variability in hydrocarbon content, texture, sizing, etc., of the material and the degree of pre-processing which will be required to ensure its satisfactory use in this application. Further consideration of Option d is probably unwarranted.

Stakeholder Acceptance

In this criterion, we attempt to evaluate the acceptability of each option to the myriad of parties which (may) have an interest in this project. The assumed stakeholders are: CDF; regulatory agencies, including Ohio EPA and USEPA; potential customers, including Ashland or the asphalt plant; and neighboring property owners.

Rating structure
1 anticipates potentially insurmountable objectives
2 anticipates some objection
3 is neutral with regards to acceptance
4 is generally acceptable
5 projects complete acceptance

Most of the options (a, b, d and e) are perceived to be neutral with respect to acceptability; there are no known issues or concerns which could prohibit their application. Option c is perceived as potentially less acceptable since the stabilized material will be placed in areas subject to traffic and scrutiny (see also the concern regarding long-term stability). Option f is perceived as the most acceptable in that it permits CDF to address two issues simultaneously (i.e., with one set of actions), does not involve external scrutiny and leaves no biocell material exposed to traffic, the elements or scrutiny.

Permitting Requirements

This assessment addresses the probable need for permits or third-party approvals.

Rating structure
1 anticipates substantial/very difficult requirements
2 anticipates somewhat difficult requirements
3 anticipates moderate requirements
4 anticipates minor requirements
5 anticipates no permitting required

For Options, c and f, no external approvals or permit requirements are anticipated. For Options a, d and e, third-party approvals are required from the receiving facilities.

CDF013298

GROUND WATER POLLUTION POTENTIAL

OF STARK COUNTY, OHIO

BY

STEVEN WILLIAMS

GROUND WATER POLLUTION POTENTIAL REPORT NO. 6

OHIO DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER

GROUND WATER RESOURCES SECTION

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ABSTRACT

A ground water pollution potential mapping program for Ohio has been developed under the direction of the Division of Water, Ohio Department of Natural Resources, using the DRASTIC mapping process. The DRASTIC system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system for pollution potential.

Hydrogeologic settings form the basis of the system and incorporate the major hydrogeologic factors that affect and control ground water movement and occurrence including depth to water, net recharge, aquifer media, soil media, topography, impact of the vadose zone media and hydraulic conductivity of the aquifer. These factors, which form the acronym DRASTIC, are incorporated into a relative ranking scheme that uses a combination of weights and ratings to produce a numerical value called the ground water pollution potential index. Hydrogeologic settings are combined with the pollution potential indexes to create units that can be graphically displayed on a map.

Ground water pollution potential mapping in Stark County resulted in a map with symbols and colors which illustrate areas of varying ground water contamination vulnerability. Nine hydrogeologic settings were identified in Stark County with computed ground water pollution potential indexes ranging from 99 to 199.

The ground water pollution potential mapping program optimizes the use of existing data to rank areas with respect to relative vulnerability to contamination. The ground water pollution potential map of Stark County has been prepared to assist planners, managers, and local officials in evaluating the potential for contamination from various sources of pollution. This information can be used to help direct resources and land use activities to appropriate areas, or to assist in protection, monitoring and clean-up efforts

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INTRODUCTION

The need for protection and management of ground water resources in Ohio has been clearly recognized. About 42 per cent of Ohio citizens rely on ground water for their drinking and household uses from both municipal and private wells. Industry and agriculture also utilize significant quantities of ground water for processing and irrigation. In Ohio, approximately 700,000 rural households depend on private wells; 33,000 of these wells exist in Stark County.

The characteristics of the many aquifer systems in the state make ground water highly vulnerable to contamination. Measures to protect ground water from contamination usually cost less and create less impact on ground water users than clean up of a polluted aquifer. Based on these concerns for protection of the resource, staff of the Division of Water conducted a review of various mapping strategies useful for identifying vulnerable aquifer areas. They placed particular emphasis on reviewing mapping systems that would assist in state and local protection and management programs. Based on these factors and the quantity and quality of available data on ground water resources, the DRASTIC mapping process (Aller et al., 1987) was selected for application in the program.

Considerable interest in the mapping program followed successful production of a demonstration county map and led to the inclusion of the program as a recommended initiative in the Ohio Ground Water Protection and Management Strategy (Ohio EPA, 1986). Based on this recommendation, the Ohio General Assembly funded the mapping program. A dedicated mapping unit has been established in the Division of Water, Ground Water Resources Section to implement the ground water pollution potential mapping program on a county-wide basis in Ohio.

The purpose of this report and map is to aid in the protection of our ground water resources. This protection can be enhanced partly by understanding and implementing the results of this study which utilizes the DRASTIC system of evaluating an area's potential for ground-water pollution. The mapping program identifies areas that are more or less vulnerable to contamination and displays this information graphically on maps. The system was not designed or intended to replace site-specific investigations, but rather to be used as a planning and management tool. The results of the map and report can be combined with other information to assist in prioritizing local resources and in making land use decisions.

APPLICATIONS OF POLLUTION POTENTIAL MAPS

The pollution potential mapping program offers a wide variety of applications in many counties. The ground water pollution potential map of Stark County has been prepared to assist planners, managers, and state and local officials in evaluating the relative vulnerability of areas to ground-water contamination from various sources of pollution. This information can be used to help direct resources and land use activities to appropriate areas, or to assist in protection, monitoring and clean-up efforts.

An important application of the pollution potential maps for many areas will be to assist in county land use planning and resource expenditures related to solid waste disposal. A county may use the map to help identify areas that are more or less suitable for land disposal activities. Once these areas have been identified, a county can collect more site-specific information and combine this with other local factors to determine site suitability.

A pollution potential map can also assist in developing ground-water protection strategies. By identifying areas more vulnerable to contamination, officials can direct resources to areas where special attention or protection efforts might be warranted. This information can be utilized effectively at the local level for integration into land use decisions and as an educational tool to promote public awareness of ground water resources. Pollution potential maps may also be used to prioritize ground water monitoring and/or contamination clean-up efforts. Areas that are identified as being vulnerable to contamination may benefit from increased ground water monitoring for pollutants or from additional efforts to clean up an aquifer.

Other beneficial uses of the pollution potential maps will be recognized by individuals in the county who are familiar with specific land use and management problems. Planning commissions and zoning boards can use these maps to help make informed decisions about the development of areas within their jurisdiction. Developments proposed to occur within ground-water sensitive areas may be required to show how ground water will be protected.

Regardless of the application, emphasis must be placed on the fact that the system is not designed to replace a site specific investigation. The strength of the system lies in its ability to make a "first-cut approximation" by identifying areas that are vulnerable to contamination. Any potential applications of the system should also recognize the assumptions inherent in the system.

SUMMARY OF THE DRASTIC MAPPING PROCESS

The system chosen for implementation of a ground water pollution potential mapping program in Ohio, DRASTIC, was developed by the National Water Well Association for the United States Environmental Protection Agency. A detailed discussion of this system can be found in Aller et al. (1987).

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The DRASTIC mapping system allows the pollution potential of any area to be evaluated systematically using existing information. The vulnerability of an area to contamination is a combination of hydrogeologic factors, anthropogenic influences and sources of contamination in any given area. The DRASTIC system focuses only on those hydrogeologic factors which influence ground water pollution potential. The system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system to determine pollution potential.

The application of DRASTIC to an area requires the recognition of a set of assumptions made in the development of the system. DRASTIC evaluates the pollution potential of an area assuming a contaminant with the mobility of water, introduced at the surface, and flushed into the ground water by precipitation. Most important, DRASTIC cannot be applied to areas smaller than one-hundred acres in size, and is not intended or designed to replace site specific investigations.

Hydrogeologic Settings and Factors

To facilitate the designation of mappable units, the DRASTIC system used the framework of an existing classification system developed by Heath (1984), which divides the United States into fifteen ground water regions based on the factors in a ground water system that affect occurrence and availability.

Within each major hydrogeologic region, smaller units representing specific hydrogeologic settings are identified. Hydrogeologic settings form the basis of the system and represent a composite description of the major geologic and hydrogeologic factors that control ground water movement into, through, and out of an area. A hydrogeologic setting represents a mappable unit with common hydrogeologic characteristics, and, as a consequence, common vulnerability to contamination (Aller et al., 1987).

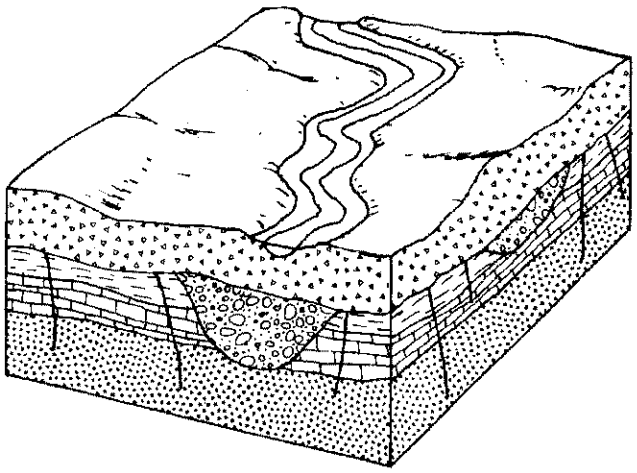
Figure 1 illustrates the format and description of a typical hydrogeologic setting found within Stark County. Inherent within each hydrogeologic setting are the physical characteristics which affect the ground water pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D - Depth to Water
R - Net Recharge
A - Aquifer Media
S - Soil Media
T - Topography
I - Impact of the Vadose Zone Media
C - Conductivity (Hydraulic) of the Aquifer

These factors incorporate concepts and mechanisms such as attenuation, retardation and time or distance of travel of a contaminant with respect to the physical characteristics of the

hydrogeologic setting. Broad consideration of these factors and mechanisms coupled with existing conditions in a setting provide a basis for determination of the area's relative vulnerability to contamination.

Depth to water is considered to be the depth from the ground surface to the water table in unconfined aquifer conditions or the depth to the top of the aquifer under confined aquifer conditions. The depth to water determines the distance a contaminant would have to travel before reaching the aquifer. The greater the distance the contaminant has to travel the greater the opportunity for attenuation to occur or restriction of movement by relatively impermeable layers.



7D Buried Valley

This hydrogeologic setting is characterized by thick deposits of sand and gravel that were laid down by glacial meltwater in a former topographic low, (i.e. a preglacial or interglacial river valley). These deposits are capable of yielding large quantities of water where they are sufficiently thick, permeable and receive adequate recharge. The deposits may or may not underlie or be in direct hydraulic connection with a present-day river. Glacial till, recent alluvium, kame, valley train or lacustrine deposits may overlie the buried valley. Soil texture is highly variable depending on the surface material. Recharge to the aquifer can be attributed to infiltration by precipitation or stream infiltration where the water table has been lowered due to pumping. The depth to water in this setting is extremely variable.

Figure 1. Format and description of the hydrogeologic setting - 7D Buried Valley.

Net recharge is the total amount of water reaching the land surface that infiltrates into the aquifer measured in inches per year. Recharge water is available to transport a contaminant from the surface into the aquifer and also affects the quantity of water available for dilution and dispersion of a contaminant. Factors to be included in the determination of net recharge include contributions due to infiltration of precipitation, in addition to infiltration from rivers, streams and lakes, irrigation, and artificial recharge.

Aquifer media represents consolidated or unconsolidated rock material capable of yielding sufficient quantities of water for use. Aquifer media accounts for the various physical characteristics of the rock that provide mechanisms of attenuation, retardation, and flow pathways that affect a contaminant reaching and moving through an aquifer.

Soil media refers to the upper six feet of the unsaturated zone that is characterized by significant biological activity. The type of soil media can influence the amount of recharge that can move through the soil column due to variations in soil permeability. Various soil types also have the ability to attenuate or retard a contaminant as it moves through the soil profile. Soil media is based on textural classifications of soils and considers relative thicknesses and attenuation characteristics of each profile within the soil.

Topography refers to the slope of the land expressed as percent slope. The amount of slope in an area affects the likelihood that a contaminant will run off from an area or be ponded and ultimately infiltrate into the subsurface. Topography also affects soil development and often can be used to help determine the direction and gradient of ground water flow under water table conditions.

The impact of the vadose zone media refers to the attenuation and retardation processes that can occur as a contaminant moves through the unsaturated zone above the aquifer. The vadose zone represents that area below the soil horizon and above the aquifer that is unsaturated or discontinuously saturated. Various attenuation, travel time and distance mechanisms related to the types of geologic materials present can affect the movement of contaminants in the vadose zone. Where an aquifer is unconfined, the vadose zone media represents the materials below the soil horizon and above the water table. Under confined aquifer conditions, the vadose zone is simply referred to as a confining layer. The presence of the confining layer in the unsaturated zone significantly impacts the pollution potential of the ground water in an area

Hydraulic conductivity of an aquifer is a measure of the ability of the aquifer to transmit water, and is also related to ground water velocity and gradient. Hydraulic conductivity is dependent upon the amount and interconnectivity of void spaces and fractures within a consolidated or unconsolidated rock unit. Higher hydraulic conductivity typically corresponds to higher vulnerability to contamination. Hydraulic conductivity considers the capability for a contaminant that reaches an aquifer to be transported throughout that aquifer over time.

Weighting and Rating System

DRASTIC uses a numerical weighting and rating system that is combined with the DRASTIC factors to calculate a ground water pollution potential index or relative measure of vulnerability to contamination. The DRASTIC factors are weighted from 1 to 5 according to their relative importance to each other with regard to contamination potential (Table 1). Each factor is then divided into ranges or media types and assigned a rating from 1 to 10 based on their significance to pollution potential (Tables 2-8). The rating for each factor is selected based on available information and professional judgement. The selected rating for each factor is multiplied by the assigned weight for each factor. These numbers are summed to calculate the DRASTIC or pollution potential index.

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination. The index generated provides only a relative evaluation tool and is not designed to produce absolute answers or to represent units of vulnerability. Pollution potential indexes of various settings should be compared to each other only with consideration of the factors that were evaluated in determining the vulnerability of the area.

Pesticide DRASTIC

A special version of DRASTIC was developed to be used where the application of pesticides is a concern. The weights assigned to the DRASTIC factors were changed to reflect the processes that affect pesticide movement into the subsurface with particular emphasis on soils. Where other agricultural practices, such as the application of fertilizers, are a concern, general DRASTIC should be used to evaluate relative vulnerability to contamination. The process for calculating the pesticide DRASTIC index is identical to the process used for calculating the general DRASTIC index. However, general DRASTIC and pesticide DRASTIC numbers should not be compared because the conceptual basis in factor weighting and evaluation significantly differs. Table 1 lists the weights used for general and pesticide DRASTIC.

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TABLE 1. ASSIGNED WEIGHTS FOR DRASTIC FEATURES

Feature	General DRASTIC Weight	Pesticide DRASTIC Weight
Depth to Water	5	5
Net Recharge	4	4
Aquifer Media	3	3
Soil Media	2	5
Topography	1	3
Impact of the Vadose Zone Media	5	4
Hydraulic Conductivity of the Aquifer	3	2

TABLE 2. RANGES AND RATINGS FOR DEPTH TO WATER

DEPTH TO WATER (FEET)	
Range	Rating
0-5	10
5-15	9
15-30	7
30-50	5
50-75	3
75-100	2
100+	1
Weight: 5	Pesticide Weight: 5

TABLE 3. RANGES AND RATINGS FOR NET RECHARGE

NET RECHARGE (INCHES)	
Range	Rating
0-2	1
2-4	3
4-7	6
7-10	8
10+	9
Weight: 4	Pesticide Weight: 4

TABLE 4. RANGES AND RATINGS FOR AQUIFER MEDIA

AQUIFER MEDIA		
Range	Rating	Typical Rating
Massive Shale	1-3	2
Metamorphic/Igneous	2-5	3
Weathered Metamorphic / Igneous	3-5	4
Glacial Till	4-6	5
Bedded Sandstone, Limestone and Shale Sequences	5-9	6
Massive Sandstone	4-9	6
Massive Limestone	4-9	6
Sand and Gravel	4-9	8
Basalt	2-10	9
Karst Limestone	9-10	10
Weight: 3	Pesticide Weight: 3	

TABLE 5. RANGES AND RATINGS FOR SOIL MEDIA

SOIL MEDIA	
Range	Rating
Thin or Absent	10
Gravel	10
Sand	9
Peat	8
Shrinking and / or Aggregated Clay	7
Sandy Loam	6
Loam	5
Silty Loam	4
Clay Loam	3
Muck	2
Nonshrinking and Nonaggregated Clay	1
Weight: 2	Pesticide Weight: 5

TABLE 6. RANGES AND RATINGS FOR TOPOGRAPHY

TOPOGRAPHY (PERCENT SLOPE)	
Range	Rating
0-2	10
2-6	9
6-12	5
12-18	3
18+	1
Weight: 1	Pesticide Weight: 3

TABLE 7. RANGES AND RATINGS FOR IMPACT OF THE VADOSE ZONE MEDIA

IMPACT OF THE VADOSE ZONE MEDIA		
Range	Rating	Typical Rating
Confining Layer	1	1
Silt/Clay	2-6	3
Shale	2-5	3
Limestone	2-7	6
Sandstone	4-8	6
Bedded Limestone, Sandstone, Shale	4-8	6
Sand and Gravel with significant Silt and Clay	4-8	6
Metamorphic/Igneous	2-8	4
Sand and Gravel	6-9	8
Basalt	2-10	9
Karst Limestone	8-10	10
Weight: 5	Pesticide Weight: 4	

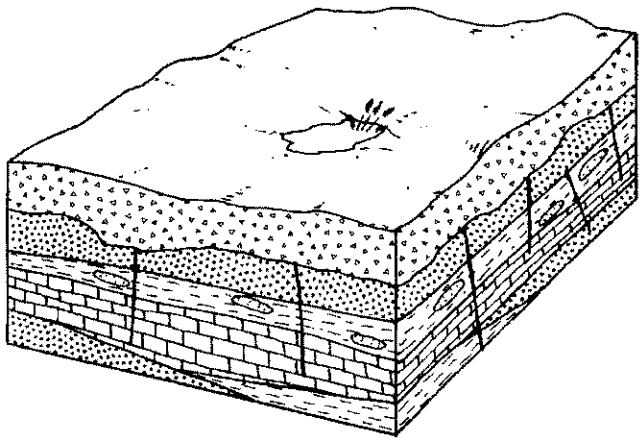
TABLE 8. RANGES AND RATINGS FOR HYDRAULIC CONDUCTIVITY

HYDRAULIC CONDUCTIVITY (GPD/FT^2)	
Range	Rating
1-100	1
100-300	2
300-700	4
700-1000	6
1000-2000	8
2000+	10
Weight: 3	Pesticide Weight: 2

Integration of Hydrogeologic Settings and DRASTIC Factors

Figure 2 illustrates the hydrogeologic setting 7Aa5 Glacial Till Over Bedded Sedimentary Rocks identified in mapping Stark County, and the pollution potential index calculated for the setting. Based on selected ratings for this setting, the pollution potential index is calculated to be 113. This numerical value has no intrinsic meaning, but can be readily compared to a value obtained for other settings in the county. DRASTIC indexes for typical hydrogeologic settings and values across the United States range from 65 to 223. The diversity of hydrogeologic conditions in Stark County produces settings with a wide range of vulnerability to ground water contamination. Calculated pollution potential indexes for the seven settings identified in the County range from 90 to 199.

Hydrogeologic settings identified in an area are combined with the pollution potential indexes to create units that can be graphically displayed on maps. Pollution potential mapping in Stark County resulted in a map with symbols and colors that illustrate areas of ground water vulnerability. The map describing the ground water pollution potential of Stark County is included with this report.



SETTING 7Aa5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	NUMBER
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Bedded Ss,Ls,Sh & Coal	3	6	18
Soil Media	Clay loam	2	3	6
Topography	2-6	1	9	9
Impact Vadose Zone	s & g w/ sl & cl	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		DRASTIC	INDEX	113

Figure 2. Description of the hydrogeologic setting - 7Aa5
Glacial Till Over Bedded Sedimentary Rocks

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INTERPRETATION AND USE OF A GROUND WATER POLLUTION POTENTIAL MAP

The application of the DRASTIC system to evaluate an area's vulnerability to contamination produces hydrogeologic settings with corresponding pollution potential indexes. The higher the pollution potential index, the greater the susceptibility to contamination. This numeric value determined for one area can be compared to the pollution potential index calculated for another area.

The map accompanying this report displays both the hydrogeologic settings identified in the county and the associated pollution potential indexes calculated in those hydrogeologic settings. The symbols on the map represent the following information:

7Aa5 - defines the hydrogeologic region and setting

113 - defines the relative pollution potential

Here the first number (7) refers to the major hydrogeologic region and the upper and lower case letters (Aa5) refer to a specific hydrogeologic setting. The following number references a certain set of DRASTIC parameters that are unique to this setting and are described in the corresponding setting chart. The second number (113) is the calculated pollution potential index for this unique setting. The charts for each setting provide a reference to show how the pollution potential index was derived in an area.

The maps are color coded using ranges depicted on the map legend. The color codes used are part of a national color coding scheme developed to assist the user in gaining a general insight into the vulnerability of the ground water in the area. The color codes were chosen to represent the colors of the spectrum, with warm colors (red, orange and yellow), representing areas of higher vulnerability (higher pollution potential indexes), and cool colors (greens, blues, and violet), representing areas of lower vulnerability to contamination.

The map also includes information on the locations of selected observation wells. Available information on these observation wells is referenced in Appendix A, Description of the Logic in Factor Selection. Large man-made features such as landfills, quarries or strip mines have also been marked on the map for reference.

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GENERAL INFORMATION ABOUT STARK COUNTY

Stark County is located in northeastern Ohio, approximately 50 miles south of Cleveland (Figure 3). The County covers 579.4 square miles, ranking it 11th in area of all counties in Ohio (Delong and White, 1963). It is bounded on the north by Summit and Portage Counties, on the east by Mahoning and Columbiana Counties, on the south by Carroll and Tuscarawas Counties, and on the west by Holmes and Wayne Counties.

According to the Stark County Regional Planning Commission (SCRPC) (1986, 1989), approximately one-half (49.7%) of the land use in Stark County is agricultural, while 24.7 % is urban/suburban. Other major land uses in the County include: undeveloped land (23%), strip mined land (1.5%) and water (1.1%).

In 1986, Stark County had an estimated population of 373,500. Canton is the county seat and the largest city with a population of about 87,110 (U.S. Department of Commerce, 1988). The Canton and Massillon area is the center of industrial activity for the County; however, in recent years, growth of the industrial economy has declined.

Physiography

Stark County lies entirely within the Appalachian Plateaus physiographic province (Fenneman, 1938). The glacial boundary (see Figure 3) transects the southeast corner of the County subdividing the plateau into nonglaciated and glaciated regions.

The nonglaciated region of Stark County is characterized by narrow bedrock ridges and steeply sloped valleys. The relief in this area is about 500 to 1000 feet per mile. The floodplains and terraces along perennial streams, such as Sandy Creek and several of its tributaries, represent the only flat topography in the nonglaciated region of the County (Delong and White, 1963).

In contrast, the glaciated region of Stark County is generally characterized by flat to rolling topography with moderate relief and gentle slopes. The bedrock topography is mostly buried by glacial drift. The drift ranges in thickness from only a few feet on bedrock ridges to 250 feet in several of the buried valleys. Relief in this region usually does not exceed 100 feet per mile of distance (Delong and White, 1963). An exception to this characterization occurs along the "fringe" of the glacial boundary in southern Stark County. This area is marked by thin and discontinuous glacial till deposits that have only slightly modified the existing steep topography. Although glaciated, prominent bedrock hills are common in Sugar Creek, Bethlehem, Canton, Osnaburg and Paris Townships (Delong and White, 1963). This area shows physiographic characteristic more commonly found in the nonglaciated region.

Figure 3. Location of Stark County, Ohio.

Drainage

Stark County lies within the boundaries of three major watersheds: the Tuscarawas River, the Mahoning River and the Cuyahoga River. The vast majority of surface water flows south via the Tuscarawas River to the Muskingum River of the Ohio River Basin. Tributaries of the Tuscarawas River which drain the County include Sugar Creek in southwestern Stark County and Sandy Creek in southeastern Stark County. The central portion of the County is drained by Nimishillen Creek which flows to Sandy Creek.

The Mahoning River, also part of the Ohio River Basin, drains Lexington, northern Washington and eastern Marlboro Townships in northeastern Stark County. The Cuyahoga River of the Lake Erie Basin drains only a small area of north-central Stark County via the Congress Lake Outlet.

Climate

Data from the U. S. Weather Bureau Station at the Akron-Canton Airport shows a 30–year (1951-1980) average annual precipitation of 35.90 inches and a mean annual temperature of 49.5 degrees Fahrenheit (U.S. Department of Commerce, 1982).

Preglacial Drainage

According to Stout et al., (1943), the preglacial Dover and Ravenna Rivers flowed northward and cut wide valleys through Stark County. The Dover River entered the County at Beach City, and continued on a course north to Brewster, Navarre, Massillon and Canal Fulton. The Tuscarawas River and Sugar Creek occupy portions of this valley today. Preglacial tributaries to the Dover River included Sandyville Creek, which was located in the southern part of the County, and an unnamed tributary located centrally in the vicinity of Canton (Delong and White, 1963) (Figure 4).

The Ravenna River drained a considerably smaller portion of Stark County than did the Dover River. The Ravenna River entered Stark County near Alliance and flowed northward and exited at the northeastern corner of the County. Both the Dover and Ravenna Rivers disappeared with the occurrence of Pleistocene glaciation (Delong and White, 1963).

Glacial Geology

During the Pleistocene Epoch (2 million to 10,000 years ago) northern North America experienced at least four distinct periods of glaciation. These glacial stages are termed the Nebraskan (earliest), Kansan, Illinoian, and Wisconsinan (most recent).

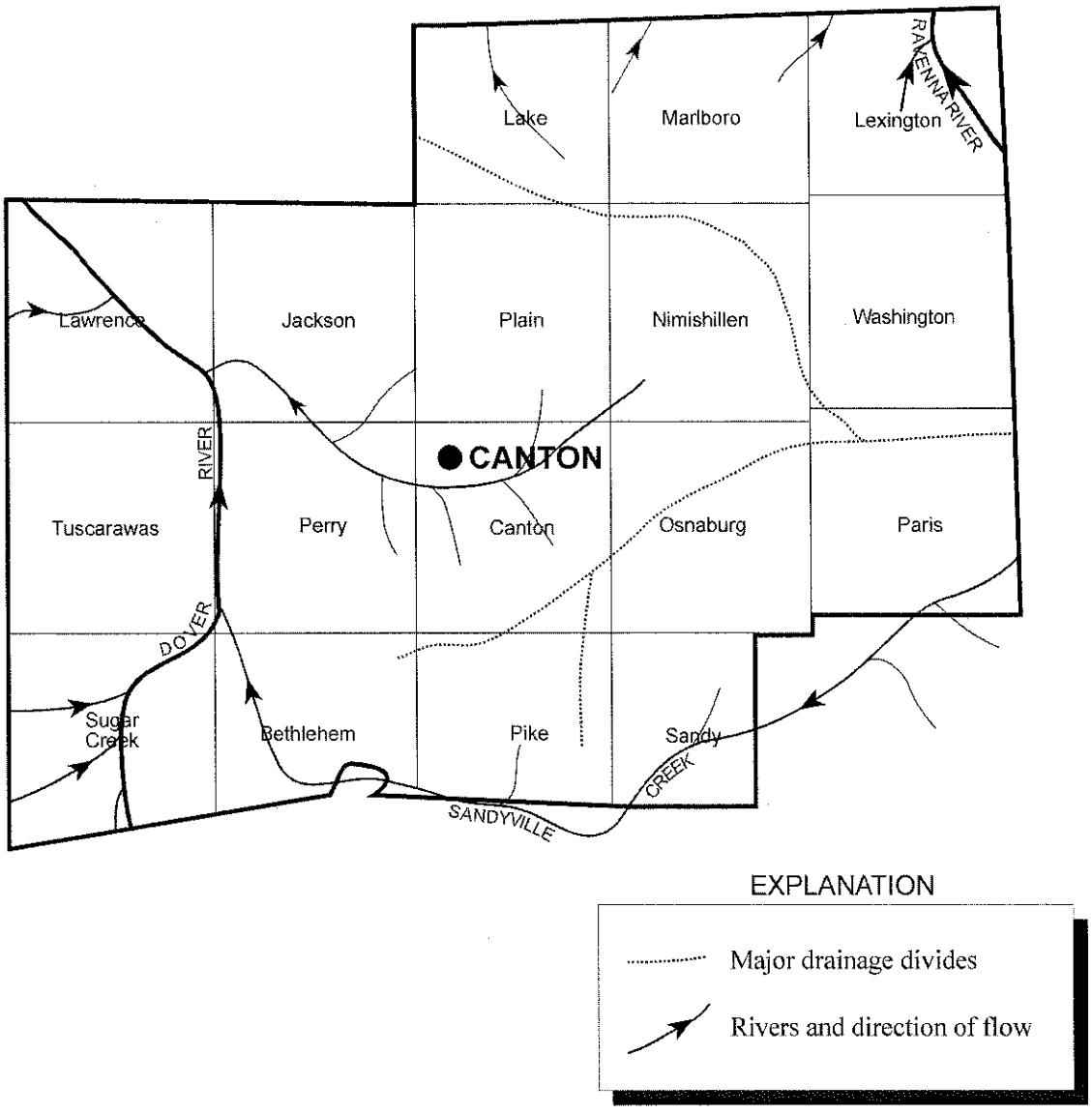

Figure 4. Preglacial drainage in Stark County

The Nebraskan and Kansan glacial periods are poorly defined and are commonly collectively referred to as the pre-Illinoian. Significant effects of all the glacial stages on Stark County are briefly discussed below, followed by a more detailed description of the glacial deposits observed in the County.

Pre-Illinoian

The most significant effect of pre-Illinoian glaciation on Stark County was the disruption of the preglacial drainage system. According to Delong and White, (1963), the northern outlet of the Dover River, and presumably the Ravenna River, was blocked by early Pleistocene glaciers. When the glaciers melted, floodwaters reversed the flow of the Dover River and established a new south-flowing stream, named the Newark River (Tight, 1903). The Newark River occupied the old Dover River valley throughout its course in Stark County. During a long interglacial stage between pre-Illinoian and Illinoian glaciation, the Newark River deeply entrenched this valley as much as 200 feet. The Deep Stage drainage system established during this period ended with the beginning of the Illinoian glaciation (Delong and White, 1963).

Illinoian and Wisconsinan

During the Illinoian and Wisconsinan stages, glacial ice advanced southward from the Erie basin in a series of lobes. Glacial ice of the Grand River lobe advanced over most of eastern Stark County, while ice of the Killbuck lobe glaciated the western portion of the County. These two lobes met north of Canton along the West Branch of Nimishillen Creek. This area is termed the interlobate zone (Delong and White, 1963). These glaciers covered most of Stark County, leaving only the southeastern corner of the County unglaciated.

Several important drainage changes occurred in Stark County as a result of Illinoian and Wisconsinan glaciation. In the southeastern part of the County, meltwaters from Illinoian or Wisconsinan ice cut several deep valleys that are evident today. These valleys are now occupied by Little Sandy Creek in Osnaburg Township and Hugle Run in Washington and Paris Townships. As a result of Wisconsinan glaciation, the south-flowing stream of the old Dover and Newark river valley was diverted at Navarre. The present course of the Tuscarawas River reflects this drainage change as it now occupies the former valley of Sandyville Creek to Bolivar. The abandoned valley from Navarre to Beach City is today mostly buried by glacial drift of Illinoian and Wisconsinan age (Delong and White, 1963).

Glacial Deposits

The glacial deposits found in Stark County are some of the more diverse of any county in Ohio. The variety of deposits can be classified primarily as Wisconsinan age ground moraine, end moraine, kames, and valley trains.

Ground moraine or till is deposited directly by the glacier and is composed of varying amounts of unsorted, unstratified clay, silt and sand with some gravel and cobbles. Figure 5 defines the extent of the major till sheets in Stark County. According to Delong and White

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(1963), the individual till sheets vary in composition and thickness because each was deposited by a separate glacial advance. In general, the older tills are characteristically sandy and have numerous pebbles and cobbles. These would include the Millbrook and Titusville tills of the early Wisconsinan, and the overlying Navarre and Kent tills of mid-Wisconsinan. The younger Lavery, Hayesville and Hiram tills have few pebbles and cobbles and have considerably more silt and clay. The Hiram till in northeastern Stark County is particularly clay-rich, with an average composition of 13% sand, 42% silt and 46% clay (Delong and White, 1963). The thicknesses of glacial till sheets in Stark County are variable, ranging from thin and discontinuous to 15 feet thick (Delong and White, 1963). The topography of ground moraines is generally smooth to slightly undulating.

Two end moraines are evident in Stark County, the Buck Hill Moraine of the Killbuck lobe, and the Kent Moraine of the Grand River lobe. The Buck Hill Moraine begins 5 miles east of Beach City and extends northeast along the glacial boundary toward Canton. In this area the hummocky moraine is 1 to 2 miles wide and is composed mostly of till. At Canton, the till moraine gives way to numerous kames or knolls up to 100 feet high that are composed of sand and gravel with some interbedded till masses (White, 1982). The kames were formed when glacial ice of the Killbuck lobe stagnated and meltwaters poured through holes and crevices of the waning ice margin. The rugged kame and kettle topography extends northwest of Canton into Jackson and Lawrence Townships. The kame terraces in the valley of Sugar Creek are also associated with the Buck Hill Moraine (White, 1982).

The Kent Moraine roughly forms the outer margin of the Grand River lobe in Stark County. In the eastern part of the County, the moraine is composed of till masses in knolls, some up to 80 feet high. Near Canton, the Kent Moraine is composed of kames similar to the Buck Hill Moraine (White, 1982). The large kame and kettle complex of the Kent Moraine extends from Plain Township north to Lake and Marlboro Townships. Near Hartville, large kettle holes containing muck soils have been drained and are now used extensively for agriculture.

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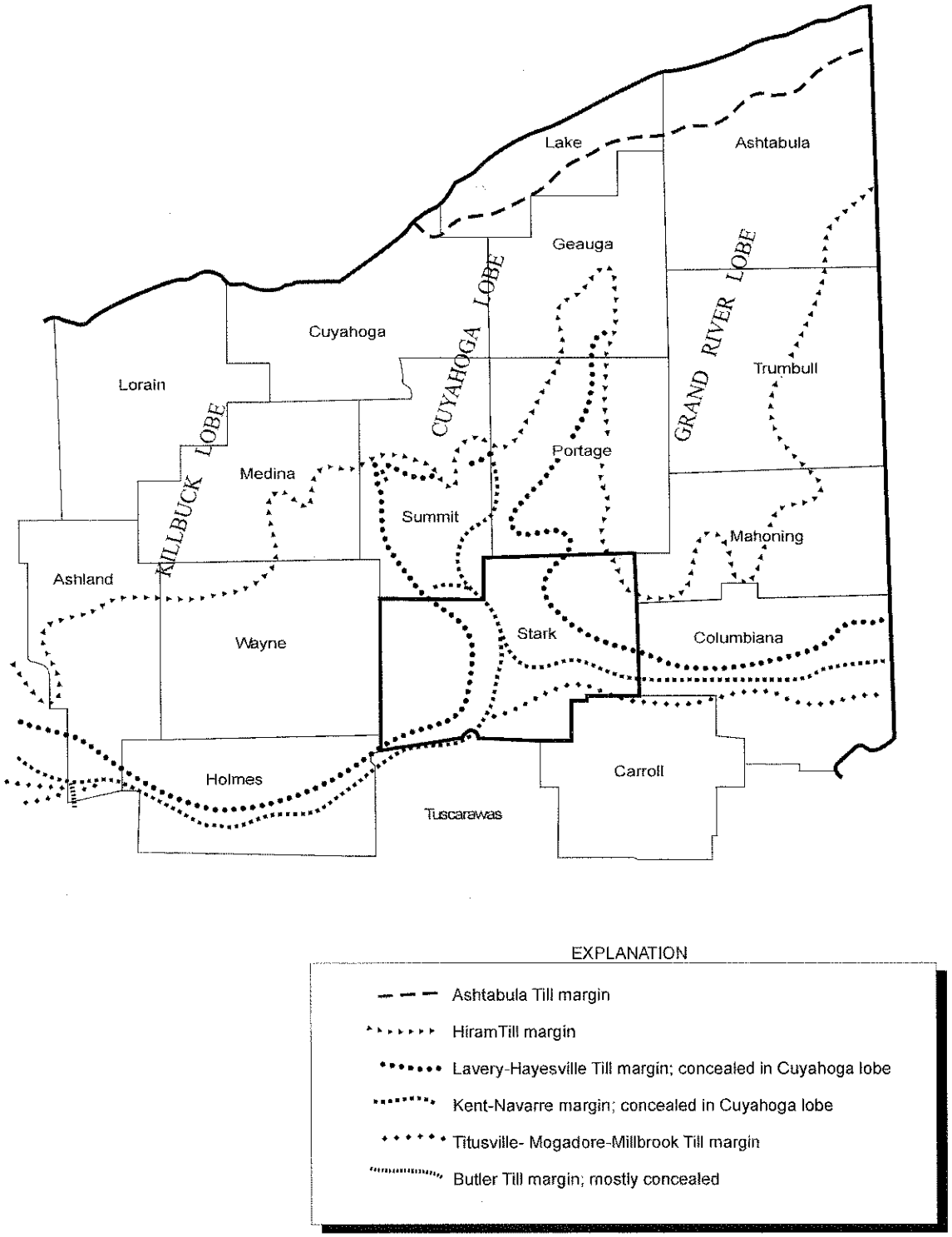

Figure 5. Ice-sheet margins in northeastern Ohio (after White, 1982).

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Outwash valley fill deposits in Stark County contain stratified, well sorted and well washed sand and gravel that may be over 200 feet thick in some buried valleys. The sand and gravel was deposited by glacial meltwater flowing down valleys away from the dissipating ice margin. The valley fill deposits are located in the Tuscarawas River valley from Massillon to Bolivar, the Sugar Creek valley south of Beach City, and the Sandy Creek valley as well as several of its tributaries to include Nimishillen Creek, Little Sandy Creek and Hugle Run. The West, Middle and East Branches of Nimishillen Creek north of Canton also have extensive valley fill deposits. These valley deposits joined to form the extensive outwash plain upon which Canton is built (White, 1982).

Nonglacial Pleistocene Deposits

According to Delong and White, (1963), nonglacial lacustrine deposits of Pleistocene age are found in the valleys of Bear Run, Limestone Creek, Pleasant Valley and Indian Run in southeastern Stark County. The origin of these deposits is related to the deposition of outwash material across the outlet of each of these tributary streams. The lakes that were created received silt, sand, and fine gravel material from the surrounding unglaciated terrain. The lacustrine deposits were built to the level of the Sandy Creek valley train surface. Subsequent erosion has dissected these deposits leaving only terraced remnants along the valley walls.

Bedrock Geology

The bedrock exposed in Stark County, from oldest to youngest, includes the Pottsville and Allegheny Groups, and the lowest member of the Conemaugh Group of the Pennsylvanian System. These Groups are generally characterized by alternating layers of moderately fractured sandstone, limestone, shale, coal and clay. The sandstone and shale units have variable thicknesses and often grade laterally into shaley sandstones or sandy shales. The coal, clay and limestone units are relatively thin but are usually persistent across the county. Table 9 is a generalized stratigraphic column of the Pennsylvanian bedrock in Stark County.

According to Harker and Bernhagen (1943), the regional dip of strata in Stark County is approximately 14 feet per mile to the southeast. Thus, the Pottsville Group generally occurs at the bedrock surface in the western, central, and northern portion of the County, while the overlying Allegheny Group is exposed in the eastern and southern part of the county. The lowest member of the Conemaugh Group is found only on ridge tops in southeastern Stark County.

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TABLE 9. GENERAL STRATIGRAPHIC COLUMN OF STARK COUNTY
(after Delong and White, 1963)

SYSTEM	GROUP	MEMBER	ROCK TYPE	THICKNESS Ft.	In.
PENNSYLVANIAN	Cone-maugh	Lower Mahoning	Thin bedded shale and channel-fill sandstone	20-130	
	ALLEGHENY	Upper Freeport	Coal, variable	2	
			Clay	4	
			Limestone, discontinuous	3	
		Bolivar	Coal and Clay, discontinuous		3
		Shawnee	Limestone, discontinuous		4
		Upper Freeport	Shale and Sandstone	60	
		Door Run	Shale, local		6
		Lower Freeport	Coal		10
			Clay	3	6
			Limestone, discontinuous	1	7
		Lower Freeport	Shale and Sandstone	50	
		Upper Kittanning	Coal and Clay, very local		2
			Shale	23	
		Washingtonville	Shale, discontinuous		10
		Middle Kittanning	Coal	2	4
			Clay	6	
		Leetonia	Nodular Siderite, and Coal, local		7
		Middle Kittanning	Shale	17	
		Strasburg	Coal, local		9
		Oak Hill	Clay		6
		Strasburg	Shale	11	
		Columbiana	Shale	1	2
		Lower Kittanning	Coal	2	
			Clay	6	
		Lawrence	Coal and Clay, very local		2
			Shale	16	
		Vanport	Limestone discontinuous	8	
		Clarion	Shale	50	
		Putnam Hill	Limestome and Shale	10	
		Brookville	Coal	2	
	POTTSVILLE	Brookville	Clay	4	
		Homewood	Shale and channel-fill Sandstone	15-35	
		Tionesta	Coal, discontinuous		6
			Clay, local	8	
			Shale and Sandy Shale	10	
		Upper Mercer	Limestone	2	
		Bedford	Coal, persistent, irregular	1	6
			Clay	1	6
			Shale	23	
		Lower Mercer	Limestone	2	6
		Middle Mercer	Coal, irregular	1	6
			Clay	2	
			Shale and fine grained Sandstone	15	
		Flint Ridge	Coal	1	
			Clay	2	5
			Shale	15	
		Boggs	Limestone, irregular	2	
		Lower Mercer	Coal		6
			Clay	3	
			Silty Shale	18	
		Vandusen	Coal		6
			Clay		7
			Silty Shale and Siltstone	14	
		Bear Run	Coal		3
		Massillon	Massive Sandstone or Shale	30-100	
		Quakertown	Coal	1	
			Clay	?	
			Shale	34	
		Anthony	Coal		2
		Sciotoville	Clay	5	
			Shale	30	
		Sharon (No. 1)	Coal	0-5	
			Clay	?	
		Sharon	Conglomerate and Sandstone	?-200	

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The Sharon Conglomerate is the lowermost member of the Pottsville Group and lies almost entirely below drainage in Stark County (Delong and White, 1963). The thickness of the Sharon varies considerably because it was deposited on the steeply eroded surface of Mississippian bedrock (Sedam, 1973). At one locality, the Sharon may be thin or non- existent and only several hundred yards away be over 200 feet thick (Harker and Bernhagen, 1943). The greater thicknesses of the Sharon were deposited in the deeper valleys of the Mississippian surface.

Overlying the Sharon are usually sequences of shale, coal and clay; however, in some localities, the Massillon Sandstone has coalesced with the Sharon Conglomerate. The Massillon Sandstone consists of a coarse-grained, channel-fill sandstone that varies in thickness from 30 to 100 feet. Characteristic of channel-fill sandstones, the Massillon changes rapidly laterally to a relatively thin, nonresistant shale. Above the Massillon, the rock units of the Pottsville Group consist mostly of thin shales and sandy shales interbedded with limestone, coal and clay. At the top of the Group, the Homewood Sandstone occurs locally as a medium to coarse grained channel-fill sandstone with a thickness of 15 to 35 feet (Delong and White, 1963).

The Allegheny Group in Stark County is characterized by shale and sandstone members interbedded with numerous clays and coals and several limestones. The sandstone members of the Allegheny Group are much less extensive than the sandstone members of the Pottsville Group. The thickest members of the Allegheny include the Clarion Shale and the Lower and Upper Freeport Shale and Sandstone. The Clarion is a slightly silty, nonresistant shale that contains vertical joints. The Lower Freeport typically grades upward from a fissile shale to a fine-grained sandstone, while the Upper Freeport is composed mostly of fine to medium-grained sandstone and grades vertically to silty shale (Delong and White, 1963). The numerous clay and coal beds of the Allegheny Group are a valuable resource; thus, they have been extensively strip mined in the County.

The Lower Mahoning Shale and Sandstone Member of the Conemaugh Group represents the youngest bedrock found in Stark County. In Paris Township, this member is composed of thinly-bedded shale, siltstone and sandstone approximately 20 feet thick. However, in Sandy, Pike, southern Canton and western Osnaburg Townships, the Lower Mahoning occurs as a channel-fill sandstone which may be 20 to 130 feet thick (Delong and White, 1963).

Hydrogeology

An aquifer is a body of consolidated or unconsolidated rock material capable of yielding sufficient quantities of water for use (Aller et al., 1987) The yield to a drilled well or spring is largely dependent on the number, shape and size of pore spaces within the rock material, and the degree of interconnection of pore spaces. As these factors change because of varied geologic conditions, so does the yield of an aquifer. In Stark County, aquifers may be divided into two broad categories: (1) consolidated sedimentary rocks of Pennsylvanian age and (2) unconsolidated glacial drift deposits of Pleistocene age.

Bedrock aquifers in Stark County are found primarily in the alternating strata of the Pottsville and Allegheny Groups of the Pennsylvanian System. The Conemaugh is generally not a water-bearing formation in Stark County due to its limited extent on bedrock ridge

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tops. Water wells drilled below the Pennsylvanian bedrock typically encounter salt water that can not be used as a water supply (Harker and Bernhagen, 1943).

In the Pottsville and Allegheny Groups, ground water typically occurs within the pore spaces between individual grains in sandstone and shale and also in fractures along bedding planes and vertical joints (Booth, 1988). Small amounts of ground water may occur along fractures in thin limestones and coal seams.

Bedrock water wells in Stark County are generally drilled to a sufficient depth to encounter sandstone or sandy shale aquifers, or less frequently, fractures within shale (Groenewold, 1974). Well logs indicate that occasionally water is available from limestone beds and coal seams. Although semi-confining conditions do occur, the aquifers are considered unconfined because of fracturing and downward leakage between units.

The two most productive bedrock aquifers in Stark County are the Sharon Conglomerate and the Massillon Sandstone of the lower Pottsville Group. These members are able to produce sustained yields of 50 gallons per minute (gpm) in some areas of the County (Walker, 1979).

Overlying the Massillon, the members of the Upper Pottsville and Allegheny Groups yield less than 25 gpm and typically only enough water for domestic supplies (Walker, 1979). Locally important aquifers within these Groups are the Homewood Sandstone, and the Lower and Upper Freeport Shale and Sandstone. Thin shale, coal and limestone members may contribute to the yield of a well, if the bedrock is sufficiently fractured.

The unconsolidated aquifers in Stark County are composed of clay, silt, sand and gravel deposited by glacial meltwater. The ability of the unconsolidated deposits to yield ground water depends largely on the percentage of fine material (clay and silt), the degree of sorting, and availability of recharge.

The glacial till deposits in Stark County are generally not a source of water. However, if localized sand and gravel lenses are encountered in thick glacial till, properly constructed drilled wells may yield 5 to 20 gpm (Walker, 1979). These conditions are found in portions of northeastern Stark County. Similarly, valley fill deposits primarily consisting of clay, but with sand and gravel lenses of limited thickness, can be expected to yield up to 30 gpm (Walker, 1979).

Unconsolidated deposits composed of mostly sand and gravel with some silt and clay provide good supplies of ground water. These deposits are often associated with kames and may yield 25 to 100 gpm (Walker, 1979).

The most permeable and highest yielding aquifers in the County are the buried valleys that contain thick valley fill deposits of well washed and sorted sand and gravel. The major buried valleys include: the old Dover and Newark River valley underlying portions of the Tuscarawas River and Sugar Creek; the network of buried valleys underlying Canton and the buried valley underlying Sandy Creek. These deposits of sand and gravel may yield several hundred or more gallons per minute and are suitable areas for industrial and municipal well fields (Walker, 1979).

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APPENDIX A

DESCRIPTION OF THE LOGIC IN FACTOR SELECTION

Depth to Water

This factor was primarily evaluated using information obtained from water well logs on file at the Ohio Department of Natural Resources, Division of Water. Water well logs provide important information such as depth to static water level and description of rock materials. The depth to water in an area was determined by the average static water level in the uppermost aquifer. In a multi-layer aquifer system, shallow wells more accurately reflect this condition. Other important sources of information include reports by Schaefer et al. (1946); Kazmann (1947); Kaser (1962); and Kaser and Harstine (1965). Observation well data was also obtained from the Ohio Department of Natural Resources, Division of Water. In areas of little or no depth to water data, interpretation of surface geology and topography were used to evaluate the depth to water rating. In bedrock aquifers overlain by glacial drift, depth to water averaged 30 to 50 feet below the surface. The corresponding DRASTIC rating for 30 - 50 feet is (5). In areas where glacial material is thin or absent, depth to water in bedrock aquifers was more variable, ranging from 30 to 50 feet (5), 50 to 75 feet (3) and 75 to 100 feet (2). In unconsolidated aquifers, depth to water was generally more shallow. The shallowest water levels are 5 to 15 (9) feet below the surface, occurring near ground water discharge areas (streams and wetlands). The deepest water levels in unconsolidated aquifers are 50 to 75 feet (3) found in some buried valleys covered by glacial till.

Net Recharge

Net recharge values are based primarily on information contained in Pettyjohn and Henning (1979). In this report, the "effective ground water recharge rate" is equated to ground water runoff and calculated from stream hydrographs and flow duration curves. The report gives the average effective recharge rate during a year of normal precipitation for different hydrogeologic regions in Ohio. To supplement this general information, two specific net recharge values were obtained for a buried valley aquifer setting in Stark County (Schaefer et al., 1946). These general and site specific values were used as guidance for estimating net recharge in Stark County. A net recharge of 2 to 4 (3) was chosen for unglaciated areas and where thin glacial till overlies bedrock. This is primarily due to the generally deep water table, the steep topography, and the shale and clay bedrock in the vadose zone. In strip mine areas, the net recharge was adjusted to 4 to 7 (6) because of the increased exposure of fractured bedrock and the ability of spoil material to retain and discharge precipitation. In areas were the surface material is glacial till or lacustrine sediments, a moderate net recharge of 4 to 7 (6) was chosen. For glacial outwash areas (kames and valley fill deposits), a net recharge of 7 to 10 (8) was generally selected to reflect the

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increased permeability of outwash material. The highest recharge rate, 10+ (9), was chosen for sand and gravel pits because of the lack of soil cover.

Aquifer Media

This factor was evaluated using information obtained from water well logs on file at the Ohio Department of Natural Resources, Division of Water and the following reports: Cummins (1947); Delong and White (1963); Delong (1965, 1967); Harker and Bernhagen (1943); Kazmann (1947, 1949); Schaefer et al. (1946); Sedam (1973); Walker (1979); and White (1982). In general, the uppermost bedrock aquifer in Stark County consists of alternating layers of sandstone, shale, limestone, and coal. Although semi-confining conditions do occur, these layers of rock are considered unconfined due to fracturing and downward leakage between units. A typical rating of (6) was applied to the bedrock aquifer, except in areas of particularly low yield as defined by Walker (1979) which were rated a (5). In areas where two unconsolidated aquifers are present, the uppermost aquifer was evaluated. These aquifers consist largely of sand and gravel with varying percentages of silt and clay. A typical rating of (5) was chosen for areas where glacial till containing some sand and gravel was considered the aquifer. In areas of discontinuous sand and gravel lenses in thick glacial till, sand and gravel is considered the aquifer media and a rating of (6) was chosen. Similarly, a rating of (6) was selected for buried valley aquifers where sand and gravel is of limited thickness and extent. A rating of (7) was chosen for buried valley aquifers and kame aquifers consisting mostly of sand and gravel but with interbedded silt and clay. In general, sand and gravel aquifers capable of yielding 100 to 500 gpm were rated an (8), while those capable of producing over 500 gpm were rated a (9). These deposits consist of well washed and sorted sand and gravel; thus, a higher pollution potential rating is appropriate.

Soil Media

This factor was evaluated using soil descriptions in the Soil Survey of Stark County (Christman et al., 1971; Bauder, 1987). Each soil was examined in terms of texture, organic composition, shrink/swell potential, permeability and average thickness. A soil media description and a DRASTIC rating were then assigned to each soil series based on these factors (Table 10). The Ohio Department of Natural Resources, Division of Soil and Water Conservation produced soil media maps at the scale of 1:24,000 on the Ohio Capability Analysis Program (OCAP). Soil media varied widely across the County because of the differing composition of the parent geologic materials. In areas of swamps or depressions, muck soils develop from decomposed organic matter. In these areas, a low pollution potential rating of (2) was assigned because of the high organic content. In glacial till areas, the soil media is often a silt loam (4) or a silt loam with fragipan (3).

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TABLE 10. STARK COUNTY SOILS SERIES

SOIL SERIES	RANGE	DRASTIC RATING
Arkport: ArB, ArC, ArD	Sandy Loam	6
Bogart: BgA, BgB, BoA, BoB, BoC, Bu	Sandy Loam	6
Brooke: BwC2, BwE2	Clay Loam	3
Canadice: Ca	Clay Loam	3
Canfield: CdA, CdB, CdC, CdC2, CdD, CdD2, CeB, CeC,	Silty Loam*	3
Canfield: CfB, CfC	Clay Loam	3
Carlisle: Ch	Muck	2
Chagrin: Ck, Cm	Sand	9
Chili: CnA, CnB, CpA, CpB	Sand	9
Chili: CpC, CpC2, CuB, CuC, CuF	Sandy Loam	6
Chili: CoC, CoC2, CoD2, CoE2, CvF2	Gravel	10
Conotton: CwA, CyB, CyC, CyD2, CyE2	Gravel	10
Dekalb: DkB, DkC, DkE2, DkF2	Sandy Loam	6
Edwards: Ed :	Muck	2
Fitchville: FcA, FcB , FcC, Fu	Silty Loam	4
Geeburg: GbC2, GbE2	Shrink/Swell Clay	7
Gilpin: GdB, GdC, GdD	Silty Loam	4
Ginat: Ge	Sandy Loam	6
Glenford: GfA, GfB, GfC, GfC2, GfD2	Silty Loam	4
Keene: KeB, KeC, KeC2, KeD, KeD2, KeE	Clay Loam	3
Killbuck: Kk	Silty Loam	4
Latham: LaB, LaC, LaC2, LaD, LaD2, LaF	Clay Loam	3
Licking: LcA, LcB, LcC, LcC2, LcE2	Silty Loam	4
Linwood: Ld	Muck	2
Lobdell: Le	Silty Loam	4
Loudonville: LoB, LoC, LoC2, LoD, LoD2, LoE2, LoF2 , LuB, LuC	Silty Loam	4
Luray: Ly	Clay Loam	3
Luray: Lz	Sandy Loam	6
Mentor: MeA, MeB, MeC, MeD	Silty Loam	4
Montgomery: Mg	Shrink/Swell Clay	7
Muskingum: MsB,. MsC, MsD, MvE, MvE3, MvF, MvG, MwF	Silty Loam	4
Plainfield: PlB , PlC	Sand	9
Rainsboro: RaB. RaC	Silty Loam	4
Ramsey: RcC, RcD, RcE2, RcF2	Thin or Absent	10
Ravenna: ReA, ReB, Rn	Silty Loam*	3
Remsen: RoA, RoB, Ro	Shrink/Swell Clay	7
Rittman: RsB, RsC, RsC2, RsD2	Clay Loam	3
Sebring: Sb, Sg	Silty Loam	4
Sebring: Se	Clay Loam	3
Shoals: Sh	Loam	5
Sloan: Sl	Loam	5
Tilsit: TlC, TlD	Silty Loam	4
Trumbull: Tr	Shrink/Swell Clay	7
Wadsworth: WaA, WaB, WaC, WaC2, WbD	Clay Loam	3
Wallkill : Wa	Muck	2
Wayland: Wd	Silty Loam	4
Weikert: WeC, WeD, WeE2, WeF2	Thin or Absent	10
Weinbach: WhA, WhB, Wk	Sandy Loam	6
Wellston: WlB, WlC	Silty Loam	4
Wheeling: WmA, WmB, WmC2, WrA, WrB, WrC, WrC2, WsD2	Sandy Loam	6
Willette: Wt	Muck	2
Wooster: WuB, WuC, Wuc2, WuD2, WuE2, WuF2, WvD	Sandy Loam	6
Strip Mine Spoil, Gravel Pits: SoC, SoE, SoF, SsC, SsE, SsF, StC, StD, StF, Gp	Thin or Absent	10

Note: In the Glaciated Central Region, the soil medium, silt loam with an asterisk (*), indicates that a fragipan is present; thus, the rating has been reduced from a (4) to a (3).

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The fragipan layer is composed of dense and cemented silt or fine sand that restricts infiltration; thus, a lower pollution potential rating is appropriate. In the upland areas, silt loam typically develops over bedrock. A rating of (4) was chosen for these areas. Soils that developed from slack water lacustrine deposits or river alluvium were described as silt loam (4) or loam (5). Soil associated with the Hiram Till in northeastern Stark County was rated a (7) because of its high shrink/swell potential. In kame and valley train areas, the soil media primarily were designated sandy loam (6), sand (9) or gravel (10). A soil media rating of thin or absent (10) was chosen for strip mines, gravel pits, and areas of soil less than 10 inches thick.

Topography

Percent slope maps were generated by the Ohio Department of Natural Resources, Division of Soil and Water Conservation on the OCAP mapping system. Information for the data base was obtained from the Soil Survey of Stark County (Christman et al., 1971). In general, percent slope is moderate in areas of glacial outwash and thick deposits of glacial till. In these areas, slope ranges from 0 to 2% (10), 2 to 6% (9), and 6 to 12% (5). An exception occurs in some areas of kames where slope averages 12 to 18% (3). In the unglaciated uplands and in areas of thin glacial till over bedrock, slope is generally steep, ranging from 6 to 12% (5), 12 to 18% (3) and greater than 18% (1).

Impact of the Vadose Zone Media

Determinations about this factor were made using information obtained from ODNR well log files; Christman et al. (1971); Delong and White (1963); Delong (1965, 1967); Groenewold (1974); Kazmann (1947, 1949); Schaefer et al. (1946); Walker (1979); and White (1982). Unconsolidated vadose zone media were rated largely on the proportion of fine material (silt and clay) to coarse material (sand and gravel). The Hiram Till in northeastern Stark County is mostly composed of silt/clay (4). Lucustrine deposits in several tributary valleys of Sandy Creek were rated as either silt/clay (4), or sand and gravel with significant silt and clay (5). Although these deposits are relatively thin, the silt and clay particles reduce infiltration and increase attenuation of potential contaminants. Besides the Hiram Till, most of the ground and end moraine glacial till is sandy and has numerous pebbles and cobbles. A vadose zone media of sand and gravel with significant silt and clay (5) or (6) was chosen to reflect the sandy nature of most of the glacial till deposits (i.e. Millbrook, Titusville, Navarre and Kent). Kames associated with the end moraines are composed of irregularly bedded, poorly washed and poorly sorted sand and gravel containing some till masses. For these deposits, a vadose zone media of sand and gravel with significant silt and clay (7) was chosen. The most permeable vadose media consist of well washed and sorted sand and gravel in valley fill deposits. Accordingly, these deposits were rated as sand and gravel (9). Vadose zone media of interbedded sandstone, limestone, shale, coal and clay occur in hydrogeologic settings 6Da, 6Db and 7G. Fracturing of the bedrock is considered moderate; thus, a typical rating of (6) was chosen for these settings.

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Hydraulic Conductivity

Hydraulic conductivity values were based on published data from Sedam (1973); Schaefer et al. (1946) and general information from Walker (1979) and Freeze and Cherry (1979). Conservatively high estimates of hydraulic conductivity were chosen for bedrock aquifers to reflect a moderate degree of fracturing. A hydraulic conductivity value from 1 to 100 gpd/ft^2 (1) was chosen for low yield bedrock aquifers (3 to 10 gpm) and a value of 100 to 300 gpd/ft^2 (2) was chosen for higher yielding aquifers (10 to 25 gpm) (Walker, 1979).

The hydraulic conductivity of unconsolidated aquifers is partly dependent on the percentage of coarse-grained material and the degree of sorting. In setting 7Af - Sand and Gravel Interbedded in Glacial Till, the hydraulic conductivity of the glacial till aquifer is estimated to be 100 to 300 gpd/ft^2 (2) because of localized lenses of sand and gravel. In this same setting where sand and gravel lenses are more extensive, a hydraulic conductivity of 300 to 700 gpd/ft^2 (4) was chosen. In setting 7C - Moraine, hydraulic conductivity values ranged from 300 to 700 gpd/ft^2 (4) to 700 to 1000 gpd/ft^2 (6). In setting 7D - Buried Valley, the hydraulic conductivity of sand and gravel aquifers range from 300 to 700 gpd/ft^2 (4) to greater 2000 gpd/ft^2 (9).

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APPENDIX B

DESCRIPTION OF HYDROGEOLOGIC SETTINGS AND CHARTS

In mapping the pollution potential of Stark County, seven hydrogeologic settings were identified in the Glaciated Central Region and two were identified in the Nonglaciated Central Region. The list of these settings, the range of the pollution potential index calculations and the number of pollution potential index calculations for each setting are provided in Table 11. Computed pollution potential index values range from 90 to 199.

TABLE 11. HYDROGEOLOGIC SETTINGS MAPPED IN STARK COUNTY, OHIO

Hydrogeologic Settings	Range of GWPP Indexes	Number of Index Calculations
6Da - Alternating Sandstone, Limestone, Shale, Coal and Clay - Thin Soil	102-116	4
6Db - Alternating Sandstone, Limestone, Shale, Coal and Clay - Deep Regolith	90-126	7
7Aa - Glacial Till Over Bedded Sedimentary Rock	99-125	20
7Af - Sand & Gravel Interbedded in Glacial Till	106-136	17
7Ba - Outwash	148-174	17
7Bb - Outwash Over Bedded Sedimentary Rock	123-164	14
7C - Moraine	129-140	6
7D - Buried Valley	111-199	101
7G - Thin Till Over Bedded Sedimentary Rock	90-132	23

The following information provides a description of each hydrogeologic setting identified in Stark County, a block diagram illustrating the characteristics of each setting, and a listing of charts for each unique combination of pollution potential indexes calculated for each setting. The charts provide information on how the ground water pollution potential index was calculated and are a quick and easy reference for the accompanying ground water pollution potential map. A complete discussion of the rating and evaluation for each factor in the hydrogeologic settings is presented in Appendix A, Description of the Logic in Factor Selection.

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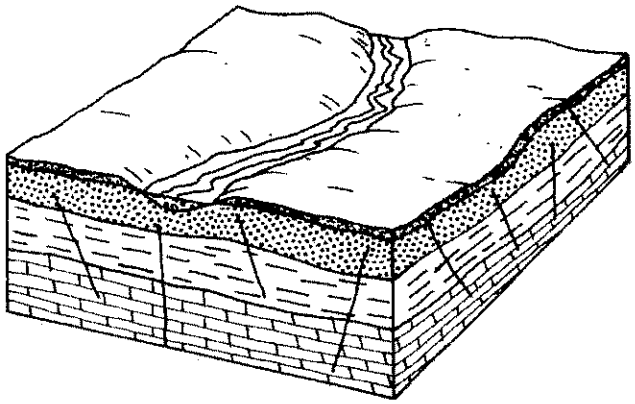

6Da Alternating Sandstone, Limestone, Shale, Coal and Clay - Thin Soil

This hydrogeologic setting is characterized by moderate to steep topography, and absent or thin silty soils overlying slightly dipping alternating layers of fractured sedimentary rock. The sandstone and shale units are most prevalent and have variable thicknesses, while the interbedded limestones, coals and clays are relatively thin. Ground water is obtained primarily from sandstones and sandy shales, along the bedding planes, and in intersecting vertical fractures. Depth to water is usually greater than 50 feet. Strip mines in the nonglaciated region are included in this setting. The natural soils have been removed and strip mine spoil containing mostly weathered shale and sandstone may randomly occupy the surface. Bedrock is exposed where spoil material is absent. Recharge is moderate due to increased capacity of spoil material to retain and discharge precipitation.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
6Da1	75-100	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	12-18	interbedded ss/sh/ls/cl/coal	100-300	111
6Da2	50-75	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	18+	interbedded ss/sh/ls/cl/coal	100-300	114
6Da3	50-75	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	12-18	interbedded ss/sh/ls/cl/coal	100-300	116
6Da4	50-75	2-4	interbedded ss/sh/ls/cl/coal	Thin or Absent	18+	interbedded ss/sh/ls/cl/coal	100-300	102

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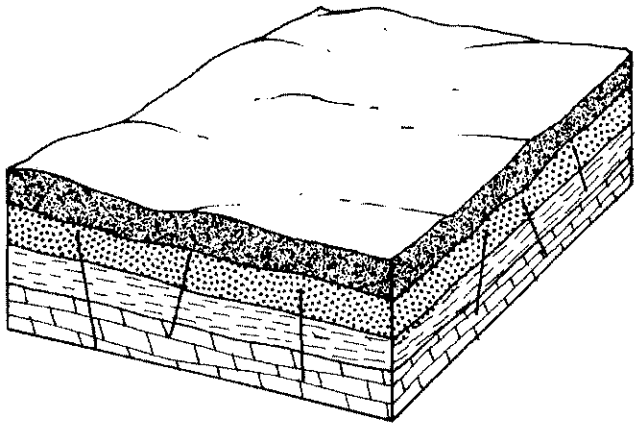
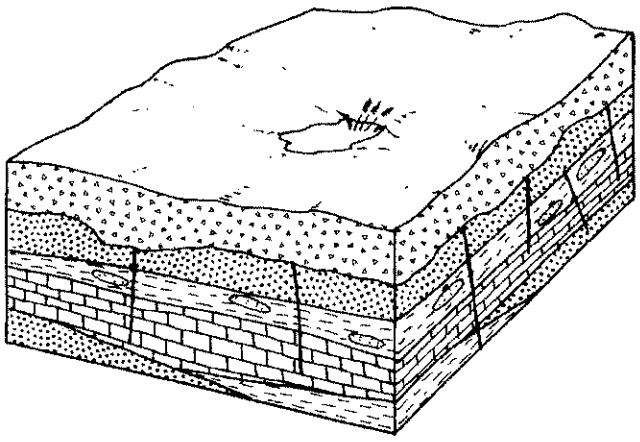


6Db Alternating Sandstone, Limestone, Shale, Coal and Clay - Deep Regolith

This hydrogeologic setting is similar to 6Da, except that deep soils are present over weathered bedrock or valley lacustrine deposits. The silt or clay loam soils in this setting help retard the movement of contaminants to the water table. Recharge in the uplands is low due to steep slopes and moderate on the gently sloped lacustrine deposits.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
6Db1	50-75	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	12-18	interbedded ss/sh/ls/cl/coal	100-300	92
6Db2	30-50	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	2-6	sd+gvl/silt+clay	100-300	115
6Db3	50-75	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	12-18	interbedded ss/sh/ls/cl/coal	100-300	90
6Db4	15-30	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	0-2	sd+gvl/silt+clay	100-300	126
6Db5	50-75	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	18+	interbedded ss/sh/ls/cl/coal	100-300	90
6Db6	15-30	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	2-6	silt/clay	100-300	120
6Db7	15-30	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	0-2	silt/clay	100-300	121



7Aa Glacial Till Over Bedded Sedimentary Rock

This hydrogeologic setting is characterized by low to moderate topography and varying thicknesses of glacial till covering alternating layers of fractured sedimentary rock. The glacial till occurs in layers or sheets each composed of varying amounts of unsorted clay, silt and sand with some pebbles and cobbles. Soil texture is variable depending largely on the composition of the uppermost till sheet. Although ground water may occur within the till and localized sand and gravel lenses, the bedrock is the principal aquifer. Ground water is obtained primarily from sandstones and sandy shales, along the bedding planes, and in intersecting vertical fractures. Precipitation infiltrating through the till serves as a source of recharge to the underlying bedrock. Depth to water is highly variable.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7Aa1	30-50	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	2-6	sd+gvl/silt +clay	100-300	115
7Aa2	50-75	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	6-12	sd+gvl/silt +clay	100-300	99
7Aa3	50-75	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	0-2	sd+gvl/silt +clay	100-300	106
7Aa4	50-75	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	sd+gvl/silt +clay	100-300	103
7Aa5	30-50	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	sd+gvl/silt +clay	100-300	113
7Aa6	30-50	4-7	interbedded ss/sh/ls/cl/coal	Sandy Loam	2-6	sd+gvl/silt +clay	100-300	119
7Aa7	30-50	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	0-2	sd+gvl/silt +clay	100-300	116
7Aa8	15-30	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	2-6	sd+gvl/silt +clay	100-300	125
7Aa9	50-75	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	2-6	sd+gvl/silt +clay	100-300	105
7Aa10	15-30	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	sd+gvl/silt +clay	100-300	123
7Aa11	30-50	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	6-12	sd+gvl/silt +clay	100-300	109
7Aa12	30-50	4-7	interbedded ss/sh/ls/cl/coal	Sandy Loam	6-12	sd+gvl/silt +clay	100-300	115

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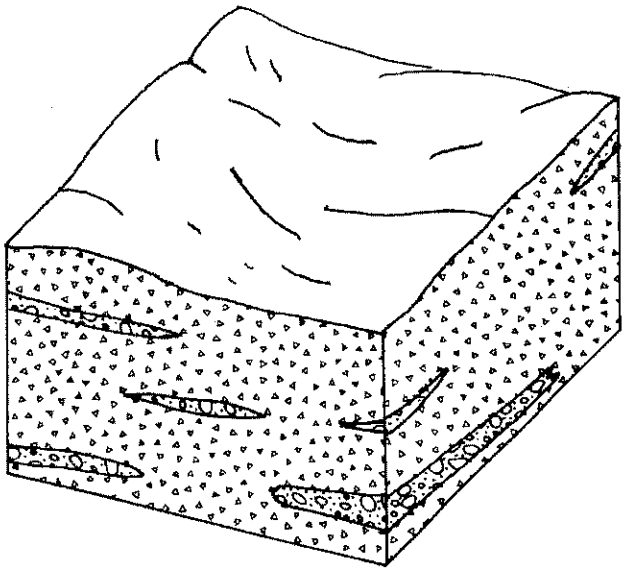
Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7Aa13	30-50	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	0-2	sd+gvl/silt +clay	100-300	114
7Aa14	30-50	4-7	interbedded ss/sh/ls/cl/coal	Sandy Loam	0-2	sd+gvl/silt +clay	1-100	114
7Aa15	30-50	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	6-12	sd+gvl/silt +clay	100-300	111
7Aa16	30-50	4-7	interbedded ss/sh/ls/cl/coal	Sandy Loam	0-2	sd+gvl/silt +clay	100-300	120
7Aa17	30-50	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	sd+gvl/silt +clay	1-100	107
7Aa18	30-50	4-7	interbedded ss/sh/ls/cl/coal	Clay Loam	0-2	sd+gvl/silt +clay	1-100	108
7Aa19	30-50	4-7	interbedded ss/sh/ls/cl/coal	Shrink-swell (Aggregated) Clay	0-2	silt/clay	1-100	111
7Aa20	30-50	4-7	interbedded ss/sh/ls/cl/coal	Shrink-swell (Aggregated) Clay	0-2	silt/clay	100-300	117



7Af Sand and Gravel Interbedded in Glacial Till

This hydrogeologic setting is similar to 7Aa, except that the till is generally thick, and the sand and gravel lenses in the till serve as the principal aquifer. Recharge to the sand and gravel lenses occurs from precipitation infiltrating through the till. Depth to water is variable but averages around 30 feet.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7Af1	30-50	4-7	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	100-300	106
7Af2	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	100-300	123
7Af3	15-30	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	100-300	120
7Af4	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	300-700	132
7Af5	15-30	4-7	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	300-700	136
7Af6	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	100-300	126
7Af7	15-30	4-7	sand/gravel	Clay Loam	0-2	sd+gvl/silt+clay	100-300	121
7Af8	15-30	4-7	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	100-300	126
7Af9	15-30	4-7	sand/gravel	Shrink-swell (Aggregated) Clay	0-2	silt/clay	300-700	133
7Af10	15-30	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	300-700	129
7Af11	15-30	4-7	sand/gravel	Loam	0-2	sd+gvl/silt+clay	300-700	134
7Af12	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	300-700	132
7Af13	15-30	4-7	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	100-300	116
7Af14	15-30	4-7	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	300-700	125
7Af15	15-30	4-7	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	100-300	122
7Af16	30-50	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	100-300	110
7Af17	15-30	4-7	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	300-700	131

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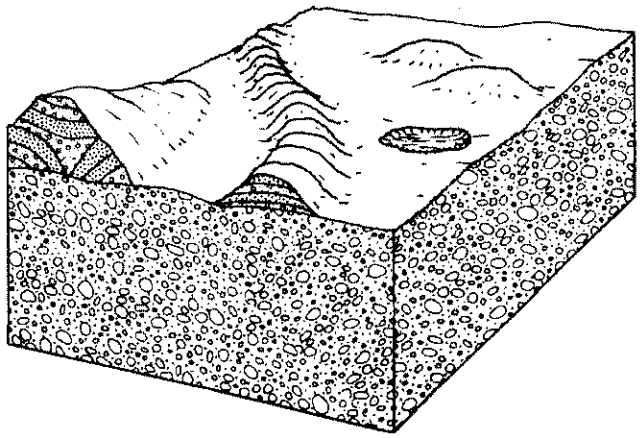
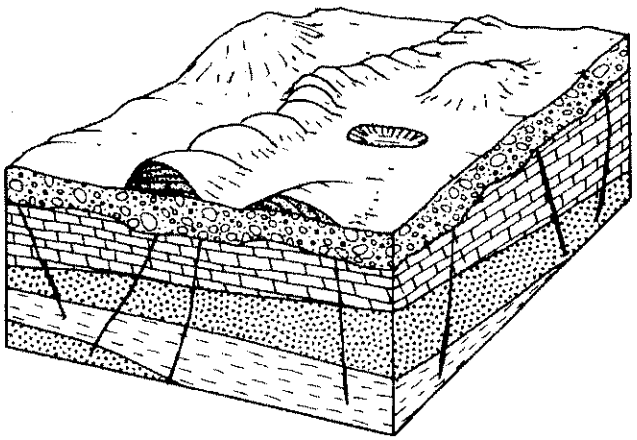


7Ba Outwash

This hydrogeologic setting is characterized by moderate topography and varying thicknesses of outwash that overlie alternating layers of sedimentary rock. The outwash consists of glacial meltwater ice contact deposits of sand and gravel in the form of kames which serve as the principal aquifer. The kames contain irregularly bedded, poorly washed and sorted sand and gravel that may include till masses. Associated with kames are depressions called kettle holes that often contain muck soils or may form a swamp or lake if below the water table. The water table occurs at relatively shallow depths below the base of the kames. Recharge is high because of the typically sandy soils and permeable vadose zone media.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7Ba1	30-50	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	700-1000	148
7Ba2	30-50	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	700-1000	153
7Ba3	15-30	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	700-1000	163
7Ba4	15-30	7-10	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	700-1000	162
7Ba5	30-50	7-10	sand/gravel	Sand	6-12	sd+gvl/silt+clay	700-1000	154
7Ba6	15-30	7-10	sand/gravel	Gravel	6-12	sd+gvl/silt+clay	700-1000	166
7Ba7	15-30	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	700-1000	158
7Ba8	15-30	7-10	sand/gravel	Muck	0-2	sd+gvl/silt+clay	700-1000	155
7Ba9	15-30	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	1000-2000	167
7Ba10	15-30	7-10	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	1000-2000	171
7Ba11	15-30	7-10	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	1000-2000	165
7Ba12	15-30	7-10	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	1000-2000	161
7Ba13	15-30	7-10	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	700-1000	156
7Ba14	5-15	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	700-1000	173
7Ba15	5-15	7-10	sand/gravel	Muck	0-2	sd+gvl/silt+clay	700-1000	165
7Ba16	15-30	7-10	sand/gravel	Sand	2-6	sd+gvl/silt+clay	700-1000	168
7Ba17	5-15	7-10	sand/gravel	Muck	0-2	sd+gvl/silt+clay	1000-2000	174



7Bb Outwash Over Bedded Sedimentary Rock

This hydrogeologic setting is characterized by low to moderate topography and relatively thin outwash that overlies alternating layers of fractured sedimentary rock. The outwash consists of glacial meltwater deposits of sand and gravel in the form of kames and valley fill deposits. The kames contain irregularly bedded, poorly washed and sorted sand and gravel that may include till masses. The valley fill deposits contain stratified, well washed and well sorted sand and gravel with a small amount of clay and silt. Due to the relatively thin outwash, the underlying bedrock is the principal aquifer. Ground water is obtained primarily from sandstones and sandy shales, along the bedding planes, and in intersecting vertical fractures. Precipitation infiltrating through the outwash serves as the main source of recharge to the bedrock. Depth to water is variable, but averages 30 to 50 feet below the surface.

Setting	Depth to Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7Bb1	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sand	2-6	sd+gvl/silt+clay	100-300	143
7Bb2	30-50	4-7	interbedded ss/sh/ls/cl/coal	Silty Loam	0-2	sd+gvl/silt+clay	100-300	136
7Bb3	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sandy Loam	2-6	sd+gvl/silt+clay	100-300	137
7Bb4	50-75	7-10	interbedded ss/sh/ls/cl/coal	Sandy Loam	6-12	sd+gvl/silt+clay	100-300	123
7Bb5	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sandy Loam	6-12	sd+gvl/silt+clay	100-300	133
7Bb6	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sandy Loam	0-2	sd+gvl/silt+clay	100-300	138
7Bb7	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sand	6-12	sd+gvl/silt+clay	100-300	139
7Bb8	30-50	7-10	interbedded ss/sh/ls/cl/coal	Thin or Absent	12-18	sd+gvl/silt+clay	100-300	139
7Bb9	15-30	7-10	interbedded ss/sh/ls/cl/coal	Sandy Loam	0-2	sand + gravel	100-300	158
7Bb10	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sand	2-6	sand + gravel	100-300	153
7Bb11	30-50	7-10	interbedded ss/sh/ls/cl/coal	Clay Loam	6-12	sand + gravel	100-300	127
7Bb12	30-50	7-10	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	sd+gvl/silt+clay	100-300	131
7Bb13	30-50	7-10	interbedded ss/sh/ls/cl/coal	Sand	12-18	sd+gvl/silt+clay	100-300	137
7Bb14	15-30	7-10	interbedded ss/sh/ls/cl/coal	Sand	0-2	sand + gravel	100-300	164

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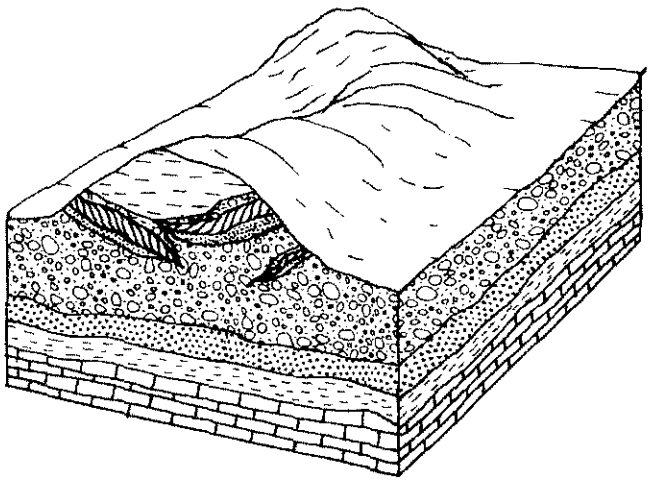

7C Moraine

This hydrogeologic setting is characterized by hummocky topography and varying thicknesses of glacial till that includes sand and gravel. This setting is similar to 7Ba, in that the sand and gravel in the moraine deposit may be well sorted and serve as the principal aquifer. Moraines also contain sediments that are typically unsorted and unstratified; these deposits contain more fines than outwash deposits, are less permeable and are characteristic of glacial till. Soil texture is extremely variable depending on the composition of till sheets at the surface. Recharge by precipitation is moderate and depth to water is fairly shallow; averaging 15 to 30 feet below the surface.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
"7C1"	"15-30"	"4-7"	"sand/gravel"	"Clay Loam"	"2-6"	"sd+gvl/silt+clay"	"300-700"	129
"7C2"	"15-30"	"4-7"	"sand/gravel"	"Sand"	"6-12"	"sd+gvl/silt+clay"	"300-700"	137
"7C3"	"15-30"	"4-7"	"sand/gravel"	"Sandy Loam"	"2-6"	"sd+gvl/silt+clay"	"300-700"	135
"7C4"	"15-30"	"4-7"	"sand/gravel"	"Sandy Loam"	"6-12"	"sd+gvl/silt+clay"	"700-1000"	140
"7C5"	"15-30"	"4-7"	"sand/gravel"	"Clay Loam"	"6-12"	"sd+gvl/silt+clay"	"700-1000"	139
"7C6"	"15-30"	"4-7"	"sand/gravel"	"Clay Loam"	"2-6"	"sd+gvl/silt+clay"	"700-1000"	138

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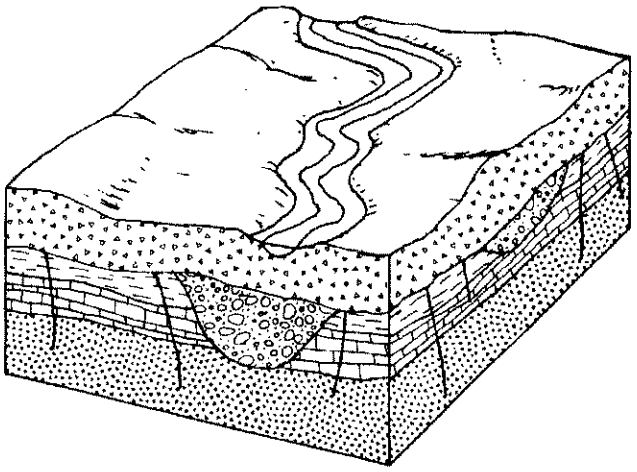

7D Buried Valley

This hydrogeologic setting is characterized by thick deposits of sand and gravel that were laid down by glacial meltwater in a former topographic low, (i.e. a preglacial or interglacial river valley). These deposits are capable of yielding large quantities of water where they are sufficiently thick, permeable and receive adequate recharge. The deposits may or may not underlie or be in direct hydraulic connection with a present–day river. Glacial till, recent alluvium, kame, valley train or lacustrine deposits may overlie the buried valley. Soil texture is highly variable depending on the surface material. Recharge to the aquifer can be attributed to infiltration by precipitation or stream infiltration where the water table has been lowered due to pumping. The depth to water in this setting is extremely variable.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7D1	30-50	7-10	sand/gravel	Sand	0-2	sd+gvl/silt+clay	700-1000	159
7D2	30-50	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	700-1000	141
7D3	30-50	7-10	sand/gravel	Sand	0-2	sd+gvl/silt+clay	1000-2000	168
7D4	30-50	4-7	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	700-1000	134
7D5	30-50	7-10	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	1000-2000	161
7D6	30-50	7-10	sand/gravel	Sand	2-6	sd+gvl/silt+clay	1000-2000	167
7D7	30-50	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	1000-2000	162
7D8	30-50	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	1000-2000	172
7D9	30-50	4-7	sand/gravel	Silty Loam	0-2	sand + gravel	1000-2000	160
7D10	5-15	4-7	sand/gravel	Silty Loam	0-2	silt/clay	300-700	137
7D11	30-50	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	300-700	154
7D12	30-50	7-10	sand/gravel	Sand	2-6	sand + gravel	300-700	159
7D13	30-50	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	300-700	122
7D14	30-50	7-10	sand/gravel	Sand	0-2	sand + gravel	2000+	187
7D15	50-75	7-10	sand/gravel	Gravel	6-12	sand + gravel	300-700	137
7D16	50-75	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	700-1000	118
7D17	50-75	4-7	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	700-1000	124
7D18	30-50	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	2000+	181

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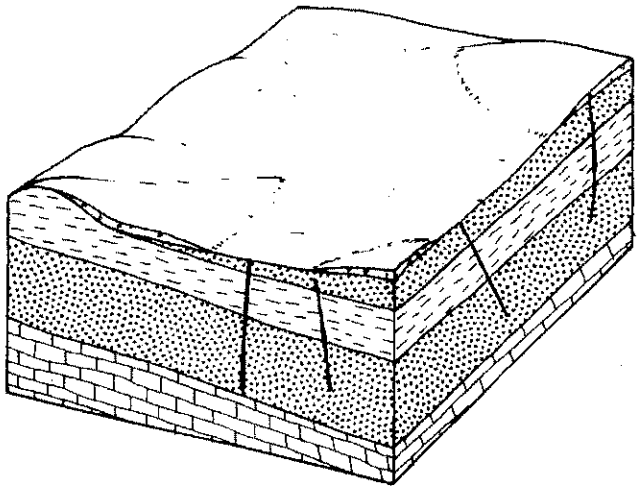
Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7D19	30-50	10+	sand/gravel	Gravel	2-6	sd+gvl/silt+clay	300-700	155
7D20	30-50	7-10	sand/gravel	Sand	0-2	sand + gravel	300-700	160
7D21	50-75	4-7	sand/gravel	Sand	6-12	sd+gvl/silt+clay	300-700	117
7D22	30-50	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	1000-2000	150
7D23	50-75	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	1000-2000	140
7D24	50-75	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	1000-2000	130
7D25	50-75	7-10	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	1000-2000	151
7D26	50-75	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	1000-2000	127
7D27	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	1000-2000	150
7D28	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	700-1000	141
7D29	30-50	4-7	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	300-700	125
7D30	50-75	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	300-700	129
7D31	50-75	4-7	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	300-700	111
7D32	50-75	7-10	sand/gravel	Sand	6-12	sd+gvl/silt+clay	300-700	135
7D33	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	300-700	132
7D34	30-50	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	700-1000	163
7D35	15-30	4-7	sand/gravel	Sand	0-2	sd+gvl/silt+clay	300-700	142
7D36	30-50	7-10	sand/gravel	Sandy Loam	2-6	sand + gravel	1000-2000	171
7D37	5-15	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	300-700	144
7D38	30-50	7-10	sand/gravel	Gravel	6-12	sd+gvl/silt+clay	1000-2000	165
7D39	30-50	7-10	sand/gravel	Sand	0-2	sand + gravel	1000-2000	178
7D40	50-75	7-10	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	700-1000	132
7D41	30-50	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	1000-2000	157
7D42	30-50	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	700-1000	148
7D43	30-50	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	700-1000	153
7D44	30-50	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	2000+	166
7D45	5-15	4-7	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	300-700	151
7D46	15-30	4-7	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	300-700	136
7D47	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	300-700	132
7D48	30-50	7-10	sand/gravel	Sand	6-12	sd+gvl/silt+clay	1000-2000	163
7D49	30-50	10+	sand/gravel	Gravel	6-12	sd+gvl/silt+clay	1000-2000	169
7D50	30-50	7-10	sand/gravel	Sand	6-12	sd+gvl/silt+clay	700-1000	154
7D51	15-30	7-10	sand/gravel	Muck	0-2	sd+gvl/silt+clay	700-1000	155
7D52	15-30	7-10	sand/gravel	Sand	6-12	sd+gvl/silt+clay	700-1000	164
7D54	30-50	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	2000+	171
7D55	15-30	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	700-1000	173
7D56	30-50	7-10	sand/gravel	Gravel	12-18	sd+gvl/silt+clay	700-1000	154
7D57	30-50	4-7	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	700-1000	135
7D58	30-50	4-7	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	700-1000	130
7D59	15-30	7-10	sand/gravel	Sand	0-2	sd+gvl/silt+clay	1000-2000	178
7D60	15-30	7-10	sand/gravel	Muck	0-2	sd+gvl/silt+clay	1000-2000	164
7D61	30-50	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	700-1000	128
7D62	15-30	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	1000-2000	172
7D63	5-15	7-10	sand/gravel	Muck	0-2	sd+gvl/silt+clay	1000-2000	174
7D64	5-15	7-10	sand/gravel	Loam	0-2	sd+gvl/silt+clay	1000-2000	180
7D65	15-30	7-10	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	2000+	181
7D66	5-15	7-10	sand/gravel	Loam	0-2	sand + gravel	2000+	199
7D67	5-15	7-10	sand/gravel	Muck	0-2	sand + gravel	2000+	193

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7D68	5-15	7-10	sand/gravel	Loam	0-2	sand + gravel	300-700	172
7D69	15-30	7-10	sand/gravel	Sand	0-2	sand + gravel	1000-2000	188
7D70	15-30	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	1000-2000	167
7D71	15-30	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	700-1000	158
7D72	30-50	4-7	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	700-1000	124
7D73	30-50	4-7	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	1000-2000	133
7D74	15-30	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	1000-2000	182
7D75	30-50	7-10	sand/gravel	Clay Loam	6-12	sd+gvl/silt+clay	700-1000	142
7D76	15-30	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	2000+	191
7D77	15-30	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	300-700	164
7D78	15-30	7-10	sand/gravel	Sandy Loam	6-12	sd+gvl/silt+clay	300-700	149
7D79	30-50	7-10	sand/gravel	Sandy Loam	12-18	sd+gvl/silt+clay	700-1000	146
7D80	30-50	7-10	sand/gravel	Sand	12-18	sd+gvl/silt+clay	700-1000	152
7D81	30-50	4-7	sand/gravel	Clay Loam	12-18	sd+gvl/silt+clay	700-1000	122
7D82	30-50	7-10	sand/gravel	Sand	2-6	sd+gvl/silt+clay	700-1000	158
7D83	30-50	7-10	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	300-700	143
7D84	15-30	7-10	sand/gravel	Muck	0-2	sand + gravel	300-700	146
7D85	30-50	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	300-700	154
7D86	5-15	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	300-700	174
7D87	15-30	4-7	sand/gravel	Silty Loam	0-2	sd+gvl/silt+clay	300-700	137
7D88	30-50	7-10	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	700-1000	146
7D89	15-30	4-7	sand/gravel	Clay Loam	0-2	sd+gvl/silt+clay	300-700	130
7D90	30-50	4-7	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	1000-2000	144
7D91	15-30	4-7	sand/gravel	Clay Loam	2-6	sd+gvl/silt+clay	300-700	129
7D92	15-30	4-7	sand/gravel	Shrink-swell (Aggregated) Clay	0-2	silt/clay	1000-2000	151
7D93	15-30	4-7	sand/gravel	Sandy Loam	0-2	sd+gvl/silt+clay	1000-2000	154
7D94	15-30	4-7	sand/gravel	Clay Loam	0-2	sd+gvl/silt+clay	1000-2000	148
7D95	5-15	7-10	sand/gravel	Sand	0-2	sand + gravel	300-700	180
7D96	15-30	4-7	sand/gravel	Sandy Loam	2-6	sd+gvl/silt+clay	300-700	135
7D97	5-15	7-10	sand/gravel	Silty Loam	0-2	sand + gravel	300-700	170
7D98	5-15	7-10	sand/gravel	Sand	0-2	sand + gravel	700-1000	189
7D99	15-30	7-10	sand/gravel	Sand	0-2	sand + gravel	300-700	170
7D100	5-15	7-10	sand/gravel	Sand	0-2	sand + gravel	1000-2000	198
7D101	5-15	7-10	sand/gravel	Sandy Loam	0-2	sand + gravel	700-1000	183



7G Thin Glacial Till Over Bedded Sedimentary Rock

This hydrogeologic setting is characterized by moderate to steep topography and deposits of thin, patchy glacial till overlying alternating layers of fractured sedimentary rock. The till is generally less than 20 feet thick and consists of varying amounts of unsorted clay, silt and sand with some pebbles and cobbles. Ground water is obtained primarily from sandstones and sandy shales, along the bedding planes, and in intersecting vertical fractures. Shale or clay layers can form aquitards, and perched ground water may be developed for domestic water supplies. Strip mines in the glaciated region are included in this setting. In these areas, the natural soils have been removed, and strip mine spoil containing mostly weathered shale and sandstone may randomly occupy the surface. Bedrock is exposed where spoil material is absent. Recharge is moderate due to increased capacity of spoil material to retain and discharge precipitation.

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7G1	75-100	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	12-18	interbedded ss/sh/ls/cl/coal	100-300	111
7G2	50-75	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	12-18	interbedded ss/sh/ls/cl/coal	100-300	92
7G3	50-75	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	6-12	interbedded ss/sh/ls/cl/coal	100-300	92
7G4	50-75	2-4	interbedded ss/sh/ls/cl/coal	Sandy Loam	12-18	interbedded ss/sh/ls/cl/coal	100-300	96
7G5	50-75	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	6-12	interbedded ss/sh/ls/cl/coal	100-300	94
7G6	50-75	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	12-18	interbedded ss/sh/ls/cl/coal	100-300	90
7G7	30-50	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	2-6	interbedded ss/sh/ls/cl/coal	100-300	108
7G8	30-50	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	interbedded ss/sh/ls/cl/coal	100-300	106
7G9	50-75	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	interbedded ss/sh/ls/cl/coal	100-300	96

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Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography	Vadose Zone Media	Hydraulic Conductivity	Rating
7G10	30-50	2-4	interbedded ss/sh/ls/cl/coal	Sandy Loam	2-6	interbedded ss/sh/ls/cl/coal	100-300	112
7G11	50-75	2-4	interbedded ss/sh/ls/cl/coal	Sandy Loam	6-12	interbedded ss/sh/ls/cl/coal	100-300	98
7G12	50-75	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	6-12	interbedded ss/sh/ls/cl/coal	100-300	118
7G13	50-75	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	12-18	interbedded ss/sh/ls/cl/coal	100-300	116
7G14	30-50	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	6-12	interbedded ss/sh/ls/cl/coal	100-300	104
7G15	50-75	2-4	interbedded ss/sh/ls/cl/coal	Sand	6-12	interbedded ss/sh/ls/cl/coal	100-300	104
7G16	30-50	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	6-12	interbedded ss/sh/ls/cl/coal	100-300	102
7G17	30-50	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	6-12	interbedded ss/sh/ls/cl/coal	100-300	128
7G18	30-50	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	2-6	interbedded ss/sh/ls/cl/coal	100-300	132
7G19	30-50	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	2-6	interbedded ss/sh/ls/cl/coal	1-100	100
7G20	30-50	2-4	interbedded ss/sh/ls/cl/coal	Clay Loam	0-2	interbedded ss/sh/ls/cl/coal	100-300	107
7G21	30-50	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	2-6	interbedded ss/sh/ls/cl/coal	1-100	126
7G22	50-75	2-4	interbedded ss/sh/ls/cl/coal	Silty Loam	18+	interbedded ss/sh/ls/cl/coal	100-300	90
7G23	50-75	4-7	interbedded ss/sh/ls/cl/coal	Thin or Absent	18+	interbedded ss/sh/ls/cl/coal	100-300	114

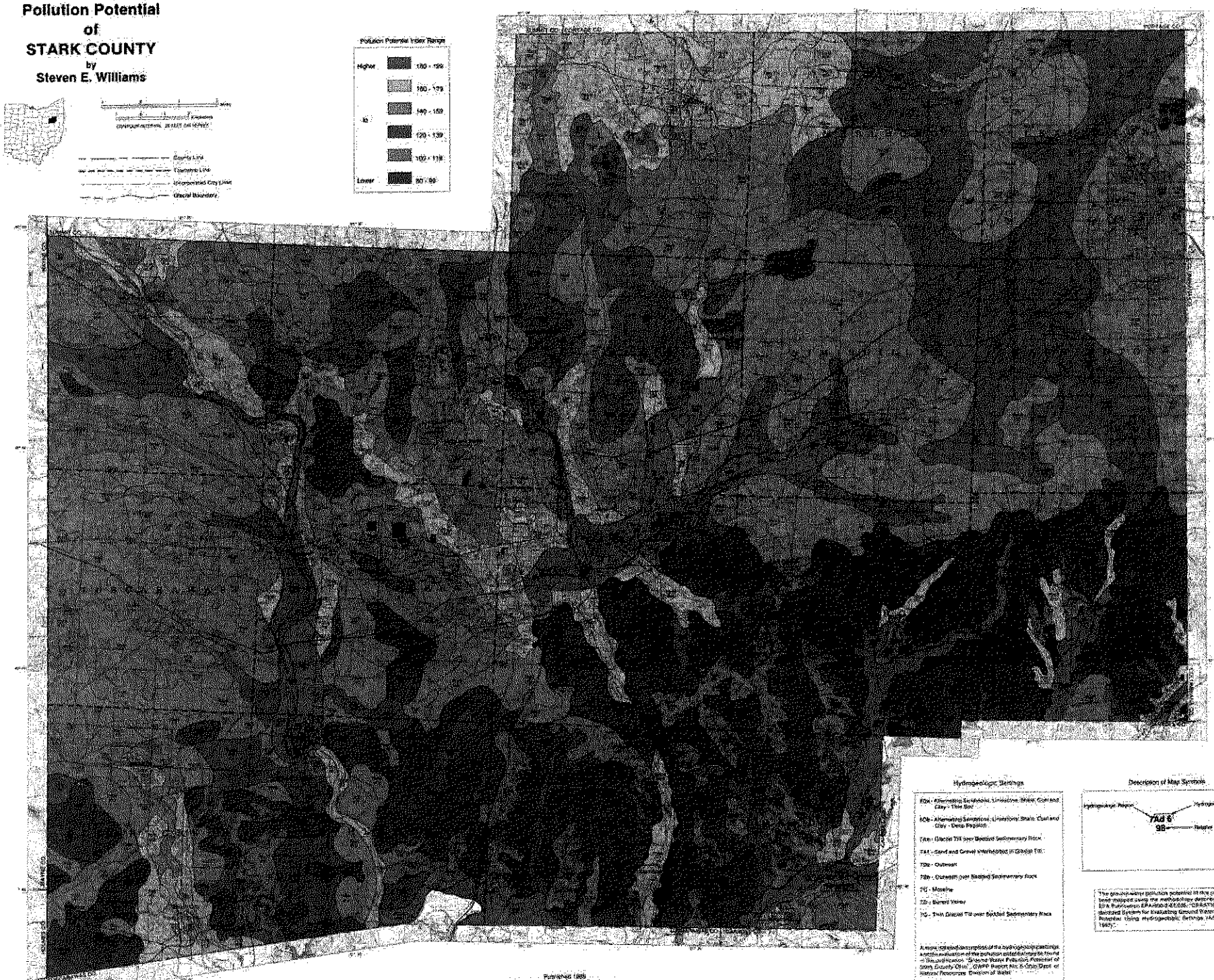
Ground-Water Pollution Potential of STARK COUNTY

by

Steven E. Williams

Pollution Potential Index Range

Higher	180 - 199
	160 - 179
	140 - 159
	120 - 139
	100 - 119
Lower	80 - 99



Hydrogeologic Settings

Description of Map Symbols

Published 1989
Ohio Department of Natural Resources
Division of Water
Ground-Water Resources Section
1939 Fountain Square
Columbus, Ohio 43224

David G. Orr, Cartographer

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SOIL SURVEY

Stark County Ohio

Issued October 1971

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Lands and Soil
and
OHIO AGRICULTURAL RESEARCH AND
DEVELOPMENT CENTER

CDF013350

HOW TO USE THE SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in many ways. It contains predictions of soil behavior for selected land uses. It contains estimates of soil properties and limitations that affect soil behavior for specified purposes. It can help you understand the potential of the soil and the hazards or limitations that you should be aware of.

The survey can help farmers, foresters, and agronomists plan profitable use and management of the soils. It can help engineers, builders, and contractors find potential sites for residential, commercial, recreational, and industrial developments. It can help scientists and others who study, manage, and develop land. It can help others locate sites for roads, pipelines, and underground cables. It can help you find information about the soils in your community or area.

Locating Soils

All of the soils in Stark County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with numbers on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil scientist is inside the area (delineation) when he identifies it, as outside and a guide shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in this soil survey. It lists map units in the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each unit is described and also the page for the capability unit in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many uses (or purposes) can be developed by using the soil map and the information in the text. Those different materials can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about the soil management group of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Woodland," where the soils in the county are grouped according to their ability for trees.

Those managing parklands or other recreational areas can read about the soils and their suitability for recreational uses in the section "Use of Soils for Wildlife."

Those seeking information about the soils as a source of gravel, sand, or topsoil can refer to the section "Soil Properties."

Those wanting to learn about the kinds of soil profiles that are in the county can read about the soil series and their morphology in the section "Formation and Classification of Soils."

Newcomers in Stark County may be especially interested in the section "General Soil Map," where broad patterns of soil are described. They may also be interested in the section "General Nature of the County."

(continued on next page)

Soil Survey of Stark County, Ohio, by Dominic Pastor, Jr., Soil Conservation Service, United States Department of Agriculture, in cooperation with the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center, Wooster. This survey is part of the national cooperative soil survey conducted in the United States by the Soil Conservation Service.

Preparation of this soil survey was partly financed through an urban planning assistance grant from the Department of Housing and Urban Development under the provisions of Section 701 of the Housing Act of 1954, as amended.

Major fieldwork for this soil survey was completed in 1961. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1961. This survey was made cooperatively by the Soil Conservation Service and the Ohio Department of Natural Resources, Division of Lands and Soil, and the Ohio Agricultural Research and Development Center. It is part of the technical assistance furnished to the Stark Soil Conservation District.

Reproduction of this soil survey map partly financed through an urban planning assistance grant from the Department of Housing and Urban Development under the provisions of Section 701 of the Housing Act of 1954, as amended.

Items appearing in colored print in the publication are links to other pages, figures, or tables. Items appearing in colored print in the table of contents are links to the corresponding section. Soil conservation service terms are defined in the Soil Survey Manual.

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SOIL SURVEY OF STARK COUNTY, OHIO

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF LANDS AND SOIL, AND OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER

STARK COUNTY, in the northeastern part of Ohio (fig. 1), has a total land area of 366,720 acres, or about 573 square miles. Canton, the county seat and largest city, is near the center of the county and lies about 50 miles south of Cleveland. In 1960 the population of the county was 340,345, and that of Canton was about 113.631.

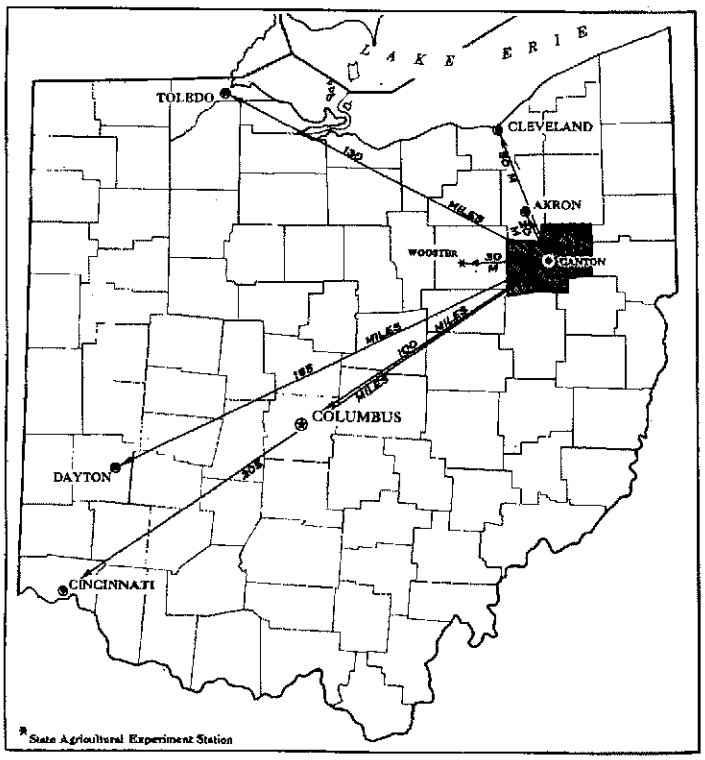

Figure 1.—Location of Stark County in Ohio.

Most of the land area in the county is farmland, but the county is in the expanding metropolitan and industrialized area of northeastern Ohio, and an increasingly large acreage is being diverted to nonfarm uses. Dairying is the main farm enterprise in the county. Industries related to iron and steel are dominant.

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How This Survey Was Made

This survey was made to learn what kinds of soils are in Stark County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not.

They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The categories of the classification most used in a local survey are the *soil series* and the *soil phase*.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all of the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Chili and Wheeling, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Chili silt loam, 0 to 2 percent slopes, is one of several phases within the Chili series.

After a guide for classifying and naming the soils

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had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared on aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Stark County: the soil complex and the undifferentiated group.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Chili-Urban land complex, undulating, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Chili and Conotton gravelly loams, 25 to 50 percent slopes, moderately eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Cut and fill land and Made land are examples of two land types in Stark County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

The soil scientists set up trial groups of soils on the basis of the data they have collected. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultations. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this soil survey shows, in color, the soil associations in Stark County. A soil association is a landscape that has a distinctive pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Stark County are discussed in the following pages.

1. Fitchville-Sebring Association

Deep, nearly level, somewhat poorly drained and poorly drained soils that have a loamy subsoil; formed in glacial lake sediments

This association of nearly level soils is in scattered areas throughout the county. These areas are old glacial lake beds that generally are lower than the surrounding topography.

This association occupies about 7 percent of the county. About 26 percent of the association is Fitchville soils, 24 percent is Sebring soils, and the remaining 50 percent is soils of minor extent.

The Fitchville soils are slightly higher than the Sebring soils in most places. Fitchville soils are somewhat poorly drained, and the Sebring soils are poorly drained. Both kinds of soils have a silt loam surface layer and a seasonal high water table. They are soft and compressible when wet.

The minor soils in this association are the very poorly drained Luray and Montgomery soils and the moderately well drained Glenford soils.

Undrained areas of this association are swampy, but most areas have been cleared and drained. The poor or somewhat poor natural drainage is the main limitation to use of the major soils for farming and for most other purposes. Flooding and ponding are common in winter and early in spring. It is essential that an artificial drainage system be maintained on these soils to keep them from reverting to swamp.

This association is used mainly for pasture, but some local areas are used for cultivated crops. If the Fitchville and Sebring soils are intensively managed, they are well suited to the field crops commonly grown in the county. Use for many nonfarm purposes is limited

by a seasonal high water table and, in some areas, by unstable soil material. Undrained areas are valuable as habitat for wetland wildlife.

2. Chili-Wheeling-Shoals Association

Deep, nearly level to steep, well-drained and somewhat poorly drained soils that have a loamy subsoil; formed mainly in glacial outwash

Most of this association is in an irregularly shaped area that surrounds Canton and extends northward to Portage County, northwestward to Summit County, and westward to Wayne County. Many smaller areas of other associations lie within this large area. This association also is along the main streams throughout the county. It occupies sloping and steep hills in Lake, Plain, Jackson, and Lawrence Townships. South of Massillon the soils are nearly level to gently sloping.

This association occupies about 27 percent of the county. About 55 percent of the association is Chili soils, 10 percent is Wheeling soils, 10 percent is Shoals soils, and the remaining 25 percent is minor soils.

The Chili and Wheeling soils formed in silty material underlain by gravelly outwash, and they are well drained. The Shoals soils formed in recent alluvium and are somewhat poorly drained.

Among the minor soils in this association are the well-drained Arkport and Plainfield soils, the very poorly drained Sloan soils, and the poorly drained Wayland soils.

This association is used mainly for general farming and dairying. The Chili and Wheeling soils are well suited to cultivated crops. Potatoes and melons could be grown on these soils, particularly where water for irrigation is available. Erosion is a hazard in the more sloping areas. Because flooding is a hazard, the Shoals soils are used mainly for pasture.

The Chili and Wheeling soils have few limitations to use as homesites, and in many areas community development is competing with farming. In these soils, however, there is a danger of contaminating underground water because septic tank effluent is not adequately filtered. This danger is greatest where septic tanks are concentrated in a small area. Because they are subject to flooding, the Shoals soils have severe limitations for most nonfarm uses.

3. Ravenna-Canfield Association

Deep, nearly level to sloping, somewhat poorly drained and moderately well drained soils that have a fragipan in the subsoil; formed in loam or silt loam glacial till

This association occupies large undulating to rolling areas in Marlboro, Nimishillen, and Tuscarawas Townships. Smaller, irregularly shaped areas are scattered throughout most of the county. Topography is typical of that in glacial till areas.

This association occupies about 20 percent of the county. About 45 percent of the association is Ravenna soils, 45 percent is Canfield soils, and the remaining 10 percent is minor soils.

The Ravenna soils are less sloping than the Canfield soils and are somewhat poorly drained. The Canfield soils are moderately well drained. Both kinds of soils have a dense, compact subsoil that restricts the internal movement of water and the growth of roots.

Among the minor soils in this association are the well-drained Wooster soils, which are steeper than the Canfield soils. Other minor soils are the somewhat poorly drained Fitchville soils and the poorly drained Sebring soils.

This association is used mainly for general farming and dairying. Use of the major soils is limited by seasonal wetness and, in cultiviated areas, by a hazard of erosion. Artificial drainage is needed for the good growth of crops. Wetness is generally caused by the lateral movement of water along the top of the dense, compact subsoil.

Buildings constructed on these soils tend to have wet foundations and basements unless adequate drainage is provided. Because the dominant soils have moderately slow permeability, filter fields do not function well during wet periods.

4. Canfield-Wooster Association

Deep, sloping to steep, moderately well drained and well drained soils that have a fragipan in the subsoil; formed in loamy glacial till

This association occurs through all the county except the extreme southeastern corner. It is in large and small areas of various shapes. Slopes are smooth and rounded.

This association occupies about 26 percent of the county. About 65 percent of the association is Canfield soils, 25 percent is Wooster soils, and the remaining 10 percent is minor soils.

The Canfield and Wooster soils formed in deep, loamy glacial till. The Canfield soils are moderately well drained. They have a dense, compact subsoil that slows the movement of water and the growth of roots. Wooster soils are well drained. They generally are higher and steeper than the Canfield soils.

Among the minor soils in this association are the moderately well drained and well drained, steep Loudonville soils and the nearly level, somewhat poorly drained Ravenna soils.

This association is used mostly for general farming and dairying, though the acreage in community development is increasing. The hazard of erosion is the main limitation to the use of the Canfield and Wooster soils for farming, but wetness commonly delays tillage in spring in less sloping areas of the Canfield soils.

Wetness is a less serious limitation for community development in this association than in the Wadsworth-Rittman, the Ravenna-Canfield, and the Remsen associations. But unless adequate drainage is provided in the Canfield soils, basements are wet and septic tanks do not function well because water seeps along the top of the dense, compact subsoil. For many nonfarm uses, the major soils in this association are limited by moderately slow permeability and, in some places, by steep slopes.

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5. Glenford-Licking Association

Deep, gently sloping to steep, moderately well drained soils that have a loamy and clayey subsoil; formed in water-deposited sediments

This association is on benchlike terraces along small streams in the south-central part of the county. It lies in the valleys between the adjacent uplands and the flood plains.

This association occupies about 1 percent of the county. About 40 percent of the association is Glenford soils, 25 percent is Licking soils, and the remaining 35 percent is minor soils.

The Glenford soils formed in water-deposited sediments, mainly silt but some clay. They are moderately well drained and have moderately slow permeability. The Licking soils formed in silty clay and clay sediments. They also are moderately well drained, but they have slow permeability. Both the Glenford and Licking soils have a high water table in winter and spring.

Among the minor soils in this association are the poorly drained Sebring soils and the moderately well drained Rainsboro soils.

In this association seasonal wetness and, in some areas, the hazard of erosion are the main limitations to use of the soils for farming. Some local areas receive runoff from the adjacent uplands. Use for many nonfarm purposes is limited by a seasonal high water table and restricted permeability.

More than half of this association is wooded or is in unimproved pasture. Most of the remaining acreage is used for general farming and dairy farming (fig. 2). Community development has not been extensive.

Figure 2.—An area in the Glenford-Licking soil association. In the background are pine trees growing on a Licking silt loam, and in the foreground is a poorly drained Sebring silt loam.

6. Carlisle-Willette-Linwood Association

Very poorly drained organic soils that are mainly in depressions

This association occurs in scattered nearly level and depressional areas in the north-central and central parts of the county. It consists of muck soils that are underlain by mineral soil material at various depths. Undrained areas of these soils are swampy.

This association occupies about 2 percent of the county. About 80 percent of this association is Carlisle soils, 10 percent is Willette soils, and 10 percent is Linwood soils.

The Carlisle, Willette, and Linwood soils are dark colored, very poorly drained, and nearly level. These soils have a muck surface layer. Depth to the mineral material is 5 to 30 feet or more in the Carlisle soils, about 26 inches in the Willette soils, and about 23 inches in the Linwood soils. The thinner Linwood and Willette soils commonly occur at the outer edge of the association.

Poor natural drainage is the main limitation to use of this association for farming. The muck tends to oxidize and subside when the water table is lowered. This subsidence is particularly serious where the muck is thin. When dry, all areas of these mucks can be damaged or destroyed by fire. Dry areas are also subject to soil blowing. If these soils are used for farming, they need intensive management that includes artificial drainage and control of the water table.

About 60 percent of this association is used for truck farming. The remaining acreage is unimproved and swampy. Under good management these soils are well suited to endive, radishes, onions, lettuce, and other truck crops. They have severe limitations to use in community development because the muck is unstable and tends to subside.

7. Wadsworth-Rittman Association

Deep, nearly level to sloping, somewhat poorly drained and moderately well drained soils that have a fragipan in the subsoil; formed in clay loam or silty clay loam glacial till

This association is in the northeastern part of the county. It consists of soils that formed in clay loam or silty clay loam glacial till and that have a compact layer in the subsoil that restricts the movement of water.

This association occupies about 2 percent of the county. About 65 percent of the association is Wadsworth soils, 25 percent is Rittman soils, and the remaining 10 percent is minor soils.

The Wadsworth soils are mainly nearly level and are somewhat poorly drained. The Rittman soils are sloping and moderately well drained. In addition to the restrictive subsoil, both kinds of soils have a seasonal high water table.

Among the minor soils in this association are the moderately well drained Canfield, the somewhat poorly drained Fitchville, and the poorly drained Sebring soils.

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General farming and dairying are the major farming enterprises in this association. The main limitation to farming is seasonal wetness. Artificial drainage is needed for good growth of crops, particularly on the Wadsworth soils. Erosion is a hazard in cultivated areas of Rittman soils.

For community development, use of most of the soils is severely limited by a seasonal high water table and slow permeability. On these soils septic tank filter fields do not function properly, even in dry periods.

8. Loudonville-Wooster Association

Moderately deep and deep, sloping to very steep, well-drained soils that have a loamy subsoil; formed in loamy glacial till over sandstone

This association occurs in widely separated areas throughout the county, mainly in the southern half. In most areas the glacial till is less than 4 feet thick over residuum from shale and sandstone.

This association occupies about 5 percent of the county. About 80 percent of the association is Loudonville soils, 15 percent is Wooster soils, and the remaining 5 percent is minor soils.

The Loudonville soils formed in glacial till 20 to 40 inches thick over bedrock. They are well drained. The Wooster soils formed in glacial till more than 40 inches thick. They are well drained and contain a fragipan.

Among the minor soils in this association are the well drained Latham and Muskingum soils and the moderately well drained Keene soils.

The main farming on the soils of this association is general farming, dairying, and producing fruit. Much of the acreage is used for pasture. The main limitation to farming is steep or very steep slopes. In many areas these soils are so steep that erosion would be a severe hazard if they were cultivated. In these areas runoff is very rapid. Community development is limited by steep slopes, but many areas have scenic value. Locally, many nonfarm uses are limited by shallowness to bedrock.

9. Remsen Association

Deep, mainly nearly level to gently sloping, somewhat poorly drained soils that have a dominantly clayey subsoil; formed in silty clay glacial till

This association occurs in the northeastern part of the county, where it practically surrounds the Berlin Reservoir. The soils are mainly nearly level to gently sloping, but they are steeper along streams and drainageways.

This association occupies about 1 percent of the county. About 80 percent is Remsen soils, and the remaining 20 percent is minor soils.

The Remsen soils occur on uplands. They are somewhat poorly drained and have a slowly permeable, clayey subsoil.

The minor soils in this association are the moderately well drained Geeburg soils, the very poorly drained, dark-colored Montgomery soils, and the poorly drained Trumbull soils.

Because this association is adjacent to the Berlin Reservoir, it is used mainly as recreational and wildlife areas. Some areas are pastured. Seasonal wetness and slow permeability are the main limitations to use. Because the soils in this association are difficult to drain and are low in natural fertility, use for farming is limited. The clayey subsoil of the Remsen soils prevents septic tank filter fields from functioning properly.

10. Latham-Keene Association

Moderately deep and deep, sloping to steep, well drained and moderately well drained soils that have a loamy and clayey subsoil; formed over shale

This association occupies scattered areas in the south-central part of the county. It occurs in the unglaciated part of the county and consists of sloping to steep soils.

This association occupies about 2 percent of the county. About 50 percent of this association is Latham soils, 40 percent is Keene soils, and the remaining 10 percent is minor soils.

The Latham soils formed in place from weathered shale. They are well drained and have a slowly permeable subsoil. The Keene soils formed in place from weathered shale and thin strata of siltstone bedrock. They generally are not so steep as the Latham soils. Keene soils are moderately well drained; permeability is moderately slow in the upper part of the subsoil and slow in the lower part.

The minor soils in this association are the well drained Brooke, Gilpin, and Muskingum soils and the moderately well drained Tilsit soils.

This association is used mainly for general farming. Much of the acreage is wooded or pastured, but some local areas are strip mined for coal and shale. Because of steep slopes and rapid runoff, erosion is a severe hazard in cultivated areas.

Little of this association has been used for community development. Some areas that have attractive views are suitable for homesites, but use of the major soils for septic tank filter fields is severely limited by moderately slow and slow permeability.

11. Muskingum-Gilpin-Dekalb Association

Moderately deep, sloping to very steep, well-drained soils that have a loamy subsoil; formed mainly over sandstone and shale

This association occurs in unglaciated areas in the southern and southeastern parts of the county (fig. 3).

This association occupies 7 percent of the county. About 40 percent of the association is Muskingum soils, 20 percent is Gilpin soils, 20 percent is Dekalb soils, and the remaining 20 percent is minor soils.

The Muskingum soils formed in the residuum from siltstone, sandstone, and shale. The Gilpin soils formed in the residuum from thin beds of siltstone, shale, and sandstone. The Dekalb soils formed in the resi-

Figure 3.—Typical landscape in the Muskingum-Gilpin-Dekalb soil association

duum from sandstone and thin beds of siltstone. All of these soils are well drained, low in natural fertility, and droughty.

The minor soils in this association are the moderately well drained Keene and Tilsit soils and the well drained Ramsey, Wellston, and Weikert soils.

Large areas of this association have been strip mined for coal. General farming and producing fruit are the main farm enterprises. The less sloping soils are used mainly for pasture, but row crops are grown in a few areas. The soils suited to cultivated crops are in such small areas that use of farm machines is restricted. Intensive practices of erosion control are needed in cultivated areas. The steeper soils are used for apple orchards, for pasture, and as woodland. Because runoff is very rapid on these soils, the hazard of erosion is severe.

Use of the soils in this association for many nonfarm purposes is limited by slopes and, in some areas, by bedrock near the surface. Community development is not extensive in this association.

Use and Management of Soils

This section contains information on the use and management of soils in the county for crops and pasture and also as woodland, for wildlife, in engineering, and for town and country planning. Also given are estimated yields of the principal crops.

In presenting information about the use of soils for crops and pasture, the procedure is to describe a group of similar soils that are suitable for those purposes and to suggest use and management for the group. To determine the soils in each capability unit, refer to the "Guide to Mapping Units" at the back of this survey. In the subsection on woodland, a table lists the woodland suitability groups into which the

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soils have been placed. The subsection on wildlife gives information about the suitability of the soils for the elements of wildlife habitat. In the subsection on engineering, the soils are not grouped but are placed in tables so that properties significant to engineering work can be given readily. In the subsection on town and country planning, the soils are rated according to their limitations for selected uses.

Crops and Pasture

In this section general practices of soil management are discussed, the system of capability classification used by the Soil Conservation Service is described, and suggested management for capability groups of soils is given. Also, a table lists estimated yields of principal crops under two levels of management. Special crops grown for commercial use are discussed, and the suitability of the soils for irrigated crops.

Field crops commonly grown in Stark County are corn, wheat, oats, and other small grains. Plants suitable for pasture and hay are alfalfa, alsike clover, Ladino clover, red clover, timothy, orchardgrass, bromegrass and bluegrass. Special crops commonly grown are sweet corn, celery, lettuce, radishes, strawberries and other crops adapted to the climate. The crops just mentioned serve to indicate the kind of crops that are adapted to conditions in the county.

General practices of management

Although the soils in Stark County vary in their suitability for specific crops and require widely different management, some basic, or general, management practices are needed on practically all of the soils.

This section discusses the basic practices of maintaining fertility, utilizing crop residue, improving drainage, and controlling erosion. The management of specified groups of soils is discussed under "Management by capability units," and more specific information can be obtained by consulting a representative of the Soil Conservation Service or the Ohio Agricultural Extension Service.

Maintenance of adequate levels of fertility.—Because most of the soils in the county, particularly the light-colored ones, are naturally acid and low in content of plant nutrients, additions of lime and fertilizer are needed. Such additions should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. For assistance in determining the kinds and amounts of fertilizer and lime to apply, farmers should consult the Ohio Agricultural Extension Service.

Figure 4.—A tile drainage system on a Fitchville silt loam.

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Utilization of crop residue.—Most of the soils in this county, particularly the light-colored ones, are not naturally high in organic-matter content. All crop residues should be incorporated into the soil. If crops that produce little residue are grown, the cropping system should provide cover crops and sod crops.

Drainage.—In this county wetness is a hazard on about 34 percent of the acreage suitable for cultivated crops. Few or no practices are needed for improving drainage on the moderately well drained soils. Crops grow well on most of the somewhat poorly drained, poorly drained, and very poorly drained soils where excess water has been removed by tile, surface drains, or both (fig. 4). Land smoothing is also needed in some areas.

Control of erosion.—Controlling erosion is one of the main management needs in Stark County (fig. 5). Erosion is a hazard on gently sloping to very steep soils. About 62 percent of the acreage that is suitable for cultivated crops is susceptible to erosion. Practices of erosion control commonly used in the county are constructing diversions, terraces, and waterways, contour stripcropping, contour tillage, minimum tillage, utilizing crop residue, and planting close-growing crops.

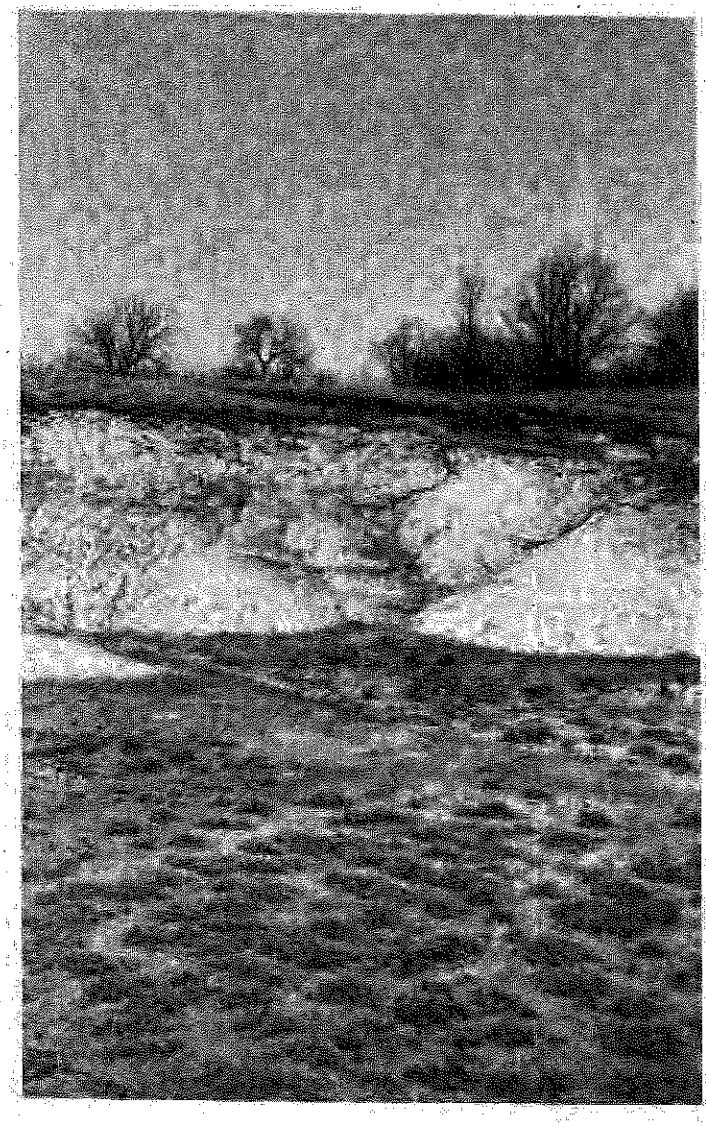

Figure 5.—An area of a Licking silt loam that has been eroded.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Stark County.)

Class VI soils have very severe limitations that make them generally unsuited to cultivation and that restrict their use largely to pasture, range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

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CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States and not in Ohio, shows that the chief limitation is climate that is too cold or dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-5. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Stark County are described and suggestions for the use and management of the soils are given.

Management by capability units [2]

The soils in Stark County have been placed in 46 capability units. The soils in each unit have about the same limitations, are subject to similar risks of damage, need about the same kind of management, and respond to management in about the same way. Borrow pits, Gravel pits, Quarries, Urban land, and the 16 mapping units that include Urban land have not been placed in a capability unit because they, except Borrow pits, Gravel pits, and Quarries, are generally the sites for industrial, residential, or other community development.

In the following pages each capability unit is described, and management for each is discussed. The names of the soil series represented are given in the description of each capability unit, but this does not mean that all of the soils in a given series are in the unit. To determine the soils in each capability unit, refer to the "Guide to Mapping Units" at the back of this survey. Also, the capability unit assigned to any soil is listed at the end of the description of that soil in the section "Descriptions of the Soils."

[2] By MARVIN BUREAU, soil scientist, Soil Conservation Service.

In the discussions of the capability units, improved and intensive levels of management are mentioned for cropland and pasture. These levels of management are defined in the subsection "Estimated Yields."

Also in the descriptions of the capability units, depth of the root zone refers to the depth of the soil to a high water table, a fragipan layer, a layer of dense clay or compact till, bedrock, or other material that restricts the growth of roots. Reference to low, medium, or high available moisture capacity is related to the normal depth of roots of corn, small grain, or other commonly grown field crops.

These descriptions also point out soil features that limit the use of soils for crops or pasture. Only general recommendations for overcoming the limitations are given. Erosion control or drainage, for example, can be achieved by many methods or combinations of practices on any given field of any kind of soil. For specific information regarding erosion control, artificial drainage, recommended crop varieties, or other management practices, the reader should contact the nearest Soil Conservation Service Office or the Ohio Agricultural Extension Service.

CAPABILITY UNIT I–1

This unit consists of moderately well drained and well drained, nearly level soils on stream terraces. These soils are in the Glenford, Mentor, and Wheeling series. They generally are above the level of flooding but are subject to occasional flooding in some areas. Erosion, however, is not likely. These soils have a silt loam or loam surface layer.

The soils in this unit have a moderately deep or deep root zone and medium to high available moisture capacity. Water moves through these soils easily, and they seldom are too wet or too dry to be cropped.

These soils are easily worked, and crops on them can be planted fairly early in spring. They have no limitation to use for field crops and pasture. Soil structure can be maintained by using crops that produce large amounts of residue.

The soils in this unit are suited to the field crops and hay and pasture plants commonly grown in the county and to adapted special crops. If management is intensive, cultivated crops can be grown year after year. These soils, particularly the Wheeling soils, are well suited to irrigation by the sprinkler system.

CAPABILITY UNIT IIe–1

This unit consists of moderately well drained and well drained, gently sloping soils on terraces and uplands. These soils are in the Glenford, Mentor, Wellston, Wheeling, and Wooster series. They have a silt loam or loam surface layer.

These soils have a deep root zone and are easy to work. Available moisture capacity is medium to high, and permeability is moderate to moderately slow. Runoff is rapid.

The hazard of erosion is the major limitation to use of these soils. In cultivated areas, particularly on long slopes, practices of erosion control are needed. In frequently cultivated areas, practices also are needed for

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maintaining fertility, good soil structure, and organic-matter content.

The soils in this unit are suited to the crops and the hay and pasture plants commonly grown in the county. If management is intensive, cultivated crops, including special crops, can be grown frequently. Where management is less than intensive, the cropping sequence should include close-growing crops, grasses, and legumes. Returning large amounts of crop residue to the soil is necessary for maintaining tilth and controlling erosion. These soils are well suited to early pasture and to irrigation by the sprinkler system.

CAPABILITY UNIT IIe-2

In this unit are moderately well drained, gently sloping soils that occur on terraces and uplands and have a fragipan. These soils are in the Canfield and Rainsboro series. They have a silt loam surface layer.

In these soils the root zone and the available moisture capacity are limited by the dense, firm fragipan in the lower part of the subsoil. Permeability is moderate to a depth of 15 to 30 inches, but it is moderately slow in the fragipan. Runoff is rapid. Good tilth is easy to maintain on these soils.

The hazard of erosion limits the use of these soils for row crops, particularly on long slopes that have a gradient of about 6 percent. Seasonal wet spots occur near the base of some slopes and along waterways.

The soils in this unit are suited to the field crops, special crops, and the hay and pasture plants commonly grown in the county. If management is intensive, cultivated crops, including special crops, can be grown frequently. Where management is less than intensive, the cropping sequence should include a small grain or another close-growing crop, and sod or pasture crops that help to maintain soil structure and organic-matter content and to control erosion.

The general farm crops grow better on these soils if the seep spots are drained by a random tile system. Areas used for special crops of high value generally require a complete tile system of drainage. Grasses and legumes that tolerate some wetness should be included in the seeding mixture.

CAPABILITY UNIT IIe-3

This unit consists of well-drained, gently sloping soils that occur on outwash plains or on stream terraces that normally are above flood stage. These soils are in the Bogart and Chili series. They have a silt loam or loam surface layer and are underlain by sandy and gravelly material.

Water moves through these soils at a moderately rapid rate. Their available moisture capacity and root zone are limited by the depth to coarse-textured material. These soils warm up early in spring, are easy to work, and crops on them respond well to good management. Erosion is a moderate hazard. Plant nutrients are easily removed from these soils by leaching.

The soils in this unit need management that controls erosion, conserves moisture, maintains or improves the content of organic matter, and maintains fertility. Mechanical practices for controlling erosion are difficult or impractical in many areas because of the complex slopes.

These soils are suited to the crops commonly grown in the county and to adapted special crops. Because the available moisture capacity is limited, crops that mature early are better suited than crops that mature late in summer. Row crops can be grown frequently if erosion is controlled, if crop residue is used, and if fertility is maintained at the highest possible level. These soils are well suited to sprinkler irrigation. To provide forage in dry periods, the seeding mixture for hay or pasture should include grasses and legumes that are deep rooted and drought tolerant.

CAPABILITY UNIT IIe-4

The soils in this capability unit are moderately well drained or well drained and are gently sloping. These soils are in the Canfield, Dekalb, Gilpin, Loudonville, and Muskingum series. They occur in the glaciated and the unglaciated areas of uplands, and they have a sandy loam or silt loam surface layer.

The soils in this unit have a moderately deep root zone and medium to low available moisture capacity. Except for the Canfield soil, permeability is moderate to rapid throughout the profile; it is moderately slow in the fragipan of the Canfield soil. Erosion is a moderate hazard, particularly on long slopes that have a gradient of about 6 percent.

In addition to controlling erosion on all the soils, artificial drainage is needed in areas of the Canfield and Loudonville soils that are subject to seepage. In some places bedrock interferes with the installation of tile drains.

This group of soils is suited to the crops generally grown in the county. Because available moisture capacity is limited, plants do not grow well in some areas in summer. Cultivated crops can be grown frequently if the level of management is intensive. Where management is less than intensive, the cropping sequence should include a small grain or some other close-growing crop, and a sod crop or pasture. This cropping sequence helps to control erosion and to maintain soil structure and organic-matter content. Seeding hay and pasture plants that can withstand drought helps to increase the production of forage during dry periods.

CAPABILITY UNIT IIe-5

Keene silt loam, 2 to 6 percent slopes, is the only soil in this capability unit. It occurs on terraces and uplands in the unglaciated part of the county and is moderately well drained.

This soil has a moderately deep to deep root zone and medium available moisture capacity. Permeability is moderately slow in the surface layer and slow in the subsoil. Runoff is rapid, and erosion is a moderate hazard. Crops grown on this soil generally do not respond so well to good management as those grown on the other soils in capability subclass IIe.

The hazard of erosion limits the use of this soil for cultivated crops, particularly on long slopes that have a gradient of about 6 percent. Wetness caused by seeps

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is also a limitation in some areas, and tile lines are needed to drain these areas. In cultivated areas, practices are needed for maintaining fertility at a high level and for producing large amounts of crop residue. Also needed are practices that dispose of excess water safely and that help to control erosion.

This soil is only moderately well suited to cultivated crops, but it is well suited to adapted grasses and legumes grown for hay and pasture. Because this soil is slow to warm in spring, planting is frequently delayed. Moisture that is available to plants is likely to be limited late in the growing season.

CAPABILITY UNIT IIe–6

Only Arkport fine sandy loam, 0 to 6 percent slopes, is in this capability unit. It occurs on kames, terraces, and glacial outwash plains and is well drained.

This soil has a deep root zone and low or very low available moisture capacity. Permeability is rapid. This soil dries out and warms up early in spring, but it tends to be droughty in summer and is easily leached of plant nutrients. Water erosion and soil blowing are hazards.

A moderate hazard of erosion is the major limitation to use of this soil for cultivated crops, and its control is of primary importance, but other concerns are conserving moisture and maintaining the organic-matter content. Vegetation, in addition to helping control erosion, helps to conserve moisture and to maintain the organic-matter content.

The crops that are commonly grown in the county can be grown on this soil. Because the soil tends to be droughty, crops that mature early are better suited than crops that mature late in summer. If erosion is controlled, cultivated crops can be grown frequently. Special crops generally require irrigation. Deep-rooted plants that can withstand droughts should be seeded for good production of hay and pasture.

CAPABILITY UNIT IIe–7

The only soil in this unit is Rittman silt loam, 2 to 6 percent slopes. It is moderately well drained and has a fragipan.

This soil has a moderately deep root zone and medium available moisture capacity within the root zone. Permeability is slow. The dense, compact fragipan in the subsoil restricts the penetration of roots and the movement of water. Runoff is rapid. Surface crusting is likely in cultivated areas.

A moderate hazard of erosion is the major limitation to the use of this soil for field crops, but seasonal wetness caused by seepage is also a limitation in some areas. Random tile lines can be used to drain seeps, but water moves slowly into the tile lines.

This soil is suited to the field crops and the hay and pasture plants commonly grown in the county. It is less well suited to special crops than are the soils in capability unit IIe–2. Cultivated crops can be grown frequently on this soil if management is intensive. Grasses and legumes that withstand some wetness are suitable for hay and pasture.

CAPABILITY UNIT IIw–1

This unit consists of somewhat poorly drained, level to gently sloping Fitchville soils that occur on low stream terraces and in drainageways and basins on uplands. These soils have a silt loam surface layer. Some of the lower lying areas are subject to flooding.

The soils in this unit have a deep root zone, a seasonal high water table, and medium to high available moisture capacity. Water moves through these soils at a moderately slow rate.

Poor natural drainage is the main limitation to the use of these soils, but erosion is a hazard in the gently sloping areas. Tile lines generally provide adequate drainage, but a combination of diversion terraces, shallow ditches, and tile drains are needed in some places.

If drainage is adequate, these soils are suited to most crops commonly grown in the county. If management is intensive, cultivated crops can be grown frequently. Returning large amounts of residue to the soil is necessary for maintaining soil structure, good tilth, and the content of organic matter. If these soils are worked or grazed when they are too wet, they are compacted, soil structure breaks down, tillage is more difficult, and the pasture is less productive. In the gently sloping, cultivated areas, practices used for controlling erosion should not cause additional wetness. If drainage is inadequate, these soils are better suited to pasture or hay than to row crops. In these areas seeding mixtures should include grasses and legumes that tolerate some wetness.

CAPABILITY UNIT IIw–2

This unit consists of somewhat poorly drained, level to gently sloping soils that have a fragipan. These soils are in the Ravenna and Weinbach series. They occur on uplands and on outwash plains and terraces. These soils have a silt loam surface layer. In a few areas the Weinbach soils are shallow to fine-textured material.

The soils in this unit have a high water table in winter and spring. Available moisture capacity is medium. Permeability is moderately slow in the dense, firm fragipan; internal drainage and the penetration of roots are also restricted in this layer.

Somewhat poor natural drainage is the main limitation to the use of these soils, but they generally can be drained adequately by installing tile lines. Erosion is a slight hazard in cultivated areas of the gently sloping soils.

This group of soils is suited to most of the crops commonly grown in the county if drainage is adequate. These soils are also suited to adapted hay and pasture plants. If management is intensive, cultivated crops can be grown frequently. Soil structure, tilth, and organic-matter content can be maintained by using crops that produce large amounts of residue. The control of erosion should be stressed in the management of the gently sloping soils, but these practices should not add to the wetness of the soils. Grasses and legumes grow better where excess water has been removed by shallow ditches, furrows, or tile lines.

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CAPABILITY UNIT IIw–3

Shoals silt loam is the only soil in this unit. It is level or nearly level and somewhat poorly drained. It occurs on bottom lands and is subject to occasional flooding, particularly in winter and early in spring.

This soil has a deep root zone when the water table is low. Available moisture capacity is high. Runoff is slow, and the water table is seasonally high.

Flooding and the resulting wetness are the major limitations to use of this soil. The water table, particularly in the early part of the growing season, can be lowered by installing tile drains where outlets are available. Diversion terraces or ditches can be used to intercept excessive runoff from nearby higher areas.

Where floods are not damaging and drainage is adequate, this soil is well suited to most of the crops commonly grown in the county. Crops grown in summer are seldom damaged by flooding. If management is intensive, cultivated crops can be grown year after year.

Hay and pasture plants grow well on this soil. The seeding mixtures should include water-tolerant plants. In dry weather, plants grow better on this soil than on most soils of the uplands, but controlling weeds is difficult in many places.

CAPABILITY UNIT IIw–4

Canfield silt loam, 0 to 2 percent slopes, is the only soil in this unit. It occurs on uplands and has a fragipan. This soil is moderately well drained.

This soil has a dense, firm layer in the lower part of the subsoil that restricts the penetration of roots and limits the amount of moisture available to plants. Permeability is moderate in the upper part of the subsoil, is moderately slow in the lower part, and is moderately slow to moderate in the underlying glacial till. This soil has a perched water table during long wet periods.

Wetness limits the use of this soil for cultivated crops. Generally, the soil is slower in drying out and warming up in spring than the other nearly level, moderately well drained soils in the county. Tile drains are needed in some places, particularly where special crops are grown.

This soil is suited to the field crops and the hay and pasture plants commonly grown in the county. If management is intensive, cultivated crops can be grown year after year. Good tilth and soil structure can be maintained by using crops that produce large amounts of crop residue. The grasses and legumes that are seeded for hay and pasture should include some plants that can withstand wetness.

CAPABILITY UNIT IIw–5

This unit consists of moderately well drained and well drained, nearly level soils on bottom lands. These soils are in the Chagrin and Lobdell series. They have a loam or silt loam surface layer. These soils are subject to occasional flooding, especially in winter and early in spring.

The soils in the unit have a deep root zone. Available moisture capacity is high. These soils are easy to work and to maintain, and they are suitable for planting fairly early in spring.

Flooding is the only limitation to use of these soils for field crops and pasture. The Lobdell soils are generally wetter in winter than the Chagrin soils and are somewhat slower to dry out in spring. Crusting is less likely on the loams than on the silt loams. Diversion terraces or ditches along the base of slopes help to intercept runoff from higher, nearby areas.

The soils in this unit are suited to the field crops and the hay and pasture plants commonly grown in the county. They can be cultivated continuously if management is intensive. In dry periods plants generally grow better on these soils than on most of the other soils on uplands in the county, but controlling weeds is likely to be more difficult. These soils are well suited to irrigation by the sprinkler system.

CAPABILITY UNIT IIw–6

In this unit are dark-colored, very poorly drained, nearly level soils in the Luray series. These soils formed in material deposited by water. They have a silt loam surface layer. Flooding is a hazard in some local areas.

These soils have a moderately deep to deep root zone. The available moisture is high, and permeability is moderately slow in the subsoil. Surface runoff is slow, and the water table is high most of the year. These soils have a high content of organic matter.

Excessive wetness is the main limitation to use of these soils, but maintaining soil structure and tilth is also important if they are cropped. These soils can be worked only within a narrow range of moisture content. They are easily compacted or made cloddy if they are worked with heavy machinery or grazed when too wet. Tile lines and open ditches are generally needed for drainage. In many places runoff from adjacent, higher areas can be intercepted and diverted from these soils.

Unless these soils are drained, they generally are too wet for cultivated crops. If drainage is adequate and management is intensive, cultivated crops can be grown frequently or even year after year. Pasture and hay plants grow well in areas that have been drained by ditches, tile, or both. The seeding mixtures should contain water-tolerant grasses and legumes. Trees and plants that provide food and cover for wildlife can be grown where crops or pasture are not feasible.

CAPABILITY UNIT IIs–1

This unit consists of well-drained, nearly level soils on outwash plains and terraces that are normally above flood stage. These soils are in the Bogart and Chili series. They have a loam or silt loam surface layer and are relatively shallow to sand and gravel.

The soils in this unit have a moderately deep root zone. The available moisture capacity is low in all of these soils, but it is significantly higher in the Chili silt loam than in the Chili loam. All of these soils are easy to work, and crops on them respond well to good management.

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Conserving moisture is the chief concern in managing these soils, but practices are also needed for maintaining or improving fertility and the organic-matter content. Plant nutrients are more easily leached from these soils than from the finer textured soils in the county.

This group of soils is suited to the field crops and hay and pasture plants commonly grown in the county, and to adapted special crops. If management is intensive, cultivated crops can be grown frequently. Because of droughtiness, crops that mature early grow better on these soils than crops that mature late in summer and early in fall. Crop growth is less than normal in dry periods. Returning large amounts of crop residue to the soil and maintaining fertility should be stressed in the management of these soils. Seeding mixtures for hay and pasture should include drought-resistant plants. These soils are well suited to irrigation by the sprinkler system.

CAPABILITY UNIT IIIe-1

This unit consists of well drained and moderately well drained, sloping soils on terraces and uplands. These soils are in the Arkport, Bogart, Chili, Loudonville, Wellston, and Wooster series. They have a surface layer of silt loam, gravelly loam, or fine sandy loam. The Chili and Arkport soils are underlain by sand, gravel, or both. A few of the soils are moderately eroded.

These soils have a moderately deep or deep root zone. The available moisture capacity is very low to high. It is lowest in the Arkport and Chili soils and highest in the Wooster soils. Runoff is moderately rapid from all of these soils.

A hazard of erosion is the main limitation to use of these soils. In addition to controlling erosion, practices are needed to maintain soil structure and fertility. Because the Chili soils are on irregular, complex slopes, controlling erosion is more difficult on them than on the other soils in this unit.

This group of soils is suited to most of the crops commonly grown in the county and to adapted hay and pasture plants. They are poorly suited to special crops unless management is very intensive. If erosion is controlled and management is intensive, cultivated crops can be grown frequently. Intensive management for field crops provides close-growing crops, grasses, and legumes and returns large amounts of crop residue to the soil. In hay meadows and in pastures, erosion is controlled by maintaining an adequate plant cover. In dry periods, forage yields are generally lower on the Arkport and Chili soils than on the other soils in this unit.

CAPABILITY UNIT IIIe-2

This unit consists of somewhat poorly drained and moderately well drained, sloping soils that have a fragipan. These soils occur on uplands. They are in the Canfield, Rainsboro, Tilsit, and Wadsworth series. They have a silt loam surface layer, and some are moderately eroded.

These soils have a fragipan in the lower part of the subsoil that restricts the penetration of roots and the movement of water. It also limits the amount of moisture that is available to plants. Runoff is rapid from these soils.

A hazard of erosion, particularly on long slopes, is the major limitation to the use of these soils. Wetness caused by seepage is also a limitation, especially on the Wadsworth soils. Wet spots generally occur at the base of slopes early in spring, but these areas can be drained by tile. In cultivated areas, practices also are needed for maintaining fertility, good soil structure, and the content of organic matter.

The soils in this unit are suited to most of the field crops and the hay and pasture plants commonly grown in the county. Unless management is very intensive, they are not well suited to special crops. If management is intensive, cultivated crops can be grown frequently. Intensive management provides close-growing crops, grasses, and legumes and returns large amounts of crop residue to the soil. In areas used for hay or pasture, erosion is controlled by maintaining an adequate plant cover for protection. Seeding mixtures should include grasses and legumes that tolerate some wetness.

CAPABILITY UNIT IIIe-3

This unit consists of moderately well drained and well drained, sloping soils on uplands in the unglaciated southern part of the county. These soils are in the Brooke, Canfield, Dekalb, Gilpin, and Muskingum series. They have a silty clay loam, silt loam, or sandy loam surface layer. These soils are relatively shallow to bedrock. The Brooke soil is moderately eroded.

The soils in this unit have a moderately deep root zone. The available moisture capacity is low to medium.

A severe hazard of erosion is the main limitation to use of these soils for cultivated crops. Practices for the control of erosion should be those that also help to improve the available moisture capacity of the soil. Seep spots occur in some areas of Canfield soils early in spring. These areas, however, can be drained by tile if bedrock does not interfere with the installation of the tile.

The soils in this unit are suited to most of the crops commonly grown in the county, and to hay and pasture plants. Cultivated crops can be grown frequently if erosion is controlled. Erosion is reduced by intensive management that provides close-growing crops, grasses, and legumes and returns large amounts of crop residue to the soil. Seeding mixtures should include some drought-tolerant plants.

CAPABILITY UNIT IIIe-4

Latham silt loam, 2 to 6 percent slopes, is the only soil in this unit. It is well drained and moderately deep to shale bedrock.

This soil has a moderately deep root zone in most places. The available moisture capacity is medium to low. Permeability is slow in the subsoil, and water moves slowly through the soil. This soil is slow to warm up in spring, but it tends to be droughty in dry periods.

Erosion is the main limitation to use of this soil for cultivated crops; another limitation is droughti-

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ness. Maintaining good soil structure and tilth are also concerns of management.

This soil is suited to most of the crops commonly grown in the county. It is well suited to adapted hay and pasture plants. If management is intensive, cultivated crops can be grown frequently. The cropping system should include close-growing crops, grasses, and legumes. Seeding mixtures should contain some grasses and legumes that can withstand wetness and some that are drought tolerant.

CAPABILITY UNIT IIIe-5

This unit consists of well-drained to somewhat poorly drained, sloping soils on stream terraces and in dissected areas of slack water. These soils are in the Fitchville, Glenford, Licking, Mentor, and Wheeling series. They have a loam or silt loam surface layer. Some areas are moderately eroded.

The soils in this unit have a moderately deep or deep root zone. The available moisture capacity is medium to high. Permeability is moderate to slow. Surface crusting is likely.

A severe hazard of erosion is the main limitation to the use of these soils for cultivated crops, and its control is important. Also needed are practices that help to maintain soil structure and good tilth.

These soils are well suited to most field crops and to the hay and pasture plants commonly grown in the county. If erosion is controlled, cultivated crops can be grown frequently. The cropping system should include close-growing crops, grasses, and legumes.

CAPABILITY UNIT IIIe-6

This unit consists of moderately well drained, sloping soils in the Keene series. These soils are on uplands and old high terraces. They have a silt loam surface layer and a clayey subsoil. Some areas are moderately eroded.

These soils have a clayey subsoil that restricts the penetration of roots and slows the movement of water. Permeability is moderately slow to slow in the subsoil. Runoff is moderately rapid, and only a limited amount of water is absorbed by the soil. These soils are slow to warm up in spring. They can be worked only within a narrow range of moisture content.

A severe hazard of erosion is the major limitation to use of these soils, and its control is important, particularly on long slopes. Some wet spots may need drainage early in spring; tile can be used for drainage. The surface layer of the moderately eroded soil has a high content of clay, is low in organic-matter content, and is difficult to work.

This group of soils is only moderately well suited to cultivated crops but is well suited to adapted hay and pasture plants. If management is intensive, cultivated crops can be grown frequently. Practices for controlling erosion, conserving moisture, and maintaining good tilth should be stressed in the management of these soils. Seeding mixtures for hay and pasture should contain water-tolerant and drought-tolerant grasses and legumes. Forage plants are more likely to be killed on these soils in winter than on the other moderately well drained, sloping soils in the county.

CAPABILITY UNIT IIIe-7

This unit consists of moderately well drained, light-colored, sloping soils that have a fragipan. These soils are in the Rittman series. They have a silt loam surface layer, and some of them are moderately eroded.

These soils have a moderately deep root zone, a seasonal high water table, and medium available moisture capacity. Permeability is slow in the subsoil and the underlying material. Runoff is rapid. The organic-matter content is low, and surface crusting is common.

The use of these soils for cultivated crops is limited mainly by a severe hazard of erosion, but seep spots and seasonal wetness are also limitations.

If management is intensive, the soils in this unit are suited to most field crops and hay and pasture plants. They are not well suited to special crops. In areas used for hay or pasture, an adequate plant cover must be maintained for the control of erosion. Grasses and legumes that can withstand some wetness should be grown on these soils.

CAPABILITY UNIT IIIw-1

This unit consists of somewhat poorly drained and moderately well drained, nearly level to gently sloping soils in the Licking and Remsen series. These soils have a silt loam surface layer and a moderately fine textured to fine textured subsoil.

The soils in this unit have a moderately deep or deep root zone. Available moisture capacity is medium to high. Permeability is slow in the subsoil, and water moves slowly through these soils.

Wetness is the main limitation to the use of these soils. In addition to drainage, practices that help to maintain soil structure and tilth are desirable. Erosion is a hazard on the gently sloping Remsen soil. The soils in this unit puddle and become cloddy if they are worked or grazed when wet. Tile and open ditches can be used for drainage, but drainage by tile is slow.

Drained areas of these soils are suited to most of the crops commonly grown in the county and to adapted hay and pasture plants. If management is intensive, cultivated crops can be grown frequently. Drainage and returning large amounts of crop residue to the soil should be stressed in the management of these soils.

CAPABILITY UNIT IIIw-2

This unit consists of somewhat poorly drained, level to sloping soils that have a fragipan. These soils are in the Wadsworth series and Wadsworth series, moderately shallow variant. They have a silt loam surface layer.

The soils in this unit have a moderately deep root zone. Permeability is slow, and available moisture capacity is medium.

A seasonal high water table is the main limitation to the use of these soils for cultivated crops, but erosion is a hazard on the stronger slopes. Practices are needed for maintaining good soil structure and tilth. The soils in this unit are generally more difficult to drain than are the soils in capability unit IIw–2.

If these soils are adequately drained, they are

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suited to most of the crops grown in the county. If management is intensive, cultivated crops can be grown frequently. Returning large amounts of crop residue to the soil is necessary for maintaining good soil structure, tilth, and organic-matter content. If these soils are worked or pastured when too wet, they become compacted and soil structure breaks down, which makes tillage more difficult and the pasture less productive. Practices for controlling erosion should not cause additional wetness.

These soils are suited to adapted grasses and legumes grown for hay and pasture, but forage grows better in drained areas than in undrained areas.

CAPABILITY UNIT IIIw–3

This unit consists of poorly drained and very poorly drained, nearly level soils. These soils are in the Killbuck, Sloan, Wallkill, and Wayland series. They occur on bottom lands and are subject to flooding. Their surface layer is silt loam. The Sloan and Wallkill soils are dark colored.

The soils in this unit have a deep root zone when the water table is low. The water table is at or near the surface most of the year. Available moisture capacity is high. Permeability is moderate to slow, and runoff is very slow or ponded. These soils have a high capacity for storing and releasing plant nutrients.

Excessive wetness is the primary limitation to the use of these soils for cultivated crops. In addition to drainage, practices are needed to maintain good soil structure and tilth. Because these soils are in low areas, they are difficult to drain in many places. Tile and surface drains are generally needed for adequate drainage. Wetness can be reduced by diverting runoff from nearby high areas. These soils are damaged if they are tilled or pastured when too wet.

In areas where flooding is infrequent and drainage is adequate, these soils are suited to row crops and to adapted pasture plants. Flooding can damage winter grain. If management is intensive, cultivated crops can be grown year after year. Shallow-rooted plants that can tolerate wetness are the most suitable for seeding pasture. Areas that cannot be drained are suited to adapted plants that provide food and cover for wildlife.

CAPABILITY UNIT IIIw–4

The soils in this unit are poorly drained and nearly level or depressional. They occur on terraces and uplands and are in the Ginat and Sebring series. These soils have a silt loam surface layer.

The soils in this unit have a moderately deep or deep root zone. The available moisture capacity is medium. Permeability is moderately slow or slow in the subsoil. These soils have a seasonal high water table and are very slow to dry. Runoff is slow or very slow.

Poor natural drainage and the resulting wetness are the main limitations to use of these soils, but maintaining soil structure, tilth, and a high level of fertility are also concerns in cultivated areas. Surface wetness can be reduced by digging shallow ditches and by installing diversions where runoff from higher areas is a hazard. Tile drains are generally needed in areas used for cultivated crops. These soils can be drained moderately well by tile drains where adequate outlets are available.

Drained areas of these soils are moderately well suited to most crops grown in the county, but these soils are poorly suited to special crops. Intensive management includes growing crops that produce large amounts of residue and returning the residue to the soil. Water-tolerant pasture and hay plants can be grown on these soils, but they grow better in drained or partly drained areas. Areas that are too wet for pasture are suited to adapted plants that provide food and cover for wildlife.

CAPABILITY UNIT IIIw–5

This unit consists of very poorly drained, dark-colored, organic soils that have a muck surface layer. These soils are in the Carlisle, Edwards, Linwood, and Willette series. They occupy level and basinlike areas in the glaciated part of the county. The Carlisle, Linwood, and Willette soils are underlain by mineral material, and the Edwards soil is underlain by marl.

These soils have a moderately deep or deep root zone and high or very high available moisture capacity. Under natural conditions, they have a high water table most of the year. Permeability is variable. These soils are subject to soil blowing and to damage by fire during dry periods.

Figure 6.—An open ditch draining an area of Carlisle muck near Hartville.

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These soils mainly need management that provides artificial drainage and the control of the water table so that subsidence of the muck is reduced. Tile, open ditches, or both of these, generally are suitable for drainage (fig. 6). Diversion ditches or waterways can be constructed to intercept the runoff from adjacent higher areas and to prevent temporary flooding. Because several variable factors affect drainage on these muck soils, a drainage specialist generally needs to be consulted so that the drainage system is properly designed and installed.

Where adequately drained, these soils are suited to most crops commonly grown in the county and to adapted special crops. If managed intensively, these soils can be continuously cultivated. Intensive management should include cover crops between row crops for protection against soil blowing. Frost damage is more likely on these low-lying soils than on higher soils. These soils generally are well suited to irrigation.

Partly drained areas of these soils are suited to adapted hay and pasture plants. Some areas that cannot be drained, or that are subject to frequent flooding, can be developed for permanent pasture. Areas that are too wet for pasture are well suited to plants that provide food and cover for wildlife.

CAPABILITY UNIT IIIw–6

Montgomery silty clay loam is the only soil in this unit. It is very poorly drained, dark colored, and nearly level. This soil occurs on stream terraces and in areas of old glacial fill deposited by slack water.

This soil has a deep root zone when the water table is low. The available moisture capacity is high within the root zone. Permeability is slow. The water table is at or near the surface in winter and spring, and the surface is ponded in some places. This soil can be worked only within a narrow range of moisture content. Its content of organic matter is high, and surface crusting is not likely.

Excessive wetness is the major limitation to the use of this soil for cultivated crops. Artificial drainage is needed. Tile can be used for drainage in most places, and ponding can be reduced by digging shallow ditches.

If this soil is drained, it is suited to the field crops commonly grown in the county. It is suited to adapted hay and pasture plants that can withstand wetness. If management is intensive, cultivated crops can be grown year after year. This soil is likely to become cloddy if it is worked when too wet.

CAPABILITY UNIT IIIs–1

This unit consists of well-drained, level to sloping Conotton soils on outwash plains and terraces. These soils have a loam or gravelly loam surface layer, and they are underlain by sand and gravel.

These soils have a moderately deep to deep root zone and are easy to work. Available moisture capacity is low. Permeability is rapid, and water moves rapidly through the soil. These soils have a low capacity for storing and releasing plant nutrients. They dry out rapidly and warm up early in spring.

Droughtiness is the principal limitation to use of these soils, but erosion is a slight hazard on the gently sloping soils. Returning large amounts of crop residue to these soils is necessary for maintaining moisture.

The soils in this unit are suited to most crops commonly grown in the county and to adapted special crops. If management is intensive, cultivated crops can be grown frequently, and they grow well. Conserving moisture should be stressed in the management of these soils. Because of droughtiness, crops that mature early are better suited than crops that mature late in summer, unless irrigation is provided. Drought-resistant hay and pasture plants can be grown on these soils, but they do not grow well in dry periods unless they are irrigated.

CAPABILITY UNIT IVe–1

This unit consists of well drained and moderately well drained, moderately steep soils on terraces and uplands. These soils are in the Arkport, Chili, Glenford, Mentor, Wheeling, and Wooster series. They have a fine sandy loam, gravelly loam, or silt loam surface layer. Most of the soils are moderately eroded.

The soils in this unit have a moderately deep or deep root zone. Available moisture capacity is very low to high. Permeability is moderately rapid in the Arkport soil, moderately rapid in the Chili soil, moderately slow in the Glenford soil, and moderate in the Mentor, Wheeling, and Wooster soils. Runoff is rapid.

A very severe hazard of erosion is the primary limitation to the use of these soils for cultivated crops, but other concerns include maintaining good tilth and a high level of fertility.

The soils in this unit are suited to the crops commonly grown in the county. If management is intensive, cultivated crops can be grown at infrequent intervals, but grasses and legumes should be grown most of the time so as to help to control erosion. A row crop can be grown occasionally if erosion is controlled. An adequate protective cover is needed in winter. Row crops grown on these soils are more likely to be damaged by drought than are row crops grown on the less sloping soils of the same series.

These soils are well suited to adapted grasses and legumes grown for hay and pasture. If management is good, these plants provide excellent cover that helps to control erosion. During dry periods, however, especially on the Chili and Arkport soils, growth of these plants is limited.

CAPABILITY UNIT IVe–2

This unit consists of moderately well drained, strongly sloping soils that have a fragipan. These soils are in the Canfield, Rittman, and Tilsit series. They occur mainly on uplands, but some are on old terraces in the southern part of the county. These soils have a silt loam surface layer, and some of them are moderately eroded.

The soils in this unit have a dense, firm fragipan in the subsoil that restricts the penetration of roots and the movement of water and limits the amount of moisture that is available to plants. Runoff is rapid.

A severe hazard of erosion is the primary limitation

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to the use of these soils. In addition to erosion control, practices are needed for maintaining fertility and good soil tilth.

These soils are suited to the crops commonly grown in the county. They are well suited to adapted grasses and legumes grown for hay and pasture. If management is intensive, cultivated crops can be grown occasionally. However, close-growing crops, grasses, and legumes should be grown most of the time to help control erosion. Returning large amounts of crop residue to the soil improves soil structure and the infiltration of water and helps to control erosion. Because a good plant cover is needed in hay meadows and pastures, grazing should be regulated so as to maintain enough vegetation for the control of erosion.

CAPABILITY UNIT IVe-3

In this unit are moderately well drained and well drained, sloping to steep soils on uplands, mainly in the unglaciated southern part of the county. These soils are in the Dekalb, Gilpin, Loudonville, and Muskingum series. They have a sandy loam or silt loam surface layer. Most of these soils are moderately deep to bedrock, and some are moderately eroded.

The soils in this unit have a moderately deep root zone and low available moisture capacity. They are strongly acid.

A very severe hazard of erosion is the major limitation to use of these soils, but droughtiness is also a concern. Practices that will help to increase the amount of moisture available to plants are needed for the control of erosion. Also needed are practices that help to maintain a high level of fertility and that return large amounts of crop residue to the soil.

If management is intensive, the soils in this unit are suited to most crops commonly grown in the county and to adapted grasses and legumes grown for hay or pasture. Because of the limited moisture capacity and the hazard of erosion on these soils, winter grain and close-growing forage crops are better suited than row crops. Close-growing crops, grasses, and legumes should be grown most of the time. Drought-resistant grasses and legumes should be included in the seeding mixtures.

CAPABILITY UNIT IVe-4

This unit consists of moderately well drained and well drained, sloping to moderately steep soils on uplands and old high terraces. These soils are in the Geeburg, Keene, Latham, and Licking series. They have a silt loam surface layer. Some of these soils are moderately eroded.

The soils in this unit have a clayey subsoil through which the penetration of roots and the movement of water is restricted. Permeability is slow in the subsoil. Runoff is rapid from these soils, and they absorb a very limited amount of rainfall. These soils are slow to warm up in spring. If worked or pastured when too wet, they become compacted and cloddy. The moderately eroded soils have a clayey surface layer, are low in organic-matter content, and are difficult to till.

The major limitation to the use of the soils in this unit is a very severe hazard of erosion, particularly on the longer slopes. In some places wetness caused by seepage is a concern early in spring.

The soils in this unit are moderately well suited to the crops commonly grown in the county. A row crop can be grown occasionally, provided management is intensive and includes practices for controlling erosion. Close-growing crops, grasses, and legumes should be kept on the soils most of the time. Large amounts of crop residue are needed to maintain soil structure, tilth, and content of organic matter and to help control erosion.

CAPABILITY UNIT IVw-1

This unit consists of poorly drained, nearly level soils. These soils are in the Canadice and Trumbull series. They occupy low-lying areas scattered throughout the glaciated part of the county. These soils have a silt loam surface layer and a clayey subsoil.

The soils in this unit have a moderately deep or deep root zone when the water table is low. Available moisture capacity is medium. Permeability is slow in the subsoil. Runoff is slow or ponded. These soils have a high water table most of the year, and they dry out and warm up very slowly. If they are tilled or grazed when too wet, they become compacted and cloddy.

Excessive wetness is a primary limitation to the use of these soils. In addition to drainage, practices are needed to maintain soil structure, tilth, and an adequate level of fertility. These soils are poorly suited to drainage by tile, but surface water generally can be reduced by ditches and by intercepting and diverting runoff from nearby higher areas.

Drained areas of these soils are moderately well suited to most of the general farm crops commonly grown in the county. They are poorly suited to special crops, but they are suited to hay and pasture plants. Cultivated crops can be grown at infrequent intervals, provided management is intensive. Grasses and legumes should be grown frequently to provide enough crop residue to help maintain soil structure and tilth. Areas used for hay and pasture generally need some drainage, and they should be seeded to grasses and legumes that can withstand some wetness. Areas that cannot be drained are suited to permanent pasture and to plants that provide food and cover for wildlife.

CAPABILITY UNIT IVs-1

This unit consists of well-drained, nearly level to sloping soils in the Plainfield series. These soils occur on terraces and in outwash areas. They have a loamy sand surface layer and are underlain by sand and gravel.

The soils in this unit have a moderately deep to deep root zone. The available moisture capacity is low or very low. Permeability is rapid. These soils have a low or very low capacity for storing and releasing plant nutrients. They dry out and warm up rapidly in spring, and they are droughty in dry periods.

Droughtiness is the major limitation to the use of

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these soils, but water erosion and soil blowing are also hazards. These porous soils are easily leached of plant nutrients. Practices are needed that will help to increase the content of organic matter, to replace plant nutrients, and to control water erosion and soil blowing.

The soils in this unit are suited to adapted hay and pasture plants. They are limited, particularly those on the steeper slopes, in their use for general farm crops and special crops. These soils need intensive management. Unless irrigated, they are better suited to crops that are planted early in spring and that mature before dry periods than they are to crops that mature late in summer. Maintaining a high level of fertility and returning crop residue to the soil should be stressed in the management of these soils. Drought-resistant grasses and legumes should be grown for hay and pasture. During summer, however, growth of these plants is limited unless irrigation is provided.

CAPABILITY UNIT VIe–1

In this unit are well-drained, sloping to steep soils on terraces and uplands. These soils are in the Chili, Conotton, and Wooster series. They have a gravelly loam or silt loam surface layer. Except for the Wooster soils, which are underlain by glacial till, these soils are underlain by sand or gravel. All of the soils are moderately eroded.

These soils have a moderately deep to shallow root zone in most places. Available moisture capacity is low in the Chili and Conotton soils, but it is medium to high in the Wooster soils. Permeability is moderately rapid to very rapid in all of these soils.

Erosion is a severe limitation to use of all of these soils. The Chili and Conotton soils are also limited by droughtiness.

The soils in this unit generally are not suited to cultivated crops. They are suited to drought-resistant hay and pasture plants. Management is needed that maintains fertility and a good plant cover. Care should be taken not to overgraze pasture.

CAPABILITY UNIT VIe–2

This unit consists of moderately well drained and well drained, sloping to steep soils on terraces and uplands. These soils are in the Brooke, Geeburg, Keene, Latham, and Licking series. They have a silt loam or silty clay loam surface layer and a clayey subsoil. Some of these soils are moderately eroded.

The soils in this unit have a moderately deep to shallow root zone. Permeability is slow in the subsoil. Because runoff is rapid from these soils, little water is absorbed. The water that does move into the soil is held tightly in the clayey subsoil. Consequently, these soils tend to be droughty during much of the growing season.

Because the soils in this unit are sloping to steep and have a severe hazard of erosion, they are not suited to cultivated crops. They are, however, suited to adapted grasses and legumes grown for hay or permanent pasture, provided management is intensive. This management includes practices that maintain an adequate level of fertility and control grazing so as to maintain enough vegetation to control erosion.

CAPABILITY UNIT VIe–3

This unit consists of well-drained, moderately deep, steep soils on uplands, mainly in the unglaciated southern part of the county. These soils are in the Dekalb, Gilpin, Loudonville, and Muskingum series. They have a sandy loam or silt loam surface layer and are underlain mainly by sandstone and siltstone. Some of these soils are moderately eroded, and some are severely eroded.

The soils in this unit have a moderately deep to shallow root zone. Permeability is moderate to moderately rapid above the bedrock. Available moisture capacity is low. These soils dry out rapidly in spring and are likely to be droughty in summer.

Because the soils in this unit are steep and highly susceptible to erosion, they are not suited to cultivated crops. If management is intensive, these soils are suited to drought-resistant grasses and legumes grown for permanent pasture. Erosion is a very severe hazard when pastures are reseeded and when adequate cover is not maintained. Controlling grazing and maintaining fertility are essential on these soils. The use of heavy machinery in the steeper areas is hazardous.

CAPABILITY UNIT VIs–1

The soils in this unit are sloping and moderately steep, shallow, and well drained. They are in the Ramsey and Weikert series and occur in the unglaciated southern part of the county. They have a channery sandy loam and silt loam surface layer.

These soils have a shallow root zone and low to very low available moisture capacity. Permeability is rapid above the bedrock. These soils are droughty during dry periods.

A hazard of erosion and shallowness to bedrock are major limitations to use of these soils. Stones on the surface are likely to interfere with the use of machinery in some places.

The soils in this unit are better suited to permanent vegetation than to other uses, especially the moderately steep soils. All of these soils are moderately well suited to drought-resistant plants grown for pasture, but a good stand is difficult to establish. Permanent pasture does not do well during dry periods and is easily damaged by overgrazing. Maintaining adequate fertility and a protective cover should be stressed in the management of these soils.

CAPABILITY UNIT VIs–2

This unit consists of Strip mine spoil in undulating and rolling areas. The spoil consists of sandstone and shale material and nonacid glacial till material that has been excavated during mining operations. This spoil contains many rock fragments, but it has enough fine material at the surface to support some vegetation. The spoil has been graded to some extent, which has disposed of the largest rocks. The spoil consisting of shale and sandstone material is toxic in some areas.

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The Strip mine spoil in this unit has slow to rapid permeability and, in most places, has medium available moisture capacity. The depth of the root zone varies.

The poor physical condition of the spoil material is the major limitation to the use of this spoil. This material is droughty during dry periods, and erosion is a hazard in the steeper areas. The surface of this spoil generally is too rough for the operation of equipment used for harvesting hay.

This Strip mine spoil is not suited to general farm crops. It has been seeded to grasses or planted to trees. If these areas are pastured, an adequate plant cover should be maintained for the control of erosion.

CAPABILITY UNIT VIIe-1

This unit consists of well-drained, steep and very steep soils on terraces and uplands. These soils are in the Chili and Conotton series. They have a gravelly loam surface layer and are underlain by sand and gravel. These soils are moderately eroded.

The soils in this unit have a moderately deep to shallow root zone and very low available moisture capacity. Permeability is rapid or very rapid.

These soils are highly susceptible to erosion unless they are protected by permanent vegetation. Their suitability for pasture is limited by steepness, roughness, and difficulty in the use of machinery. Some areas can be renovated and reseeded to adapted grasses and legumes, but grazing should be restricted in dry periods so as to maintain the stand. Management is needed that provides an adequate protective cover. These soils are suited to adapted trees and to other vegetation grown for wildlife developments.

CAPABILITY UNIT VIIe-2

The soils in this unit are well drained, moderately deep to shallow, and very steep. They are in the Gilpin and Muskingum series. These soils occur on uplands, mainly in the unglaciated southern part of the county. They have a silt loam surface layer and are underlain by sandstone and siltstone.

These soils have a moderately deep to shallow root zone. The available moisture capacity is low.

The hazard of erosion is very severe on these soils unless a protective cover is maintained. Their suitability for pasture is limited. Because of the slope the use of machines is very difficult in most places and is impossible in some areas. The growth of pasture plants is slow in dry periods. and the pasture is easily damaged by overgrazing. Management is needed that provides an adequate plant cover at all times. Adapted trees and other vegetation can be planted to help control erosion and to provide food and cover for wildlife.

CAPABILITY UNIT VIIs-1

This unit consists of shallow, well-drained, steep and very steep soils on uplands in the unglaciated southern part of the county. These soils are in the Ramsey and Weikert series. They have a channery sandy loam and silt loam surface layer and are moderately eroded.

The soils in this unit have a shallow root zone and very low available moisture capacity. They are extremely droughty.

These soils are highly susceptible to erosion unless a protective cover is maintained. Their use for pasture is limited by steepness, shallowness, and stones on the surface. Maintaining a sod is difficult on these soils, and care should be taken not to overgraze the pasture. Adapted trees and other vegetation can be planted to help control erosion and for wildlife developments. An adequate protective cover is essential on these soils.

CAPABILITY UNIT VIIs-2

This unit consists of Strip mine spoil in undulating, rolling, or steep areas. This spoil is mainly acid clay shale material, but some is sandstone and shale material, and some is nonacid material. All of this spoil material has very low available moisture capacity and is very stony.

The physical condition of the spoil material limits the use of the Strip mine spoil in this unit. Erosion is a severe hazard in the steeper areas. Silty material is washed from areas that are bare and is deposited in adjacent lower areas and streams.

The spoil material in this unit is suited only to trees. Black locust is suitable for planting.

CAPABILITY UNIT VIIIw-1

Only Alluvial land is in this unit. It occupies areas at the edges of the larger streams in the county and is flooded frequently. For esthetic or recreational use, this land has little or no value.

CAPABILITY UNIT VIIIs-1

This unit consists of Cut and fill land and Made land. This land consists of areas where the soil material has been leveled, moved, or removed and of areas where earth or trash, or both, have been dumped. In these areas onsite investigation generally is needed to determine the most suitable use.

Estimated yields

Table 1 shows, for most soils in the county, the estimated average acre yield of principal crops. The yields are the averages of those expected over a period of years under improved and intensive management. Yields are not listed in the table for Alluvial land, Borrow pits, Cut and fill land, Gravel pits, Made land, Quarries, Strip mine spoil, Urban land, and the 16 complexes that include Urban land. These mapping units are not suitable for farming.

In table 1, yields in columns A are those obtained under improved management, and those in columns B are obtained under intensive management. An intensive level of management includes: (1) Practices that increase the intake of water and the water-holding capacity of the soils; (2) the disposal of excess water by approximate means; (3) practices that help to control erosion; (4) suitable methods of plowing, preparing the seedbed, and cultivating; (5) controlling weeds, diseases, and insects; (6) maintaining fertility and the pH content at an optimum level; (7) ap-

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plying the trace elements, such as zinc, cobalt, manganese, and copper, if they are needed; (8) selecting high-yielding crop varieties suited to the soil; and (9) planting, cultivating, and harvesting at the proper time and in the proper way.

In an improved level of management the farmer uses some, but not all, of the practices listed under intensive management, or the practices used are not adequate for the crop. This is the management ordinarily followed by most farmers in the county.

TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are to be expected under an improved level of management; those in columns B, under an intensive level of management. Absence of yield indicates that crop is not commonly grown at that level of management, or that the soil is not suited to the crop specified]

Soil	Corn		Wheat		Oats		Hay		Rotation pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days*[1]	*Cow-acre-days*[1]
Arkport fine sandy loam, 0 to 6 percent slopes	57	97	23	35	50	72	3.0	3.5	150	180
Arkport fine sandy loam, 6 to 12 percent slopes	56	95	23	35	48	70	3.0	3.5	150	180
Arkport fine sandy loam, 12 to 18 percent slopes	53	93	23	35	46	68	3.0	3.5	150	180
Bogart loam, 0 to 2 percent slopes	64	104	25	38	53	75	3.0	4.5	150	230
Bogart loam, 2 to 6 percent slopes	64	104	25	38	53	75	3.0	4.5	150	230
Bogart silt loam, 0 to 2 percent slopes	65	105	25	39	55	76	3.0	4.5	150	230
Bogart silt loam, 2 to 6 percent slopes	65	105	25	39	55	76	3.0	4.5	150	230
Bogart silt loam, 6 to 12 percent slopes	65	105	25	39	55	76	3.0	4.5	150	230
Brooke silty clay loam, 4 to 12 percent slopes, moderately eroded	70	105	26	41	50	63	3.0	4.5	150	230
Brooke silty clay loam, 12 to 25 percent slopes, moderately eroded	68	100	24	40	49	62	3.0	4.5	150	230
Canadice silt loam	43	81	18	28	36	60	1.5	3.0	80	150
Canfield silt loam, 0 to 2 percent slopes	71	105	26	40	60	76	3.0	4.0	150	200
Canfield silt loam, 2 to 6 percent slopes	71	105	26	40	60	76	3.0	4.0	150	200
Canfield silt loam, 6 to 12 percent slopes	70	103	25	39	58	74	3.0	4.0	150	200
Canfield silt loam, 6 to 12 percent slopes, moderately eroded	64	101	23	37	55	70	3.0	4.0	150	200
Canfield silt loam, 12 to 18 percent slopes	67	105	23	37	56	72	3.0	4.0	150	200
Canfield silt loam, 12 to 18 percent slopes, moderately eroded	60	93	21	35	53	68	3.0	4.0	150	200
Canfield silt loam, moderately shallow variant, 2 to 6 percent slopes	69	105	24	38	58	74	3.0	4.0	150	200
Canfield silt loam, moderately shallow variant, 6 to 12 percent slopes	68	94	22	37	56	72	3.0	4.0	150	200
Carlisle muck	85	130	--	--	--	--	--	--	---	---
Chagrin loam, alkaline phase	77	110	26	42	50	74	2.5	4.5	130	230
Chagrin silt loam, alkaline phase	77	115	26	42	50	74	2.5	4.5	130	230
Chili loam, 0 to 2 percent slopes	62	102	25	37	55	74	3.0	4.5	150	230
Chili loam, 2 to 6 percent slopes	62	102	25	37	55	74	3.0	4.5	150	230
Chili gravelly loam, 6 to 12 percent slopes	60	100	24	36	51	68	3.0	4.5	150	230
Chili gravelly loam, 6 to 12 percent slopes, moderately eroded	53	90	22	34	48	66	3.0	4.5	150	230
Chili gravelly loam, 12 to 18 percent slopes, moderately eroded	52	89	21	33	46	64	3.0	4.5	150	230
Chili gravelly loam, 18 to 25 percent slopes, moderately eroded	--	---	--	--	--	--	3.0	4.5	150	230
Chili silt loam, 0 to 2 percent slopes	65	105	26	38	57	76	3.0	4.5	150	230
Chili silt loam, 2 to 6 percent slopes	65	105	26	38	57	76	3.0	4.5	150	230
Chili silt loam, 6 to 12 percent slopes	63	103	25	37	55	72	3.0	4.5	150	230
Chili silt loam, 6 to 12 percent slopes, moderately eroded	57	95	23	35	52	70	3.0	4.5	150	230
Chili and Conotton gravelly loams, 25 to 50 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	4.0	130	200
Conotton loam, 0 to 2 percent slopes	57	97	23	35	50	72	3.0	3.5	150	180
Conotton gravelly loam, 2 to 6 percent slopes	52	90	21	33	45	67	3.0	3.5	150	180
Conotton gravelly loam, 6 to 12 percent slopes	52	90	21	33	45	67	3.0	3.5	150	180
Conotton gravelly loam, 12 to 18 percent slopes, moderately eroded	--	---	--	--	--	--	3.0	3.5	150	180
Conotton gravelly loam, 18 to 25 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	3.0	130	150
Dekalb sandy loam, 2 to 6 percent slopes	60	90	15	35	46	60	2.5	3.0	130	150

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TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats		Hay		Rotation pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Dekalb sandy loam, 6 to 12 percent slopes	60	90	15	35	46	60	2.5	3.0	130	150
Dekalb sandy loam, 12 to 25 percent slopes, moderately eroded	56	85	15	33	44	56	2.5	3.0	130	150
Dekalb sandy loam, 25 to 50 percent slopes, moderately eroded	--	---	--	--	--	--	--	--	100	150
Edwards muck	85	135	--	--	--	--	--	--	---	---
Fitchville silt loam, 0 to 2 percent slopes	60	105	22	36	46	74	2.5	4.0	130	200
Fitchville silt loam, 2 to 6 percent slopes	60	105	22	36	46	74	2.5	4.0	130	200
Fitchville silt loam, 6 to 12 percent slopes	59	100	22	36	46	74	2.5	4.0	130	200
Geeburg silt loam, 6 to 12 percent slopes, moderately eroded	45	65	20	31	40	62	2.0	3.0	100	150
Geeburg silt loam, 12 to 25 percent slopes, moderately eroded	--	---	--	--	--	--	2.0	3.0	200	250
Gilpin silt loam, 2 to 6 percent slopes	68	105	20	40	50	65	2.5	4.5	130	230
Gilpin silt loam, 6 to 12 percent slopes	66	103	20	40	48	65	2.5	4.5	130	230
Gilpin silt loam, 12 to 18 percent slopes	64	101	19	38	47	63	2.5	4.5	130	230
Ginat silt loam	60	83	20	30	40	62	2.0	3.0	100	150
Glenford silt loam, 0 to 2 percent slopes	66	105	24	40	50	76	3.0	4.0	150	200
Glenford silt loam, 2 to 6 percent slopes	66	105	24	40	50	76	3.0	4.0	150	200
Glenford silt loam, 6 to 12 percent slopes	66	105	24	40	50	76	3.0	4.0	150	200
Glenford silt loam, 6 to 12 percent slopes, moderately eroded	64	102	22	37	47	73	3.0	4.0	150	200
Glenford silt loam, 12 to 18 percent slopes, moderately eroded	63	100	21	36	45	70	3.0	4.0	150	200
Keene silt loam, 2 to 6 percent slopes	63	95	21	37	53	63	2.0	3.5	100	180
Keene silt loam, 6 to 12 percent slopes	63	95	21	37	53	63	2.0	3.5	100	180
Keene silt loam, 6 to 12 percent slopes, moderately eroded	60	93	20	36	50	60	2.0	3.5	100	180
Keene silt loam, 12 to 18 percent slopes	62	94	20	36	50	60	2.0	3.5	100	180
Keene silt loam, 12 to 18 percent slopes, moderately eroded	58	90	19	34	48	58	2.0	3.5	100	180
Keene silt loam, 18 to 25 percent slopes	--	---	--	--	--	--	2.0	3.5	100	180
Killbuck silt loam	70	125	24	42	46	70	2.0	3.5	100	180
Latham silt loam, 2 to 6 percent slopes	57	95	22	36	40	50	2.0	3.0	100	180
Latham silt loam, 6 to 12 percent slopes	57	95	22	36	40	50	2.0	3.5	100	180
Latham silt loam, 6 to 12 percent slopes, moderately eroded	55	90	21	35	38	48	2.0	3.5	100	180
Latham silt loam, 12 to 18 percent slopes	--	---	--	--	--	--	2.0	3.5	100	180
Latham silt loam, 12 to 18 percent slopes, moderately eroded	--	---	--	--	--	--	2.0	3.5	100	180
Latham silt loam, 18 to 35 percent slopes	--	---	--	--	--	--	2.0	3.5	100	180
Licking silt loam, 0 to 2 percent slopes	60	93	22	36	48	70	2.5	3.5	130	180
Licking silt loam, 2 to 6 percent slopes	60	93	22	36	48	70	2.5	3.5	130	180
Licking silt loam, 6 to 12 percent slopes	60	93	22	36	48	70	2.5	3.5	130	180
Licking silt loam, 6 to 12 percent slopes, moderately eroded	57	90	21	35	46	66	2.5	3.5	130	180
Licking silt loam, 12 to 25 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	3.5	130	180
Linwood muck	83	130	--	--	--	--	--	--	---	---
Lobdell silt loam, alkaline phase	80	120	26	40	50	74	2.5	4.5	130	230
Loudonville silt loam, 2 to 6 percent slopes	68	95	24	42	53	72	3.0	4.0	150	200
Loudonville silt loam, 6 to 12 percent slopes	68	95	24	42	53	72	3.0	4.0	150	200
Loudonville silt loam, 6 to 12 percent slopes, moderately eroded	65	90	22	40	46	68	3.0	4.0	150	200
Loudonville silt loam, 12 to 18 percent slopes	68	85	24	40	48	70	3.0	4.0	150	200
Loudonville silt loam, 12 to 18 percent slopes, moderately eroded	63	85	22	38	45	66	3.0	4.0	150	200
Loudonville silt loam, 18 to 25 percent slopes, moderately eroded	62	80	20	36	43	64	3.0	4.0	150	200
Loudonville silt loam, 25 to 35 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	3.5	130	180
Luray silt loam	80	120	22	44	50	74	3.5	4.5	180	230
Luray silt loam, gravelly subsoil variant	80	120	22	50	53	88	3.5	5.0	180	250
Mentor silt loam, 0 to 2 percent slopes	75	120	24	38	50	76	3.0	4.0	150	200
Mentor silt loam, 2 to 6 percent slopes	75	120	24	38	50	76	3.0	4.0	150	200
Mentor silt loam, 6 to 12 percent slopes	73	115	24	38	50	76	3.0	4.0	150	200
Mentor silt loam, 12 to 18 percent slopes	70	112	23	37	49	75	3.0	4.0	150	200
Montgomery silty clay loam	80	120	24	40	55	70	3.5	4.5	180	230

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TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats		Hay		Rotation pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Muskingum silt loam, 2 to 6 percent slopes	65	95	18	38	46	60	2.5	4.0	130	200
Muskingum silt loam, 6 to 12 percent slopes	64	95	18	38	46	60	2.5	4.0	130	200
Muskingum silt loam, 12 to 18 percent slopes	62	90	18	38	44	60	2.5	4.0	130	200
Muskingum and Gilpin silt loams, 18 to 25 percent slopes	58	90	18	37	44	60	2.5	4.0	130	200
Muskingum and Gilpin silt loams, 18 to 25 percent slopes, severely eroded	--	---	--	--	--	--	2.0	3.5	100	180
Muskingum and Gilpin silt loams, 25 to 35 percent slopes	--	---	--	--	--	--	2.5	4.0	130	200
Muskingum and Gilpin silt loams, 35 to 50 percent slopes	--	---	--	--	--	--	2.5	4.0	130	200
Plainfield loamy sand, 0 to 6 percent slopes	50	80	24	34	46	68	2.0	3.5	100	180
Plainfield loamy sand, 6 to 12 percent slopes	50	80	24	34	46	68	2.0	3.5	100	180
Rainsboro silt loam, 2 to 6 percent slopes	90	110	22	38	50	70	3.0	3.5	150	180
Rainsboro silt loam, 6 to 12 percent slopes	88	108	22	38	50	70	3.0	3.5	150	180
Ramsey channery sandy loam, 6 to 12 percent slopes	50	70	15	30	40	50	2.0	3.0	100	150
Ramsey channery sandy loam, 12 to 18 percent slopes	50	70	15	30	40	50	2.0	3.0	100	150
Ramsey channery sandy loam, 18 to 25 percent slopes, moderately eroded	45	65	14	28	38	48	2.0	3.0	100	150
Ramsey channery sandy loam, 25 to 50 percent slopes, moderately eroded	--	---	--	--	--	--	--	--	100	150
Ravenna silt loam, 0 to 2 percent slopes	70	95	24	36	50	74	2.5	3.5	130	180
Ravenna silt loam, 2 to 6 percent slopes	70	100	24	36	50	74	2.5	3.5	130	180
Remsen silt loam, 0 to 2 percent slopes	42	95	18	30	38	62	2.0	3.0	100	150
Remsen silt loam, 2 to 6 percent slopes	45	95	20	30	40	62	2.0	3.0	100	150
Rittman silt loam, 2 to 6 percent slopes	60	90	22	38	50	70	2.5	3.5	130	180
Rittman silt loam, 6 to 12 percent slopes	60	90	22	38	50	70	2.5	3.5	130	180
Rittman silt loam, 6 to 12 percent slopes, moderately eroded	55	80	20	36	45	65	2.5	3.5	130	180
Rittman silt loam, 12 to 18 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	3.5	130	180
Sebring silt loam	60	95	22	30	40	68	2.0	3.5	100	180
Sebring silt loam, till substratum	55	90	20	30	35	65	2.0	3.5	100	180
Shoals silt loam	60	110	22	34	46	70	2.0	3.5	100	180
Sloan silt loam	65	120	24	44	46	74	2.5	4.5	130	230
Tilsit silt loam, 6 to 12 percent slopes	60	95	22	38	48	60	2.5	3.5	130	180
Tilsit silt loam, 12 to 18 percent slopes	58	92	21	36	46	58	2.5	3.5	130	180
Trumbull silt loam	45	80	18	28	36	60	1.5	2.5	80	130
Wadsworth silt loam, 0 to 2 percent slopes	48	92	19	30	44	64	2.0	3.5	100	180
Wadsworth silt loam, 2 to 6 percent slopes	50	95	20	32	46	66	2.0	3.5	100	180
Wadsworth silt loam, 6 to 12 percent slopes	48	92	19	30	44	64	2.0	3.5	100	180
Wadsworth silt loam, 6 to 12 percent slopes, moderately eroded	46	90	18	29	42	63	2.0	3.5	100	180
Wadsworth silt loam, moderately shallow variant, 2 to 6 percent slopes	50	95	20	32	46	66	2.0	3.5	100	180
Wallkill silt loam, clayey subsoil variant	80	120	36	42	56	74	3.5	4.5	180	230
Wayland silt loam	55	90	20	33	40	65	1.5	3.0	80	150
Weikert channery silt loam, 6 to 12 percent slopes	50	70	15	30	40	50	2.0	3.0	100	150
Weikert channery silt loam, 12 to 18 percent slopes	45	65	15	30	40	50	2.0	3.0	100	150
Weikert channery silt loam, 18 to 25 percent slopes, moderately eroded	40	60	15	30	38	48	2.0	3.0	100	150
Weikert channery silt loam, 25 to 50 percent slopes, moderately eroded	--	---	--	--	--	--	1.5	2.5	80	230
Weinbach silt loam, 0 to 2 percent slopes	65	115	22	38	46	70	2.5	4.0	130	200
Weinbach silt loam, 2 to 6 percent slopes	65	115	22	38	46	70	2.5	4.0	130	200
Wellston silt loam, 2 to 6 percent slopes	65	105	22	44	50	62	3.0	4.5	150	230
Wellston silt loam, 6 to 12 percent slopes	65	105	22	44	50	62	3.0	4.5	150	230
Wheeling loam, 0 to 2 percent slopes	70	120	28	40	50	76	3.0	4.0	150	200
Wheeling loam, 2 to 6 percent slopes	70	120	28	40	50	76	3.0	4.0	150	200
Wheeling loam, 6 to 12 percent slopes, moderately eroded	65	110	26	38	48	74	3.0	4.0	150	200
Wheeling silt loam, 0 to 2 percent slopes	70	120	28	40	50	76	3.0	4.0	150	200

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TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats		Hay		Rotation pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Cow-acre-days* [1]
Wheeling silt loam, 2 to 6 percent slopes	70	120	28	40	50	76	3.0	4.0	150	200
Wheeling silt loam, 6 to 12 percent slopes	70	120	28	40	50	76	3.0	4.0	150	200
Wheeling silt loam, 6 to 12 percent slopes, moderately eroded	65	110	26	38	48	74	3.0	4.0	150	200
Wheeling soils, 12 to 18 percent slopes, moderately eroded	64	108	26	38	48	74	3.0	4.0	150	200
Willette muck	80	125	--	--	--	--	--	--	---	---
Wooster silt loam, 2 to 6 percent slopes	75	100	30	48	53	85	3.0	4.0	150	200
Wooster silt loam, 6 to 12 percent slopes	75	100	30	48	53	85	3.0	4.0	150	200
Wooster silt loam, 6 to 12 percent slopes, moderately eroded	71	105	26	44	50	78	3.0	4.0	150	200
Wooster silt loam, 12 to 18 percent slopes, moderately eroded	70	100	25	43	49	76	3.0	4.0	150	200
Wooster silt loam, 18 to 25 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	4.0	130	200
Wooster silt loam, 25 to 50 percent slopes, moderately eroded	--	---	--	--	--	--	2.5	4.0	130	200

[1] Cow-acre-days is a term used to express the carrying capacity of the pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the sod. An acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 cow-acre-days.

The yields given in table 1 do not apply to a specific field for any particular year because the soils vary from place to place, management practices vary from farm to farm, and weather conditions are variable from year to year. These yields are intended only as a general guide that shows the relative productivity of the soils, the response of soils to management, and the relationship of soils to each other. Although the general level of crop yields may change as new methods and new crop varieties are developed, the relative reponse of the different soils is not likely to change much.

The estimates of yields given in table 1 are based primarily on information obtained from farmers, and on observations and field trials made by the county agent and by the work unit conservationists of the Soil Conservation Service. They are also based on experiments made by the Ohio Agricultural Research and Development Center and on field observations made by members of the soil survey party.

Special crops

Special crops grown for commercial use in Stark County include vegetables, small fruits, tree fruits, and nursery plants. Radishes, onions, and lettuce are grown in the large mucky areas east of Hartville. Smaller areas throughout the county are used for celery, sweet corn, tomatoes, peppers, melons, strawberries, raspberries, and other vegetables and small fruits. Apples and peaches are the more important tree fruits grown in the county.

In this county the soils in capability units I-1, IIe-1, IIe-3, and IIs-1 are especially well suited to vegetables and small fruits. They have good natural drainage, warm up early in spring and, if moisture is favorable throughout the growing season, crops grown on them can generally be harvested earlier than crops on the other soils. Managing and harvesting special crops on these soils are difficult in some local areas because slopes and soil patterns are complex. If the muck soils in capability unit IIIw-5 are adequately drained, they are suited to radishes, onions, lettuce, and other vegetable crops.

Many of the well-drained soils in the county have properties that make them suitable for orchards and nursery plants. Soils that are frequently subject to frost, however, should not be used for early vegetables, small fruits, and orchards.

Suggestions for growing special crops are not given in this survey, but the latest and more complete information can be obtained from a representative of the Ohio Agricultural Extension Service and the Soil Conservation Service.

Irrigation

In Stark County irrigation is increasing in importance, particularly for the production of crops of high value and of turf of high quality. Some of the soils in the county are well suited to irrigation, but others are very poorly suited. Soil features that affect the suitability of individual soils for irrigation are given in table 6 in the section "Engineering Uses of Soils."

For a soil to be suitable for irrigation, the surface layer should be porous, or able to absorb water readily, the soil should have a good water-holding capacity, and the water and air in the subsoil or underlying material should be able to move freely to prevent waterlogging.

The well-drained soils on outwash plains and terraces such as the Chili, Mentor, and Wheeling soils that have slopes of less than 6 percent are well suited to sprinkler irrigation where vegetables are grown. The Chili soils dry out quickly and warm up early in spring, but they have limited available moisture capacity and are likely to have insufficient moisture dur-

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ing the growing season unless they are irrigated frequently. The Wooster, Wellston, and other well-drained soils on uplands are suitable for irrigation. The Chagrin, Lobdell, and other well drained and moderately well drained soils on first bottoms are well suited to irrigation if crops on them are not damaged by flooding.

The deep, well-drained soils that are excellent for orchards have few limitations that affect use for irrigated crops (fig. 7). If the sloping soils are irrigated, however, the rate of water application must be regulated for the control of runoff and erosion. Developing a dependable supply of water for irrigation is a serious concern in some areas.

Crop yields on nearly all soils in Stark County can be improved by supplemental irrigation in dry periods during the growing season. Soil characteristics should be studied carefully before an irrigation system is installed. In addition, a qualified engineer should carefully evaluate the water supply, the crop or crops to be irrigated, the cost of equipment, and the economy of the operation. Additional information on irrigation is available from local representatives of the Agricultural Extension Service and the Soil Conservation Service.

Woodland

The original forest in Stark County has been cut, and most of the acreage has been cleared for farming. According to the 1966–67 Conservation Needs Inventory, woodland occupied about 67,120 acres, or about 18 percent of the total land area of the county. Woodland is in the largest tracts in the southern part of the county, but much of it is scattered throughout the county in small woodlots. Many of the existing stands of trees are similar to the original forest, which con-

Figure 7.—An apple orchard on Muskingum and Gilpin silt loams.

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sisted mainly of beech, maple, hickory, and oak. Beech and maple were dominant in the northeastern one-third of the county.

The wooded acreage in this county is slowly increasing as more farmland in the southern part is abandoned and reverts to forest, and as other areas throughout the county are replanted to trees. Each year, however, some woodland is lost to community development and, in the southern half of the county, to strip mining.

In most areas that are reverting naturally to woodland, the plant cover first is grasses. The grasses are followed by blackberry, thornapple, and finally mixed forest. This forest consists mainly of black cherry, red maple, hickory, elm, white ash, dogwood, sassafras, spicebush, blue beech, ironwood, and in some places, black locust. Eroded soils revert to woodland more slowly and to less desirable trees than do uneroded soils.

Generally, native and planted trees grow best on deep soils that have high available moisture capacity and north- and east-facing slopes that are protected from the wind and sun. Trees grow more poorly on soils having slopes that face south and west.

Black walnut grows best on the better drained, neutral soils on bottom lands. Yellow-poplar is most productive on the moderately moist, deep, better drained soils in coves and in other of the less exposed areas. Black cherry is most common in cutover areas of well-drained soils. Black locust grows well in eroded areas and on Strip mine spoil, but it is subject to damage by the locust borer.

Sugar maple and beech grow well on the moderately well drained and somewhat poorly drained soils that developed over glacial drift or that occur on north-facing slopes in the unglaciated part of the county. White oak, red oak, and black oak are dominant on the well-drained soils that have south- and west-facing slopes. White oak is dominant in many of the old stands. Hickory grows well on most of the better drained soils in the county.

White ash is common in second-growth stands on the moderately well drained and somewhat poorly drained soils on uplands in the glaciated part of the county. Sycamore and American elm are prominent on the somewhat poorly drained soils of the bottom lands. Blackgum, elm, red maple, pin oak, and swamp white oak are the main trees on the poorly drained soils in all areas.

Woodland suitability groups

Some of the soils in Stark County have been grouped according to those characteristics that affect the growth of trees and management of the stand. Each group is made up of soils that are similar in potential productivity for trees, that have about the same suitability for trees, and that require about the same management.

Listed in table 2 are the 19 woodland suitability groups into which most of the soils of the county have been placed. The soils in each group are designated by their map symbols. Because trees suitable for commercial use do not grow on them, Alluvial land, Alluvial land-Urban land complex, Borrow pits, Made land, Quarries, Strip mine spoil, Carlisle muck, Edwards muck, Linwood muck, and Willette muck have not been placed in woodland groups. The woodland group assigned to any soil is listed in the "Guide to Mapping Units" at the back of this survey and at the end of the description of that soil in the section "Descriptions of the Soils."

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TABLE 2.—*Woodland suitability groups, potential productivity, trees*

Woodland suitability group, series, and map symbols	Potential productivity [1]		Trees preferred—		
	Site index for upland oaks [2]	Mean annual growth per acre	In natural stands	For planting	For Christmas trees
		Bd. ft.			
Group 1o1	85–95(19)	423	White oak, tulip-poplar, black walnut, black cherry, white oak, red oak, sugar maple.	White pine, Austrian pine, tulip-poplar, black walnut.	Scotch pine, Norway spruce, Douglas fir, white pine.
Bogart: BgA, BgB, BoA, BoB, BoC, Bu.					
Canfield: CdA, CdB, CdC, CdC2, CdD, CdD2, CeB, CeC, CfB, CfC.					
Chagrin: Ck, Cm.					
Chili: CnA, CnB, CoC, CoC2, CuB, CuC, CoD2, CpA, CpB, CpC, CpC2.					
Glenford: GfA, GfB, GfC, GfC2, GfD2.					
Lobdell: Le.					
Mentor: MeA, MeB, MeC, MeD.					
Rittman: RsB, RsC, RsC2, RsD2.					
Wooster: WuB, WuC, WuC2, WuD2, WvD.					
Group 1w1	85–95(17)	423	Swamp white oak, red oak, pin oak, red maple, sycamore.	Northern white-cedar, cottonwood, sycamore.	Not suited
Canadice: Ca.					
Fitchville: FcA, FcB, FcC, Fu.					
Ginat: Ge.					
Sebring: Sb, Se, Sg.					
Trumbull: Tr.					
Wadsworth: WaA, WaB, WaC, WaC2, WbB.					
Group 1r1	85–95(69)	423	White oak, tulip-poplar, black walnut, black cherry, white ash, red oak, sugar maple.	White pine, Austrian pine, tulip-poplar.	Scotch pine, Norway spruce, white pine, Douglas fir.
Wooster: WuE2, WuF2.					
Group 2o1	76–85(32)	341	White oak, tulip-poplar, red oak, black cherry, black walnut.	White pine, black walnut, tulip-poplar.	Scotch pine, Norway spruce, Douglas fir, white pine.
Loudonville: LoB, LoC, LoC2, LoD, LoD2, LuB, LuC.					
Wellston: WlB, WlC.					
Wheeling: WmA, WmB, WmC2, WrA, WrB, WrC, WrC2, WsD2					
Group 2w1	76–85(2)	341	Swamp white oak, red oak, red maple, sycamore, pin oak.	Northern white-cedar, cottonwood, sycamore.	Not suited
Killbuck: Kk.					
Luray: Ly, Lz.					
Montgomery: Mg.					
Sloan: Sl.					
Wallkill: Wc.					
Wayland: Wd.					
Group 2w2	76–85(2)	341	Swamp white oak, red oak, red maple, sycamore.	Northern white-cedar, cottonwood, sycamore.	Not suited
Ravenna: ReA, ReB, Rn.					
Remsen: RoA, RoB, Rr.					
Shoals: Sh.					
Weinbach: WhA, WhB, Wk.					
Group 2c1	[3] 76–85	341	Red oak, white oak, tulip-poplar, white ash, black cherry.	White pine, tulip-poplar, Norway spruce.	Scotch pine, white pine, Austrian pine.
Geeburg: GbC2, GbE2.					
Licking: LcA, LcB, LcC, LcC2, LcE2.					
Group 2s1	76–85(1)	341	White pine, red oak, white oak, black oak, sugar maple, black cherry.	White pine, red pine.	Not suited
Arkport: ArB, ArC, ArD.					
Plainfield: PlB, PlC.					

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preferred, and hazards and limitations that affect management

Erosion hazard	Equipment limitations	Seedling mortality	Plant competition for—		Windthrow hazard	Remarks
			Conifers	Hardwoods		
Slight	Slight	Slight	Severe	Moderate	Slight	Canfield and Rittman soils have a fragipan. Chagrin and Lobdell soils are subject to occasional flooding.
Slight	Severe for Ca, FcA, FcB, FcC, Fu, Ge, Sb, Se, Sg, and Tr. Moderate for WaA, WaB, WaC, WaC2, and WbB.	Severe for Ca, FcA, FcB, FcC, Fu, Ge, Sb, Se, Sg, and Tr. Moderate for WaA, WaB, WaC, WaC2, and WbB.	Severe	Severe	Moderate	Soils are subject to ponding; wet late in spring.
Moderate for WuE2. Moderate to severe for WuF2.	Moderate for WuE2. Moderate to severe for WuF2.	Slight	Moderate	Slight	Slight	
Slight	Slight	Slight	Severe	Moderate	Slight	
Slight	Severe	Severe	Severe	Severe	Severe	Soils are soft and wet for long periods. Occasional flooding in most areas.
Slight	Moderate	Slight	Severe	Severe	Slight	Ravenna soils have a fragipan. Shoal soils are subject to flooding.
Moderate for GbC2, LcA, LcB, LcC, LcC2, and LcE2. Severe for GbE2.	Moderate for GbC2, LcA, LcB, LcC, LcC2, and LcE2. Severe for GbE2.	Moderate	Severe	Moderate	Slight	
Slight	Slight	Moderate	Severe	Severe	Slight	Sandy soils that have low available moisture capacity.

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TABLE 2.—*Woodland suitability groups, potential productivity, trees*

Woodland suitability group, series, and map symbols	Potential productivity [1]		Trees preferred—		
	Site index for upland oaks [2]	Mean annual growth per acre	In natural stands	For planting	For Christmas trees
		Bd. ft.			
Group 2r1 Chili: CoE2. Dekalb: DkE2, DkF2 (on north- and east-facing slopes). Loudonville: LoE2, LoF2. Muskingum: MvE, MvE3, MvF, MvG, MwF (on north- and east-facing slopes).	76–85 (48)	341	Red oak, white oak, tulip-poplar, black walnut, Virginia pine, black cherry, sugar maple, white pine.	White pine, black walnut.	Scotch pine, Virginia pine.
Group 3w1 Keene: KeB. Rainsboro: RaB, RaC.	66–75 (9)	265	Red oak, tulip-poplar, black oak, white oak.	White pine, Virginia pine, tulip-poplar.	Not suited
Group 3w2 Keene: KeC, KeC2, KeD, KeD2, KeE. Tilsit: TlC, TlD.	66–75 (9)	265	Red oak, tulip-poplar, black oak, white oak.	White pine, Virginia pine, tulip-poplar.	Not suited
Group 3r1 Dekalb: DkE2, DkF2 (on south- and west-facing slopes). Muskingum: MvE, MvE3, MvF, MvG, MwF (on south- and west-facing slopes).	66–75 (56)	265	Tulip-poplar, red oak, white oak, black cherry, sugar maple, black walnut.	Virginia pine	Not suited
Group 3o1 Dekalb: DkB, DkC. Gilpin: GdB, GdC, GdD. Muskingum: MsB, MsC, MsD.	66–75 (63)	265	Tulip-poplar, red oak, white oak, black cherry, sugar maple.	Tulip-poplar, white pine.	White pine, scotch pine, Austrian pine.
Group 3c1 Brooke: BwC2. Brooke: BwE2 (on north- and east-facing slopes). Latham: LaB, LaC, LaC2, LaD, LaD2. Latham: LaF (on north- and east-facing slopes).	66–75 (24)	265	Red oak, tulip-poplar, white ash, white oak.	White pine, tulip-poplar, black oak.	Not suited
Group 3f1 Chili: CvF2, CuF. Conotton: CwA, CyB, CyC, CyD2, CyE2.	66–75 (1)	265	Red oak, tulip-poplar, white oak, black cherry.	White pine, red oak, Norway spruce.	Not suited
Group 4c1 Brooke: BwE2 (on south- and west-facing slopes). Latham: LaF (on south- and west-facing slopes).	56–65 (5)	196	Red oak, tulip-poplar, black walnut, white ash, white oak.	White pine, black locust.	Not suited
Group 4d1 Ramsey: RcC, RcD, RcE2 (on north- and east-facing slopes). Weikert: WeC. Weikert: WeD, WeE2 (on north- and east-facing slopes).	56–65 (2)	196	Chestnut oak, black oak, Virginia pine.	White pine, Virginia pine.	Not suited

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preferred, and hazards and limitations that affect management—Continued

Erosion hazard	Equipment limitations	Seedling mortality	Plant competition for—		Windthrow hazard	Remarks
			Conifers	Hardwoods		
Moderate	Moderate for CoE2, DkE2, LoE2, LoF2, MvE, MvE3, and MvF. Severe for DkF2, MvG, and MwF.	Slight	Severe	Moderate	Slight	
Slight	Moderate	Slight	Moderate to severe.	Slight	Slight	
Moderate to severe.	Moderate	Slight	Moderate to severe.	Slight to moderate.	Slight	
Moderate	Moderate to severe.	Slight to moderate.	Moderate	Slight	Slight	
Slight	Slight	Slight	Moderate	Slight	Slight	Soils are droughty.
Severe	Moderate for LaB, LaC, LaC2, LaD, LaD2, and LaF. Severe for BwC2 and BwE2.	Slight	Moderate for LaB, LaC, LaC2, LaD, LaD2, and LaF. Severe for BwC2 and BwE2.	Slight	Slight	Subsoil is clayey.
Slight for CwA, CyB, CyC, CyD2, and CyE2. Severe for CvF2 and CuF.	Slight for CwA, CyB, CyC, CyD2, and CyE2. Severe for CvF2 and CuF.	Moderate	Moderate	Slight	Slight	
Severe	Moderate to severe.	Severe	Severe	Moderate	Slight	
Slight	Slight to moderate.	Severe	Slight	Slight	Slight	

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TABLE 2.—*Woodland suitability groups, potential productivity, trees*

Woodland suitability group, series, and map symbols	Potential productivity [1]		Trees preferred—		
	Site index for upland oaks [2]	Mean annual growth per acre	In natural stands	For planting	For Christmas trees
		Bd. ft.			
Group 4d2 Ramsey: RcF2 (on north- and east-facing slopes). Weikert: WeF2 (on north- and east-facing slopes).	56–65 (2)	196	Chestnut oak, black oak, Virginia pine.	White pine, Virginia pine.	Not suited
Group 5d1 Ramsey: RcC, RcD, RcE2, RcF2 (on south- and west-facing slopes). Weikert: WeD, WeE2, WeF2 (on south-and west-facing slopes).	46–55 (4)	131	Chestnut oak, black oak, Virginia pine.	White pine, Virginia pine.	Not suited

[1] Based on data in USDA Technical Bulletin No. 560 (*9*).
[2] Numbers in parentheses following site index are the number of plots on which studies were made of the growth rate. These studies were used to determine site index.

Each woodland group is identified by a three-part symbol, such as 1o1, 2w2, or 3r1. The first part of the symbol is a number that indicates relative potential productivity of the soils in the group; 1 means very high; 2, high; 3, moderately high; 4, moderate; and 5, low. These ratings are based on field determinations of average site indexes.

The second part of the symbol identifying a woodland group is a small letter. Except for the letter *o* this letter indicates an important soil property that imposes a moderate or severe hazard or limitation that affects managing the soils of the group for trees. The letter *o* shows that the soils have few limitations that restrict their use for trees. The letter *c* indicates that the main limitation is the kind or amount of clay in the upper part of the soils in the group; *d* means that rooting depth is restricted because the soils are shallow to a hardpan, to hard rock, or to some other restrictive material; *f* denotes that the main limitation is large amounts of fragments in the soil that are more than 2 millimeters but less than 10 inches in size; *r* shows that the main limitation is steep slopes; *s* indicates that the soils are sandy and dry, have little or no difference in texture between surface layer and subsoil, have low moisture holding capacity, and generally have a low supply of plant nutrients; *t* denotes that the soils are excessively alkaline, excessively acid, or contain sodium salts or other toxic substances in amounts that limit or impede tree growth; *w* means that water in or on the soil, either seasonally or year round, is the chief limitation; and *x* shows that stones or rocks in and on the soils are the chief limiting factor.

The last part of the symbol, another number, merely differentiates one woodland suitability group from others that have identical first and second parts in their identifying symbol. For example, the last number in the symbol *1o1* differentiates the woodland suitability group bearing the last number from all other groups having *1o* as the first two parts of their identifying symbol.

Given for each woodland group listed in table 2 are potential productivity, expressed as site index and as annual growth; the trees generally preferred in management of the existing stands, for planting, and for Christmas trees; and some hazards and limitations that affect management. The terms used in table 2 are explained in the following paragraphs.

In table 2 potential productivity is expressed as site index and as mean annual growth. A site index for a given soil is the height, in feet, that a tree growing on that soil will reach in 50 years. The site indexes and the mean annual growth for upland oaks given in table 2 were based on data from the USDA Technical Bulletin No. 560 (*9*).[3]

The site indexes are given as a range in table 2, for example, 85 to 95. They are based on data obtained by measuring the height and age of a number of trees growing on the same kind of soil. The mean annual growth, to 50 years of age expressed in board feet per acre, was calculated by site index, according to the ⅛ inch International rule to a top diameter of 5 inches, inside bark. The potential yield to 80 years of age can be estimated by using data given in table 28 in USDA Bulletin 560 (*9*).

Slope position, the direction toward which the slopes face, soil depth, and moisture content of a soil affect the productivity of a site for trees. If all other factors are favorable, sites on the lower slopes and those on slopes that face north or east generally are the most productive.

Listed in table 2 for each woodland suitability group are the trees that are preferred in managing the existing stands, trees preferred for planting, and trees

[3] Italicized numbers in parentheses refer to Literature Cited, p. 155.

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preferred, and hazards and limitations that affect management—Continued

Erosion hazard	Equipment limitations	Seedling mortality	Plant competition for—		Windthrow hazard	Remarks
			Conifers	Hardwoods		
Moderate	Severe	Severe	Slight	Slight	Slight	
Slight for RcC, RcD, RcE2, WeD, and WeE2. Moderate for RcF2 and WeF2.	Moderate for RcC, RcD, RcE2, WeD, and WeE2. Severe for RcF2 and WeF2.	Slight for RcC, RcD, RcE2, WeD, and WeE2. Moderate for RcF2 and WeF2.	Slight	Slight	Slight	

[1] Site index was estimated for this woodland group.

preferred for Christmas trees. Trees preferred in existing stands and for planting are hardy, are long lived, provide shade for recreational use, and are suitable for wood crops. As trees in immature stands grow and become crowded, the preferred species, if of good quality, are favored over other trees when the stand is thinned. Not all species, notably species of broad-leaved trees, have been successfully transplanted. The conifers and broad-leaved trees listed as preferred for planting on the soils in a woodland suitability group are suited to those soils and have been successfully planted on them. Other species that are not listed in table 2 may be suited to the soils in the woodland suitability groups.

Specific information about planting trees and woodland management can be obtained from the local Soil Conservation Service representative or a farm forester.

On the soils of each woodland suitability group are varying degrees of hazards and limitations that affect management. These limitations and hazards are rated slight, moderate, or severe. The ratings are shown for each woodland group in table 2 and are explained in the following paragraphs.

Erosion hazard refers to the potential hazard of soil losses in managed woodland. The hazard is *slight* if no special practices are needed. It is *moderate* if some practices are needed to reduce the risk of erosion. The erosion hazard is *severe* if intensive practices, special equipment, and special methods of operation are needed to reduce soil losses. Generally, the risk of erosion is slight on slopes of 25 percent or less and is moderate or severe on slopes of more than 25 percent.

Equipment limitations are rated on the basis of soil characteristics and topographic features that restrict or prohibit the use of conventional equipment needed in woodland management. Considered in the ratings are slope; stoniness, rockiness, seasonal wetness, and stability of the soil. *Slight* means that there is no restriction in the kind of equipment or in the time of year it is used. A rating of *moderate* indicates that the use of conventional equipment is restricted by one or more unfavorable characteristics. A *severe* rating means that special equipment is needed, and its use is severely restricted by one or more unfavorable characteristics.

Seedling mortality refers to the expected losses of naturally occurring or planted seedlings that are a result of unfavorable soil characteristics or topographic features, but not a result of plant competition. Mortality is *slight* if less than 25 percent of the seedlings are expected to die and is *moderate* if this percentage is 25 to 50. It is *severe* if the loss of seedlings is more than 50 percent.

Plant competition is rated on the basis of the degree that weeds, grass, and brush are expected to compete with desirable trees when openings are made in the tree canopy. Competition tends to be greatest on soils that have poor drainage and those that have high fertility. A rating of *slight* indicates that competition from other plants does not interfere with natural regeneration or with the early growth of planted seedlings. Competition is *moderate* if competing plants delay but do not prevent the establishment and early growth of a normal fully stocked stand of desirable trees. It is *severe* if undesirable plants prevent adequate restocking of planted seedlings or natural regeneration, unless there is intensive site preparation and maintenance, including weeding.

Windthrow hazard is determined by the resistance of trees to the force of the wind. Soil characteristics that affect the normal development of tree roots include shallowness, stoniness, droughtiness, a restricting layer, and wetness. The hazard of windthrow is *slight* if no trees are expected to be blown down by a normal wind. It is *moderate* if some trees are expected to be blown down when the soil is excessively

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wet and the wind is strong. Windthrow is a *severe* hazard if many trees are expected to be blown down during periods of excessive soil wetness and a moderate or strong wind.

Use of Soils for Wildlife

Stark County is a part of the Appalachian Plateau. The northern two-thirds of the county is glaciated and is undulating and rolling; the southern part is unglaciated and is hilly and steep.

Wildlife is an important natural resource in the county. Ringneck pheasant, quail, squirrel, cottontail rabbit, and white-tailed deer are abundant. All of the soils in the county are suited as habitat for some kind of wildlife.

The survival and increase of any kind of wildlife species depend on the presence and distribution of water and of plants that provide food and cover. If any of these habitat elements is lacking or inadequate, desired wildlife will be absent or scarce. The kinds of wildlife that live in a given area and the number of each kind are closely related to land use, the resulting kinds and patterns of vegetation, and the kinds and distribution of water.

Most wildlife habitat is created or improved by planting suitable vegetation, manipulating existing vegetation so as to increase or improve desirable plants, or by a combination of these measures. For this management, a knowledge of the soils is needed so that the growth of plants suitable for wildlife can be estimated. Water areas also can be established or improved for wetland wildlife. Specific information about managing wildlife areas can be obtained from the local game protector, the county agent, or a representative of the Soil Conservation Service.

Elements of habitat and kinds of wildlife

In table 3 most of the soils of Stark County are rated for their suitability for eight elements of wildlife habitat and for three broad classes of wildlife. More detailed information about the rating system is given in a paper by Allan, Garland, and Dugan (*1*). Not rated in table 3 are the land types and the 16 complexes that include Urban land.

The information given in table 3 is useful in (1) broadly planning for wildlife habitat in parks, in public and private refuges, and in private and commercial shooting preserves; (2) selecting soils that are most suitable as sites for creating, improving, or maintaining a specific kind of element of wildlife habitat; (3) determining the intensity of management needed for a specific habitat element; (4) eliminating sites that are difficult or are not feasible to manage for specific kinds of wildlife; and (5) determining areas that are suitable for acquiring and developing as wildlife habitat.

The numerical ratings used in table 3 are 1 for well suited, 2 for suited, 3 for poorly suited, and 4 for unsuited. A soil is *well suited* to an element of wildlife habitat if there are few limitations to use; it is *suited* if there are moderate limitations to use; and it is *poorly suited* if there are severe limitations to use. Not considered in the ratings given in table 3 are the present land use, the location of a soil in relation to other soils, and the mobility of wildlife.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*

[Not rated are Alluvial land, Borrow pits, Cut and fill land, Gravel pits, Made land, Quarries, Strip mine spoil, Urban land, and the 16 complexes that include Urban land]

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Arkport:											
ArB, ArC, ArD	3	2	2	3	1	5	5	5	2	3	4
Bogart:											
BgA, BoA	2	1	1	1–2	3	3	3	3	1	1–2	3
BgB, BoB, BoC	2	1	1	1–2	3	3	[1]4	[1]4	1	1–2	[1]4
Brooke:											
BwC2	2	2	2	2	3	4	4	4	2	3	4
BwE2	3	2	2	2	3	4	4	4	2	3	4
Canadice:											
Ca	3	3	2	2	2	1	1	1	3	2	1
Canfield:											
CdA	2	1	1	1–2	3	3	3	3	1	1–2	3
CdB, CdC, CdC2, CdD, dC2	2	1	1	1–2	3	4	4	4	1	1–2	4
CdD, CdD2	3	2	1	1–2	3	4	4	4	2	2	4
Carlisle:											
Ch	4	3	4	4	1	1	1	1	4	4	1

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TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Chagrin:											
Ck, Cm	2	1	1	1	3	4	4	4	1	1	4
Chili:											
CnA, CpA, CnB, CpB, CoC, CpC, CpC2, CoC2	2	2	1–2	2	1	4	4	4	1–2	2	4
CoD2, CoE2	3	2	2	3	1	4	4	4	2	3	4
CvF2	4	3	2	3	1	4	4	4	3	3	4
Conotton:											
CwA, CyB, CyC, CyD2, CyE2	3	3	2	3	1	4	4	4	3	3	4
Dekalb:											
DkB, DkC	3	2	2	2–3	1	4	4	4	2	2–3	4
DkE2	3	2	2	3	1	4	4	4	2	3	4
DkF2	4	3	3	3	1	4	4	4	4	4	4
Edwards:											
Ed	4	3	4	4	1	1	1	1	4	4	1
Fitchville:											
FcB, FcC	2	2	1	1	3	3	4	4	1	2	4
FcA	2	2	1	1	3	2	2	2	1	2	2
Geeburg:											
GbC2	2	2	2	2	2	4	4	4	1	2	4
GbE2	3	2	2	2	2	4	4	4	3	2	4
Gilpin:											
GdB, GdC	2	2	2	2–3	2	4	4	4	2	2	4
GdD	3	2	2	2–3	2	4	4	4	2	2–3	4
Ginat:											
Ge	4	3	3	1	1	1	1	1	3	1	1
Glenford:											
GfA	2	1	1	2	2	3	3	3	1	2	3
GfB, GfC, GfC2	2	1	1	2	2	[1]4	4	[1]4	1	2	[1]4
GfD2	3	2	1	2	2	4	4	4	2	2	4
Keene:											
KeB	2	2	2	2	2	4	4	4	1	1	4
KeC, KeC2	2	2	2	2	2	4	4	4	1	2	4
KeD, KeD2, KeE	3	2	2	2	2	4	4	4	2	2	4
Killbuck:											
Kk	4	3	3	1	1	1	2	4	3	1	2
Latham:											
LaB	2	2	2	2	2	4	4	4	1	1	4
LaC, LaC2	2	2	2	2	2	4	4	4	2	2	4
LaD, LaD2	3	2	2	2	2	4	4	4	2	2	4
LaF	4	2	2	2	2	4	4	4	3	2	4
Licking:											
LcA	2	1	2	1	3	2	2	2	2	3	2
LcB	2	2	2	2	2	4	4	4	1	1	4
LcC, LcC2	2	2	2	2	2	4	4	4	1	2	4
LcE2	3	2	2	1	2	4	4	4	3	2	4
Linwood:											
Ld	4	3	4	4	1	1	1	1	4	4	1
Lobdell:											
Le	2	1	1	1	3	3	3	3	1	1	3

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TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Loudonville:											
LoB, LoC, LoC2	2	2	2	2	2	4	4	4	2	2	4
LoD, LoD2	3	2	2	2	2	4	4	4	2	2–3	4
LoE2	3	2	2	2	1–2	4	4	4	2	2	4
LoF2	4	3	3	2–3	1–2	4	4	4	3–4	2–3	4
Luray:											
Ly, Lz	4	3	3	1	1	1	1	1	3	1	1
Mentor:											
MeA	1	1	1	1	3	4	4	4	1	1	4
MeB, MeC	2	1	1	1	3	4	4	4	1	1	4
MeD	3	2	1	1	3	4	4	4	2	2	4
Montgomery:											
Mg	4	3	3	1	1	1	1	1	3	1	1
Muskingum:											
MsB, MsC	3	2	2	2–3	1	4	4	4	2	2	4
MvE, MvE3, MsD	3	2	2	3	1	4	4	4	2	3	4
MvF, MvG	4	3	3	3	1	4	4	4	4	4	4
Plainfield:											
PlB, PlC	3	2	2	3	1	4	4	4	2	3	4
Rainsboro:											
RaB, RaC	2	1	1	1	3	4	4	4	1	2	4
Ramsey:											
RcC, RcD, RcE2 RcF2	4	4	3	4	1	4	4	4	4	4	4
Ravenna:											
ReA	2	2	1	1	3	2	2	2	1	2	2
ReB	2	2	1	1	3	3	4	4	1	2	4
Remsen:											
RoA	2–3	2	2	1	2–3	2	[1]2	[1]2	2	1–2	2
RoB	2–3	2	2	1	2–3	3	[1]4	[1]4	2	1–2	4
Rittman:											
RsB, RsC, RsC2	2	1	1	1–2	3	4	4	4	1	1–2	4
RsD2	3	2	1	1–2	3	4	4	4	2	2	4
Sebring:											
Sb, Se	3	2	2	1	2	1	1	1	2	1	1
Shoals:											
Sh	2	2	1	1	3	2	2	3	1	2	2
Sloan:											
Sl	4	3	3	1	1	1	2	4	3	1	2
Tilsit:											
TlC	2	1	1	1–2	3	4	4	4	1	1–2	4
TlD	3	2	1	1–2	3	4	4	4	1	2	4
Trumbull:											
Tr	3	3	2	2	2	1	1	1	3	2	1
Wadsworth:											
WaA	2	2	1	1	2	2	[1]2	[1]2	1	1	2
WaB, WbB	2	2	1	1	2	3	[1]4	[1]4	1	1	4
WaC, WaC2	2	2	1	2	2	4	4	4	1	2	4
Wallkill:											
Wc	4	3	3	1	1	1	2	4	3	1	2

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TABLE 3.—*Suitability of soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Wayland:											
Wd	3	2	2	1	2	2	2	4	2	1	2
Weikert:											
WeC	3	3	2	2	2	4	4	4	3	2	4
WeD, WeE2	4	3	2	2	2	4	4	4	3	2	4
WeF2	4	4	2	2	2	4	4	4	3	3	4
Weinbach:											
WhA	2	2	1	1	2	2	2	2	1	1	2
WhB	2	2	1	1	2	3	[1]4	[1]4	1	1	4
Wellston:											
WlB, WlC	2	1	1	2	2–3	4	4	4	1	2	4
Wheeling:											
WmA, WrA	1	1	1	1	3	4	4	4	1	1	4
WmB, WrB, WmC2, WrC, WrC2	2	1	1	1	3	4	4	4	1	1	4
	3	2	1	1	3	4	4	4	2	2	4
Willette:											
Wt	4	3	4	4	1	1	1	1	4	4	1
Wooster:											
WuB, WuC, WuC2	2	1	1	1	3	4	4	4	1	1	4
WuD2	3	2	1	1	3	4	4	4	2	2	4
WuE2, WuF2	4	2	1	1	3	4	4	4	2	2	4

[1] Rating is 3 on slopes of less than 4 percent.

The eight elements of wildlife habitat listed in table 3 are discussed in the following paragraphs.

Grain and seed crops.—These crops include corn, wheat, barley, oats, rye, buckwheat, and other seed-producing annuals used by wildlife. These crops can be grown each year on the soils rated *well suited* in table 3. Such soils are deep, nearly level or very gently sloping, medium textured, well drained, and free or nearly free of stones. They have high available moisture capacity and are not subject to frequent flooding. The soils that are not rated well suited require more intensive management than those rated well suited.

Grasses and legumes.—These plants are domestic grasses and legumes that are planted to furnish food and cover for wildlife. They include bluegrass, fescue, bromegrass, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, and alfalfa. A rating of *well suited* means that adequate stands of these plants can be maintained for at least 10 years. Soils that are well suited to these plants have slopes of not more than 15 percent, are well drained or moderately well drained, and have moderately high or high available moisture capacity. Occasional floods and surface stones are not serious concerns, for these soils are seldom tilled.

Wild herbaceous upland plants.—These plants are perennial grasses and weeds that generally are established naturally. They include switchgrass, milkweed, daisy, goldenrod, strawberry, nightshade, and dandelion. The soils that are *well suited* to these plants vary widely in texture, drainage, and slope. If these soils are well drained to somewhat poorly drained, slope is not limiting. Stoniness and occasional flooding are not serious concerns.

Hardwood woody plants.—These plants are nonconiferous trees, shrubs, and woody vines that produce nuts, fruits, buds, catkins, twigs, or foliage that wildlife eat. They are generally established naturally, but they also may be planted. Among the native plants are oak, beech, cherry, maple, hickory, poplar, aspen, walnut, dogwood, roses, and briers. Soils that are *well suited* to these plants are deep or moderately deep, medium textured or moderately fine textured, and moderately well drained to somewhat excessively drained. Slope and surface stoniness are of little significance.

Also in this group are several kinds of fruiting shrubs that are raised commercially for planting. They include autumn-olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, and dogwood. These shrubs generally are available and can be planted on soils that are rated *well suited* in table 3. Hardwoods that are not available commercially commonly can be transplanted successfully.

Coniferous woody plants.—These are cone-bearing evergreen trees and shrubs that are used by wildlife

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primarily as cover, though they also provide food in the form of browse and seeds. Examples are Norway spruce, white pine, arborvitae, redcedar, and juniper. These trees and shrubs are established naturally in areas where the cover of weeds and sod is thin. In table 3 the soils are rated *well suited* if the trees and shrubs grow slowly and have delayed canopy closure. It is important that branches be maintained close to the ground so that food and cover are readily available to rabbits, pheasants, and other small animals. If the trees quickly form a dense canopy that shuts out the light, the lower branches die.

On soils rated *poorly suited* for coniferous woody plants, the widely spaced plants may grow quickly but temporarily, and establishment or maintenance is difficult because these soils are well suited to competing hardwoods. Unless the stand is carefully managed, hardwoods invade and commonly overtop the conifers.

Wetland food and cover plants.—In this group are wild, herbaceous annuals and perennials that grow on moist to wet sites. They include smartweed, wild millet, rush, bulrush, spikerush, burreed, wildrice, buttonbush, rice cutgrass, cattails, and various kinds of sedges. Soils that are rated *well suited* are nearly level and poorly drained or very poorly drained; those rated *suited* are nearly level and somewhat poorly drained or frequently flooded. Depth, stoniness, and texture of the surface layer are of little concern.

Shallow water developments.—These are impoundments or excavations that provide areas of shallow water near food and cover for wetland wildlife. They are shallow dugouts, level ditches, blasted potholes, or devices that keep the water 6 to 24 inches deep in marshy areas. Soils that are rated *well suited* to this use have slopes of 0 to 1 percent, are more than 36 inches deep to bedrock, and are poorly drained or very poorly drained. Soils rated *suited* are nearly level and somewhat poorly drained. They may be only 20 to 36 inches deep to bedrock.

Excavated ponds.—These are dug-out areas or a combination of these and impoundments behind low dikes. The water is of suitable quality and depth to support fish or wildlife. If fish are produced, part of the pond should be at least 6 feet deep. The soils that are rated *well suited* for excavated ponds are nearly level, more than 72 inches deep, and poorly drained or very poorly drained. The degree of limitation to use of soils for excavated ponds increases with slope, and increasing slope reduces the size of pond that is feasible.

In table 3 the soils are also rated according to their suitability for three kinds of wildlife. The ratings are based on the ratings given to the elements of wildlife habitat shown in the first part of the table. For openland wildlife the ratings are based on the ratings given to grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. The ratings for woodland wildlife are based on those shown for all the elements except grain and seed crops. For wetland wildlife the ratings are based on those given to wetland food and cover plants, shallow water developments, and excavated ponds.

The following lists the important animals and birds in each of the three categories of wildlife listed in table 3.

Openland wildlife.—Examples of openland wildlife are pheasant, quail, meadowlark, field sparrow, dove, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home on cropland, in pastures and meadows, on lawns, and in areas overgrown with grasses, herbs, and shrubs.

Woodland wildlife.—Among the birds and mammals that prefer woodland are ruffed grouse, woodcock, thrush, vireo, scarlet tanager, gray squirrel, fox squirrel, gray fox, white-tailed deer, raccoon, opossum, and woodpecker. They obtain food and cover in areas of hardwood trees and shrubs, coniferous trees and shrubs, or a mixture of these plants.

Wetland wildlife.—Duck, geese, rail, heron, shore birds, mink, and muskrat are examples of birds and mammals that normally make their home in and around ponds, marshes, swamps, and other wet areas.

Engineering Uses of Soils [4]

Much of the information in this section is useful to engineers and others whose work involves the use of soil mechanics or soil engineering data. Some properties of soils are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the properties most important to the engineer are permeability to water, shear strength, compaction characteristics, soil drainage, shrink-swell potential, grain-size distribution, plasticity, and reaction. Depth to water table, depth to bedrock, slope, and available moisture capacity are also important.

The information in this survey can be used to—

1. Make soil and land use studies that will aid in selecting and developing sites for light industry, businesses, residences, and recreation.
2. Make preliminary estimates of the engineering properties of soils that help in planning farm drainage systems, farm ponds, irrigation systems, terraces and diversions, and waterways.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand and gravel and other material suitable for construction.
5. Correlate performance of engineering structures with soil mapping units, and thus develop information that will be useful in designing and maintaining the structures.

[4] This section has been reviewed by LLOYD E. GILLOGLY, construction engineer, Soil Conservation Service, State Office, Columbus, Ohio.

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6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and from aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

With the use of the soil map for identification, the engineering interpretations in this section can be useful for many purposes. It should be emphasized, however, that the interpretations do not eliminate the need for sampling and testing at the site of specific engineering works where loads are heavy and where the excavations are deeper than the layers reported. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Much of the information in this section is given in tables 4, 5, and 6. Additional information useful to engineers can be found in other sections of this soil survey, particularly the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used by soil scientists may not be familiar to the engineer, and some commonly used terms may have special meaning in soil science. Several of these terms are defined in the Glossary at the back of this survey.

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TABLE 4.—*Engineering test data for soil*

[Tests performed by the Ohio Department of Highways in accordance with standard

Soil and location	Parent material	Ohio report No. So—	Depth	Moisture density [1]		Mechanical analysis [2]	
				Maximum dry density	Optimum moisture	Percentage passing sieve—	
						3 in.	¾ in.
			Inches	*Lbs. per cu. ft.*	*Percent*		
Canfield silt loam:							
NW¼ of section 35 (Lawrence Township)	Glacial till (Wisconsin age).	8472	2–8	108	15	----	100
		8473	20–50	115	14	100	96
		8474	84–120	122	12	----	100
NW¼ of section 9 (Tuscarawas Township)	Glacial till (Wisconsin age).	8469	0–8	----	----	----	100
		8470	25–30	----	----	----	100
		8471	90–117	----	----	100	97
Chili silt loam:							
SE¼ of section 20 (Perry Township)	Glacial outwash on high terraces (Wisconsin age).	42045	0–9	106	15	----	100
		42046	12–19	113	15	100	95
		42047	19–29	121	12	100	88
		42048	29–60	121	11	100	77
Fitchville silt loam:							
SW¼ of section 35 (Nimishillen Township)	Slack water deposits.	42049	0–9	97	19	----	----
		42050	20–32	100	19	----	----
		42051	40–52	103	19	----	----
Geeburg silt loam:							
NE¼NE¼ of section 2 (Lexington Township)	Glacial till (Wisconsin age).	81177	0–7	----	----	----	----
		81178	16–24	----	----	----	----
		81179	46–72	----	----	----	----
Luray silt loam:							
SW¼ of section 24 (Perry Township)	Slack water deposits.	42052	0–7	91	26	----	----
		42053	15–30	95	21	----	100
		42054	38–60	112	15	----	100
Sebring silt loam:							
SE¼NE¼ of section 16 (Washington Township)	Lacustrine sediments on slack water terraces (Wisconsin age).	79875	0–10	----	----	----	----
		79876	30–42	----	----	----	----
		79877	42–78	----	----	----	----
Sebring silt loam, till substratum:							
NE¼ of section 3 (Marlboro Township)	Glacial till (Wisconsin age).	79884	0–8	----	----	----	----
		79885	26–41	----	----	----	----
		79886	58–83	----	----	----	100
Weinbach silt loam:							
SW¼SE¼ of section 28 (Lake Township)	Glacial outwash (Wisconsin valley train).	79881	0–8	----	----	----	----
		79882	19–30	----	----	----	100
		79883	38–60	----	----	----	100
Wheeling silt loam:							
SW¼SW¼ of section 16 (Jackson Township)	Glacial outwash (Wisconsin age).	42042	0–8	99	20	----	----
		42043	21–40	107	18	----	----
		42044	50–70	107	11	100	60
Wooster silt loam:							
SE¼NE¼ of section 36 (Lake Township)	Glacial till (early Wisconsin age).	79878	0–8	----	----	----	----
		79879	15–22	----	----	----	100
		79880	39–51	----	----	----	100

[1] Based on AASHO Designation: T 99–57, Method A (*2*).

[2] Mechanical analyses according to AASHO Designation T 88 (*2*). Results obtained by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses data used in this table are not suitable for naming textural classes for soils.

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samples taken from 11 soil profiles

procedures of the American Association of State Highway Officials (AASHO) (*2*)]

Mechanical analysis [3]—Continued					Liquid Limit	Plasticity index	Classification		
Percentage passing sieve—Continued				Percentage smaller than—					
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.005 mm.			AASHO [3]	Unified [4]	Ohio [5]
92	86	81	68	26	[6] NP	NP	A–4(7)	ML	A–4a
91	80	76	64	30	30	8	A–4(6)	ML–CL	A–4a
86	78	71	54	22	23	5	A–4(4)	ML–CL	A–4a
97	95	92	85	32	NP	NP	A–4(8)	ML	A–4b
83	73	68	54	25	28	9	A–4(4)	CL	A–4a
86	78	71	51	22	23	4	A–4(3)	ML–CL	A–4a
90	84	79	70	23	NP	NP	A–4(7)	ML	A–4a
86	79	75	67	28	29	9	A–4(6)	CL	A–4a
73	64	40	14	12	NP	NP	A–1–b(0)	SM	A–1–b
56	48	26	7	0	NP	NP	A–1–a(0)	SW–SM	A–1–a
----------	100	96	89	35	NP	NP	A–4(8)	ML	A–4b
----------	----------	100	99	50	47	25	A–7–6(15)	CL	A–7–6
----------	100	99	98	47	45	23	A–7–6(14)	CL	A–7–6
----------	100	97	88	46	40	12	A–6(9)	ML	A–6a
----------	100	99	95	67	48	23	A–7–6(15)	CL	A–7–6
----------	100	99	96	61	40	20	A–6(12)	CL	A–6b
----------	100	99	95	47	43	15	A–7–6(11)	ML–CL	A–7–6
99	92	91	87	42	55	30	A–7–6(19)	CH	A–7–6
98	90	87	83	33	31	9	A–4(8)	ML–CL	A–4b
----------	100	99	95	47	39	11	A–6(8)	ML	A–6a
----------	100	98	91	54	42	16	A–7–6(11)	ML–CL	A–7–6
----------	100	98	96	53	44	16	A–7–6(11)	ML–CL	A–7–6
----------	100	96	81	21	33	7	A–4(8)	ML	A–4b
----------	100	98	92	54	46	22	A–7–6(14)	CL	A–7–6
93	85	77	57	29	24	7	A–4(4)	ML–CL	A–4a
----------	100	98	92	35	NP	NP	A–4(8)	ML	A–4b
----------	81	73	45	20	26	7	A–4(2)	SM–SC	A–4a
----------	57	36	20	11	NP	NP	A–1–b(0)	SM	A–1–b
----------	100	99	96	30	NP	NP	A–4(8)	ML	A–4b
----------	----------	100	98	34	33	11	A–6(8)	ML–CL	A–6a
42	29	7	3	0	NP	NP	A–1–a(0)	GW	A–1–a
----------	100	96	83	31	32	6	A–4(8)	ML	A–4b
94	83	74	46	24	25	6	A–4(2)	SM–SC	A–4a
90	82	75	50	21	21	5	A–4(3)	SM–SC	A–4a

[3] Based on AASHO Designation M 145–49 (*2*).

[4] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Corps of Engineers (*15*). SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML–CL and SM–SC.

[5] Based on "Classification of Soils," Ohio State Highway Testing Laboratory. Feb. 1, 1955.

[6] NP = Nonplastic.

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TABLE 5.—*Estimated engineering*

[Absence of data indicates estimate was not made. The sign < means less than, and > means more than. Estimates were not made

Soil and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Percentage passing sieve—		
					No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*			
Arkport: ArB, ArC, ArD	>4	>6	0–9		100	95–100	40–55
			9–55		100	95–100	15–45
Bogart: BgA, BgB, BoA, BoB, BoC, Bu (The Urban land part of mapping unit Bu is too variable to rate.)	1½–3	>6	0–7		100	90–100	70–90
			7–22		100	90–100	75–90
			22–28	1–5	70–85	50–60	35–50
			28–42	1–5	30–100	25–35	15–25
			42–60	1–5	50–100	30–50	5–15
Brooke: BwC2, BwE2	>3	1⅔–3	0–7	0–10	85–95	80–90	70–80
			7–23	5–15	80–90	65–75	60–70
			23–30				
Canadice: Ca	0–½	>10	0–7		100	96–100	70–90
			7–45		100	95–100	90–100
			45–60		100	95–100	90–100
Canfield: CdA, CdB, CdC, CdC2, CdD, CdD2, CeB, CeC. (The Urban land part of mapping units CeB and CeC is too variable to rate.)	1½–3	>10	0–8		90–100	85–100	65–90
			8–25		85–100	75–90	65–90
			25–55		85–95	70–90	55–70
			55–62	1–5	85–95	75–90	50–65
Canfield, moderately shallow variant: CfB, CfC	>1	1⅔–3⅓	0–7		80–100	80–95	65–90
			7–24		85–95	70–95	55–70
			24–36	1–10	80–90	70–80	65–75
			36–42				
Carlisle: Ch	0–½	>10	0–60	(2)	(2)	(2)	(2)
			60–80	(2)	(2)	(2)	(2)
Chagrin: Ck, Cm	[1] >3	>4	0–32		95–100	90–100	70–90
			32–48		95–100	90–100	60–75
			48–60				

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properties of soils

for Alluvial land, Borrow pits, Cut and fill land, Gravel pits, Made land, Quarries, Strip mine spoil, and Urban land]

Classification			Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
Dominant USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Fine sandy loam.	SM or ML	A–4	2.0–6.3	0.05–0.10	5.0–6.0	Low	Low	Moderate.
Fine sandy loam, loamy fine sand, and fine sand.	SM	A–2 or A–4	6.3–12.0	.05–.10	5.0–5.5	Low	Low	Moderate.
Silt loam	ML	A–4	.63–2.0	.17–.20	5.5–6.5	Low		Moderate to low.
Silt loam	ML or CL	A–4, A–6	.63–2.0	.16–.18	5.1–5.5	Low	Moderate	Moderate.
Gravelly clay loam.	SC	A–6	.63–2.0	.12–.15	5.1–5.5	Low	Moderate	Moderate.
Gravelly sandy loam.	SM or GM	A–2	2.0–6.3	.04–.07	5.1–5.5	Low	Moderate	Moderate to high.
Gravel and sand.	SW–SM, SM, GW–GM, GM	A–1, A–2	6.3–12.0	<.05	5.0–6.0	Low	Moderate	Moderate to high.
Silty clay loam.	MH or CH	A–7	.2–.63	.17–.22	5.6–7.3	Moderate		Moderate to low.
Channery silty clay or clay. Limestone with thin strata of clay shale and siltstone.	CH	A–7	.063–.2	.13–.15	5.6–7.3	High	High	Moderate to low.
Silt loam	ML or CL	A–4, A–6	.2–.63	.17–.19	5.6–7.3	Moderate		Moderate to low.
Silty clay or clay	CH	A–7	<.063	.13–.15	5.6–7.3	Moderate to high.	High	Moderate to low.
Silty clay [1]	CH or MH	A–7	<.063	.13–.15	6.1–7.7	Moderate to high.	High	Low.
Silt loam	ML, ML–CL	A–4	.63–2.0	.18–.22	4.6–5.5	Low		Moderate to high.
Silt loam	ML or CL	A–4	.63–2.0	.17–.21	4.6–5.5	Low	Moderate	Moderate to high.
Loam (fragipan).	ML, CL–ML	A–4	.2–.63	.07–.10	5.1–6.0	Low	Moderate	Moderate.
Loam	CL–ML	A–4	.2–.63	.10–.14	5.6–6.0	Low	Moderate	Moderate.
Silt loam	ML, ML–CL	A–4	.63–2.0	.18–.22	4.6–5.0	Low	Moderate	Moderate.
Silt loam and loam	ML or CL–ML.	A–4	.63–12.0	.10–.18	4.6–5.0	Low	Moderate	High.
Silty clay loam	CH	A–7	.063–.20	.07–.10	4.6–5.0	Moderate	High	High.
Shale with thin strata of siltstone.								
Muck	Pt		>6.3	.20–.25	5.1–6.6	(2)	High	Moderate to low.
Variable mineral soil material.	ML–CL, CH	A–6, A–7	.063–.2	.07–.10	7.4–8.4	Moderate	High	Low.
Silt loam	CL or ML	A–6 or A–4	.63–2.0	.19–.23	5.6–7.8	Low	Low	Low.
Loam	CL or ML–CL.	A–6 or A–4	2.0–6.3	.15–.19	5.6–7.8	Low	Low	Low.
Gravelly and sandy loam.			6.3–12.0					

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TABLE 5.—*Estimated engineering*

Soil and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Percentage passing sieve—		
					No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*			
Chili: CnA, CnB, CpA, CpB, CpC, CpC2, CuB, CuC, CuF. (The Urban land part of mapping units CuB, CuC, and CuF is too variable to rate.)	>4	>10	0–9	----------	80–100	75–95	55–75
			9–19	----------	80–100	75–95	55–75
			19–36	1–10	40–75	30–65	10–20
			36–60	1–10	20–75	20–60	0–25
Chili gravelly loam: CoC, CoC2, CoD2, CoE2, CvF2. (For Conotton part of mapping unit CvF2, refer to Conotton series.)	>4	>10	0–8	----------	75–90	55–70	35–55
			8–18	----------	70–85	40–55	25–40
			18–24	1–10	60–80	20–40	0–15
			24–60	1–10	30–75	20–60	0–25
Conotton: CwA, CyB, CyC, CyD2, CyE2 (Mapping unit CwA has less than 20 percent, by volume, of gravel in the uppermost 15 inches.)	5	>10	0–9	1–5	60–80	55–70	25–55
			9–42	1–5	40–55	15–40	5–15
			42–60	1–10	45–70	15–50	0–20
DeKalb: DkB, DkC, DkE2, DkF2	>3	2–3½	0–7	1–10	85–95	80–95	30–40
			7–34	1–20	60–85	40–60	12–40
			34–50	----------	------	-------	------
Edwards: Ed	0–½	>10	0–28	(1)	(1)	(1)	(1)
			28–50	----------	------	-------	------
Fitchville: FcA, FcB, FcC, Fu (The Urban land part of mapping unit Fu is too variable to rate.)	½–1½	>10	0–9	----------	95–100	90–100	85–100
			9–40	----------	95–100	90–100	85–100
			40–52	----------	95–100	90–100	80–100
Geeburg: GbC2, GbE2	1–3	>5	0–7	----------	95–100	95–100	85–100
			7–27	----------	100	100	90–100
			27–60	----------	100	100	90–100
Gilpin: GdB, GdC, GdD	>3	1 2/3–3	0–9	----------	95–100	90–100	70–90
			9–30	10–15	80–95	70–90	50–75
			30	----------	------	-------	------
Ginat: Ge	0–½	>5	0–8	----------	95–100	90–100	70–95
			8–36	----------	95–100	85–95	65–90
			36–60	1–5	80–90	55–70	20–30

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properties of soils—Continued

Classification			Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
Dominant USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	ML	A–4	2.0–6.3	.15–.19	4.5–5.5	Low	Low	Moderate.
Silt loam	CL or ML	A–4	2.0–6.3	.15–.19	4.5–5.5	Low	Low	Moderate.
Gravelly sandy loam.	SM, SW–SM, GM or GW–GM.	A–1	>12.0	.02–.04	4.5–6.0	Low	Low	Moderate.
Loamy coarse sand.	GW, GP, SW, SP, SM, GM.	A–1	>12.0	.02–.04	5.1–5.5	Low	Low	Moderate.
Gravelly loam.	SM or ML	A–2, A–4, A–6.	2.0–6.3	.12–.16	4.5–5.5	Low		Moderate.
Gravelly loam.	SM	A–2, A–4	6.3–12.0	.10–.14	4.5–5.5	Low	Low	Moderate.
Very gravelly sandy loam.	SW or SM	A–1	>12.0	.02–.04	4.5–5.5	Low	Low	Moderate.
Stratified coarse sand and gravel.	GW, GP, SW, SP, GM, SM.	A–1	>12.0	.02–.04	5.1–5.5	Low	Low	Moderate.
Gravelly loam.	ML or SM or GM.	A–4 or A–2	6.3–12.0	.11–.15	5.6–6.0	Low		Moderate.
Very gravelly sandy loam.	GW–GM, or GM.	A–1	6.3–12.0	.06–.10	5.1–6.0	Low	Low	Moderate.
Sand and gravel.	GW, GM or SW, SM.	A–1	>12.0	.02–.04	5.6–6.0	Low	Low	Moderate.
Sandy loam.	SM	A–2 or A–4	2.0–6.3	.14–.18	4.5–5.5	Low		High.
Channery sandy loam.	SM	A–4 or A–2	2.0–6.3	.08–.12	4.5–5.5	Low	Low	High.
Sandstone normally shattered.								
Muck	Pt	(2)	(2)	.20–.25	5.6–7.3	Low	High	Low.
Marl						Low	High	Low.
Silt loam	CL–ML or MH.	A–4	.63–2.0	.17–.20	5.0–6.0	Low		Moderate.
Silt loam or silty clay loam.	CL, CL–ML	A–7, A–6	.20–.63	.17–.20	4.5–6.0	Low to moderate.	High	Moderate.
Silty clay loam.	CL, CL–ML	A–7, A–6	.20–.63	.17–.20	6.1–7.3	Low	High	Low.
Silt loam	CL or ML	A–6	.20–.63	.18–.22	4.5–5.5	Moderate		Moderate.
Silty clay or clay	CH or ML–CL.	A–7	<.063	.13–.15	4.5–6.6	High	High	Moderate.
Clay	CH or CL	A–7, A–6	<.063	.13–.15	7.9–8.2	High	High	Low.
Silt loam	ML, ML–CL	A–4, A–6	.63–2.0	.17–.20	4.5–5.5	Low		High.
Silt loam	ML–CL or CL.	A–4 or A–6	.63–2.0	.14–.17	4.5–5.5	Low	Moderate	High.
Mostly siltstone and fine-grained sandstone.								
Silt loam	ML or CL	A–4, A–6	.63–2.0	.18–.23	5.6–6.0	Low	High	Moderate.
Silt loam or loam (fragipan).	CL	A–6	.20–.63	.10–.16	5.1–6.0	Moderate	High	Moderate.
Gravelly sandy loam.	SM	A–2	.63–2.0	.06–.10	5.1–5.5	Low	High	Moderate.

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TABLE 5.—*Estimated engineering*

Soil and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Percentage passing sieve—		
					No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*			
Glenford: GfA, GfB, GfC, GfC2, GfD2	1½–3	>10	0–8	.....	95–100	90–100	70–90
			8–40	.....	95–100	90–100	70–90
			40–50	100	95–100	90–100	65–90
Keene: KeB, KeC, KeC2, KeD, KeD2, KeE.	1–3	3–5	0–8	.....	85–100	80–100	70–95
			8–19	.....	85–100	80–100	70–95
			19–34	.....	70–90	70–90	60–90
			34–40	.....	.....	.....	.....
Killbuck: Kk	0–½	>5	0–22	.....	95–100	90–100	70–95
			22–36	.....	95–100	90–100	80–95
			36–40	.....	95–100	90–100	60–75
Latham: LaB, LaC, LaC2, LaD, LaD2, LaF.	1½–>3	2–3½	0–7	.....	85–100	80–100	70–95
			7–38	.....	90–100	80–95	75–95
			38–45	.....	.....	.....	.....
Licking: LcA, LcB, LcC, LcC2, LcE2	1½–3	>5	0–7	.....	100	95–100	75–95
			7–20	.....	.....	100	80–95
			20–44	.....	.....	100	80–95
			44–60	.....	.....	100	70–95
Linwood: Ld	0–½	>10	0–23	.....	(2)	(2)	(2)
			23–50	.....	85–100	80–100	30–60
Lobdell, alkaline phase: Le	[1] 1½–3	>4	0–60	.....	95–100	85–100	60–85
Loudonville: LoB, LoC, LoC2, LoD, LoD2, LoE2, LoF2, LuB, LuC. (The Urban land part of mapping units LuB and LuC is too variable to rate.)	>3	1⅔–3⅓	0–14	1–5	80–95	70–90	50–65
			14–28	1–10	70–90	60–85	50–60
			28–56	.....	.....	.....	.....
Luray: Ly	0–½	>5	0–11	.....	95–100	90–100	85–100
			11–38	.....	95–100	90–100	85–100
			38–60	.....	90–100	90–100	70–90
Luray, gravelly subsoil variant: Lz	0–½	7.5	0–8	.....	95–100	90–100	85–100
			8–18	.....	95–100	90–100	85–100
			18–34	.....	90–100	90–100	70–90
			34–44	1–10	70–85	45–55	30–40
			44–60	10–15	55–70	15–25	5–10

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properties of soils—Continued

Classification			Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
Dominant USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	CL or ML	A–4	.63–2.0	.17–.20	5.1–6.0	Low		Moderate.
Silt loam or silty clay loam.	CL or ML–CL.	A–6, A–4	.20–.63	.10–.15	5.1–6.0	Moderate	Moderate to high.	Moderate.
Silt loam	CL or ML–CL.	A–6 or A–4	.63–2.0	.14–.17	5.1–6.0	Low	Moderate to high.	Moderate to low.
Silt loam	ML, ML–CL	A–4	.63–2.0	.18–.22	5.1–6.5	Low		High.
Silty clay loam.	ML, ML–CL	A–6, A–4	.20–.63	.18–.22	4.5–5.5	Moderate	High	High.
Silty clay	CL, ML or MH–CH.	A–7	.063–.20	.14–.18	4.5–5.5	High	High	High.
Weathered, acid, gray shale.								
Silt loam	CL or ML	A–4 or A–6	.63–2.0	.17–.20	5.6–6.5	Low		Moderate.
Light silty clay loam.	CL	A–6	.20–.63	.18–.22	5.6–7.3	Moderate	High	Moderate to low.
Loam	CL	A–6	.20–.63	.14–.18	5.6–7.3	Low	High	Moderate to low.
Silt loam	ML	A–4	.63–2.0	.18–.22	5.1–5.5	Low		High.
Silty clay loam to clay.	CH	A–7	.063–.20	.14–.17	4.5–5.0	Moderate to high.	High	High.
Fragmented and weathered, acid, gray shale.								
Silt loam	ML, ML–CL	A–4	.63–2.0	.17–.20	5.1–6.0	Low		Moderate.
Silt loam	CL	A–6	.20–.63	.17–.20	4.5–5.5	Low	High	High.
Silty clay to clay.	CH	A–7	<.063	.13–.15	5.6–6.5	Moderate to high.	High	Moderate.
Stratified clay, silty clay, and silt loam.	CH or CL	A–6, A–7	<.063	.13–.15	6.6–7.3	Moderate	High	Low.
Muck	Pt		(*)	.20–.25	5.6–7.3	Low	High	Moderate to low.
Sandy loam	SM or ML	A–2 or A–4	.63–2.0	.10–.14	7.5–7.9	Low	High	Low.
Silt loam	CL or ML	A–4 or A–6	.63–2.0	.19–.23	6.6–7.8	Low	Moderate	Low.
Silt loam	ML, ML–CL	A–4	.63–2.0	.17–.20	4.5–5.5	Low	Low	High.
Loam	ML or ML–CL	A–4	.63–2.0	.14–.18	4.5–5.5	Low to moderate.	Low	High.
Sandstone, normally shattered.								
Silty clay loam.	CL, ML–CL	A–6, A–7	.63–2.0	.20–.23	6.1–6.5	Moderate	High	Low.
Silty clay loam.	CL, CH	A–6, A–7	.20–.63	.17–.20	6.1–7.3	Moderate to high.	High	Low.
Silt loam or loam.	CL or ML–CL	A–6 or A–4	.63–2.0	.18–.21	6.6–7.3	Low	High	Low.
Silty clay loam.	CL, ML	A–6, A–7	.63–2.0	.20–.23	6.1–6.5	Low	High	Low.
Silty clay loam.	CL, CH	A–6, A–7	.20–.63	.17–.20	6.1–7.3	Moderate to high.	High	Low.
Silt loam	CL–ML	A–6, A–4	.63–2.0	.18–.21	6.6–7.3	Low	High	Low.
Gravelly loam.	SM	A–2, A–4	2.0–6.3	.06–.10	6.6–7.3	Low	High	Low.
Very gravelly sandy loam.	GW–GM	A–1	>6.3	.02–.04	6.6–7.3	Low	High	Low.

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TABLE 5.—*Estimated engineering*

Soil and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Percentage passing sieve—		
					No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*			
Mentor: MeA, MeB, MeC, MeD	>4	>10	0–8		95–100	90–100	70–90
			8–44		95–100	90–100	80–90
			44–50		75–95	70–95	60–75
Montgomery: Mg	0–½	>10	0–9		100	100	85–100
			9–42		100	100	85–100
			42–60		100	100	80–100
Muskingum: MsB, MsC, MsD, MvE, MvE3, MvF, MvG, MwF. (For Gilpin part of mapping units MvE, MvE3, MvF, MvG and MwF, refer to the Gilpin series. The Urban land part of mapping unit MwF is too variable to rate.)	>3	1½–3	0–7	1–10	90–100	80–90	50–70
			7–17	1–10	80–90	75–90	50–65
			17–29	1–20	60–75	40–65	30–45
			29–33				
Plainfield: PlB, PlC	>4	>10	0–22		100	95–100	15–35
			22–34		100	95–100	5–15
			34–60		100	50–75	5–10
Rainsboro: RaB, RaC	1½–3	>10	0–8		95–100	95–100	70–90
			8–29		90–100	90–100	70–90
			29–48		75–100	50–85	25–55
			48–60		90–100	90–100	75–90
Ramsey: RcC, RcD, RcE2, RcF2	>3	1–1⅔	0–19	10–50	50–85	20–50	10–20
			19				
Ravenna: ReA, ReB, Rn (The Urban land part of mapping unit Rn is too variable to rate.)	½–1½	>10	0–8		90–100	80–95	70–85
			8–23		90–100	85–100	75–95
			23–43		80–95	70–95	55–80
			43–60	1–5	80–95	70–95	45–60
Remsen RoA, RoB, Rr (The Urban land part of mapping unit Rr is too variable to rate.)	½–1½	>4	0–7		95–100	95–100	80–90
			7–46		95–100	95–100	85–100
			46–72		95–100	95–100	85–95
Rittman: RsB, RsC, RsC2, RsD2	1½–3	>10	0–7		95–100	90–100	70–95
			7–22		90–100	85–100	60–80
			22–41		80–100	80–100	70–80
			41–78		80–95	75–95	

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properties of soils—Continued

Classification			Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
Dominant USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	CL or ML	A–4	.63–2.0	.17–.20	5.1–6.0	Low		Moderate.
Light silty clay loam, silt loam.	CL, ML–CL	A–6	.63–2.0	.16–.19	5.1–6.0	Low to moderate.	Moderate	Moderate.
Loam	ML, CL	A–4	.63–2.0	.14–.18	5.1–6.5	Low	Moderate	Moderate.
Silty clay loam.	CL, ML–CL	A–6, A–7	.20–.63	.17–.22	6.1–6.5	Moderate	High	Low.
Silty clay	CH, CL	A–7	<.063	.13–.15	5.6–7.3	High	High	Low.
Silty clay loam.	CH, CL	A–7, A–6	<.063	.15–.18	7.5–8.0	High to moderate.	High	Low.
Silt loam	ML	A–4	2.0–6.3	.16–.20	4.5–5.5	Low	Low	High.
Silt loam	ML	A–4	2.0–6.3	.13–.17	4.5–5.5	Low	Low	High.
Channery silt loam to fine sandy loam. Mostly siltstone and fine-grained sandstone.	GM or SM	A–2, A–4	2.0–6.3	.10–.15	4.5–5.0	Low	Low	High.
Loamy sand, sand.	SM	A–2	>6.3	.06–.08	4.5–5.5	Low	Low	High.
Sand	SP–SM or SM	A–2 or A–3	>6.3	.04–.06	4.5–5.5	Low	Low	High.
Gravelly sand.	SP–SM	A–1, A–2	>6.3	.04–.06	4.5–5.5	Low	Low	High.
Silt loam	ML	A–4	.63–2.0	.17–.20	5.1–6.5	Low		Moderate.
Silt loam	ML or CL	A–4 or A–6	.63–2.0	.17–.20	5.1–6.0	Low	High	Moderate.
Gravelly loam to sandy loam (fragipan).	SM or ML	A–2 or A–4	.20–.63	.10–.15	5.1–6.0	Low	High	Moderate.
Silty clay loam.	ML or CL	A–6	.063–.20	.17–.21	6.6–7.3	Moderate	High	Low.
Channery to very channery sandy loam. Sandstone, normally shattered.	SW–SM, SM or GW–GM or SM.	A–1, A–2	6.3–12.0	.10–.15	4.5–5.5	Low	Low	High.
Silt loam	ML, ML–CL	A–4	.63–2.0	.17–.20	5.1–6.0	Low		High.
Silt loam	CL, ML–CL	A–4 or A–6	.20–.63	.17–.19	4.5–5.5	Moderate	High	High.
Loam (fragipan).	CL–ML or CL	A–4 or A–6	.20–.63	.14–.18	4.5–5.5	Low	High	High.
Loam	SM or ML–CL	A–4	.20–.63	.14–.18	4.5–5.5	Low	High	High.
Silt loam	CL or ML	A–6, A–4	0.2–.63	.17–.20	4.5–5.0	Moderate		High.
Clay or silty clay.	CH	A–7, A–6	<.063	.13–.15	4.5–7.9	High	High	Moderate.
Silty clay	CH	A–7	<.063	.13–.15	7.9–8.2	High	High	Low.
Silt loam	ML	A–4	.63–2.0	.17–.20	4.5–5.5	Low	Moderate	High.
Clay loam	CL	A–6	.02–.63	.16–.19	4.5–5.5	Moderate	Moderate	High.
Clay loam (fragipan).	CL, CL–ML	A–6 or A–4	.063–.20	.06–.10	5.0–6.5	Low	Moderate	Moderate.
Clay loam	CL–ML, ML	A–4	.20–.63	.06–.10	7.5–8.0	Low	Moderate	Low.

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TABLE 5.—*Estimated engineering*

Soil and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Percentage passing sieve—		
					No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*			
Sebring: Sb, Sg	0–½	>10	0–16		100	100	90–100
(The Urban land part of mapping unit Sg is too variable to rate.)			16–40		100	100	90–100
			40–48		100	100	85–100
Sebring silt loam, till substratum: Se	0–½	>10	0–16		100	100	90–100
			16–41		100	100	90–100
	0–½	>10	41–88		80–95	75–90	60–75
Shoals: Sh	[3] ½–1½	>4	0–24		95–100	90–100	65–90
			24–60		95–100	90–100	60–75
Sloan: Sl	[3] 0–½	>4	0–25		100	95–100	70–90
			25–50		95–100	95–100	60–75
Tilsit: TlC, TlD	1½–3	3–5	0–23		100	95–100	75–90
			23–34		100	95–100	80–95
			34–47	1–5	70–80	45–75	30–65
			47				
Trumbull: Tr	0–½	>4	0–6		95–100	95–100	80–90
			6–42		95–100	95–100	85–95
			42–60		95–100	95–100	85–95
Wadsworth: WaA, WaB, WaC, WaC2	½	>5	0–7		95–100	90–100	75–90
			7–20		90–100	85–100	75–90
			20–31		95–100	90–95	70–80
			31–60		85–100	80–100	65–85
Wadsworth silt loam, moderately shallow variant: WbB	½	1⅔–3½	0–12		95–100	90–100	80–90
			12–24		95–100	90–100	75–90
			24–40		90–100	85–100	75–90
			40–50				
Wallkill: Wc	[3] 0–1½	>5	0–10		95–100	95–100	75–90
			10–25		100	100	90–100
			25–50		([2])	([2])	([2])
Wayland: Wd	[3] 0–½	>4	0–50		95–100	95–100	70–90
Weikert: WeC, WeD, WeE2, WeF2	>3	1–1⅔	0–7	1–10	80–90	60–75	45–60
			7–18	20–70		10–40	10–45
			18–24				

CDF013400

properties of soils—Continued

Classification			Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
Dominant USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	CL–ML or ML.	A–4, A–6	.63–2.0	.17–.22	4.5–5.5	Low	High	High.
Silty clay loam.	CL, ML–CL	A–6, A–7	.20–.63	.16–.19	5.1–6.0	Moderate	High	High.
Silt loam	CL, CL–ML	A–6 or A–4	.20–.63	.17–.19	5.1–7.3	Low	High	Moderate to low.
Silt loam	CL–ML, ML	A–4, A–6	.63–2.0	.17–.22	4.5–5.5	Low	High	High.
Silty clay loam.	CL, ML–CL	A–6, A–7	.20–.63	.16–.19	5.1–6.0	Moderate	High	High.
Loam	ML	A–4	.20–.63	.06–.10	5.6–7.8	Low	High	Low.
Silt loam	CL or ML	A–4 or A–6	.63–2.0	.18–.22	5.6–8.4	Low	High	Moderate to low.
Loam	CL or ML	A–4 or A–6	.63–2.0	.18–.22	6.6–7.8	Low	High	Low.
Silt loam	CL or ML	A–6 or A–4	.63–2.0	.19–.23	6.6–7.3	Low	High	Low.
Loam	ML or CL	A–6 or A–4	.63–2.0	.15–.21	6.1–8.4	Low	High	Low.
Silt loam	ML, ML–CL	A–4	.63–2.0	.17–.20	5.1–5.5	Low	Low	Moderate.
Silty clay loam (fragipan).	CL	A–6	.063–.20	.07–.12	4.5–5.5	Moderate	Low	Moderate. to high.
Silt loam	ML or SM	A–4 or A–2	.63–2.0	.14–.18	4.5–5.5	Low	Low	Moderate to high.
Stratified siltstone, sandstone, and shale.								
Silt loam	CL or ML	A–6, A–4	.20–.63	.16–.19	<4.5–5.5	Moderate		High.
Silty clay loam to clay.	CH	A–7	.063–.2	.14–.17	4.5–7.0	High	High	High to moderate.
Silty clay	CH	A–7	.063–.2	.14–.17	7.4–7.8	High	High	Low.
Silt loam	ML	A–4	.20–.63	.17–.19	5.1–6.0	Low		Moderate.
Silty clay loam.	CL, ML–CL	A–6	.20–.63	.15–.18	5.1–5.5	Moderate	High	Moderate.
Clay loam (fragipan).	CL	A–6	.063–.20	.06–.10	5.1–6.5	Moderate	High	Moderate.
Clay loam	CL, ML	A–6	.20–.63	.06–.10	6.1–7.3	Low	High	Low.
Silt loam	ML	A–4	.20–.63	.17–.19	5.1–6.0	Low	High	Moderate.
Silt loam (fragipan).	ML	A–4	.063–.20	.10–.16	5.1–5.5	Low	High	Moderate.
Silty clay loam. Shale.	CL, ML–CL	A–6	.20–.63	.15–.18	5.1–6.5	Moderate	High	Moderate.
Silt loam	CL	A–6	.63–2.0	.19–.23	5.6–7.3	Low	High	Low.
Silty clay	CH	A–7	.063–.20	.15–.18	5.6–7.3	Moderate to high.	High	Low.
Muck	Pt		(2)	.20–.25	5.6–7.3	High	High	Low.
Silt loam	CL, ML	A–4 or A–6	.63–2.0	.19–.23	6.1–6.5	Low	High	Low.
Channery silt loam.	SM, ML	A–4	2.0–6.3	.12–.16	4.5–5.5	Low	Moderate to low.	High.
Very channery silt loam. Mostly siltstone, thin strata of sandstone and shale.	GM, GP–GM	A–2, A–4	2.0–6.3	.06–.12	4.5–5.5	Low	Moderate to low.	High.

TABLE 5.—*Estimated engineering*

Soil and map symbols	Depth to seasonal high water table	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Percentage passing sieve—		
					No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)
	Feet	*Feet*	*Inches*	*Percent*			
Weinbach: WhA, WhB, Wk (The Urban land part of mapping unit Wk is too variable to rate.)	½–1½	>10	0–8	1–2	95–100	90–100	80–100
			8–19	1–2	95–100	85–95	80–90
			19–30	1–5	90–100	80–90	30–40
			30–60	5–10	55–80	45–70	15–30
Wellston: WlB, WlC	>3	2½–4	0–7	--------	90–100	80–100	70–95
			7–31	--------	90–100	80–100	70–95
			31–38	25–50	40–70	15–40	12–30
			38–50	--------	------	-------	------
Wheeling: WmA, WmB, WmC2, WrA, WrB, WrC, WrC2, WsD2.	>4	>10	0–8	--------	95–100	90–100	80–95
			8–41	--------	95–100	90–100	80–100
			41–50	0–5	30–65	15–40	0–20
Willette: Wt	0–½	>10	0–26	--------	------	-------	------
			26–50	--------	95–100	90–100	70–95
Wooster: WuB, WuC, WuC2, WuD2, WuE2, WuF2, WvD. (The Urban land part of mapping unit WvD is too variable to rate.)	>4	>4	0–21	--------	90–100	80–95	60–85
			21–40	1–5	75–95	70–95	45–70
			40–60	1–5	75–95	70–95	45–70

[1] Contains thin strata of silty clay loam, silt loam, and gravel and sand.
[2] Variable.
[3] Subject to flooding.

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properties of soils—Continued

Classification			Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosion potential	
Dominant USDA texture	Unified	AASHO					Steel	Concrete
			Inches per hour	*Inches per inch of soil*	*pH*			
Silt loam	ML, ML–CL	A–4	.63–2.0	.17–.19	4.5–5.0	Low	High	High.
Light silty clay loam.	CL, ML	A–6	.20–.63	.16–.19	4.5–5.0	Low	High	High.
Sandy loam (fragipan).	SM	A–2, A–4	.20–.63	.06–.10	5.1–6.0	Low	High	Moderate.
Gravelly sandy loam or loamy sand.	SM, GM	A–1, A–2	2.0–6.3	.04–.07	6.1–7.8	Low	High	Low.
Silt loam	ML, ML–CL	A–4	.63–2.0	.19–.24	4.5–5.5	Low		Moderate.
Heavy silt loam.	ML–CL or CL.	A–6 or A–4	.63–2.0	.16–.20	4.5–5.5	Low	Moderate to low.	Moderate to high.
Very channery silt loam.	GM, SM	A–1, A–2	2.0–6.3	.04–.07	4.5–5.5	Low	Low	High.
Interbedded siltstone, sandstone, and shale.								
Silt loam	ML, ML–CL	A–4	.63–2.0	.17–.20	5.6–6.0	Low		Moderate.
Silt loam	ML–CL	A–4, A–6	.63–2.0	.16–.20	4.5–5.5	Low	Low	Moderate to high.
Very gravelly fine sandy loam or coarse sand.	GW, GP, GM or SW, SP, SM	A–1, A–2	6.3–12.0+	.02–.04	4.5–5.5	Low	Low	Moderate to high.
Muck	Pt			.20–.25	5.1–6.5	Low	High	Moderate.
Heavy clay loam.	CL, CH	A–6, A–7	.20–.63	.12–.15	6.1–7.8	Moderate	High	Low.
Silt loam to loam.	ML, ML–CL	A–4	.63–2.0	.17–.20	4.5–6.0	Low	Low	Moderate to high.
Loam (fragipan).	ML, CL, SM	A–4	.63–2.0	.10–.15	5.1–5.5	Low	Low	Moderate.
Loam	ML, CL, SM	A–4	.63–2.0	.07–.12	5.1–6.0	Low	Low	Moderate.

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TABLE 6.—*Engineering*

[Interpretations were not made for Urban land or Borrow pits. Absence

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Soil features affecting—
			Topsoil	Sand and gravel	Road fill	Highway location
Alluvial land: Ad, An (Urban land in mapping unit An is variable and is not included in the interpretation of that unit.)	Poor: subject to flooding; seasonal high water table.	High	Fair: subject to flooding.	Not suitable.	Fair: silty material.	Subject to flooding; seasonal high water table.
Arkport: ArB, ArC, ArD	Good: well drained; sandy material.	Low	Poor: sandy material.	Good for sand: well-graded sand. Unsuitable for gravel.	Fair to good: sandy material.	Sandy; well drained.
Bogart: BgA, BgB, BoA, BoB, BoC, Bu (Urban land in mapping unit Bu is variable and is not included in the interpretation of that unit.)	Fair: sandy and gravelly material below a depth of 3 feet; can usually be graded in winter.	Moderate	Good	Good below a depth of 3 feet.	Good in solum: stable material. Good in substratum: stable material; low shrink-swell potential; good workability.	Saturated during wet periods; high stability; good workability.
Brooke: BwC2, BwE2	Poor: difficult to work when wet.	Moderate	Fair: silty clay loam texture.	Not suitable.	Poor: low stability; difficult to work when wet; 20 to 36 inches to limestone.	Limestone below a depth of 2 feet; low stability; clayey; very steep in some places.
Canadice: Ca	Poor: seasonal high water table.	Moderate	Fair: small amount of suitable material; low organic-matter content.	Not suitable.	Poor: clayey material.	High water table; plastic, clayey material; low stability.
Canfield: CdA, CdB, CdC, CdC2, CdD, CdD2, CeB, CeC. (Urban land in mapping units CeB and CeC is variable and is not included in the interpretation of those units.)	Fair: seasonal high water table.	Moderate	Good	Not suitable.	Fair: moderate stability; low shrink-swell potential; easy to compact; erodible on slopes.	Fair stability; susceptibility to frost action.
Canfield (moderately shallow variant): CfB, CfC.	Poor: seasonal high water table.	Moderate	Good	Not suitable.	Poor: shale at depth of 20 to 40 inches.	Shale at depth of 20 to 40 inches.

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interpretations of the soils

of entry indicates that the soil or land type is variable and is not rated]

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Subject to flooding; seasonal high water table.	Fair to good compaction and stability; slow seepage.	Seasonal high water table; subject to flooding.	Subject to flooding; seasonal high water table.	Not applicable	Not applicable.
High seepage	Fair stability; rapid permeability; subject to piping; fair to good compaction.	Not needed	Rapid permeability; low available moisture capacity.	Sandy and droughty.	Sandy and droughty.
High seepage; sandy and gravelly material.	Fair to good compaction; poor resistance to piping; excessive seepage.	Moderate permeability in subsoil; rapid permeability in underlying material; moderately well drained.	Medium to high infiltration; low to medium available moisture capacity.	Soil features favorable.	Moderately erodible.
Slow seepage; limestone at a depth of 2 to 3 feet; variable permeability.	Fair compaction; slow seepage; high shrink-swell potential.	Slow permeability; limestone at depth of 2 or 3 feet.	Slow infiltration; low available moisture capacity; slow permeability.	Shallow to fine-textured material; limestone at depth of 20 to 36 inches.	Moderately erodible.
High water table; very slow seepage.	Clayey material: very slow permeability when compacted; poor compaction.	Slow infiltration; low available water capacity; very slow permeability; high water table.	Slow infiltration; very slow permeability; low available moisture capacity.	Not needed	Slightly erodible; high water table.
Slight seepage	Good stability and compaction; moderate seepage; slight piping hazard.	Moderately slow permeability; seasonal high water table.	Moderate infiltration; medium available moisture capacity.	Moderately well drained; moderately steep in some places.	Moderately erodible; other soil features favorable.
Moderate seepage; shale at depth of 20 to 40 inches.	Good stability and compaction; moderate seepage; slight piping hazard; shale at depth of 20 to 40 inches.	Moderately slow permeability; seasonal high water table; shale at depth of 20 to 40 inches.	Moderate infiltration; medium available moisture capacity.	Shale at depth of 20 to 40 inches.	Moderately erodible; other soil features favorable.

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TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			
			Topsoil	Sand and gravel	Road fill	Highway location
Carlisle: Ch	Poor: organic material; commonly saturated.	High	Fair to good if mixed with mineral material; poor if used alone.	Not suitable; organic material.	Not suitable: organic material.	Organic material; very low stability; material must be removed from roadbed; high water table.
Chagrin: Ck, Cm	Fair: subject to flooding.	Moderate	Good	Not suitable.	Fair: loamy material.	Subject to flooding; moderate frost action; low stability.
Chili: CnA, CnB, CoC, CoC2, CoD2, CoE2, CpA, CpB, CpC, CpC2, CuB, CuC, CuF, CvF2. (Urban land in mapping units CuB, CuC, and CuF is variable and is not included in the interpretation of those units. For interpretations of Conotton soil in mapping unit CvF2, refer to the Conotton series.)	Good: well drained.	Low	Fair for nongravelly soils; poor for gravelly soils.	Good below a depth of 3 feet.	Fair to good in solum: loamy and gravelly material. Good in substratum: sandy and gravelly material in most places.	Good stability; well drained; droughty in cuts.
Conotton: CwA, CyB, CyC, CyD2, CyE2	Good: well-drained; gravelly material.	Low	Fair for nongravelly soils; poor for gravelly soils.	Good below a depth of 2 feet; few cobblestones.	Good: gravelly material.	Sandy and gravelly material; easy to work; high stability; droughty in cuts.
Cut and fill land: Cz			Not suitable.			Cuts and fills are commonly needed.
Dekalb: DkB, DkC, DkE2, DkF2	Poor: sandstone at a depth of 20 to 40 inches.	Low	Fair: few coarse fragments.	Not suitable.	Fair: loamy material; sandstone at depth of 24 to 40 inches.	Sandstone at depth of 24 to 40 inches; good stability.
Edwards: Ed	Poor: organic material; commonly saturated.	High	Fair to good if mixed with mineral soil; poor if used alone.	Not suitable; organic material.	Not suitable: organic material.	Organic material; marl below a depth of 20 inches; very low stability; high water table.

CDF013406

of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
High water table; high seepage.	Unstable; organic material; high seepage.	Variable permeability; high water table; surface subsidence when drained.	Rapid permeability; high available moisture capacity.	Not needed	Moderately erodible; high water table.
Subject to flooding; moderate seepage; few sandy seams.	Fair compaction; moderate permeability if compacted. Contains strata of sand in some places.	Moderate permeability; good natural drainage.	Moderate to high infiltration; high available moisture capacity.	Nearly level; subject to flooding.	Slightly to moderately erodible; subject to flooding.
High seepage; pervious; sandy and gravelly material.	Good stability; moderate to high seepage; subject to piping; sandy and gravelly material.	Good natural drainage.	High infiltration; medium to low available moisture capacity.	Droughty; sandy and gravelly material.	Moderately erodible; medium to low available moisture capacity.
Sand and gravel below a depth of 2 feet; excessive seepage.	Good compaction; rapid permeability if compacted; subject to piping; sandy and gravelly material.	Good natural drainage.	High infiltration; very low available moisture capacity.	Droughty; sandy and gravelly material.	Moderately erodible; very low available moisture capacity.
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Medium to high seepage; fractured bedrock at depth of 24 to 40 inches.	Fair stability; moderate permeability if compacted; slight piping hazard.	Good natural drainage; sandstone at depth of 24 to 40 inches.	High infiltration; low available moisture capacity.	Bedrock at depth of 20 to 40 inches; other soil features favorable.	Moderately erodible; low available moisture capacity.
High water table; high seepage.	Unstable organic material; high seepage.	High water table; marl below a depth of 20 inches; surface subsidence if drained.	Variable infiltration; high available moisture capacity.	Not needed	High water table; organic material.

CDF013407

TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Highway location
			Topsoil	Sand and gravel	Road fill	
Fitchville: FcA, FcB, FcC, Fu (Urban land part of mapping unit Fu is variable and is not included in the interpretation of that unit.)	Poor: seasonal high water table.	High	Good to depth of 12 inches; low organic-matter content.	Not suitable.	Poor: high content of silt.	Seasonal high water table; highly susceptible to frost action; low stability; unstable material; may flow when wet.
Geeburg: GbC2, GbE2	Poor: seasonal high water table.	Moderate	Fair: thin to clay.	Not suitable.	Poor: clayey material.	Perched water table during wet periods; highly plastic; clayey.
Gilpin: GdB, GdC, GdD	Poor: siltstone and sandstone at depth of 20 to 40 inches.	Moderate	Good	Not suitable.	Poor: siltstone and sandstone at a depth of 20 to 36 inches.	Siltstone and sandstone below a depth of 20 inches; stony in some places.
Ginat: Ge	Poor: seasonal high water table.	High	Good	Poor in upper 3 to 4 feet; fair to good below a depth of 3 to 4 feet.	Poor in solum: silty material. Fair in substratum: dirty sand and gravel.	Seasonal high water table; susceptible to frost action; easily excavated.
Glenford: GfA, GfB, GfC, GfC2, GfD2	Poor: seasonal high water table.	High	Good	Not suitable.	Poor: silty material; unstable when wet.	Perched water table during wet periods; highly susceptible to frost action; unstable; soil material may flow when wet.
Gravel pits: Gp	Good: well drained; gravelly material.	Low	Not suitable.	Good	Variable: sand and gravel in some places.	Well drained; permeable; cuts and fills are commonly needed.
Keene: KeB, KeC, KeC2, KeD, KeD2, KeE	Poor: seasonal high water table.	Moderate	Good	Not suitable	Poor: silty material; soft shale at depth of 20 to 40 inches.	Silty clay loam subsoil; low stability; susceptible to frost action.

CDF013408

of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Seasonal high water table; moderate seepage.	Fair compaction; fair stability; slow permeability when compacted; erodibility; fair to poor resistance to piping.	Moderately slow permeability; seasonal high water table.	Moderate infiltration; medium available moisture capacity; somewhat poor natural drainage.	Not needed	Moderately erodible; seasonal wetness.
Very slow seepage	Fair stability; fair to poor compaction; very slow permeability; high resistance to piping; high shrink-swell potential.	Very slow permeability; moderately well drained; saturated during wet periods.	Slow infiltration; low available moisture capacity.	Sloping to steep; shallow to fine-textured material.	Moderately erodible; low available moisture capacity.
Medium to high seepage; fractured bedrock below a depth of 20 inches.	Fair stability; slow permeability when compacted; siltstone and sandstone at depth of 20 to 36 inches.	Moderate permeability; bedrock at depth of 20 to 36 inches.	Moderate infiltration; low available moisture capacity.	Bedrock at depth of 20 to 36 inches.	Moderately erodible; low available moisture capacity.
Seasonal high water table; moderate to high seepage.	Fair stability; good compaction; moderate permeability when compacted; poor resistance to piping.	Moderately slow permeability in subsoil; moderate permeability below subsoil; seasonal high water table.	Moderate infiltration; medium available moisture capacity.	Not needed	Slightly erodible.
Moderate seepage	Poor stability; fair to good compaction; slow permeability when compacted; fair resistance to piping.	Moderately slow permeability; moderately good natural drainage.	Moderate infiltration; high available moisture capacity.	Moderately slow permeability; moderately erodible.	Moderately erodible; seasonal wetness.
Slow seepage; underlain with shale that is commonly impervious.	Fair stability and compaction; slow seepage.	Slow permeability; soft shale at depth of 20 to 40 inches.	Moderate infiltration; low available moisture capacity.	Slow permeability; soft shale at depth of 20 to 40 inches.	Low available moisture capacity.

CDF013409

TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Highway location
			Topsoil	Sand and gravel	Road fill	
Killbuck: Kk	Poor: seasonal high water table.	High	Good	Not suitable.	Poor: silty material.	High water table; low stability; highly susceptible to frost action.
Latham: LaB, LaC, LaC2, LaD, LaD2, LaF	Fair when dry. Poor when wet. Clayey material.	Moderate	Fair: limited amount of suitable material.	Not suitable.	Poor: silty and clayey material.	Cuts and fills are needed; clayey material is difficult to work.
Licking: LcA, LcB, LcC, LcC2, LcE2	Poor: seasonal high water table.	High	Good	Not suitable.	Poor: silty material.	High content of plastic clay below a depth of 20 inches; few thin layers of gravel at a depth of 20 to 30 inches.
Linwood: Ld	Poor: organic material; commonly saturated.	High	Fair to good if mixed with mineral material. Poor if used alone.	Not suitable; organic material.	Not suitable: organic material.	Organic material to a depth of 20 to 40 inches; very low stability. Mineral material below a depth of 20 to 40 inches; high water table.
Lobdell: Le	Poor: subject to flooding; seasonal high water table.	Moderate	Good	Not suitable	Fair: silty material.	Subject to flooding; susceptible to frost action.
Loudonville: LoB, LoC, LoC2, LoD, LoD2, LoE2, LoF2, LuB, LuC. (Urban land in mapping units LuB and LuC is variable and is not included in the interpretation of those units.)	Poor: sandstone at a depth of 20 to 40 inches.	Moderate	Good	Not suitable.	Fair: silty and loamy material; sandstone at depth of 20 to 40 inches.	Sandstone at depth of 20 to 40 inches; steep in some places.
Luray: Ly	Poor: seasonal high water table.	High	Good	Not suitable.	Poor: silty material.	Seasonal high water table; soil material is unstable and tends to flow when wet.

CDF013410

of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Subject to ponding or flooding; seasonal high water table; moderately slow seepage; few sandy seams in some places.	Fair stability and compaction; slow permeability when compacted; fair resistance to piping; mainly silty or clayey material in lower part of profile.	Moderately slow permeability; seasonal high water table; subject to flooding.	Moderate infiltration; medium available moisture capacity.	Not needed	Seasonal wetness; subject to flooding.
Slow seepage; underlain by shale that is commonly impervious.	Fair to poor stability; clayey material; slow seepage.	Slow or very slow permeability; soft shale at depth of 24 to 40 inches.	Slow infiltration; medium available moisture capacity.	Shallow to fine material.	Moderately erodible; medium available moisture capacity.
Slow seepage; few strata of gravel or sand.	Fair stability; slow permeability when compacted; high resistance to piping; clayey material below depth of 1½ feet.	Very slow permeability in lower part of subsoil and in substratum; saturated during wet periods.	Slow infiltration; medium available moisture capacity.	Shallow to very slowly permeable material.	Moderately erodible.
High water table; high seepage.	Organic material in upper 20 to 40 inches; unstable. Loamy or sandy material below; high seepage.	Moderately rapid permeability; high water table; surface subsidence if drained.	Variable infiltration; high available moisture capacity.	Not needed	High water table.
Subject to flooding; moderate to slow seepage; few sandy seams.	Fair to poor stability and compaction; moderate to slow seepage.	Moderate permeability; seasonal high water table.	Moderate infiltration; high available moisture capacity.	Not needed	Subject to flooding.
Shallow to fractured sandstone; high seepage in some places.	Poor to fair stability; fair compaction; moderate permeability when compacted.	Moderate permeability; bedrock at depth of 20 to 40 inches.	Moderate infiltration; low available moisture capacity.	Bedrock at depth of 20 to 40 inches; other soil features favorable.	Moderately erodible; low available moisture capacity.
Seasonal high water table; slow to moderate seepage.	Fair compaction; slow permeability when compacted; fair to poor resistance to piping.	Moderately slow permeability; seasonal high water table.	Moderately slow infiltration; high available moisture capacity.	Not needed	Moderately erodible; seasonal high water table.

CDF013411

TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Highway location
			Topsoil	Sand and gravel	Road fill	
Luray, gravelly subsoil variant: Lz	Poor: seasonal high water table.	Moderate	Good	Fair to poor: dirty sand and gravel.	Poor in solum: silty material. Fair in substratum: sandy, gravelly, and silty material.	Seasonal high water table; moderate stability; subject to flooding in some places.
Made land: Ma			Not suitable	Not suitable		Cuts and fills are commonly needed.
Mentor: MeA, MeB, MeC, MeD	Good when dry. Fair when wet.	High	Good	Not suitable	Poor: silty material.	Low to moderate stability; susceptibility to frost action.
Montgomery: Mg	Poor: seasonal high water table.	High	Fair: moderately erodible.	Not suitable	Poor: silty material.	Seasonal high water table; plastic, clayey material; difficult to work; low stability.
Muskingum: MsB, MsC, MsD, MvE, MvE3, MvF, MvG, MwF. (For interpretations of Gilpin soils in mapping units MvE, MvE3, MvF, MvG, and MwF, see Gilpin series. Urban land in mapping unit MwF is variable and is not included in the interpretation of that unit.)	Poor: sandstone and siltstone at a depth of 20 to 40 inches.	Low	Good	Not suitable	Fair: silty and loamy material; sandstone at depth of 20 to 36 inches.	Bedrock at depth of 20 to 36 inches.
Plainfield: PlB, PlC	Good: sandy material; well drained.	Low	Poor: sandy material; low in organic-matter content.	Good for sand. Poor for gravel.	Good: sandy material.	Loose or nearly loose sand that is easily worked; subject to soil blowing and to water erosion.
Quarries: Qu				Not suitable	Poor: bedrock material.	Cuts and fills commonly are needed; surface drainage is a hazard in most places.

CDF013412

of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Seasonal high water table; moderate to high seepage.	Fair stability; good compaction; moderate to high seepage; subject to flooding in some places.	Seasonal high water table; moderately slow permeability in subsoil, moderately rapid permeability in substratum.	Slow to medium infiltration; high available moisture capacity.	Not needed	Moderately erodible; seasonal high water table.
Moderate seepage; few seams of sand or gravel.	Fair stability; fair to good compaction; slow permeability when compacted; erodibility.	Moderate permeability in subsoil; well drained.	Moderate infiltration; high available moisture capacity.	Soil features favorable.	Moderately erodible.
Seasonal high water table; very slow seepage.	Very slow permeability; poor compaction; high shrink-swell potential.	Very slow permeability; seasonal high water table.	Slow infiltration; high available moisture capacity.	Not needed	High water table; clayey material.
Moderate to high seepage; fractured bedrock.	Fair stability; moderate permeability when compacted; slight piping hazard; stony below depth of 2 feet.	Moderately rapid permeability; bedrock at depth of 20 to 36 inches.	Moderate to high infiltration; low available moisture capacity.	Bedrock at depth of 20 to 36 inches; other soil features favorable.	Moderately erodible; low available moisture capacity.
Sandy material; highly pervious.	Sandy material; high seepage; subject to piping.	Rapid permeability; good natural drainage.	High infiltration; low available moisture capacity.	Moderately to highly erodible.	Highly erodible; low available moisture capacity.
	Bedrock material				

CDF013413

TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			
			Topsoil	Sand and gravel	Road fill	Highway location
Rainsboro: RaB, RaC	Fair: seasonal high water table.	Moderate	Good	Poor	Fair in solum: loamy material. Poor in substratum: silty and clayey material below a depth of 4 or 5 feet.	Moderately well drained; some seepage in cuts.
Ramsey: RcC, RcD, RcE2, RcF2	Good: well drained; loamy material.	Low	Poor: stony	Not suitable	Poor: loamy material; stony; sandstone at depth of less than 20 inches.	Steep in some places; sandstone at a depth of less than 20 inches.
Ravenna: ReA, ReB, Rn (Urban land in mapping unit Rn is variable and is not included in the interpretation of that unit.)	Poor: seasonal high water table.	High	Good	Not suitable	Fair: loamy material.	Seasonal high water table; highly susceptible to frost action; fairly easy to work.
Remsen: RoA, RoB, Rr (Urban land in mapping unit Rr is variable and is not included in the interpretation of that unit.)	Poor: seasonal high water table.	Moderate	Fair: shallow to clay.	Not suitable	Poor: clayey material.	Seasonal high water table; low stability; high content of clay; plastic; difficult to work.
Rittman: RsB, RsC, RsC2, RsD2	Poor: seasonal high water table.	Moderate	Good	Not suitable	Poor in solum: loamy material. Fair in substratum: loamy material.	Fair stability; susceptible to frost action; slow seepage.
Sebring: Sb, Se, Sg (Urban land in mapping unit Sg is variable and is not included in the interpretation of that unit.)	Poor: seasonal high water table.	High	Good: low in organic-matter content. Fair for Se in substratum; loamy material.	Not suitable	Poor in solum: silty material. Poor for Sb and Sg in substratum: silty material.	Seasonal high water table; low stability; silty material; may flow when wet; highly susceptible to frost action.
Shoals: Sh	Poor: subject to flooding; seasonal high water table.	High	Good	Not suitable	Poor: silty material.	Subject to flooding; seasonal high water table; low stability; susceptible to frost action.

CDF013414

of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Seepage in lower part of subsoil.	Good stability and compaction; silty and clayey material below a depth of 4 to 5 feet.	Slow and moderately slow permeability; moderately well drained.	Moderate infiltration; medium to high available moisture capacity.	Slow and moderately slow permeability; gravelly material below a depth of 2½ feet.	Slightly to moderately erodible; seepage.
Moderately rapid permeability; sandstone at a depth of less than 20 inches.	Stony; fair stability and compaction. Moderate permeability when compacted; slight piping hazard.	Rapid permeability; sandstone at a depth of less than 20 inches.	Rapid infiltration; very low available moisture capacity; shallow to bedrock.	Shallow to bedrock.	Erodible; very low available moisture capacity; bedrock at a depth of less than 20 inches.
Seasonal high water table; slow seepage.	Fair to good stability and compaction; slow permeability when compacted; good resistance to piping.	Moderately slow permeability; seasonal high water table.	Moderate infiltration; medium available moisture capacity.	Seasonal wetness; seepage.	Moderately erodible; seasonal wetness.
Seasonal high water table; very slow seepage.	Fair stability; fair to poor compaction; slow permeability when compacted; high resistance to piping.	Very slow permeability; seasonal high water table.	Slow infiltration; medium available moisture capacity.	Shallow to fine-textured material.	Moderately erodible; seasonal wetness.
Slow seepage	Good compaction and stability; slow permeability.	Slow permeability; seasonal high water table.	Slow infiltration; medium available moisture capacity.	Slow seepage	Moderately erodible; slow seepage.
Seasonal high water table; moderate to slow seepage.	Fair stability; moderately slow permeability when compacted; fair resistance to piping.	Moderately slow permeability; seasonal high water table.	Moderate infiltration; medium available moisture capacity.	Not needed	Erodible; medium available moisture capacity; poorly drained.
Subject to flooding; moderate seepage; few sandy seams in some places.	Fair compaction; fair resistance to piping; sandy strata in some places.	Moderate permeability in subsoil; somewhat poorly drained.	Moderate infiltration; high available moisture capacity; somewhat poorly drained.	Not needed	Subject to flooding; seasonal high water table.

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TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			Highway location
			Topsoil	Sand and gravel	Road fill	
Sloan: Sl	Poor: subject to flooding; seasonal high water table.	High	Good	Not suitable.	Poor: silty material.	Subject to flooding; seasonal high water table; low stability; susceptible to frost action.
Strip mine spoil: SoC, SoE, SoF, SsC, SsE, SsF, StC, StD, StF.		Low to moderate.	Not suitable.	Not suitable.		Cuts and fills are needed; variable surface drainage.
Tilsit: TlC, TlD	Fair: seasonal high water table.	Moderate	Good	Not suitable.	Fair: silty and clayey material; sandstone and shale at a depth of about 3 or 4 feet.	Susceptible to some frost action; sandstone and shale at a depth of about 3 or 4 feet; slow seepage in cuts.
Trumbull: Tr	Poor: seasonal high water table.	High	Fair: low in organic-matter content.	Not suitable.	Poor: clayey material.	Seasonal high water table; low stability; high in content of plastic clay; difficult to work.
Wadsworth: WaA, WaB, WaC, WaC2	Poor: seasonal high water table.	High	Good	Not suitable	Poor: silty clay loam and clay loam.	Seasonal high water table; highly susceptible to frost action; fairly easy to work.
Wadsworth (moderately shallow variant): WbB.	Poor: seasonal high water table.	High	Good	Not suitable.	Poor: silty clay loam; shale at a depth of 20 to 40 inches.	Uppermost material is fairly easy to work; shale at a depth of 20 to 40 inches; seasonal high water table.
Wallkill: Wc	Poor: silty and organic material; commonly saturated.	High	Good	Not suitable	Poor in solum: silty material. Poor in substratum: organic material.	Silty material to a depth of 20 to 40 inches; organic material below; very low stability.

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of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Subject to flooding; seasonal high water table; slow seepage.	Fair to poor stability; slow seepage; subject to piping.	Moderate permeability; seasonal high water table.	Moderate infiltration; high available moisture capacity; very poor natural drainage.	Not needed	Not applicable.
Slow seepage; bedrock at a depth of about 3 or 4 feet.	Fair stability; slow seepage; sandstone and shale at a depth of about 3 or 4 feet.	Slow permeability; bedrock at a depth of about 3 or 4 feet.	Moderate infiltration; medium available moisture capacity.	Slow permeability; sandstone and shale at a depth of about 3 or 4 feet.	Slow seepage.
Seasonal high water table; slow seepage.	Fair stability; fair to poor compaction; excellent resistance to piping; clayey material.	Slow permeability; seasonal high water table.	Slow infiltration; medium available moisture capacity.	Not needed	Slightly erodible; seasonal high water table; plastic, clayey material.
Slow seepage; seasonal high water table.	Good stability and compaction; slow permeability when compacted.	Slow permeability; seasonal high water table.	Slow infiltration; low to medium available moisture capacity.	Slow permeability	Moderately erodible; seasonal high water table.
Shallow to shale	Good compaction and stability; shale at a depth of 20 to 40 inches.	Slow permeability; seasonal high water table; shale at a depth of 20 to 40 inches.	Slow infiltration; low to medium available moisture capacity; shale at a depth of 20 to 40 inches.	Shallow to silty clay loam.	Moderately erodible; seasonal high water table.
High water table; shallow to organic material; high seepage.	Slow permeability in silty material; not suitable in underlying organic material.	Moderate permeability in silty material; variable permeability in muck; high water table.	Slow infiltration; high available moisture capacity; very poor natural drainage.	Not needed	Nearly level; high water table.

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TABLE 6.—*Engineering interpretations*

Soil and map symbols	Suitability for winter grading	Susceptibility to frost action	Suitability as source of—			
			Topsoil	Sand and gravel	Road fill	Highway location
Wayland: Wd	Poor: subject to flooding; seasonal high water table.	High	Good	Not suitable.	Fair: silty material.	Subject to flooding; seasonal high water table; low stability; highly susceptible to frost action.
Weikert: WeC, WeD, WeE2, WeF2	Good: well drained; siltstone and shale at a depth of less than 20 inches.	Low	Poor: very channery material.	Not suitable.	Fair: very channery material; bedrock at a depth of less than 20 inches.	Very channery material; siltstone and shale at a depth of less than 20 inches.
Weinbach: WhA, WhB, Wk (Urban land in mapping unit Wk is variable and is not included in the interpretation of that unit.)	Poor: seasonal high water table; sandy and gravelly material below a depth of 2 or 3 feet.	High	Good	Good below a depth of 3 feet.	Fair in solum: silt loam and silty clay loam. Good in substratum: sandy and gravelly material.	Somewhat poorly drained; stable material.
Wellston: WlB, WlC	Good: well drained.	Moderate	Good	Not suitable.	Fair: silty material; sandstone and shale at depth of about 3 feet.	Sandstone and shale at a depth of about 3 feet; well drained; silty material.
Wheeling: WmA, WmB, WmC2, WrA, WrB, WrC, WrC2, WsD2.	Good: well drained; sandy and gravelly material below a depth of 3 feet.	Low	Good	Good below a depth of 3 feet.	Fair in solum: silty material. Good in substratum: sandy and gravelly material.	Sandy and gravelly material below a depth of 3 feet; easy to work; moderate stability.
Willette: Wt	Poor: organic material; commonly saturated.	High	Fair to good if mixed with mineral material; poor if used alone.	Not suitable.	Not suitable in solum: organic material. Poor in substratum: clayey material.	Organic material to a depth of 20 to 40 inches; very low stability; muck must be removed from roadbed.
Wooster: WuB, WuC, WuC2, WuD2, WuE2, WuF2, WvD. (Urban land in mapping unit WvD is variable and is not included in the interpretation of that unit.)	Good: well drained.	Moderate to low.	Good	Not suitable.	Fair: loamy material.	Moderate susceptibility to frost action; material is easy to work; well drained.

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of the soils—Continued

Soil features affecting—					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankments, dikes, and levees				
Subject to flooding; seasonal high water table; moderate to slow seepage; sand lenses in some places.	Fair compaction, slow permeability when compacted; fair resistance to piping.	Moderate permeability; high water table.	Subject to flooding; poorly drained.	Moderate infiltration; high available moisture capacity; poor natural drainage.	Poorly drained.
High seepage; channery material; siltstone and shale at a depth of less than 20 inches.	Channery material; moderate to rapid permeability if compacted; slight piping hazard.	Moderately rapid permeability; siltstone and shale at a depth of less than 20 inches.	Moderate infiltration; very low available moisture capacity; siltstone and shale at a depth of less than 20 inches.	Siltstone and shale at a depth of less than 20 inches.	Moderately erodible; very low available moisture capacity.
Seasonal high water table; sandy and gravelly material below a depth of 3 feet.	Fair to good stability to a depth of 3 feet; sandy and gravelly material in substratum; pervious material.	Moderately slow permeability in subsoil; moderately rapid permeability in substratum.	Moderate infiltration; medium available moisture capacity.	Short slopes; seasonal wetness.	Moderately erodible; seasonal wetness.
Slow seepage; sandstone and shale at a depth of about 3 feet.	Fair stability and compaction; slow seepage.	Moderate permeability; sandstone and shale at a depth of about 3 feet.	Moderate infiltration; medium available moisture capacity.	Sandstone and shale at a depth of about 3 feet.	Moderately erodible.
Moderate permeability in upper 3 feet; very porous below a depth of 3 feet.	Good stability and compaction; moderate permeability if compacted; sandy and gravelly material below a depth of 3 feet.	Moderate permeability; good natural drainage.	Moderate infiltration; medium available moisture capacity; very rapid permeability below a depth of 3 feet.	Well drained; moderately erodible.	Moderately erodible.
High water table; high seepage in organic material.	Unstable; organic material in upper 20 to 40 inches; clayey material below a depth of 20 to 40 inches.	High water table; moderately slow permeability.	Variable infiltration; high available moisture capacity; very poor natural drainage.	Not needed	High water table; organic material.
Slow seepage	Good stability and compaction; moderate seepage; slight piping hazard.	Moderate permeability; well drained.	Moderate infiltration; high available moisture capacity.	Steep in some places; erosion hazard.	Moderately erodible.

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Engineering classification systems

Two systems of soil classification are in general use among engineers. Both are used in this soil survey.

Many highway engineers classify soil material according to the system approved by the American Association of State Highway Officials (AASHO)(*2*). In this system soil material is placed in seven principal groups, designated A–1 through A–7. In group A–1 are gravelly soils of high bearing capacity, or the best soils for road subgrade, and in group A–7 are the poorest soils, clays that have low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. They are shown in parentheses following the group symbol, for example, A–4(7), as is given for the surface layer of Canfield silt loam in table 4.

Some engineers prefer to use the Unified classification system (*15*). In this system soils are grouped on the basis of texture, plasticity, and their performance as material for engineering structures. Soil material is identified as coarse grained (eight classes), fine grained (six classes), or highly organic. The classification of the soils tested according to the Unified system is given in table 4, and the estimated classification for most soils in the county is given in table 5.

The United States Department of Agriculture classifies soils according to texture, which is determined by the proportion of sand, silt, and clay in the soil material (*13*). The terms "sand", "silt," and "clay" are defined in the Glossary at the back of the survey.

Except for some relatively minor modifications, the classification system of the Ohio Department of Highways (see table 4) is identical to the AASHO classification system. In the Ohio system an A–4 group is subdivided into A–4a and A–4b groups, and the A–6 group is subdivided into the A–6a and A–6b groups. Anyone using this system should consult the Ohio Department of Highways for a more detailed explanation of its soil classification system.

Soil test data

To help in evaluating the soils for engineering purposes, samples were taken from the soils of the Canfield, Chili, Fitchville, Geeburg, Luray, Sebring, Weinbach, Wheeling, and Wooster series and were tested by the Ohio Department of Highways, in accordance with standard procedures of the American Association of State Highway Officials (AASHO). The test data obtained are given in table 4. Also shown in table 4 is the classification of each sample according to the AASHO and the Unified systems, and according to the modified AASHO system used by the Ohio Department of Highways Testing Laboratory.

The engineering soil classifications given in table 4 are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by the combined sieve and hydrometer methods. The percentage of clay obtained by the hydrometer method should not be used in naming textural classes of soils.

The tests for determining the liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic state to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Some silty and sandy soils are nonplastic; that is, they do not become plastic at any moisture content.

Table 4 also gives moisture-density data for the tested soils. If a soil material is compacted at a successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in earthwork, for as a rule, soil material is most stable if it is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Engineering properties of soils

Table 5 gives estimated properties of soils important in engineering and lists estimated AASHO and Unified classifications. The textural terms for the horizons are those used by the U.S. Department of Agriculture. The estimates in table 5 are based on the test data in table 4 and on test data obtained from similar soils in other counties. Additional information useful to engineers is in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

In table 5 the depth to the seasonal high water table refers to the shallowest depth to which the water table rises in winter and spring. The water table may be a perched one or an ordinary ground water table. In estimating the depth of this water table, soil conditions immediately after heavy precipitation are not considered. In all soils, particularly sloping soils on uplands, the depth to the water table generally is greater late in spring, in winter, and in fall than the depth shown in table 5.

Depth to bedrock varies considerably in this county. Many of the soils are more than 10 feet deep to bedrock, but bedrock is at a depth of less than 2 feet in the Ramsey and Weikert soils.

The column headed "Depth from surface" lists the depths that correspond to significant changes in texture in the technical profile described as typical for the series. Some of the layers given in the technical profile have been combined. Soils having a profile that differs from the typical may have properties that vary from those shown. The depths given in table 5 for

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mapping units that include Urban land apply only to undisturbed parts of the profile.

Listed for the layers in table 5 are the estimated percentages of material that pass Nos. 4, 10, and 200 sieves. The amount of material passing a No. 200 sieve determines whether soil material is coarse grained or fine grained. Also listed are the USDA textural classification and the AASHO and Unified engineering classifications.

Permeability refers to the downward movement of water through soil horizons that are saturated but occur above a true water table and can drain freely. The estimates are based on the texture, structure, and porosity of the soil and on infiltration tests and drainage observations. Percolation of water through the surface layer of soils varies considerably and depends on land use, soil management, and the content of moisture. In table 5 permeability is estimated in inches of water percolation per hour.

The available moisture capacity, estimated in inches per inch of soil depth, is the approximate amount of capillary water in a soil that is wet to field capacity. When the soil is air dry, this amount of water wets the soil material to a depth of 1 inch without deeper percolation. Available moisture capacity is the maximum amount of water that a soil can hold available for use by plants. For medium-textured and fine-textured soils, the estimated values listed are based on the difference in percentage of moisture retained at $\frac{1}{3}$ and 15 atmospheres of tension. For sandy soils, the estimated values are based on the difference between $\frac{1}{10}$ and 15 atmospheres of tension. For compact glacial till and fragipans, the estimated values listed in table 5 are lower than normal for a given texture. Because the increased bulk density in compact layers reduces the penetration of roots, all of the stored moisture is not available to plants.

In table 5 reaction is given in pH values that indicate degree of acidity or alkalinity. The values are based on many field tests made during the survey. Reaction is defined in the Glossary at the back of this publication.

Shrink-swell potential indicates the volume change of soil material expected with a change in moisture content. Ratings are low, moderate, and high. If shrink-swell potential is rated high, use for building foundations or some other engineering structure is seriously limited.

In table 5 the ratings for corrosion potential for steel or concrete are low, moderate, or high. These ratings indicate the effects that solvents in a soil have in corroding uncoated steel and untreated concrete pipes. The rating for steel is based on soil texture, drainage, and total acidity. Electrical resistance is not considered. The corrosion potential for concrete is based on soil texture and the pH value. The ratings are for concrete that has not been mixed specifically for corrosion resistance.

Engineering interpretations of soils

In table 6, the soils of Stark County are rated according to their suitability for winter grading, susceptibility to frost action, and suitability as a source of topsoil, sand and gravel, and road fill. In addition, the table lists soil features that affect location of highways and the construction and maintenance of farm ponds, drainage systems, irrigation systems, terraces and diversions, and waterways. The interpretations are based on the estimated soil properties shown in table 5, on the test data shown in table 4, and on field experiences. Following are explanations of the data in the columns of table 6.

Suitability for winter grading.—Because of wetness, plasticity, or susceptibility to frost action, many of the soils in the county are poorly suited to winter grading.

Susceptibility to frost action.—Silt loams, silty clay loams, fine sandy loams, and mucks that are wet most of the winter are the most susceptible to damaging frost action and are rated high in table 6.

Suitability as source of topsoil.—The thickness, texture, and natural fertility of the surface layer determine suitability of a soil for use as a topdressing. Unless noted otherwise, only the surface layer of the soil is considered in this rating.

Sand and gravel.—All areas of a soil rated good for sand and gravel may not be sources that are suitable for commercial development, but a soil rated good is more likely to be suitable for such development than soils rated poor or fair.

Suitability as source of road fill.—Well-graded, coarse materials or a mixture of clay and coarse-grained materials are suitable as a source of road fill. Highly plastic, clayey soils, poorly graded, silty soils, and organic soils are difficult to compact and are not suited as road fill or are poorly suited.

Highway locations.—Soil features that affect the location of highways include the depth to rock, a high water table, steep slopes, slippage of soil material, flooding, plastic soil material, and susceptibility to frost action.

Farm ponds.—The sealing potential of the soil material is the main factor affecting the reservoir area of farm ponds, though depth to bedrock and susceptibility to flooding are also important. Stability, ease or difficulty of compaction, and permeability of soil material affect construction and maintenance of the embankments of farm ponds, low dikes, and levees. Permeability is for soil material compacted at about the optimum moisture content.

Agricultural drainage.—The soil features are described relative to their natural drainage, their in-place permeability, and the presence of a high water table.

Irrigation.—The rate of water intake, permeability, natural drainage, and available moisture capacity are properties that affect irrigation. Slope and susceptibility to erosion are also important.

Terraces and diversions.—Slope and erodibility of the soil are the main features that affect terraces and diversions, though depth to rock and a seasonal high water table are also important. Terraces are not needed on nearly level soils. Steep soils are not well suited to terracing. Special care is needed where diversions are constructed on highly erodible soils.

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Waterways.—Erodibility, available moisture capacity, and bedrock near the surface are among the soil features affecting establishment of waterways.

Town and Country Planning

Stark County is in the highly industrialized area that extends from Detroit, Mich., eastward to Buffalo, N. Y., and is also in the rapidly expanding area between Cleveland, Ohio, and Pittsburgh, Pa. The county has congested community centers, sprawling residential developments, fringe areas where town and country land uses are mixed (fig. 8), and good farmland. It also contains land that, because of its location and the characteristics of the soils, has little potential for farming or intensive town use. Because farming cannot compete with community and industrial development, the farmland in the county is slowly decreasing. Canton is the largest city in Stark County, but Alliance to the northeast and Massillon to the west, are rapidly expanding.

Farming can continue on high-quality soils where the extension of public utilities is difficult and community expansion is not feasible. This is particularly true on the organic soils in the northern part of the county where truck crops are grown. Also, dairy farming is expected to continue near the growing communities.

This section of the soil survey provides information on the properties of soils and their effect on selected nonfarm use of land. It will help community planners and industrial users of land, who generally look for areas that are least costly to develop and maintain. Development and maintenance costs are related to soil limitations. These planners will find other useful information on the soil maps and in other parts of the survey, particularly the sections "Engineering Uses of Soils" and "Descriptions of the Soils."

Table 7 gives the estimated degree and kinds of limitations of soils for some selected land uses. By using this information, alternate uses can be developed as a basis for long-range planning and zoning. Because extensive manipulation of the soil alters some of its natural properties, the rating of some uses will no longer apply to areas that have undergone extensive cutting and filling. Also, the estimates given in table 7 do not eliminate the need for an investigation at the site of the specified use.

The estimated degree of limitations of the soils for a specified land use are slight, moderate, and severe. A rating of *slight* indicates that the soil has no important limitation to the specified use. *Moderate* shows that the soil has some limitations to the specified use. These limitations need to be recognized, but they can be overcome or corrected. A rating of *severe* indicates that the soil has serious limitations that are difficult to overcome. A severe rating, however, does not mean that the soil cannot be used for the specific use.

Following are explanations of the uses rated in table 7.

Cultivated crops.—In rating the soils according to their limitations to use for cultivated crops, the degree of limitation is based on the land capability classes, which are explained in the subsection "Capability Grouping." Erosion, flooding, slope, wetness, droughtiness, stoniness, and depth to bedrock were considered in making these ratings. Cultivated crops are rated in table 7 to aid land use planners when they consider whether or not farming is the most suitable use for a particular area. Where it is decided to take cropland for residential or industrial use, the decision generally is irreversible. After the change is made the land is no longer a source of food.

Figure 8.—A housing development on a Canfield silt loam. This is a fringe area where town and country land uses are mixed.

Homesite locations.—The ratings in table 7 are for houses of three stories or less that have a basement, but the ratings also apply to sites for light industrial, commercial, and institutional buildings of three

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stories or less that have a basement. The main features that limit the use of soils as homesites are the hazard of flooding, slope, a seasonal high water table, the depth to and kind of bedrock, natural drainage, and stoniness of the soil surface. Not considered is a method for disposing of sewage.

Flooding is a severe hazard when it occurs. Buildings constructed on naturally wet soils probably will have wet basements unless adequate drainage is provided. The soils in many areas of the county are poorly drained or somewhat poorly drained. In many areas tile drains and open ditches have been installed on the naturally wet soils so that they can be used for farming, but excavations for houses or other structures can disrupt these systems. Soils that have poor natural drainage and a high content of silt generally are poor sites for building foundations because the soil material is soft and compressible. Excavating for basements and installing underground utility lines are difficult and expensive on soils that are shallow to bedrock.

Disposal of sewage effluent.—Because the installation of community systems for disposing sewage has not kept pace with the need in Stark County, the number of individual sewage systems is increasing rapidly. The proper functioning of these systems depends on the characteristics of the soils. On some soils the infiltration of effluent is at a rate that is satisfactory for the operation of septic tanks, but the use of some soils for this purpose is severely limited by flooding, by somewhat poor drainage to very poor drainage, or by slow permeability. Among the features that affect the degree of limitation are permeability, depth to the water table, depth to and kind of bedrock, slope, and the hazard of flooding.

If filter fields for septic tanks are located on steep soils, seepage downslope may be a problem. Septic tanks and sewage lines are difficult to install on soils that are shallow to bedrock. A restrictive layer in some soils, such as solid rock or a dense, compact layer, interferes with adequate filtration and the removal of effluent. Some very poorly drained to somewhat poorly drained soils have a high water table for long periods.

Some of the soils in the county are underlain by sandy or gravelly material or by cracked and creviced bedrock through which effluent that is inadequately filtered can contaminate the ground water or nearby springs, lakes, or streams.

Sewage lagoons.—Sewage lagoons are shallow ponds built to dispose of sewage through oxidation. They may be needed in an area if septic tanks or a central sewage system is not feasible or available. Among the features that control the degree of limitation are the texture of the soil material, a hazard of flooding, degree of slope, depth to bedrock, permeability, and the water table.

Lawns, landscaping, and golf fairways.—In most areas developed for homes and golf courses, the natural surface soil, or topsoil, can be used for lawns, flowers, shrubs, and trees and should be saved. It can be removed from the site, stored until construction and grading are completed, and then returned. The natural surface soil from areas graded for streets also can be saved and used for lawns and fairways. Among the soil properties that determine whether a good lawn or golf fairway can be established are natural drainage, degree of slope, depth to bedrock, texture of the surface soil, stoniness and rockiness, and hazard of flooding.

Streets and parking lots.—The ratings in table 7 are for soils used for streets and parking lots in residential areas where traffic is not heavy. Considered in estimating the ratings were the hazard of flooding, slope, depth to and kind of bedrock, depth to the water table, and the degree of stoniness. The estimated soil properties and soil features that are important in designing, constructing, and maintaining highways are given in the subsection "Engineering Uses of Soils."

Athletic fields and other intensive play areas.—Properties to consider when selecting sites to be used as athletic fields and other intensive play areas include natural drainage, slope, depth to the water table, depth to and kind of bedrock, permeability, degree of stoniness, the hazard of flooding, and the texture of the surface soil. In table 7 the use of fill material from other areas was not considered in the ratings. Soils on flood plains can be used as ball diamonds, picnic areas, and other intensive play areas that are not subject to costly damage by floodwater and that are not used during normal periods of flooding. The ratings given in table 7 for streets and parking lots are also important when considering the use of soils for tennis courts.

Parks and other extensive play areas.—Parks and other extensive play areas can be located on many kinds of soils that have severe limitations for most other uses. Flood plains, for example, can be safely developed as extensive play areas. Many areas along streams are scenic and, because of their linear shape, can be used by a relatively large number of people. Considered in rating the soils for parks and other extensive play areas were the hazard of flooding, degree of stoniness and rockiness, degree of slope, texture of the surface soil, and depth to the water table.

Campsites.—Sites suitable for tents and trailers should be located in areas suitable as unsurfaced parking lots for cars and camping trailers. Properties to consider when selecting campsites are a hazard of flooding, a seasonal high water table, permeability, the degree of slope, and soil texture. Wetness is the major factor that affects the degree of limitation for campsites. Soils that have slopes of less than 12 percent are the most desirable for use as tent campsites, but trailers require less sloping soils than tents. Soils having a medium-textured surface layer have fewer limitations to use as campsites than the very clayey or very sandy soils.

The ratings given in table 7 for the disposal of sewage effluent are also important when considering the use of soils for campsites.

Sanitary land fills.—Among the properties affecting the use of soils for the trench type of sanitary land

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TABLE 7.—*Estimated degree and kinds of*

[Not rated in this table are Borrow pits, Cut and fill land, Gravel pits, Made land,

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
Alluvial land: Ad	Severe: subject to flooding; stoniness.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Arkport: ArB	Slight	Slight	Slight [2]	Severe: rapid permeability. [2]	Severe: low available moisture capacity.
ArC	Moderate: slope; erosion hazard.	Moderate: slope	Moderate: slope	Severe: rapid permeability; slope. [2]	Severe: low available moisture capacity.
ArD	Severe: slope; erosion hazard.	Severe: slope	Severe: slope	Severe: rapid permeability; slope. [2]	Severe: low available moisture capacity.
Bogart: BgA, BoA	Slight	Moderate: seasonal high water table.	Moderate: seasonal high water table. [2]	Severe: rapid permeability in substratum. [2]	Slight
BgB, BoB	Slight	Moderate: seasonal high water table.	Moderate: seasonal high water table. [2]	Severe: rapid permeability in substratum. [2]	Slight
BoC	Moderate: slope; erosion hazard.	Moderate: seasonal high: water table; slope.	Moderate: seasonal high water table; slope. [2]	Severe: rapid permeability in substratum; slope. [2]	Moderate: slope
Brooke: BwC2	Moderate: slope; erosion hazard.	Severe: 20 to 36 inches to limestone.	Severe: slow permeability; 20 to 36 inches to limestone.	Severe: slope; 20 to 36 inches to limestone.	Moderate to severe: medium to low available moisture capacity.
BwE2	Severe: slope; erosion hazard.	Severe: 20 to 36 inches to limestone; slope.	Severe: slow permeability; slope; 20 to 36 inches to limestone.	Severe: slope; 20 to 36 inches to limestone.	Severe: low available moisture capacity; slope.
Canadice: Ca	Severe: wetness	Severe: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.
Canfield: CdA	Slight	Moderate: seasonal high water table.	Severe: moderately slow permeability.	Slight	Slight
CdB	Slight	Moderate: seasonal high water table.	Severe: moderately slow permeability.	Moderate: slope	Slight
CdC, CdC2	Moderate: slope; erosion hazard.	Moderate: seasonal high water table slope.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope

CDF013424

limitations for town and country planning

Quarries, Strip mine spoil, Urban land, and the 16 complexes that include Urban land]

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: subject to flooding.	Severe: subject to flooding; coarse fragments.	Severe: subject to flooding; coarse fragments.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[3]	Severe: subject to flooding.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe: permeable sandy material.	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe: permeable sandy material.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; permeable sandy material.	Severe: slope.
Moderate: seasonal high water table.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: rapid permeability in substratum.	Moderate: seasonal high water table.
Moderate: seasonal high water table; slope.	Moderate: seasonal high water table; slope.	Slight	Moderate: seasonal high water table.	Moderate: seasonal high water table; slope.	Severe: rapid permeability in substratum.	Moderate: seasonal high water table.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: seasonal high water table; slope.	Severe: slope	Severe: rapid permeability in substratum.	Moderate: seasonal high water table; slope.[3]
Severe: 20 to 36 inches to limestone; slope.	Severe: 20 to 36 inches to limestone; slope; slow permeability.	Moderate: 20 to 36 inches to limestone; slope; texture.	Moderate: slope.	Severe: slope	Severe: 20 to 36 inches to limestone.	Severe: 20 to 36 inches to limestone.
Severe: 20 to 36 inches to limestone; slope.	Severe: 20 to 36 inches to limestone; slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: 20 to 36 inches to limestone; slope.	Severe: 20 to 36 inches to limestone; slope.
Severe: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table; clayey material.	Severe: seasonal high water table; very slow permeability.
Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.	Slight	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.
Moderate: seasonal high water table; slope.	Moderate: seasonal high water table; moderately slow permeability; slope.	Slight	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: moderately slow permeability; seasonal high water table; slope.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: moderately slow permeability; seasonal high water table; slope.

CDF013425

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
CdD, CdD2	Severe: slope; erosion hazard.	Severe: slope	Severe: moderately slow permeability; slope.	Severe: slope	Severe: slope
CfB	Slight	Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale.	Moderate: 20 to 40 inches to siltstone and shale; medium available moisture capacity.
CfC	Moderate: slope; erosion hazard.	Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale; slope.	Moderate: 20 to 40 inches to siltstone and shale; medium available moisture capacity; slope.
Carlisle: Ch	Moderate: wetness.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.
Chagrin: Ck, Cm	Slight	Severe: subject to flooding.	Severe: subject to flooding.[3]	Severe: subject to flooding.[3]	Severe: subject to flooding.
Chili: CnA, CpA	Slight	Slight	Slight[2]	Severe: very rapid permeability in substratum.[2]	Moderate: medium available moisture capacity.
CnB, CpB	Slight	Slight	Slight[2]	Severe: very rapid permeability in substratum.[2]	Moderate: medium available moisture capacity.
CoC, CoC2, CpC, CpC2	Moderate: slope; erosion hazard.	Moderate: slope	Moderate: slope.[2]	Severe: very rapid permeability in substratum; slope.[2]	Moderate: medium available moisture capacity; slope.
CoD2, CoE2	Severe: slope; erosion hazard.	Severe: slope	Severe: slope[2]	Severe: very rapid permeability in substratum; slope.[2]	Severe: slope
CvF2 (Limitations to use of Conotton soil in this mapping unit are the same as for Chili.)	Severe: slope; erosion hazard.	Severe: slope	Severe: slope[2]	Severe: very rapid permeability in substratum; slope.[2]	Severe: low available moisture capacity; slope.
Conotton: CwA	Moderate: droughty.	Slight	Slight[2]	Severe:[2] very rapid permeability in substratum.	Severe: very low available moisture capacity.
CyB	Moderate: droughty.	Slight	Slight[2]	Severe:[2] very rapid permeability in substratum.	Severe: very low available moisture capacity.

CDF013426

for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale.	Moderate: 20 to 40 inches to siltstone and shale.	Moderate: moderately slow permeability; seasonal high water table.	Moderate: moderately slow permeability; seasonal high water table; slope.	Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale.
Severe: 20 to 40 inches to siltstone and shale; slope.	Severe: 20 to 40 inches to siltstone and shale; slope.	Moderate: 20 to 40 inches to siltstone and shale; slope.	Moderate: moderately slow permeability; seasonal high water table; slope.	Severe: slope	Severe: 20 to 40 inches to siltstone and shale.	Severe: 20 to 40 inches to siltstone and shale.
Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.
Severe: subject to flooding.	Moderate:[4] subject to flooding.	Moderate:[4] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[3]	Severe: subject to flooding.
Slight	Slight	Slight	Slight	Slight	Severe: very rapid permeability in substratum.[2]	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Severe: very rapid permeability in substratum.[3]	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe: very rapid permeability in substratum.[3]	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very rapid permeability in substratum.[2]	Severe: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very rapid permeability in substratum.[3]	Severe: slope.
Slight	Moderate: very low available moisture capacity.	Slight	Slight	Slight	Severe: very rapid permeability in subsoil and substratum.	Slight.
Moderate: slope.	Moderate: texture; slope.	Moderate: gravelly surface.	Moderate: gravelly surface.	Moderate: slope; texture surface layer.	Severe: very rapid permeability in subsoil and substratum.	Slight.

CDF013427

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
CyC	Moderate: droughty.	Moderate: slope	Moderate: [2] slope	Severe: [2] very rapid permeability in substratum; slope.	Severe: very low available moisture capacity.
CyD2, CyE2	Severe: slope; erosion hazard.	Severe: slope	Severe: [2] slope	Severe: [2] very rapid permeability in substratum; slope.	Severe: very low available moisture capacity; slope.
Dekalb:					
DkB	Slight	Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone.	Severe: low available moisture capacity;
DkC	Moderate: slope; erosion hazard.	Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone; slope.	Severe: 24 to 40 inches to sandstone; slope.
DkE2, DkF2	Severe: slope; erosion hazard.	Severe: 24 to 40 inches to sandstone; slope.	Severe: 24 to 40 inches to sandstone; slope.	Severe: 24 to 40 inches to sandstone; slope.	Severe: low available moisture capacity; slope.
Edwards:					
Ed	Moderate: wetness.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table.
Fitchville:					
FcA	Slight	Severe: seasonal high water table.	Severe: moderately slow permeability.	Slight	Moderate: seasonal high water table.
FcB	Slight	Severe: seasonal high water table.	Severe: moderately slow permeability.	Moderate: slope	Moderate: seasonal high water table.
FcC	Moderate: slope; erosion hazard.	Severe: seasonal high water table.	Severe: moderately slow permeability.	Severe: slope	Moderate: seasonal high water table; slope.
Geeburg:					
GbC2	Severe: slope; erosion hazard.	Moderate: seasonal high water table; high shrink-swell potential; slope.	Severe: very slow permeability.	Severe: slope	Moderate: slope; high clay content; very slow permeability.
GbE2	Severe: slope; erosion hazard.	Severe: seasonal high water table; slope; high shrink-swell potential.	Severe: very slow permeability; slope.	Severe: slope	Severe: low available moisture capacity; slope.

CDF013428

for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: slope	Severe: slope	Moderate: slope; gravelly surface.	Moderate: slope; gravelly surface.	Severe: slope	Severe: very rapid permeability in subsoil and substratum.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; very rapid permeability in subsoil and substratum.[2]	Severe: slope.
Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone.	Moderate: 24 to 40 inches to sandstone.	Slight	Moderate: slope.	Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone.
Severe: 24 to 40 inches to sandstone; slope.	Severe: 24 to 40 inches to sandstone; slope.	Moderate: 24 to 40 inches to sandstone; slope.	Moderate: slope.	Severe: slope	Severe: 24 to 40 inches to sandstone.	Severe: 24 to 40 inches to sandstone.
Severe: 24 to 40 inches to sandstone; slope.	Severe: 24 to 40 inches to sandstone; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: 24 to 40 inches to sandstone; slope.	Severe: 24 to 40 inches to sandstone; slope.
Severe: organic material; high water table; soft material.	Severe: organic material; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.
Severe: seasonal high water table; highly susceptible to frost heaving; soft and compressible.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; subject to ponding.	Severe: seasonal high water table.
Severe: seasonal high water table; highly susceptible to frost heaving; soft and compressible.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.
Severe: slope; highly susceptible to frost heaving; seasonal high water table.	Severe: seasonal high water table; slope.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table; slope.	Moderate: seasonal high water table; slope.	Severe: seasonal high water table.
Severe: slope	Severe: very slow permeability; slope.	Moderate: slope.	Severe: very slow permeability.	Severe: very slow permeability; slope.	Severe: clayey material.	Severe: seasonal high water table; very slow permeability.
Severe: slope	Severe: very slow permeability; slope.	Severe: slope	Severe: seasonal high water table; very slow permeability; slope.	Severe: seasonal high water table; very slow permeability; slope.	Severe: seasonal high water table; slope.	Severe: seasonal high water table; very slow permeability; slope.

CDF013429

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
Gilpin:					
GdB	Slight	Moderate: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 40 inches to siltstone.	Severe: low available moisture capacity.
GdC	Moderate: slope; erosion hazard.	Moderate: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 40 inches to siltstone; slope.	Severe: low available moisture capacity;
GdD	Severe: slope; erosion hazard.	Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Severe: low available moisture capacity; slope.
Ginat:					
Ge	Moderate: wetness.	Severe: seasonal high water table.	Severe: moderately slow permeability; seasonal high water table.[2]	Moderate: moderately slow permeability.[2]	Severe: seasonal high water table.
Glenford:					
GfA, GfB	Slight	Moderate: seasonal high water table; soft material when wet.	Severe: moderately slow permeability.	Slight on GfA; moderate on GfB; slope.	Slight
GfC, GfC2, GfD2	Moderate: slope; erosion hazard.	Moderate: seasonal high water table; slope. Severe on FfD2: slope.	Severe: moderately slow permeability; slope on GfD2.	Severe: slope	Moderate: slope. Severe on GfD2; slope.
Keene:					
KeB	Slight	Moderate: seasonal high water table.	Severe: slow permeability; clay shale substratum.	Moderate: slope	Moderate: clayey; medium available moisture capacity.
KeC, KeC2	Moderate: slope; erosion hazard.	Moderate: seasonal high water table; slope.	Severe: slow permeability; clay shale substratum.	Severe: slope	Moderate: slope; medium available moisture capacity.
KeD, KeD2, KeE	Severe: slope; erosion hazard.	Severe: slope	Severe: slow permeability; clay shale substratum; slope.	Severe: slope	Severe: low available moisture capacity; slope.
Killbuck:					
Kk	Moderate: wetness.	Severe: subject to flooding.	Severe: subject to flooding.[3]	Severe: subject to flooding.[3]	Severe: subject to flooding.
Latham:					
LaB	Moderate: slope; erosion hazard.	Severe: 24 to 40 inches to shale.	Severe: slow permeability.	Moderate: slope	Moderate: 24 to 40 inches to shale.
LaC, LaC2	Severe: slope; erosion hazard.	Severe: 24 to 40 inches to shale.	Severe: slow permeability.	Severe: slope	Moderate: 24 to 40 inches to shale.

CDF013430

for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.	Moderate: 20 to 40 inches to siltstone.	Moderate: 20 to 40 inches to bedrock.	Moderate: slope.	Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.
Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone; slope.	Moderate: 20 to 40 inches to siltstone; slope.	Moderate: slope.	Severe: slope	Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.
Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Severe: slope	Severe: slope	Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; moderately slow permeability.	Severe: seasonal high water table; moderately slow permeability.	Severe: seasonal high water table.	Severe: seasonal high water table; moderately slow permeability.
Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability; slope on GfB.	Slight	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table; moderately slow permeability; slope on GfB.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.
Severe: slope	Severe: slope	Moderate: slope. Severe on GfD2: slope.	Moderate: seasonal high water table; moderately slow permeability. Severe on GfD2: slope.	Severe: slope	Moderate: seasonal high water table; slope. Severe on GfD2: slope.	Moderate: seasonal high water table; moderately slow permeability; slope. Severe on GfD2: slope.
Moderate: seasonal high water table; slope.	Severe: slow permeability.	Slight	Severe: slow permeability.	Severe: slow permeability.	Severe: clayey; bedrock at depth of less than 5 feet.	Severe: slow permeability.
Severe: slope	Severe: slow permeability; slope.	Moderate: slope.	Severe: slow permeability.	Severe: slow permeability; slope.	Severe: clayey; bedrock at depth of less than 5 feet.	Severe: slow permeability.
Severe: slope	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability; slope.	Severe: slow permeability; slope.	Severe: slope; clayey.	Severe: slow permeability; slope.
Severe: subject to flooding.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.
Severe: 24 to 40 inches to shale.	Severe: 24 to 40 inches to shale.	Moderate: 24 to 40 inches to shale.	Moderate: 24 to 40 inches to shale.	Moderate: slope.	Severe: 24 to 40 inches to shale.	Severe: 24 to 40 inches to shale.
Severe: 24 to 40 inches to shale; slope.	Severe: 24 to 40 inches to shale; slope.	Moderate: 24 to 40 inches to shale; slope.	Moderate: slope.	Severe: slope	Severe: 24 to 40 inches to shale.	Severe: 24 to 40 inches to shale.

CDF013431

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
LaD, LaD2, LaF	Severe: slope; erosion hazard.	Severe: 24 to 40 inches to shale; slope.	Severe: slow permeability; slope.	Severe: slope	Severe: slope
Licking:					
LcA	Moderate: wetness.	Moderate: seasonal high water table.	Severe: very slow permeability.	Slight	Moderate: very slow permeability; clayey.
LcB	Moderate: wetness.	Moderate: seasonal high water table.	Severe: very slow permeability.	Moderate: slope	Moderate: very slow permeability; clayey.
LcC, LcC2	Moderate: slope; erosion hazard.	Moderate: seasonal high water table; slope.	Severe: very slow permeability.	Severe: slope	Moderate: very slow permeability; slope; clayey.
LcE2	Severe: slope; erosion hazard.	Severe: slope	Severe: very slow permeability; slope.	Severe: slope	Severe: slope
Linwood:					
Ld	Moderate: wetness.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.
Lobdell:					
Le	Slight	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.[2]	Severe: subject to flooding.
Loudonville:					
LoB	Slight	Moderate: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.	Moderate: slope; 20 to 40 inches to bedrock.
LoC, LoC2	Moderate: slope; erosion hazard.	Moderate: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone; slope.	Moderate: slope; 20 to 40 inches to bedrock.
LoD, LoD2, LoE2, LoF2	Severe: slope; erosion hazard.	Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Severe: low available moisture capacity; slope.
Luray:					
Ly	Slight	Severe: seasonal high water table.	Severe: moderately slow permeability; seasonal high water table.	Slight[3]	Severe: seasonal high water table.
Lz	Slight	Severe: seasonal high water table.	Severe: moderately slow permeability; seasonal high water table.	Severe: rapid permeability in substratum.	Severe: seasonal high water table.

CDF013432

for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: 24 to 40 inches to shale; slope.	Severe: 24 to 40 inches to shale; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: 24 to 40 inches to shale; slope.	Severe: 24 to 40 inches to shale; slope.
Moderate: seasonal high water table; very slow permeability; clayey; soft and compressible.	Severe: very slow permeability.	Slight	Severe: very slow permeability.	Severe: very slow permeability.	Slight	Severe: very slow permeability.
Moderate: seasonal high water table; slope; soft and compressible.	Severe: very slow permeability.	Slight	Severe: very slow permeability.	Severe: very slow permeability.	Slight	Severe: very slow permeability.
Severe: slope; soft and compressible.	Severe: very slow permeability; slope.	Moderate: slope.	Severe: very slow permeability.	Severe: very slow permeability; slope.	Moderate: slope.	Severe: very slow permeability.
Severe: slope; soft and compressible.	Severe: slope; very slow permeability.	Severe: slope	Severe: very slow permeability; slope.	Severe: very slow permeability; slope.	Severe: slope	Severe: very slow permeability; slope.
Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.	Severe: organic material; high water table; soft material.[2]	Severe: organic material; high water table; soft material.
Severe: subject to flooding.	Moderate: [1] seasonal high water table; subject to flooding.	Moderate: [1] subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.
Severe: 20 to 40 inches to siltstone.	Moderate: 20 to 40 inches to siltstone; slope.	Moderate: 20 to 40 inches to siltstone.	Slight	Moderate: slope.	Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.
Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Moderate: 20 to 40 inches to siltstone; slope.	Moderate: slope.	Severe: slope	Severe: 20 to 40 inches to siltstone.	Severe: 20 to 40 inches to siltstone.
Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: 20 to 40 inches to siltstone; slope.	Severe: 20 to 40 inches to siltstone; slope.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.

CDF013433

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
Mentor:					
MeA	Slight	Slight	Slight	Moderate: moderate permeability.	Slight
MeB	Slight	Slight	Slight	Moderate: moderate permeability; slope.	Slight
MeC	Moderate: slope; erosion hazard.	Moderate: seasonal high water table; slope.	Moderate: moderate permeability; slope.	Severe: slope	Moderate: slope
MeD	Severe: slope; erosion hazard.	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Montgomery:					
Mg	Moderate: wetness.	Severe: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Slight	Severe: seasonal high water table.
Muskingum:					
MsB	Slight	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.	Severe: low available moisture capacity.
MsC	Moderate: slope; erosion hazard.	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone; slope.	Severe: low available moisture capacity.
MsD	Severe: slope; erosion hazard.	Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Severe: low available moisture capacity; slope.
MvE, MvE3, MvF, MvG (Limitations to use of Gilpin soils in mapping units MvE, MvE3, MvF, and MvG are the same as for Muskingum.)	Severe: slope; erosion hazard.	Severe: 20 to 36 inches to siltstone; slope.	Severe on MvE: 20 to 36 inches to siltstone. Severe on MvE3, MvF, and MvG: 20 to 40 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Severe: low available moisture capacity; slope.
Plainfield:					
PlB	Severe: droughty.	Slight	Slight [2]	Severe: rapid permeability. [2]	Severe: low available moisture capacity.
PlC	Severe: droughty.	Slight	Moderate: slope. [2]	Severe: rapid permeability; slope.	Severe: low available moisture capacity.
Rainsboro:					
RaB	Slight	Moderate: seasonal high water table.	Severe: moderately slow permeability.	Moderate: slope	Slight
RaC	Moderate: slope; erosion hazard.	Moderate: seasonal high water table.	Severe: moderately slow permeability.	Severe: slope	Moderate: slope

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for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Slight	Slight	Slight	Slight	Slight	Slight	Slight.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Slight	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: seasonal high water table.	Severe: very slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; very slow permeability; subject to ponding.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table; clayey; very slow permeability; subject to ponding.	Severe: seasonal high water table; very slow permeability.
Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.	Moderate: 20 to 36 inches to siltstone.	Moderate: 20 to 36 inches to bedrock.	Moderate: slope.	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.
Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Moderate: 20 to 36 inches to siltstone; slope.	Moderate: slope.	Severe: slope	Severe: 20 to 36 inches to siltstone.	Severe: 20 to 36 inches to siltstone.
Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.
Severe: 20 to 30 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.	Severe on MvE, MvE3, and MvF: slope. Severe on MvG: 20 to 40 inches to siltstone; slope.	Severe: slope	Severe: slope	Severe: 20 to 36 inches to siltstone; slope.	Severe: 20 to 36 inches to siltstone; slope.
Moderate: slope.	Severe: sandy	Severe: sandy	Severe: sandy	Severe: sandy	Severe: rapid permeability.	Severe: sandy.
Severe: slope	Severe: sandy; slope.	Severe: sandy	Severe: sandy	Severe: sandy; slope.	Severe: rapid permeability.	Severe: sandy.
Moderate: seasonal high water table; slope.	Moderate: moderately slow permeability; seasonal high water table; slope.	Slight	Moderate: seasonal high water table; moderately slow permeability.	Moderate: seasonal high water table; moderately slow permeability; slope.	Moderate: seasonal high water table.	Moderate: seasonal high water table; moderately slow permeability.
Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: seasonal high water table; moderately slow permeability; slope.	Severe: slope	Moderate: seasonal high water table; slope.	Moderate: seasonal high water table; slope.

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TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
Ramsey: RcC, RcD, RcE2, RcF2	Severe: droughty.	Severe: 12 to 20 inches to sandstone.	Severe: 12 to 20 inches to sandstone.	Severe: 12 to 20 inches to sandstone; slope.	Severe on RcC: low available moisture capacity; shallow to sandstone. Severe on RcD, RcE2, and RcF2: low available moisture capacity; slope.
Ravenna: ReA, ReB	Slight	Severe: seasonal high water table.	Severe: moderately slow permeability.	Slight for ReA. Moderate for ReB: slope.	Moderate: seasonal high water table; moderately slow permeability.
Remsen: RoA, RoB	Moderate: wetness.	Severe: seasonal high water table.	Severe: very slow permeability.	Slight for RoA. Moderate for RoB: slope.	Moderate: very slow permeability; seasonal high water table.
Rittman: RsB	Slight	Moderate: seasonal high water table.	Severe: slow permeability.	Moderate: slope	Slight
RsC, RsC2	Moderate: slope; erosion hazard.	Moderate: seasonal high water table; slope.	Severe: slow permeability.	Severe: slope	Moderate: slope
RsD2	Severe: slope; erosion hazard.	Severe: slope	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability; slope.
Sebring: Sb, Se	Moderate: wetness.	Severe: seasonal high water table.	Severe: moderately slow permeability; seasonal high water table.	Slight	Severe: moderately slow permeability; seasonal high water table.
Shoals: Sh	Slight	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.[2]	Severe: subject to flooding.
Sloan: Sl	Moderate: wetness.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.[2]	Severe: subject to flooding.
Tilsit: TlC	Moderate: slope; erosion hazard.	Moderate: 36 to 60 inches to siltstone; seasonal high water table.	Severe: slow permeability.	Severe: slope	Severe: slow permeability.

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for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: 12 to 20 inches to sandstone; slope.	Severe: 12 to 20 inches to sandstone; slope.	Severe on RcC: 12 to 20 inches to sandstone. Severe on RcD, RcE2, and RcF2: slope.	Severe on RcC: 12 to 20 inches to sandstone. Severe on RcD, RcE2, and RcF2: slope.	Severe: slope	Severe on RcC: 12 to 20 inches to sandstone. Severe on RcD, RcE2, and RcF2: 12 to 20 inches to sandstone; slope.	Severe on RcC: 12 to 20 inches to sandstone. Severe on RcD, RcE2, and RcF2: 12 to 20 inches to sandstone; slope.
Moderate for ReA: seasonal high water table. Moderate for ReB: seasonal high water table; slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe for ReA; ponding; seasonal high water table. Moderate for ReB; seasonal high water table.	Severe: seasonal high water table.
Moderate: seasonal high water table; high shrink-swell potential.	Severe: very slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table; very slow permeability.	Severe: seasonal high water table; clayey material.	Severe: seasonal high water table; very slow permeability.
Moderate: seasonal high water table; slope.	Severe: slow permeability.	Slight	Severe: slow permeability.	Severe: slow permeability.	Moderate: seasonal high water table; clay loam.	Severe: slow permeability.
Severe: slope	Severe: slow permeability; slope.	Moderate: slope.	Severe: slow permeability.	Severe: slow permeability; slope.	Moderate: seasonal high water table; slope; clay loam.	Severe: slow permeability.
Severe: slope	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability.	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability; slope.
Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Severe: subject to flooding.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.
Severe: subject to flooding.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.
Severe: slope	Severe: slow permeability; slope.	Moderate: slope.	Severe: slow permeability.	Severe: slow permeability; slope.	Moderate: 36 to 60 inches to siltstone; slope.	Severe: slow permeability.

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TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
TID	Severe: slope; erosion hazard.	Severe: slope	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability; slope.
Trumbull: Tr	Severe: wetness.	Severe: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Slight	Severe: slow permeability; seasonal high water table.
Wadsworth: WaA	Moderate: wetness.	Severe: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Slight	Moderate: slow permeability; seasonal high water table.
WaB	Moderate: wetness.	Severe: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Moderate: slope	Moderate: slow permeability; seasonal high water table.
WaC, WaC2	Moderate: slope; erosion hazard.	Severe: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: slope	Severe: slow permeability; seasonal high water table.
WbB	Moderate: slope; erosion hazard.	Severe: 20 to 40 inches to shale; seasonal high water table.	Severe: slow permeability; 20 to 40 inches to shale.	Severe: 20 to 40 inches to shale.	Moderate: 20 to 40 inches to shale; slow permeability; seasonal high water table.
Wallkill: Wc	Moderate: wetness.	Severe: high water table.	Severe: high water table.	Severe: high water table; high organic content.	Severe: high water table.
Wayland: Wd	Moderate: wetness.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.[2]	Severe: subject to flooding.
Weikert: WeC, WeD, WeE2, WeF2	Severe: stoniness; 12 to 20 inches to siltstone.	Severe: 12 to 20 inches to siltstone.	Severe: 12 to 20 inches to siltstone.	Severe: 12 to 20 inches to siltstone; slope.	Severe: 12 to 20 inches to siltstone; slope.
Weinbach: WhA, WhB	Slight	Severe: seasonal high water table.	Severe: moderately slow permeability in fragipan.[2]	Severe: moderately rapid permeability in substratum.[2]	Moderate: moderately slow permeability in fragipan; medium available moisture capacity.

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for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: slope	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability; slope.	Severe: slow permeability; slope.	Severe: slope	Severe: slow permeability; slope.
Severe: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table; slow permeability.	Severe: seasonal high water table; clayey material.	Severe: seasonal high water table; slow permeability.
Moderate: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table; subject to ponding.	Severe: seasonal high water table; slow permeability.
Moderate: seasonal high water table; slope.	Severe: slow permeability; seasonal high water table.	Moderate: seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; slow permeability.
Severe: slope	Severe: slow permeability; seasonal high water table; slope.	Moderate: seasonal high water table; slope.	Severe: slow permeability; seasonal high water table.	Severe: slow permeability; seasonal high water table; slope.	Severe: seasonal high water table.	Severe: seasonal high water table: slow permeability.
Moderate: 20 to 40 inches to shale; seasonal high water table; slope.	Severe: 20 to 40 inches to shale; seasonal high water table; slow permeability.	Moderate: 20 to 40 inches to shale; seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: slow permeability; seasonal high water table.	Severe: 20 to 40 inches to shale; seasonal high water table.	Severe: 20 to 40 inches to shale; seasonal high water table; slow permeability.
Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Severe: subject to flooding.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.[2]	Severe: subject to flooding.
Severe: 12 to 20 inches to siltstone; slope.	Severe: 12 to 20 inches to siltstone; slope.	Severe on WeC: 12 to 20 inches to siltstone. Severe on WeD, WeE2, and WeF2: 12 to 20 inches to siltstone; slope.	Moderate: slope; 12 to 20 inches to siltstone.	Severe: slope; 12 to 20 inches to siltstone.	Severe on WeC: 12 to 20 inches to siltstone. Severe on WeD, WeE2, WeF2: 12 to 20 inches to siltstone; slope.	Severe on WeC: 12 to 20 inches to siltstone. Severe on WeD, WeE2, WeF2: 12 to 20 inches to siltstone; slope.
Moderate on WhA: seasonal high water table. Moderate on WhB: seasonal high water table; slope.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table; pervious substratum.[2]	Severe: seasonal high water table.

CDF013439

TABLE 7.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Cultivated crops	Sites for homes of 3 stories or less [1]	Disposal of sewage effluent	Sewage lagoons	Lawns, landscaping, and golf fairways
Wellston:					
WlB	Slight	Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone.	Moderate: 30 to 48 inches to siltstone and sandstone; medium available moisture capacity.
WlC	Moderate: slope; erosion hazard.	Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone; slope.	Moderate: 30 to 48 inches to sandstone and siltstone; medium available moisture capacity; slope.
Wheeling:					
WmA, WrA, WmB, WrB	Slight	Slight	Slight [2]	Severe: rapid permeability in substratum.[2]	Moderate: medium available moisture capacity.
WmC2, WrC, WrC2	Moderate: slope; erosion hazard.	Moderate: slope	Moderate: slope.[2]	Severe: rapid permeability in substratum.	Moderate: medium available moisture capacity; slope.
WsD2	Severe: slope; erosion hazard.	Severe: slope	Severe: slope [2]	Severe: rapid permeability in substratum; slope.[2]	Severe: slope
Willette:					
Wt	Moderate: wetness.	Severe: organic material over clayey material; high water table; soft material.	Severe: organic material over clayey material; high water table; soft material.[3]	Severe: organic material over clayey material; high water table; soft material.[3]	Severe: organic material over clayey material; high water table; soft material.
Wooster:					
WuB	Slight	Slight	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight
WuC, WuC2	Moderate: slope; erosion hazard.	Moderate: slope	Moderate: slope; moderate permeability.	Severe: slope	Moderate: slope
WuD2, WuE2 WuF2	Severe: slope; erosion hazard.	Severe: slope	Severe: slope	Severe: slope	Severe: slope

[1] Ratings also apply to commercial, institutional, and light industrial sites for buildings of 3 stories or less.
[2] There is a hazard of environment pollution if this soil is developed for this use. Some of these soils are porous, particularly in the substratum, and commonly do not provide adequate filtration. The alluvial soils are subject to flooding and can cause surface water pollution.
[3] The uppermost 12 inches should be removed because it is high in organic-matter content.
[4] Rating depends on the frequency and severity of flooding at a specific site.

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for town and country planning—Continued

Streets and parking lots	Athletic fields and other intensive play areas	Parks and other extensive play areas	Campsites		Sanitary land fills	Cemeteries
			Tents	Trailers		
Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone.	Moderate: 30 to 48 inches to siltstone and sandstone.	Slight	Moderate: slope.	Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone.
Severe: 30 to 48 inches to siltstone and sandstone; slope.	Severe: 30 to 48 inches to siltstone and sandstone; slope.	Moderate: 30 to 48 inches to siltstone and sandstone; slope.	Moderate: slope.	Severe: slope	Severe: 30 to 48 inches to siltstone and sandstone.	Severe: 30 to 48 inches to siltstone and sandstone.
Slight on WmA and WrA. Moderate on WmB and WrB; slope.	Slight on WmA and WrA. Moderate on WmB and WrB; slope.	Slight	Slight	Slight on WmA and WrA. Moderate on WmB and WrB: slope.	Severe: pervious substratum.	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Severe: pervious substratum; slope.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; pervious substratum.[2]	Severe: slope.
Severe: organic material over clayey material; high water table; soft material.	Severe: organic material over clayey material; high water table; soft material.	Severe: organic material over clayey material; high water table; soft material.	Severe: organic over clayey material; high water table; soft material.	Severe: organic material over clayey material; high water table; soft material.	Severe: organic material over clayey material; high water table; soft material.	Severe: organic material over clayey material; high water table; soft material.
Moderate: slope.	Moderate: slope.	Slight	Slight	Moderate: slope.	Slight	Slight.
Severe: slope	Severe: slope	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.
Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

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fill are depth to rock, stoniness, wetness, permeability, slope, texture of the soil material, and the hazard of flooding. The degree of slope is important when considering the use of soils for this purpose. Where the slope is the only limiting feature, the limitation is slight for slopes of less than 6 percent, moderate for slopes of 6 to 12 percent, and severe for slopes of more than 12 percent. Also important is depth to hard rock. The limitation is slight if rock is at a depth of more than 6 feet; moderate, at a depth of 3 to 6 feet; and severe, at a depth of less than 3 feet.

Sandy soils have fewer limitations as sanitary land fills than other soils in the county, but the ground water may be polluted when sandy soils and other permeable soils are used for sanitary land fills. Limitations are severe on some impermeable soils because of ponding and general wetness.

Cemeteries.—For use as cemeteries, soils have few limitations if they are deep, well drained, and permeable. The depth to rock and natural drainage are especially important. Other features that affect use as cemeteries are the hazard of flooding, slope, permeability, depth to the water table, and texture of the soil material.

Descriptions of the Soils

This section describes the soil series and mapping units in Stark County. The approximate acreage and proportionate extent of each mapping unit are given in table 8.

The procedure in this section is first to describe the soil series and then the mapping units in the series. Thus, to get full information on any one mapping unit, it is necessary to read the description of the unit and also the description of the soil series to which it belongs. The description of a soil series mentions features that apply to all the soils in the series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are indicated in the soil name. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. For example, Cut and fill land is a miscellaneous land type and does not belong to a soil series; nevertheless, it is listed in alphabetic order along with the series.

An essential part of each soil series is the description of the soil profile, the sequence of layers beginning at the surface and continuing downward to the depth beyond which roots of most plants do not penetrate. Each soil series contains a short description of a typical soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations.

TABLE 8.—*Approximate acreage and proportionate extent of soils mapped*

Soil	Acres	Percent
Alluvial land	258	0.1
Alluvial land-Urban land complex	979	.3
Arkport fine sandy loam, 0 to 6 percent slopes	258	.1
Arkport fine sandy loam, 6 to 12 percent slopes	173	(1)
Arkport fine sandy loam, 12 to 18 percent slopes	98	(1)
Bogart loam, 0 to 2 percent slopes	104	(1)
Bogart loam, 2 to 6 percent slopes	229	.1
Bogart silt loam, 0 to 2 percent slopes	638	.2
Bogart silt loam, 2 to 6 percent slopes	1,796	.5
Bogart silt loam, 6 to 12 percent slopes	220	.1
Bogart-Urban land complex	296	.1
Borrow pits	63	(1)
Brooke silty clay loam, 4 to 12 percent slopes, moderately eroded	206	.1
Brooke silty clay loam, 12 to 25 percent slopes, moderately eroded	46	(1)
Canadice silt loam	453	.1
Canfield silt loam, 0 to 2 percent slopes	1,192	.3
Canfield silt loam, 2 to 6 percent slopes	40,959	11.2
Canfield silt loam, 6 to 12 percent slopes	10,047	2.7
Canfield silt loam, 6 to 12 percent slopes, moderately eroded	8,112	2.2
Canfield silt loam, 12 to 18 percent slopes	473	.1
Canfield silt loam, 12 to 18 percent slopes, moderately eroded	1,187	.3
Canfield-Urban land complex, undulating	5,669	1.5
Canfield-Urban land complex, rolling	2,105	.6
Canfield silt loam, moderately shallow variant, 2 to 6 percent slopes	105	(1)
Canfield silt loam, moderately shallow variant, 6 to 12 percent slopes	160	(1)
Carlisle muck	5,745	1.6
Chagrin loam, alkaline phase	508	.1
Chagrin silt loam, alkaline phase	1,298	.4
Chili loam, 0 to 2 percent slopes	820	.2
Chili loam, 2 to 6 percent slopes	2,466	.7
Chili gravelly loam, 6 to 12 percent slopes	1,450	.4
Chili gravelly loam, 6 to 12 percent slopes, moderately eroded	1,493	.4
Chili gravelly loam, 12 to 18 percent slopes, moderately eroded	6,670	1.8
Chili gravelly loam, 18 to 25 percent slopes, moderately eroded	1,951	.5
Chili silt loam, 0 to 2 percent slopes	2,922	.8
Chili silt loam, 2 to 6 percent slopes	15,096	4.1
Chili silt loam, 6 to 12 percent slopes	6,267	1.7
Chili silt loam, 6 to 12 percent slopes, moderately eroded	4,960	1.3
Chili-Urban land complex, undulating	13,295	3.6
Chili-Urban land complex, rolling	2,515	.7
Chili-Urban land complex, steep	1,060	.3
Chili and Conotton gravelly loams, 25 to 50 percent slopes, moderately eroded	1,495	.4
Conotton loam, 0 to 2 percent slopes	217	.1
Conotton gravelly loam, 2 to 6 percent slopes	335	.1
Conotton gravelly loam, 6 to 12 percent slopes	486	.1
Conotton gravelly loam, 12 to 18 percent slopes, moderately eroded	1,190	.3
Conotton gravelly loam, 18 to 25 percent slopes, moderately eroded	969	.3
Cut and fill land	3,366	.9
Dekalb sandy loam, 2 to 6 percent slopes	230	.1
Dekalb sandy loam, 6 to 12 percent slopes	1,119	.3
Dekalb sandy loam, 12 to 25 percent slopes, moderately eroded	3,207	.9
Dekalb sandy loam, 25 to 50 percent slopes, moderately eroded	1,805	.5
Edwards muck	52	(1)
Fitchville silt loam, 0 to 2 percent slopes	9,345	2.5
Fitchville silt loam, 2 to 6 percent slopes	3,181	.9
Fitchville silt loam, 6 to 12 percent slopes	244	.1
Fitchville-Urban land complex	412	.1

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TABLE 8.—*Approximate acreage and proportionate extent of soils mapped*—Continued

Soil	Acres	Percent
Geeburg silt loam, 6 to 12 percent slopes, moderately eroded	231	.1
Geeburg silt loam, 12 to 25 percent slopes, moderately eroded	172	(1)
Gilpin silt loam, 2 to 6 percent slopes	686	.2
Gilpin silt loam, 6 to 12 percent slopes	2,453	.7
Gilpin silt loam, 12 to 18 percent slopes	2,280	.6
Ginat silt loam	2,169	.6
Glenford silt loam, 0 to 2 percent slopes	765	.2
Glenford silt loam, 2 to 6 percent slopes	2,809	.8
Glenford silt loam, 6 to 12 percent slopes	1,637	.4
Glenford silt loam, 6 to 12 percent slopes, moderately eroded	218	.1
Glenford silt loam, 12 to 18 percent slopes, moderately eroded	367	.1
Gravel pits	1,054	.3
Keene silt loam, 2 to 6 percent slopes	441	.1
Keene silt loam, 6 to 12 percent slopes	2,216	.6
Keene silt loam, 6 to 12 percent slopes, moderately eroded	436	.1
Keene silt loam, 12 to 18 percent slopes	983	.3
Keene silt loam, 12 to 18 percent slopes, moderately eroded	328	.1
Keene silt loam, 18 to 25 percent slopes	143	(1)
Killbuck silt loam	476	.1
Latham silt loam, 2 to 6 percent slopes	341	.1
Latham silt loam, 6 to 12 percent slopes	1,549	.4
Latham silt loam, 6 to 12 percent slopes, moderately eroded	298	.1
Latham silt loam, 12 to 18 percent slopes	1,114	.3
Latham silt loam, 12 to 18 percent slopes, moderately eroded	794	.2
Latham silt loam, 18 to 35 percent slopes	783	.2
Licking silt loam, 0 to 2 percent slopes	73	(1)
Licking silt loam, 2 to 6 percent slopes	460	.1
Licking silt loam, 6 to 12 percent slopes	235	.1
Licking silt loam, 6 to 12 percent slopes, moderately eroded	127	(1)
Licking silt loam, 12 to 25 percent slopes, moderately eroded	268	.1
Linwood muck	634	.2
Lobdell silt loam, alkaline phase	1,586	.4
Loudonville silt loam, 2 to 6 percent slopes	1,204	.3
Loudonville silt loam, 6 to 12 percent slopes	2,346	.6
Loudonville silt loam, 6 to 12 percent slopes, moderately eroded	1,447	.4
Loudonville silt loam, 12 to 18 percent slopes	1,301	.4
Loudonville silt loam, 12 to 18 percent slopes, moderately eroded	1,450	.4
Loudonville silt loam, 18 to 25 percent slopes, moderately eroded	883	.2
Loudonville silt loam, 25 to 35 percent slopes, moderately eroded	384	.1
Loudonville-Urban land complex, undulating	278	.1
Loudonville-Urban land complex, rolling	293	.1
Luray silt loam	4,079	1.1
Luray silt loam, gravelly subsoil variant	1,663	.5
Made land	328	.1
Mentor silt loam, 0 to 2 percent slopes	270	.1
Mentor silt loam, 2 to 6 percent slopes	447	.1
Mentor silt loam, 6 to 12 percent slopes	237	.1
Mentor silt loam, 12 to 18 percent slopes	176	(1)
Montgomery silty clay loam	604	.2
Muskingum silt loam, 2 to 6 percent slopes	320	.1
Muskingum silt loam, 6 to 12 percent slopes	1,738	.5
Muskingum silt loam, 12 to 18 percent slopes	2,321	.6
Muskingum and Gilpin silt loams, 18 to 25 percent slopes	4,765	1.3
Muskingum and Gilpin silt loams, 18 to 25 percent slopes, severely eroded	195	.1
Muskingum and Gilpin silt loams, 25 to 35 percent slopes	2,522	.7
Muskingum and Gilpin silt loams, 35 to 50 percent slopes	648	.2
Muskingum and Gilpin-Urban land complex, steep	290	.1
Plainfield loamy sand, 0 to 6 percent slopes	717	.2
Plainfield loamy sand, 6 to 12 percent slopes	197	.1
Quarries	187	(1)
Rainsboro silt loam, 2 to 6 percent slopes	95	(1)
Rainsboro silt loam, 6 to 12 percent slopes	60	(1)
Ramsey channery sandy loam, 6 to 12 percent slopes	151	(1)
Ramsey channery sandy loam, 12 to 18 percent slopes	55	(1)
Ramsey channery sandy loam, 18 to 25 percent slopes, moderately eroded	148	(1)
Ramsey channery sandy loam, 25 to 50 percent slopes, moderately eroded	959	.3
Ravenna silt loam, 0 to 2 percent slopes	9,721	2.6
Ravenna silt loam, 2 to 6 percent slopes	12,395	3.4
Ravenna-Urban land complex	2,462	.7
Remsen silt loam, 0 to 2 percent slopes	2,225	.6
Remsen silt loam, 2 to 6 percent slopes	2,096	.6
Remsen-Urban land complex	388	.1
Rittman silt loam, 2 to 6 percent slopes	658	.2
Rittman silt loam, 6 to 12 percent slopes	192	.1
Rittman silt loam, 6 to 12 percent slopes, moderately eroded	707	.2
Rittman silt loam, 12 to 18 percent slopes, moderately eroded	281	.1
Sebring silt loam	11,523	3.1
Sebring silt loam, till substratum	1,993	.5
Sebring-Urban land complex	370	.1
Shoals silt loam	8,022	2.2
Sloan silt loam	3,062	.8
Strip mine spoil, sandstone and shale materials, undulating	947	.3
Strip mine spoil, sandstone and shale materials, rolling	2,420	.7
Strip mine spoil, sandstone and shale materials, steep	5,878	1.6
Strip mine spoil, acid clay shale materials, undulating	128	(1)
Strip mine spoil, acid clay shale materials, rolling	283	.1
Strip mine spoil, acid clay shale materials, steep	635	.2
Strip mine spoil, nonacid materials, undulating	834	.2
Strip mine spoil, nonacid materials, rolling	690	.2
Strip mine spoil, nonacid materials, steep	966	.3
Tilsit silt loam, 6 to 12 percent slopes	143	(1)
Tilsit silt loam, 12 to 18 percent slopes	115	(1)
Trumbull silt loam	290	.1
Urban land	3,757	1.0
Wadsworth silt loam, 0 to 2 percent slopes	1,649	.4
Wadsworth silt loam, 2 to 6 percent slopes	3,143	.9
Wadsworth silt loam, 6 to 12 percent slopes	158	(1)
Wadsworth silt loam, 6 to 12 percent slopes, moderately eroded	276	.1
Wadsworth silt loam, moderately shallow variant, 2 to 6 percent slopes	223	.1
Wallkill silt loam, clayey subsoil variant	477	.1
Wayland silt loam	3,377	.9
Weikert channery silt loam, 6 to 12 percent slopes	137	(1)
Weikert channery silt loam, 12 to 18 percent slopes	211	.1
Weikert channery silt loam, 18 to 25 percent slopes, moderately eroded	482	.1
Weikert channery silt loam, 25 to 50 percent slopes, moderately eroded	1,158	.3
Weinbach silt loam, 0 to 2 percent slopes	4,005	1.1
Weinbach silt loam, 2 to 6 percent slopes	1,456	.4
Weinbach-Urban land complex	368	.1

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TABLE 8.—*Approximate acreage and proportionate extent of soils mapped*—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Wellston silt loam, 2 to 6 percent slopes	172	(1)	Wooster silt loam, 2 to 6 percent slopes	6,487	1.8
Wellston silt loam, 6 to 12 percent slopes	158	(1)	Wooster silt loam, 6 to 12 percent slopes	3,816	1.0
Wheeling loam, 0 to 2 percent slopes	282	.1	Wooster silt loam, 6 to 12 percent slopes, moderately eroded	10,791	2.9
Wheeling loam, 2 to 6 percent slopes	507	.1	Wooster silt loam, 12 to 18 percent slopes, moderately eroded	6,137	1.7
Wheeling loam, 6 to 12 percent slopes, moderately eroded	140	(1)	Wooster silt loam, 18 to 25 percent slopes, moderately eroded	1,538	.4
Wheeling silt loam, 0 to 2 percent slopes	3,107	.8	Wooster silt loam, 25 to 50 percent slopes, moderately eroded	143	(1)
Wheeling silt loam, 2 to 6 percent slopes	5,144	1.4	Wooster-Urban land complex, steep	305	.1
Wheeling silt loam, 6 to 12 percent slopes	743	.2	Water areas	2,746	.7
Wheeling silt loam, 6 to 12 percent slopes, moderately eroded	269	.1	Total	366,720	100.0
Wheeling soils, 12 to 18 percent slopes, moderately eroded	198	.1			
Willette muck	857	.2			

[1] Less than 0.05 percent.

The color of each soil horizon is described in words, such as grayish brown, but it can also be indicated by symbols for the hue, value, and chroma, such as 10YR 5/2. These symbols, called Munsell color notations, are used by the soil scientists to indicate the color of a soil precisely (*13*). In this survey the terms "light colored" and "dark colored" refer to the color of the surface layer of the soils. Soils that have a surface layer with a color value of 4 or more are light colored; those that have a surface layer with a color value of less than 4 are dark colored. Unless otherwise stated, the color is for a moist soil.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and the woodland suitability group in which the mapping unit has been placed. The page on which each capability unit is described can be found by referring to the "Guide to Mapping Units" at the back of this soil survey. The woodland suitability group in which each soil has been placed is given in table 2 in the subsection "Woodland." Many terms used in the soil descriptions and other sections of this survey are defined in the Glossary at the back of this survey and in the "Soil Survey Manual" (*13*).

Alluvial Land

Alluvial land is in two mapping units. In one it is mapped separately and in the other it is mapped in a complex with Urban land.

Alluvial land (Ad).—This mapping unit occupies nearly level areas on bottom lands along the Mahoning River. It is flooded annually by water that backs up from the Berlin Reservoir. In summer this water recedes within the river channel and the soil material is exposed. Willows and other water-tolerant plants grow on this land. Some areas are used for hunting in the fall. The lower lying, very wet, depressional areas are bare. (Capability unit VIIIw–1; woodland suitability group not assigned)

Alluvial land-Urban land complex (An).—This mapping unit occurs on nearly level bottom lands in cities and towns, and it is subject to flooding, particularly in spring. About 25 to 75 percent of this complex consists of land that has been used for building sites, of areas that have had the topsoil removed, and of areas of refuse fill. About 75 percent of the area is somewhat poorly drained and the rest is moderately well drained and well drained.

Limitations to use of this complex for recreational development is moderate in the moderately well drained and well drained areas and is severe in the somewhat poorly drained areas. Use for residential buildings is more severely limited than for recreational areas. (Capability unit not assigned; woodland suitability group not assigned)

Arkport Series

This series consists of well-drained, level to moderately steep soils on stream terraces, glacial outwash plains, and kames.

In a typical profile the plow layer is dark grayish-brown fine sandy loam about 9 inches thick. The subsoil, about 46 inches thick, consists of alternating bands of dark yellowish-brown loamy fine sand and yellowish-red or reddish-brown fine sandy loam in the uppermost 36 inches. Below this is yellowish-brown fine sand. The underlying material is stratified fine sand and silt.

The Arkport soils have a deep root zone. They are mainly strongly acid within the root zone. Water and air move through these soils at a rapid rate. The available moisture capacity is low. These soils dry out rapidly in spring, and they are droughty.

These soils are not extensive in this county, but most of the acreage is used for cultivated crops.

Typical profile of Arkport fine sandy loam, 6 to 12 percent slopes, 2 miles northeast of Canal Fulton, in a meadow in Lawrence Township, section 2, T. 1 N., R. 10 W. (analytical data in table 10):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, crumb structure that breaks to single grain (structureless); loose when dry, friable when moist; abundant roots; few pebbles; medium acid; abrupt, smooth boundary.

B2&B2t—9 to 45 inches, alternating bands of dark yellowish-brown (10YR 4/4) loamy fine sand (B2) and yellowish-red (5YR 5/6) or reddish-brown (5YR 4/4) fine sandy loam (B2t). The bands of fine sandy loam (B2t) are 1 inch to 3 inches thick; they have weak, fine and medium, subangular

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blocky structure, are loose when dry, are friable when moist, have clay coatings and bridging between sand grains, and are strongly acid. The B2 strata are thicker than the B2t bands; they have weak to very weak, fine, subangular blocky structure, are loose when dry, and are very friable when moist; few roots below a depth of 18 inches; strongly acid or very strongly acid; abrupt, wavy boundary.

B3—45 to 55 inches, yellowish-brown (10YR 5/4) fine sand; few, medium, faint mottles of light reddish brown (5YR 6/4); single grain (structureless); loose; no roots; strongly acid; abrupt, wavy boundary.

C—55 to 60 inches, stratified fine sand and silt.

In the B2&B2t horizon the matrix of the bands of fine sandy loam (B2t) includes reddish brown (5YR 4/4) and that in the bands of loamy fine sand includes yellowish brown (10YR 5/4) or light yellowish brown (10YR 6/4). Reaction ranges from very strongly acid to medium acid in the B horizon. Coarse fragments make up from 1 to 10 percent of the B horizon and the C horizon.

The Arkport soils are near the Plainfield soils. They are similar to the Plainfield soils, except for having a banded subsoil. The Arkport soils contain more sand and less gravel than the well-drained Chili and Conotton soils. They are more sandy throughout the profile than the Wheeling soils.

Arkport fine sandy loam, 0 to 6 percent slopes (ArB).—This soil occurs on stream terraces and outwash plains. Areas are convex and vary in size. Most areas range from 3 to 10 acres in size and occur mainly north of Canal Fulton in the vicinity of Lake Lucern, but an area about 30 acres in size lies east of the Tuscarawas River near the Summit County line.

Included with this soil in mapping were areas of Wheeling soils and areas of gravelly Chili and Conotton soils.

This Arkport soil is droughty, and the hazard of erosion is moderate in cultivated areas. It generally has good surface tilth although it is commonly low in organic-matter content. (Capability unit IIe-6; woodland suitability group 2s1)

Arkport fine sandy loam, 6 to 12 percent slopes (ArC).—This soil occurs in hummocky areas of glacial outwash and on terraces along the Tuscarawas River and Nimisila Creek. Areas are irregular in size and shape. This soil has the profile described as typical for the series, but in some places depth to glacial till is 40 to 60 inches.

Included with this soil in mapping were a few areas of a moderately eroded Arkport soil that has a lighter colored and thinner surface layer than that described as typical. In this soil the first band of dark-colored material is at a depth of less than 15 inches, and the first few bands of dark-colored material are not so distinct as are those that are below a depth of 20 inches. Also included in the mapping were small areas of Chili soils.

The hazard of erosion is the major limitation to the use of this soil for farming. Use for many nonfarm purposes is limited by the slope, rapid permeability, and droughtiness. (Capability unit IIIe-1; woodland suitability group 2s1)

Arkport fine sandy loam, 12 to 18 percent slopes (ArD).—This soil is on short, irregular slopes of terraces along the Tuscarawas River and hummocky outwash plains. Areas range from 3 to 10 acres in size. This soil is more droughty than the less sloping Arkport fine sandy loams. It contains more gravel than Arkport fine sandy loam, 6 to 12 percent slopes, which has the profile described as typical for the series.

Included with this soil in mapping were areas of a moderately eroded Arkport soil that has more gravel on the surface and is lighter colored than this soil. Other inclusions were small areas of the gravelly Conotton soils.

Droughtiness and the hazard of erosion are the main limitations to the use of this soil for farming. Droughtiness and the slope are limitations to use for many nonfarm purposes. (Capability unit IVe-1; woodland suitability group 2s1)

Bogart Series

The Bogart series consists of moderately well drained, level to sloping soils that occur on terraces and outwash plains throughout the county. These soils formed in sandy and gravelly glacial outwash material.

In a typical profile the plow layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is about 35 inches thick. To a depth of about 22 inches, it is strong-brown silt loam. Below this, and extending to a depth of 28 inches, is yellowish-brown gravelly clay loam that is distinctly mottled with light brownish gray, grayish brown and reddish yellow. The lower part of the subsoil is about 14 inches of yellowish-brown very gravelly sandy loam mottled with gray and reddish yellow. The underlying material is loose gravel and sand.

The Bogart soils have a moderately deep or deep root zone. Permeability is moderate in the subsoil and is rapid in the underlying material. The available moisture capacity is low to medium, depending on the depth to coarse sand and gravel. These soils have a high water table during wet periods. They tend to be less droughty than the nearby Chili soils.

The Bogart soils are not extensive in this county. Most of their acreage is used for cultivated crops.

Typical profile of Bogart silt loam, 2 to 6 percent slopes, in a cultivated field in Lake Township, section 20, T. 12 N., R. 8 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, subangular blocky structure that breaks to moderate, fine and medium, granular structure; friable; abundant roots; 10 percent pebbles; slightly acid; abrupt, smooth boundary.

B1—7 to 16 inches, strong-brown (7.5YR 5/6) silt loam; moderate, fine and medium, subangular blocky structure; slightly friable when moist, slightly plastic when wet; common roots; 10 percent pebbles, by volume, as much as 2 inches in diameter; strongly acid; gradual, wavy boundary.

B21t—16 to 22 inches, strong-brown (7.5YR 5/6) heavy silt loam; few, fine, faint mottles of grayish brown (10YR 5/2); strong, fine and medium, subangular blocky structure; friable; common roots; thin clay films on 20 percent of ped surfaces; 15 percent pebbles, by volume, as much as 2 inches in diameter; strongly acid; gradual, wavy boundary.

IIB22tg—22 to 28 inches, yellowish-brown (10YR 5/4) gravelly clay loam; many, medium, distinct mottles

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of light brownish gray (10YR 6/2), grayish brown (10YR 5/2), and reddish yellow (7.5YR 6/6); moderate, medium and coarse, subangular blocky structure; slightly firm; few roots; medium clay films on 40 percent of ped surfaces; few clay enriched masses; few, medium, very dark brown ferromanganiferous stains on ped surfaces; 30 percent pebbles, by volume, as much as 2 inches in diameter; strongly acid; gradual, wavy boundary.

IIB3C1—28 to 42 inches, yellowish-brown (10YR 5/4) very gravelly sandy loam; many, medium, distinct mottles of gray (10YR 6/1) and reddish yellow (7.5YR 6/6); weak, fine and medium, subangular blocky structure; very friable; few roots; discontinuous clay films in old root channels; few black (N 2/0) stains on a few pebbles; 60 percent pebbles in lower part of horizon; strongly acid.

IIC2—42 to 60 inches, loose gravel and sand; medium acid.

The A horizon is silt loam or loam. In some areas there is an A2 horizon in which chromas are 3 or 4 and values are 5 or 6. Depth to the B21t horizon ranges from 14 to 20 inches. The combined B21t and B22tg horizons are 10 to 30 inches thick, and in these horizons the matrix ranges from yellowish brown (10YR 5/4 or 5/5) to brown (7.5YR 5/4) or strong brown (7.5YR 5/6). In the lower part of the B2 horizon, coarse fragments make up from 5 to 30 percent of the soil mass. The C horizon contains only a few stones that are more than 3 inches in diameter.

The Bogart soils are the moderately well drained members of a drainage sequence that includes the well drained Chili soils. Bogart soils are commonly next to the somewhat poorly drained Weinbach soils and the well-drained Chili soils. The underlying material of Bogart soils is sandy and gravelly, whereas that of Glenford soils is silty and contains some clay. The Bogart soils have a more friable subsoil than the Weinbach soils.

Bogart loam, 0 to 2 percent slopes (BgA).—This soil occurs mainly on stream terraces in Marlboro and Sandy Townships. Areas vary in size. This soil has more sand in the surface layer and subsoil than Bogart silt loam, 2 to 6 percent slopes, which has the profile described as typical for the series. The surface layer of this soil is less susceptible to crusting than that of the Bogart silt loams.

Included with this soil in mapping, in Marlboro Township, were areas in which the underlying material is mainly reddish sand and is wet much of the year. Also included in the mapping, in depressions and drainageways, were small areas of the somewhat poorly drained Weinbach soils.

Limitations to use of this soil for cultivated crops are few or none. A seasonal high water table is a limitation to some nonfarm uses. (Capability unit IIs–1; woodland suitability group 1o1)

Bogart loam, 2 to 6 percent slopes (BgB).—This soil occurs on stream terraces. Its surface layer and subsoil contain more sand than do corresponding layers in the profile described as typical for the series. This soil generally has very good surface tilth.

Included with this soil in mapping were areas in which the underlying material is reddish sand 3 to 8 feet or more thick. This material is wet much of the year and is subject to caving. Also included in the mapping were small areas of the well-drained Chili soils.

Use of this Bogart soil for cultivated crops is limited by a moderate hazard of erosion. A seasonal high water table limits use for some nonfarm purposes. (Capability unit IIe–3; woodland suitability group 1o1)

Bogart silt loam, 0 to 2 percent slopes (BoA).—This soil occurs on outwash plains and terraces. It occupies small, irregularly shaped areas on benches above depressional areas. The surface layer of this soil is susceptible to crusting.

This soil commonly is next to the well-drained Chili soils and the somewhat poorly drained Weinbach soils, and small areas of both kinds of soils were included in the mapping. Also included in mapping were small areas of soils that have a dark-colored surface layer 8 to 14 inches thick and areas of soils that have a weak fragipan.

Limitations to use of this soil for cultivated crops are few or none. Seasonal wetness is the major limitation for many nonfarm uses. (Capability unit IIs–1; woodland suitability group 1o1)

Bogart silt loam, 2 to 6 percent slopes (BoB).—This soil generally occupies short slopes on stream terraces and outwash plains. Areas vary in size and shape. This soil has the profile described as typical for the series. Its surface layer is likely to crust.

Included with this soil in mapping, particularly on slopes of 4 to 6 pecent, were small areas of the well-drained Chili soils. Also included, in low drainageways, were areas of the somewhat poorly drained Fitchville and Weinbach soils. Other inclusions were a few areas of soils that have a dark-colored surface layer 8 to 14 inches thick and small areas of soils that have a weak fragipan.

A moderate hazard of erosion limits the use of this soil for cultivated crops. A seasonal high water table is the major limitation for many nonfarm uses. (Capability unit IIe–3; woodland suitability group 1o1)

Bogart silt loam, 6 to 12 percent slopes (BoC).—This soil occurs on short, irregular slopes. It occupies areas between the higher lying, well-drained Chili and Wheeling soils and the lower lying, somewhat poorly drained Weinbach soils. This soil is highly susceptible to surface crusting.

Included with this soil in mapping were small areas of soils that have a weak fragipan in the lower part of the subsoil. Also included in the mapping were a few areas of moderately eroded soils that have a thinner surface layer than is typical of Bogart soils. Other inclusions were spots of soils that have a loam surface layer and small areas of the well-drained Chili soils.

Use of this soil for cultivated crops is limited by a severe hazard of erosion. The slope limits use for many nonfarm purposes. (Capability unit IIIe–1; woodland suitability group 1o1)

Bogart-Urban land complex (Bu).—This complex consists of areas of nearly level and gently sloping Bogart soils and disturbed land. It occurs on the glacial outwash terrace in the southwestern part of the city of Canton.

Because the moderately well drained Bogart soils are dominant, areas of this complex have a high water table in winter and spring. The nearly level areas

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receive runoff from adjacent areas and are generally wet later in spring than the gently sloping areas.

Included with this complex in mapping were a few areas of soils that are more poorly drained than Bogart soils.

Seasonal wetness is the major limitation to use of this complex, although water moves readily through the soil material except when the water table is high. (Capability unit not assigned; woodland suitability group 1o1)

Borrow Pits

Borrow pits (Bv) consists of areas from which the soil material has been removed to a depth of at least 4 feet. This material has been used primarily for fill material in other areas. (Capability unit not assigned; woodland suitability group not assigned)

Brooke Series

The Brooke series consists of dark-colored, well-drained, gently sloping to steep soils. These soils occur on uplands in the unglaciated southeastern part of the county. They formed in residuum derived from limestone.

In a typical profile the surface layer is dark-brown silty clay loam about 7 inches thick. The subsoil, about 16 inches thick, is dark-brown channery silty clay in the uppermost 3 inches and is dark yellowish-brown and olive channery clay below. The subsoil is plastic when wet and contains many coarse fragments of limestone. Gray limestone bedrock is at a depth of 23 inches.

The Brooke soils have a moderately deep root zone in most places. Permeability is slow in the subsoil, and available moisture capacity is low.

These soils are not extensive in this county. Most of the acreage is used for cultivated crops or for permanent meadow.

Typical profile of a Brooke silty clay loam about 5.8 miles west of Minerva in Osnaburg Township, section 36, T. 18 N., R. 7 W.:

Ap—0 to 7 inches, dark-brown (10YR 3/3) silty clay loam; weak, fine and very fine, subangular blocky structure that breaks to moderate, fine, granular structure; friable when moist, slightly plastic when wet; abundant roots; few fragments of limestone as much as 3 inches in diameter; neutral; abrupt, smooth boundary.

B21t—7 to 11 inches, dark-brown (7.5YR 4/4) channery silty clay; moderate, fine and medium, subangular blocky structure; plastic when wet; numerous roots; thin, continuous, yellowish-brown (10YR 5/6) clay films on ped faces; 30 percent coarse fragments of limestone; neutral; clear, wavy boundary.

B22t—11 to 17 inches, dark yellowish-brown (10YR 4/4) channery clay; light olive-brown (2.5Y 5/4) ped exteriors; strong, fine and medium, snbangular blocky structure; plastic when wet; numerous roots; thick, discontinuous, yellowish-red (5YR 4/5) clay films on peds; 20 percent coarse fragments of limestone; slightly calcareous in lower part of horizon; gradual, wavy boundary.

B3C—17 to 23 inches, olive (5Y 5/3) channery clay; yellowish-brown (10YR 5/4) ped interiors; weak, coarse, prismatic structure that breaks to moderate, medium and coarse, subangular blocky structure; plastic when wet; few roots; thick, discontinuous, dark yellowish-brown (10YR 4/4) clay films on ped surfaces; 35 percent coarse fragments of limestone; calcareous; gradual, irregular boundary.

R—23 to 30 inches, gray, calcareous limestone.

The A horizon includes very dark grayish brown (10YR 3/2) in some places. Fragments more than 3 inches in diameter make up 5 to 15 percent, by volume, of the A horizon. The content of coarse fragments ranges from 20 to 50 percent in the B21t and the B22t horizons and from 30 to 70 percent in the B3C horizon. Reaction ranges from neutral to mildly alkaline in the Ap horizon and from neutral to medium acid in the B21t horizon. Calcareous material occurs at a depth of 12 to 30 inches. Depth to bedrock ranges from 20 to 36 inches. The limestone bedrock is fractured and weathered in the top 6 to 12 inches.

The Brooke soils are commonly adjacent to the well-drained Gilpin and Latham soils. Brooke soils formed on calcareous limestone, whereas the Gilpin soils formed on acid siltstone, shale, and sandstone and the Latham soils formed on acid shale.

Brooke silty clay loam, 4 to 12 percent slopes, moderately eroded (BwC2).—This soil occurs just below ridgetops and on benches. It has a sticky, plastic surface layer and is likely to become cloddy if worked when wet. Fragments of limestone are common on the surface, but they generally do not interfere with tillage.

Included with this soil in mapping, on long slopes, were small areas of the moderately well drained Keene soils.

The hazard of erosion is the major limitation to the use of this soil for farming. The slope, slow permeability, and depth to bedrock are limitations to use for many nonfarm purposes. (Capability unit IIIe–3; woodland suitability group 3c1)

Brooke silty clay loam, 12 to 25 percent slopes, moderately eroded (BwE2).—This soil occupies small, irregular areas on hillsides. It has lost some of its original surface soil through erosion, and its present surface layer includes material from the subsoil. The present surface layer is light colored, and it is sticky and plastic when wet. A few shallow gullies have formed in the steeper areas.

Use of this soil for farming is limited mainly by the continuing hazard of erosion. A few areas on the lower slopes can be used for an occasional cultivated crop, but much of the acreage is too steep for tillage. The slope and slow permeability are limitations to many nonfarm uses. (Capability unit VIe–2; woodland suitability group 3c1 on north- and east-facing slopes, 4c1 on south- and west-facing slopes)

Canadice Series

The Canadice series consists of poorly drained, nearly level soils that occur in small, scattered areas throughout the glaciated part of the county. Most areas were sites of old, shallow glacial lakes. These soils formed in silty clay and clay of Wisconsin age.

In a typical profile the plow layer is dark-gray silt loam about 7 inches thick. The subsoil is about 38 inches thick and is sticky and plastic when wet. To a depth of about 13 inches, it is dark-gray silty clay mottled with strong brown and brownish yel-

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low. Below this, and extending to a depth of 34 inches, is gray clay mottled with dark brown, light olive brown, yellowish red, and strong brown. The lower part of the subsoil is dark-gray silty clay mottled with strong brown and light olive brown. The underlying material is gray, poorly sorted and stratified silty clay, silty clay loam, silt loam, gravel, and sand.

The Canadice soils have a deep root zone in most places when the water table is low. The available moisture capacity is low to medium. Permeability is very slow in the subsoil. The water table is at or near the surface late in winter and in spring. Because water seeps in from adjacent higher areas, these soils are seldom droughty.

Most of the acreage of these soils is used for pasture.

Typical profile of Canadice silt loam, in Canton Township, section 13, T. 10 N., R. 8 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) heavy silt loam; moderate, fine, granular structure; friable; abundant roots; medium acid; abrupt, wavy boundary.

B21t—7 to 13 inches, dark-gray (5Y 4/0) silty clay; many, medium, prominent mottles of strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6); strong, medium, subangular blocky structure; plastic when wet; numerous roots; thin continuous clay films on ped faces; few white pebbles of quartz; slightly acid; gradual, wavy boundary.

B22tg—13 to 20 inches, gray (N 5/0) clay; many, medium, prominent mottles of dark brown (7.5YR 4/4) and light olive brown (2.5Y 5/4); weak, coarse, prismatic structure that breaks to strong, fine and medium, subangular blocky structure; very plastic when wet; numerous roots; medium continuous clay films on ped faces; slightly acid; gradual, wavy boundary.

B23tg—20 to 34 inches, gray (N 5/0) clay; many, medium, prominent mottles of yellowish red (5YR 4/6), strong brown (7.5YR 4/4), and light olive brown (2.5Y 5/4); weak, coarse, prismatic structure that breaks to strong, fine and medium, subangular blocky structure; very plastic when wet; few roots; very dark gray (N 3/0), thick, continuous clay films on ped faces; slightly acid; gradual, wavy boundary.

B24tg—34 to 45 inches, dark-gray (N 4/0) silty clay; many, medium, prominent mottles of strong brown (7.5YR 5/8) and light olive brown (2.5Y 5/4); moderate, fine and medium, subangular blocky structure; plastic when wet; few roots; medium discontinuous clay films on ped faces; neutral; gradual, wavy boundary.

IIC—45 to 60 inches, gray (N 5/0) poorly sorted and stratified silty clay, silty clay loam, silt loam, gravel, and sand; many, coarse, distinct mottles of yellowish brown (10YR 5/4), light olive brown (2.5Y 5/4), and brown (7.5YR 4/4); massive (structureless); no roots; many rounded pebbles of quartz and granite; neutral to mildly alkaline in lower part of horizon.

In uncultivated areas there is a very dark brown (10YR 2/2) or very dark gray (10YR 3/1) A1 horizon that is 2 to 4 inches thick and a gray (10YR 5/1) or dark-gray (10YR 4/1) A2 horizon 3 to 6 inches thick. In the B2 horizon, the clay content ranges from 45 to 55 percent, and the matrix ranges from light gray (N 6/0), gray (N 5/0), and dark gray (5YR 4/1 and N 4/0) to olive gray (5Y 5/2). Reaction ranges from slightly acid to medium acid in the upper part of the B horizon and from neutral to slightly acid in the lower part. Coarse fragments in the solum make up less than 5 percent of the soil mass. From 5 to 15 percent of the IIC horizon consists of coarse fragments.

The Canadice soils are the poorly drained members of a drainage sequence that includes the very poorly drained Montgomery soils. Canadice soils are next to the Sebring soils in many places, but they are more clayey in their subsoil and are less acid throughout their profile than these soils. The Canadice soils are similar to the Trumbull soils, but unlike them are underlain by stratified material deposited by water.

Canadice silt loam (0 to 2 percent slopes) (Ca).—This soil occurs in swales and in somewhat depressional areas that are commonly dissected by small streams. It is subject to flooding in some places. Ponding is likely in undrained areas.

Included with this soil in mapping were a few areas of soils that have a dark-colored surface layer that is very high in organic-matter content and small areas of soils that have a silty clay loam surface layer that is sticky when wet. Also included in the mapping were small areas of the Wallkill soils that are underlain by muck and small areas of the somewhat poorly drained Fitchville soils.

Wetness is the major limitation to use of this soil for most purposes. This soil is difficult to drain. (Capability unit IVw–1; woodland suitability group 1w1)

Canfield Series

The Canfield series consists of moderately well drained, level to moderately steep soils that occur on uplands throughout the glaciated part of the county. These soils formed in loam or silt loam glacial till of Wisconsin age.

In a typical profile the surface layer is silt loam about 10 inches thick. It is dark grayish brown in the upper 8 inches and yellowish brown below. The subsoil is about 45 inches thick. To a depth of about 25 inches, it is yellowish-brown, friable silt loam mottled with dark grayish brown, yellowish brown, brown, and strong brown. Below this, and extending to a depth of 55 inches, is a dark yellowish-brown and yellowish-brown loam fragipan that is mottled with yellowish brown, gray, and dark gray. The underlying material is yellowish-brown loam that is mottled with grayish brown and contains fragments of sandstone and shale.

The Canfield soils have a moderately deep root zone. Permeability is moderate in the upper part of the subsoil, and it is moderately slow in the lower part of the subsoil and in the underlying material. The available moisture capacity is medium. These soils have a perched water table during long wet periods.

The Canfield soils are the most extensive soils in this county. Most of the acreage is used for cultivated crops.

Typical profile of Canfield silt loam, 2 to 6 percent slopes, in a meadow in Tuscarawas Township, section 9, T. 12 N., R. 10 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

A2—8 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure that breaks to weak, very fine, subangular blocky structure; fria-

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ble; abundant roots; strongly acid; clear, wavy boundary.

B21t—10 to 20 inches, yellowish-brown (10YR 5/4) silt loam; few, fine, faint mottles of dark grayish brown (10YR 4/2), yellowish brown (10YR 5/8), and brown (7.5YR 5/4); moderate, medium, subangular blocky structure; friable; many roots; thin patchy clay films; very strongly acid; diffuse, wavy boundary.

B22t—20 to 25 inches, yellowish-brown (10YR 5/4) silt loam; many, medium, distinct mottles of strong brown (7.5YR 5/8) and grayish brown (10YR 5/2); weak, medium, subangular blocky structure; friable; many roots; thin discontinuous clay films on ped faces; strongly acid; clear, wavy boundary.

IIBx1—25 to 36 inches, dark yellowish-brown (10YR 4/4) loam; common, medium, faint mottles of yellowish brown (10YR 5/6) and gray (10YR 5/1); weak, coarse, prismatic structure that breaks to weak, thick, platy structure; very firm, brittle; few roots; black and dark-brown stains on platy surfaces; few stones as much as 3 inches in diameter; strongly acid; gradual, wavy boundary.

IIBx2—36 to 46 inches, yellowish-brown (10YR 5/4) loam; weak, coarse, prismatic structure that breaks to weak, thick, platy structure; very firm, brittle; few roots; thin dark-gray (10YR 4/1) clay films on ped faces; dark-brown stains on platy surfaces; strongly acid; gradual, wavy boundary.

IIBx3—46 to 55 inches, dark yellowish-brown (10YR 4/4) loam; few, medium, faint mottles of dark gray (10YR 4/1); very weak, coarse, subangular blocky structure; very firm, brittle; few roots; black and brown stains on ped faces; strongly acid; clear, smooth boundary.

IIC—55 to 62 inches, yellowish-brown (10YR 5/4) loam; few, medium, faint mottles of grayish brown (10YR 5/2); massive (structureless); firm; no roots; common fragments of sandstone and shale; medium acid.

The B21, Bx1, and Bx2 horizons are loam, silt loam, or light clay loam and are 25 to 40 inches thick; their clay content is typically 23 percent, but it ranges from 20 to 27 percent. Depth to the Bx1 horizon (fragipan) generally is 25 inches, but it ranges from 15 to 30 inches. The Bx horizon is 20 to 36 inches thick, and it contains primary prisms 6 to 14 inches across and black coats that cover 20 to 50 percent of the horizontal surfaces. Reaction ranges from slightly acid to very strongly acid in the solum. The texture of the Bx and C horizons is silt loam, loam, or fine sandy loam. Depth to calcareous till ranges from 60 to 100 inches, and the calcium-carbonate equivalent of this material is 2 to 4 percent.

The Canfield soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Ravenna soils and the well drained Wooster soils. Along the boundary between soil associations 3 and 7, Canfield soils are commonly adjacent to Rittman soils. Canfield soils have less clay in their subsoil and underlying glacial till than Rittman soils, and they are deeper to limy material.

Canfield silt loam, 0 to 2 percent slopes (CdA).—This soil occurs on hilltops, mainly in areas that range from 5 to 10 acres in size. Slopes are most commonly 1 or 2 percent. This soil tends to dry out more slowly in spring than the other Canfield soils.

Included with this soil in mapping, in drainageways and small concave areas, were small areas of the poorly drained Sebring soil that has a till substratum. Other inclusions were small areas of Canfield soils that have slopes of more than 2 percent.

Seasonal wetness limits the use of this Canfield soil for cultivated crops. For many nonfarm uses, moderately slow permeability and seasonal wetness are limitations. (Capability unit IIw–4; woodland suitability group 1o1)

Canfield silt loam, 2 to 6 percent slopes (CdB).—This soil occupies convex areas on uplands. Most areas are large and irregularly shaped. This soil has the profile described as typical for the series.

Included with this soil in mapping were small areas of a moderately eroded Canfield soil that has more gravel on the surface and has a lighter colored and thinner surface layer than that described as typical. Also included in mapping were small areas of the poorly drained Sebring soil that has a till substratum. Other inclusions, on the crests of small knolls, were spots of the well-drained Wooster soils.

A moderate hazard of erosion is the major limitation to the use of this soil for farming. Wet areas caused by seepage are common on the lower third of long slopes. Moderately slow permeability is the main limitation to many nonfarm uses. (Capability unit IIe–2; woodland suitability group 1o1)

Canfield silt loam, 6 to 12 percent slopes (CdC).—This soil occupies irregularly shaped areas that vary in size.

Included with this soil in mapping were small areas of a moderately eroded Canfield soil that has more gravel on the surface and has a thinner and lighter colored surface layer than this soil. Also included in the mapping, in narrow drainageways, were small areas of the poorly drained Sebring soil that has a till substratum.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. For many nonfarm uses, it is limited by the slope and moderately slow permeability. (Capability unit IIIe–2; woodland suitability group 1o1)

Canfield silt loam, 6 to 12 percent slopes, moderately eroded (CdC2).—This soil occurs along drainageways and on the lower part of long slopes. Areas are irregular in size and shape. This soil has more gravel on the surface than the soil described as typical for the series, and its surface layer is thinner and lighter colored. Past erosion has thinned the root zone and lowered the available moisture capacity of this soil. Because of the loss of organic matter, good tilth is difficult to maintain on this soil. The surface layer is susceptible to crusting, and runoff is rapid.

Included with this soil in mapping were a few small areas of a severely eroded soil; shallow gullies have formed in these areas. Also included in the mapping, at the base of slopes, were small areas of the somewhat poorly drained Ravenna soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. Moderately slow permeability and the slope are limitations to many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 1o1)

Canfield silt loam, 12 to 18 percent slopes (CdD).—This soil generally occupies long, narrow areas along drainageways. In the profile of this soil the fragipan is at a depth of 18 to 20 inches, which is nearer the surface than in the profile described as typical for the series. Because runoff is very rapid, the hazard of erosion is very severe.

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Included with this soil in mapping were small areas of moderately eroded Canfield soils that have more pebbles on the surface and are lighter colored than this soil. Other inclusions were small areas of the well-drained Wooster soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope is a severe limitation for many nonfarm uses. (Capability unit IVe-2; woodland suitability group 1o1)

Canfield silt loam, 12 to 18 percent slopes, moderately eroded (CdD2).—This soil generally occurs in long, narrow areas along drainageways and streams. It has lost most of its original surface layer through erosion, and the fragipan is only 15 to 20 inches below the surface. There is more gravel on the surface of this soil than is on the surface of the surrounding uneroded Canfield soils. This soil is droughty. A few shallow gullies have formed in some places.

Included with this soil in mapping were small areas of the well-drained Wooster soils.

The major limitation to the use of this soil for cultivated crops is a very severe hazard of erosion. The slope is a severe limitation for many nonfarm uses. (Capability unit IVe-2; woodland suitability group 1o1)

Canfield-Urban land complex, undulating (CeB).—This complex occupies broad areas in the glaciated part of the county. It consists of areas of unaltered, or only slightly altered, Canfield soils and of areas where the soil material has been severely altered or disturbed by cutting and filling during construction.

Included in the mapping of this complex were a few areas of the well-drained Wooster soils.

In areas outside the cities about 50 to 60 percent of the area has been altered by construction, but the percentage is much larger within the cities. In some places, where grading has been extensive, the compact glacial till underlying these areas has been exposed. In the relatively undisturbed areas, the dense fragipan in the Canfield soils is at a depth of 24 to 50 inches, and permeability is moderately slow.

Because the dominant Canfield soils are moderately well drained and the fragipan slows the movement of water, areas of this complex have a high water table in winter and in spring; in disturbed areas, runoff generally is rapid, and the hazard of erosion is moderate. (Capability unit not assigned; woodland suitability group 1o1)

Canfield-Urban land complex, rolling (CeC).—This mapping unit consists of moderately well drained Canfield soils and disturbed land that have been used for community development.

Included in the mapping of this complex were a few areas of the well-drained Wooster soils.

The dominant Canfield soils have a fragipan that slows the movement of water through the soil, and seepage downslope is common. Runoff is rapid, and erosion is a severe hazard in the disturbed areas. Unprotected ditchbanks along roads tend to erode rapidly, and in places material from the dense, compact fragipan is exposed. (Capability unit not assigned; woodland suitability group 1o1)

Canfield Series, Moderately Shallow Variant

In some soil series, a variant is included. A variant has many of the characteristics of the series in which it is placed, but it differs in at least one important characteristic, which is indicated by its name. The acreage of a variant is not large enough to justify establishing a new series. The moderately shallow variant of the Canfield series is similar to normal Canfield soils but is thinner to bedrock.

The profile of the moderately shallow variant of the Canfield series has a dark grayish-brown and yellowish-brown silt loam surface layer about 7 inches thick. The subsoil is about 29 inches thick. To a depth of about 20 inches, it is brown and dark-brown, friable silt loam. Below this is a dark yellowish-brown loam fragipan 4 inches thick that is mottled with grayish brown and yellowish brown. The lower part of the subsoil is 12 inches of yellowish-brown silty clay loam mottled with grayish brown.

Typical profile of a Canfield silt loam, moderately shallow variant, in Bethlehem Township, section 3, T. 9 N., R. 9 W.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, crumb structure; friable; abundant roots; very strongly acid; clear, wavy boundary.

A2—4 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; common roots; very strongly acid; gradual, wavy boundary.

B1—7 to 14 inches, brown (7.5YR 4/4) silt loam; few, fine faint mottles of grayish brown (10YR 5/2); moderate, medium, subangular blocky structure; friable; common roots; very strongly acid; gradual, wavy boundary.

B2t—14 to 20 inches, dark-brown (7.5YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; common roots; thin, patchy, gray (5Y 5/1) clay films in pores and in root channels; many fragments of granite, siltstone, and shale; very strongly acid; gradual, wavy boundary.

Bx—20 to 24 inches, dark yellowish-brown (10YR 4/4) loam; common, medium, distinct mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; firm, somewhat brittle; few roots; very dark brown (10YR 2/2) ferromanganiferous stains on pebbles and stone fragments; 15 percent coarse fragments; very strongly acid; abrupt, wavy boundary.

IIB3—24 to 36 inches, yellowish-brown (10YR 5/4) silty clay loam; many, medium, distinct mottles of grayish brown (2.5Y 5/2); weak, medium, subangular blocky structure; friable when moist, slightly plastic when wet; few roots; 15 percent fragments of weathered shale; very strongly acid; clear, wavy boundary.

Depth to shale bedrock ranges from 20 to 40 inches.

Canfield silt loam, moderately shallow variant, 2 to 6 percent slopes (CfB).—This soil occurs mainly in small areas on or near crests of hills. Slopes are slightly convex. This Canfield soil is well drained and moderately well drained, but it is moderately well drained in most areas.

This soil is commonly next to normal Canfield soils, and small areas of those soils were included in mapping.

A moderate hazard of erosion is the major limi-

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tation to the use of this soil for farming. Moderate permeability and shallowness to shale limit use for many nonfarm purposes. (Capability unit IIe–4; woodland suitability group 1o1)

Canfield silt loam, moderately shallow variant, 6 to 12 percent slopes (CfC).—This soil occurs mainly in small areas in the southern part of the county. It is generally moderately well drained, but it is well drained in some places. Thin layers of glacial till are underlain by shale bedrock. In most places, this soil contains more fragments of shale or sandstone than the other Canfield soils. This soil has the profile described as typical for the series.

Included with this soil in mapping, in the northeastern part of the county, were a few small areas of somewhat poorly drained soils.

A severe hazard of erosion is the major limitation to the use of this soil for farming. The slope and the limited depth to bedrock are limitations for many nonfarm uses. (Capability unit IIIe–3; woodland suitability group 1o1)

Carlisle Series

In the Carlisle series are very poorly drained, black organic soils that occur in level and depressed areas in the glaciated part of the county. The organic material formed from partly decomposed plant material from fibrous grasses, sedges, and trees.

A typical cultivated Carlisle soil is black muck to a depth of about 9 inches. Below this, and extending to a depth of 22 inches, is dark reddish-brown muck and partly decomposed peat. Below a depth of 22 inches is dark yellowish-brown, partly decomposed peat.

The Carlisle soils have a deep root zone when the water table is low. They have rapid permeability in the layers of muck, but the underlying material is nearly impervious. The available moisture capacity is very high. These soils are wet for long periods unless they are artificially drained.

These soils are moderately extensive in this county. Some areas have been drained and are used for vegetables and special crops. Undrained areas are swampy much of the time.

Typical profile of Carlisle muck in a cultivated field in Marlboro Township, section 5, T. 20 N., R. 7 W. (analytical data in table 10):

1—0 to 9 inches, black (N 2/0) muck; moderate, fine and very fine, granular structure; very friable; abundant roots; strongly acid; clear, smooth boundary.
2—9 to 22 inches, dark reddish-brown (5YR 2/2) muck and partly decomposed peat; fibrous; platy structure; abundant roots; many roots of old plants; few pieces of wood as much as 2 inches in diameter; very strongly acid; gradual, wavy boundary.
3—22 to 50 inches, dark yellowish-brown (10YR 4/4), partly decomposed peat; fibrous; thick platy structure; abundant, coarse and fine, woody roots; strong odor of hydrogen-sulfide; water table is at a depth of 50 inches; strongly acid.

The surface layer ranges from 8 to 14 inches in thickness. Depth to the underlying mineral material is 5 to 30 feet or more. The horizon below the surface layer includes black (N 2/2), and the layer of peat includes dark reddish brown (5YR 2/2). Reaction ranges from very strongly acid to slightly acid but is most commonly strongly acid.

The Carlisle soils are next to the very poorly drained, organic Linwood and Willette soils. They are deeper to mineral material than either the Linwood soil or the Willette soil.

Carlisle muck (0 to 2 percent slopes) (Ch).—This soil occupies level to depressional areas that vary in size. A large area is in the Hartville Swamp (fig. 9). This soil is very soft and spongy, and it quakes when a person jumps up and down on it. Drainage outlets are not available in many places, especially in areas of kames. When this soil is saturated in winter and spring, it is extremely dangerous to traverse with machinery in unfarmed areas because of the danger of sinking.

Included with this soil in mapping were small areas of the shallow Willette and Linwood soils. Also included in mapping were a few knolls of the poorly drained Ginat soils.

Wetness is a major limitation to the use of this soil. During dry periods, however, this soil is subject to soil blowing in cultivated areas and to damage by fire. In drained areas the muck tends to subside be-

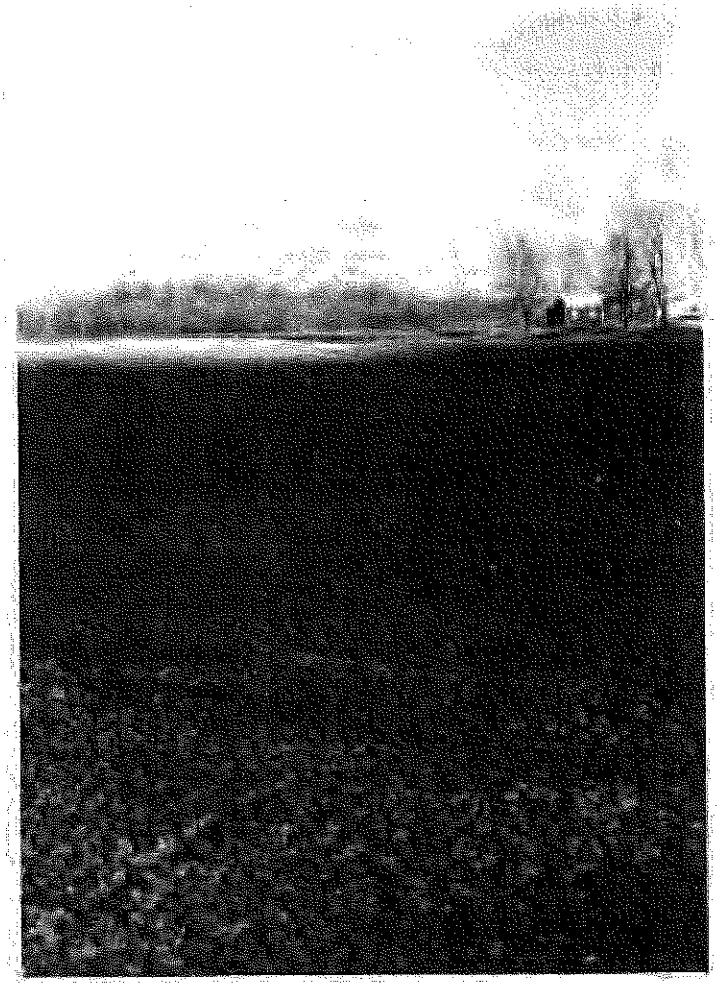

Figure 9.—An area of Carlisle muck is in the foreground. A light-colored Chili soil is in the background.

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cause the organic material oxidizes. (Capability unit IIIw–5; woodland suitability group not assigned)

Chagrin Series

In the Chagrin series are well-drained, nearly level soils on flood plains. These soils formed in recent alluvium washed from uplands.

In a typical profile the surface layer is dark-brown silt loam about 21 inches thick. The subsoil, about 27 inches thick, is dark-brown, friable silt loam in the uppermost 11 inches and is strong-brown, friable loam below. The underlying material is stratified, loose gravelly loam and sandy loam.

The Chagrin soils have a deep root zone and high available moisture capacity. Their water table fluctuates, but generally it is more than 3 feet below the surface. Flooding is a hazard.

These soils are inextensive in this county. Areas along the larger streams are used for corn and hay. Most of the acreage on narrow flood plains along the smaller streams is used for pasture or trees.

Typical profile of Chagrin silt loam, alkaline phase, in a meadow in Pike Township, section 29, T. 9 N., R. 8 W.:

A1—0 to 21 inches, dark-brown (10YR 4/3) silt loam; weak, fine, crumb structure and weak, fine, subangular blocky structure; friable; abundant roots; mildly alkaline; clear, wavy boundary.

B21—21 to 32 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, subangular blocky structure; friable; few roots; mildly alkaline; diffuse, wavy boundary.

B22—32 to 48 inches, strong-brown (7.5YR 5/6) loam; weak, fine, subangular blocky structure, friable; few roots; medium acid; gradual, wavy boundary.

C—48 to 60 inches, stratified, loose, gravelly and sandy loam.

The A horizon is silt loam or loam. It is dark grayish brown (10YR 4/2) or dark brown (10YR 4/3) and is 12 to 24 inches thick. The C horizon contains stratified material of gravelly loam or sandy loam texture. Reaction ranges from medium acid to moderately alkaline. In this county the Chagrin soils are more alkaline throughout than is typical.

The Chagrin soils are the well drained members of a drainage sequence that includes the moderately well drained Lobdell soils, the somewhat poorly drained Shoals soils, the poorly drained Wayland soils, and the very poorly drained Sloan soils. They are generally above the topographic level of the other soils in this drainage sequence. Chagrin soils are commonly adjacent to the Lobdell soils next to the stream channels. They are similar to Wheeling soils but occupy lower positions than those soils.

Chagrin loam, alkaline phase (Ck).—This soil occurs primarily along Sandy Creek and its tributaries. It contains more sand and is in better tilth than Chagrin silt loam, alkaline phase, which has the profile described as typical for the Chagrin series. Gravel is commonly on the surface of this soil.

Included with this soil in mapping were a few areas of soils that have a sandy loam surface layer.

A hazard of flooding is the major limitation to the use of this soil for farming and for nonfarm purposes. (Capability unit IIw–5; woodland suitability group 1o1)

Chagrin silt loam, alkaline phase (Cm).—This soil occupies long bands along streams and higher areas on the flood plains of the Tuscarawas River and Sandy Creek. It has the profile described as typical for the Chagrin series.

Included with this soil in mapping were small areas of the somewhat poorly drained Shoals soils. Also included in mapping were small areas of Chagrin soils that have a loam surface layer and areas, along breaks of abandoned stream channels, where slopes are 2 to 6 percent.

Use of this soil for farming and for nonfarm purposes is limited mainly by a hazard of flooding. (Capability unit IIw–5; woodland suitability group 1o1)

Chili Series

The Chili series consists of well-drained, level to steep soils that occur on broad stream terraces, outwash plains, and kames. These soils formed in glacial outwash of Wisconsin age (fig. 10).

In a typical profile the surface layer is dark-brown

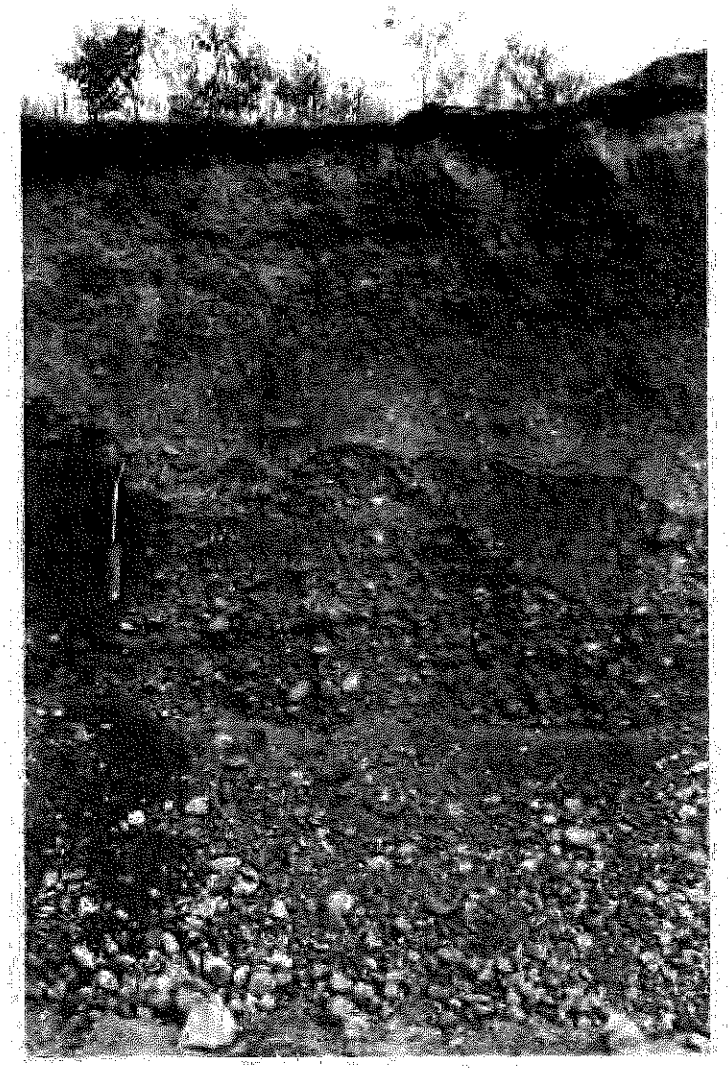

Figure 10.—**Profile of a Chili silt loam.**

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silt loam about 9 inches thick. The subsoil, about 27 inches thick, is dark-brown and reddish-brown, friable silt loam in the uppermost 10 inches and is dark-brown, reddish-brown, and dark reddish-brown, firm gravelly sandy loam below. The underlying material is reddish-brown and brownish-yellow gravelly loamy sand.

The Chili soils have a moderately deep root zone in most places. Permeability is moderately rapid to rapid in the subsoil and is very rapid in the underlying material. Available moisture capacity ranges from medium to very low. These soils are generally droughty.

The Chili soils are extensive in this county. Most of the acreage is used for cultivated crops, but many acres are in community development.

Typical profile of Chili silt loam, 2 to 6 percent slopes, in a cultivated field in Perry Township, section 20, T. 10 N., R. 9 W. (analytical data in table 10):

Ap—0 to 9 inches, dark-brown (10YR 4/3) crushed silt loam; moderate, fine, granular structure; friable; abundant roots; strongly acid; abrupt, smooth boundary.

B1—9 to 12 inches, dark-brown (7.5YR 4/4) silt loam; moderate, thin and medium, platy structure; friable; plentiful roots; very strongly acid; clear, wavy boundary.

B2t—12 to 19 inches, dark-brown (7.5YR 4/4) and reddish-brown (5YR 4/3) silt loam; moderate, medium, subangular blocky structure; thin, patchy clay films on ped faces; friable; plentiful roots; 5 to 10 percent, by volume, is gravel below a depth of 15 inches; very strongly acid; clear, wavy boundary.

IIB3t—19 to 36 inches, dark-brown (7.5YR 4/4), reddish-brown (5YR 4/4), and dark reddish-brown (5YR 3/4) gravelly sandy loam; massive (structureless); firm; clay films on gravel faces; clay bridging between sand grains; 35 percent, by volume, is gravel; common, distinct, dark stains at a depth of 19 to 25 inches; plentiful roots; very strongly acid; clear, wavy boundary.

IIIC—36 to 60 inches, reddish-brown (5YR 4/4) and brownish-yellow (10YR 6/6) gravelly loamy sand; loose; plentiful roots; strongly acid.

The A horizon is silt loam, loam, or gravelly loam. It is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4). Where the A horizon is silt loam, the silty layer ranges from 15 to 30 inches in thickness. The B1 horizon ranges from silt loam to clay loam, and the B2t horizon from silt loam to sandy clay loam. The clay content of the B2 horizon ranges from 18 to 25 percent. Typically, hue in the B horizon is 7.5YR, but it ranges from 10YR to 5YR. Reaction ranges from very strongly acid to medium acid in the B horizon. Depth to calcareous material ranges from 45 inches to more than 100 inches, but tongues of calcareous material are within 36 inches of the surface in some places.

The Chili soils are the well drained members of a drainage sequence that includes the moderately well drained Bogart soils. Chili soils commonly are adjacent to the Wheeling, Bogart, and Weinbach soils and, in a few places, adjoin Ginat and Conotton soils. The upper part of the subsoil of Chili soils does not contain so much gravel as that of the Conotton soils. Chili soils have a thinner mantle of silt than Wheeling soils, and they lack the fragipan that is typical for Weinbach soils.

Chili loam, 0 to 2 percent slopes (CnA).—This soil occurs along the larger streams and on the stream terraces, mainly along Little Sandy Creek. Its surface layer contains more sand and is in better tilth than the Chili silt loams. The available moisture capacity is low.

Included with this soil in mapping were spots and larger areas that have a sandy loam surface layer.

The low available moisture capacity is the major limitation to use of this soil for cultivated crops. Limitations for many nonfarm uses are few. (Capability unit IIs–1; woodland suitability group 1o1)

Chili loam, 2 to 6 percent slopes (CnB).—This soil occupies outwash plains and stream terraces. Areas are slightly convex and vary in size and shape.

Included with this soil in mapping, generally on the stronger slopes, were small moderately eroded areas that have gravel on the surface.

Although this soil absorbs rainwater well, surface runoff is moderate. The hazard of erosion is moderate in cultivated areas. Limitations for most nonfarm uses are few. (Capability unit IIe–3; woodland suitability group 1o1)

Chili gravelly loam, 6 to 12 percent slopes (CoC).—This soil is on crests of knolls and terrace breaks along drainageways. It has more sand and gravel in the surface layer and subsoil and tends to be more droughty than Chili silt loam, 2 to 6 percent slopes, which has the profile described as typical for the series.

This soil commonly is next to Conotton soils, and small areas of those soils were included in the mapping. Also included were small areas of eroded Chili soils that have a very gravelly surface layer. Where kames occur in the north-central part of the county, there are inclusions in which the subsoil and underlying material contain granitic boulders 1 or 2 feet in diameter.

Use of this soil for farming is limited mainly by a severe hazard of erosion. The slope is a limitation to some nonfarm uses. (Capability unit IIIe–1; woodland suitability group 1o1)

Chili gravelly loam, 6 to 12 percent slopes, moderately eroded (CoC2).—This soil occurs on crests of knolls and on breaks. Areas vary in size and shape. In the profile of this soil the surface layer and subsoil contain more sand and gravel than do corresponding layers in the profile described as typical for the series, and the gravelly loamy sand part of the underlying material is not more than 20 inches from the surface. This soil commonly is lighter colored than the uneroded Chili gravelly loam. Because runoff is rapid, the hazard of erosion is severe. The available moisture capacity is very low.

Included with this soil in mapping were small areas of Conotton soils. Other areas of Conotton soils are near areas of this Chili soil.

The severe erosion hazard and droughtiness are the major limitations to the use of this soil for farming. Slope is a limitation for some nonfarm uses. (Capability unit IIIe–1; woodland suitability group 1o1)

Chili gravelly loam, 12 to 18 percent slopes, moderatley eroded (CoD2).—This soil occurs along drainageways and on banks of stream terraces. Its surface layer and subsoil contain more gravel than do corresponding layers in the profile described as typical for the series, and the gravelly and sandy underlying material is less than 20 inches from the soil surface.

Included with this soil in mapping were areas of gravelly Conotton soils.

The major limitations to the use of this soil for

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farming are a very severe hazard of erosion and droughtiness. The slope is a limitation to many nonfarm uses. (Capability unit IVe–1; woodland suitability group 1o1)

Chili gravelly loam, 18 to 25 percent slopes, moderately eroded (CoE2).—This soil occurs along streams, in areas of kames, and on terrace breaks. In the profile of this soil, the subsoil contains more gravel and the gravelly and sandy underlying material is nearer the surface than in the profile described as typical for the series.

Included with this soil in mapping were areas of gravelly Conotton soils.

This Chili soil is better suited to pasture than to crops, but the hazard of erosion is severe in pastured areas. The steep slopes severely limit use of this soil for nonfarm purposes. (Capability unit VIe–1; woodland suitability group 2r1)

Chili silt loam, 0 to 2 percent slopes (CpA).—This soil occupies long areas on stream terraces and areas of various shapes and sizes on outwash plains. Depth to sandy and gravelly material is 15 to 40 inches. Available moisture capacity is no more than medium.

Included with this soil in mapping were areas of gently sloping Chili soils that were too small to map separately. Also included, in drainageways and depressions, were small areas of the somewhat poorly drained Weinbach soils and the moderately well drained Bogart soils.

Although the available moisture capacity of this Chili soil is more favorable for the growth of plants than that of the other Chili soils, moderate droughtiness is the main limitation to use for cultivated crops. Limitations for many nonfarm uses are few or none. (Capability unit IIs–1; woodland suitability group 1o1)

Chili silt loam, 2 to 6 percent slopes (CpB).—This soil occupies areas that vary in size and shape, and it is one of the most extensive soils in the county. It has the profile described as typical for the Chili series.

Included with this soil in mapping were areas of soils that contain erratic globs of glacial till that are less permeable than this soil. These included areas were in the north-central part of the county where kames occur. Also included, on tops of convex slopes, were a few small areas of moderately eroded soils.

This soil is well suited to cultivated crops, but erosion is a moderate hazard. Limitations for many nonfarm uses are few or none. (Capability unit IIe–3; woodland suitability group 1o1)

Chili silt loam, 6 to 12 percent slopes (CpC).—This soil occurs along drainageways and on low knolls and hills. In most places it is susceptible to surface crusting. This soil is more droughty than the less sloping Chili silt loams.

Included with this soil in mapping were spots of moderately eroded soils that have gravel on the surface and are lighter colored than this soil. Also included, in the mapping in the north-central part of the county, were areas of soils that have a mass or layer of glacial till in the subsoil or the underlying material. The soils having glacial till in the subsoil are more slowly permeable than the surrounding Chili soil.

Use of this soil for farming is limited mainly by a severe hazard of erosion. Runoff is rapid in some places. The slope limits use for some nonfarm purposes. (Capability unit IIIe–1; woodland suitability group 1o1)

Chili silt loam, 6 to 12 percent slopes, moderately eroded (CpC2).—This soil occurs along drainageways and on low knolls and hills. It has some gravel on the surface, and its surface layer is lighter colored and more susceptible to crusting than that of the uneroded Chili silt loams. The underlying material ranges from loam or sandy loam that contains very little gravel to gravelly loamy sand.

Included with this soil in mapping were small areas of more slowly permeable soils that contain a layer of glacial till in their subsoil or underlying material.

Droughtiness and a severe hazard of erosion are major limitations to use of this soil for farming. The slope is the main limitation for nonfarm uses. (Capability unit IIIe–1; woodland suitability group 1o1)

Chili-Urban land complex, undulating (CuB).—This complex occupies large areas in the cities of Massillon and Canton and in the villages of Waynesburg, Magnolia, Minerva, and Beach City. It consists of areas of relatively undisturbed Chili soils and of areas where the soil material has been severely altered or disturbed by cutting and filling. Slopes range from 0 to 6 percent. Depth to the underlying gravelly material varies considerably within short distances. Locally, large cobblestones and a few boulders are excavated. Chili soils have moderately rapid permeability and tend to dry out quickly after a rain. Where septic tanks are installed, pollution of ground water is a danger. (Capability unit not assigned; woodland suitability group 1o1)

Chili-Urban land complex, rolling (CuC).—This complex occurs in residential areas and on breaks between stream terraces and bottom lands. In many areas cut and fill operations have so altered the Chili soils that the soil profile cannot be recognized. In areas outside of cities and towns, about 25 percent of the area can be recognized as Chili soils. Areas of this complex are well drained. They dry out rapidly after rains, and much of the complex is droughty. Pollution of ground water is a danger where septic tanks have been installed. (Capability unit not assigned; woodland suitability group 1o1)

Chili-Urban land complex, steep (CuF).—This mapping unit consists of Chili soils and disturbed land that have been used for residential or other community development. Slopes range from 12 to 25 percent. Runoff is rapid, and erosion and siltation are serious concerns during and following construction. The gravelly Chili soils are droughty. Effluent is likely to seep out of hillsides in areas where septic tanks are installed. (Capability unit not assigned; woodland suitability group 3f1)

Chili and Conotton gravelly loams, 25 to 50 percent slopes, moderately eroded (CvF2).—These soils occur on banks of terraces and on kames. Any area may consist of either the Chili soil or the Conotton soil, or of both soils in any proportion. These gravelly soils are very droughty and highly susceptible to erosion.

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In some local areas of kames, boulders 1 to 3 feet in diameter occur in the subsoil. (Capability unit VIIe–1; woodland suitability group 3f1)

Conotton Series

This series consists of well-drained, level to steep soils that occur in outwash areas throughout the county. These soils contain a large amount of gravel throughout.

In a typical profile the plow layer is dark-brown gravelly loam about 9 inches thick. The subsoil is about 33 inches thick. To a depth of about 15 inches, it is dark-brown very gravelly sandy clay loam. Below this, and extending to a depth of 34 inches, is dark-brown, dark yellowish-brown, and dark grayish-brown very gravelly sandy loam. The lower part of the subsoil is 8 inches of dark reddish-brown and dark grayish-brown very gravelly sandy clay loam. The underlying material is brown very gravelly sandy loam.

The Conotton soils have a shallow to moderately deep root zone and very low available moisture capacity. Permeability is rapid or very rapid, and the water table is below 5 feet throughout the year. The soils dry out rapidly in spring, and they are droughty.

The Conotton soils are inextensive in this county. Most of the acreage is used for crops and pasture.

Typical profile of a Conotton gravelly loam on slopes of 18 to 25 percent, in Bethlehem Township, section 27, T. 9 N., R. 9 W.:

Ap—0 to 9 inches, dark-brown (10YR 4/3) gravelly loam; moderate, medium, crumb structure; friable; abundant roots; 25 percent, skeletal material, by volume; medium acid.

B21t—9 to 15 inches, dark-brown (7.5YR 4/4) very gravelly sandy clay loam; weak, medium, subangular blocky structure; friable when moist, sticky when wet; common roots; thick continuous clay films on skeletal material and bridging between sand grains; 60 percent skeletal material, by volume; stones as much as 4 inches in diameter; medium acid; gradual, wavy boundary.

B22t—15 to 24 inches, dark-brown (7.5YR 4/4) very gravelly sandy loam; massive (structureless), breaks to weak, medium, subangular blocky structure; friable when moist, sticky when wet; occasional roots; medium continuous clay films on skeletal material and bridging between sand grains; patchy, black (N 2/0) ferromanganiferous stains on a few stones; 75 percent skeletal material, by volume; strongly acid; gradual, smooth boundary.

B23t—24 to 34 inches, dark yellowish-brown (10YR 4/4) and dark grayish-brown (10YR 4/2) very gravelly sandy loam; massive (structureless); friable when moist, sticky when wet; occasional roots; thick continuous clay coatings on pebbles and bridging between sand grains; few black (N 2/0) concretions 2 or 3 millimeters in diameter that are easily crushed; 80 percent skeletal material, by volume; pebbles dominantly less than 1 inch in diameter; more coarse sand and less gravel more than 1 inch in diameter than in B22t horizon; strongly acid; gradual, wavy boundary.

B3t—34 to 42 inches, dark reddish-brown (5YR 3/4) and dark grayish-brown (10YR 4/2) very gravelly sandy clay loam; massive (structureless); friable when moist, slightly sticky when wet; no roots; medium continuous clay coatings on skeletal material and bridging between sand grains; 80 percent skeletal material, by volume; medium acid; gradual, smooth boundary.

C—42 to 60 inches, brown (10YR 4/3) very gravelly sandy loam; single grain (structureless); loose; sandstone and shale gravel is dominant; no roots; 80 percent skeletal material, by volume; medium acid.

The A horizon is loam or gravelly loam. The B horizon is 18 to 40 inches thick. The clay films in the B horizon are thin and discontinuous in some places. Depth to calcareous material is more than 60 inches. The content of coarse fragments makes up 25 to 70 percent of the upper part of the solum and ranges to more than 80 percent in the lower part of the B horizon and the C horizon.

The Conotton soils are commonly adjacent to the well-drained Chili soils. They contain considerably more gravel in their subsoil than Chili soils.

Conotton loam, 0 to 2 percent slopes (CwA).—This soil occurs mainly on low terraces along the Tuscarawas River. It commonly is next to the Chili soils. It is relatively free of gravel to a depth of 15 inches.

Included with this soil in mapping, in slightly depressed areas, were small areas of the moderately well drained Bogart soils.

Severe droughtiness limits the use of this soil for farming and for most nonfarm purposes. (Capability unit IIIs–1; woodland suitability group 3f1)

Conotton gravelly loam, 2 to 6 percent slopes (CyB).—This soil occupies small, slightly convex areas, and it has a considerable amount of gravel on the surface.

Included with this soil in mapping were small areas that are not gravelly on the surface. Also included, in drainageways and in small depressions, were areas of the moderately well drained Bogart soils.

Droughtiness late in summer is the major limitation to the use of this soil for farming, but the hazard of erosion is also a concern. Except for droughtiness, limitations for nonfarm uses are few or none. (Capability unit IIIs–1; woodland suitability group 3f1)

Conotton gravelly loam, 6 to 12 percent slopes (CyC).—This soil occupies areas that vary in size and shape, and it is scattered throughout the county.

Included with this soil in mapping at the base of slopes, were small areas of the moderately well drained Bogart soils.

A hazard of erosion and droughtiness late in summer are the major limitations to the use of this soil for farming. Droughtiness and the slope are limitations for nonfarm uses. (Capability unit IIIs–1; woodland suitability group 3f1)

Conotton gravelly loam, 12 to 18 percent slopes, moderately eroded (CyD2).—This soil occurs on terrace breaks and along dissected drainageways of terraces. It has a thinner, lighter colored surface layer than that of the soil described as typical for the series, and it has more gravel and cobblestones on the surface than that soil. The soil is very low in organic-matter content.

This soil is better suited to pasture than to cultivated crops. A severe hazard of erosion and droughtiness are the major limitations to use for farming. The slope and droughtiness limit use for many nonfarm purposes. (Capability unit VIe–1; woodland suitability group 3f1)

Conotton gravelly loam, 18 to 25 percent slopes, moderately eroded (CyE2).—This soil occupies areas that

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are scattered throughout the county, but it is primarily on terrace breaks along Sandy Creek, the Tuscarawas River, and in areas of kames in the north-central part of the county. This soil contains more gravel and has a shallower root zone than the uneroded Conotton soils.

This soil is better suited to permanent pasture than to hay or to rotation pasture. A very severe hazard of erosion and droughtiness are major limitations to use for farming. The slope is the main limitation for nonfarm uses. (Capability unit VIIe–1; woodland suitability group 3f1)

Cut and Fill Land

Cut and fill land (Cz) consists of areas where grading has removed or disturbed the soil material or where the original soil has been covered with 3 feet or more of fill material. (Capability unit VIIIs–1; woodland suitability group not assigned)

Dekalb Series

The Dekalb series consists of well-drained, gently sloping to steep soils that occur on hillsides in the unglaciated southern part of the county. These soils formed in material weathered from sandstone and thin beds of siltstone.

In a typical profile the plow layer is dark grayish brown sandy loam about 7 inches thick. The subsoil, to a depth of about 25 inches, is brown and pale-brown channery sandy loam. At a depth of 25 inches is a layer of light yellowish-brown very channery loam in which coarse fragments make up about 60 percent of the soil mass. Thin beds of light-gray, weathered, fractured sandstone are at a depth of 34 inches.

The Dekalb soils have a moderately deep root zone in most places. Permeability is moderately rapid, and available moisture capacity is low.

These soils are extensive in the county. Most of the acreage is woodland or is pastured.

Typical profile of Dekalb sandy loam, 6 to 12 percent slopes, in an abandoned meadow in Sandy Township, section 17, T. 17 N., R. 7 W. (analytical data in table 10):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine and medium, subangular blocky structure; friable; abundant roots; 5 percent coarse fragments, by volume; strongly acid; abrupt, smooth boundary.

B1—7 to 15 inches, brown (10YR 4/3) channery sandy loam; weak, medium and coarse, subangular blocky structure; friable; common roots; thin coats of dark-brown (10YR 3/3) clay loam on weathered upper surfaces of stone fragments; few, thin, patchy, light yellowish-brown (10YR 6/6) clay films on some ped faces; 35 percent coarse fragments, by volume; very strongly acid; clear, wavy boundary.

B2—15 to 25 inches, pale-brown (10YR 6/3) channery sandy loam; weak, medium, subangular blocky structure; friable; few roots; coats of dark-brown (10YR 4/3) clay loam on weathered upper surfaces of stone fragments; few, thin, patchy, pale-brown (10YR 6/3) clay films on some ped faces; 35 percent coarse fragments, by volume, strongly acid gradual, wavy boundary.

B&C—25 to 34 inches, light yellowish-brown (10YR 6/4 very channery sandy loam; weak, medium, subangular blocky structure; friable; few roots; coats of dark-brown (10YR 3/3) clay loam on upper surfaces of stone fragments; few, thin, patchy, very pale brown (10YR 7/3) clay films on ped surfaces; 60 percent coarse fragments; strongly acid; gradual, wavy boundary.

R—34 to 50 inches, thin beds of light-gray (N 7/0), medium-grained, fractured sandstone; weathered surface of sandstone is yellowish brown (10YR 5/6) and dark brown (10YR 4/3); some soil material is in fractures and bedding planes.

In wooded areas there is a 3- to 5-inch A1 horizon that is very dark gray (10YR 3/1) or very dark grayish brown (10YR 3/2). The B horizon ranges from loam or sandy loam to coarse loamy sand. The matrix of the B2 horizon includes light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/4 to 5/6). Reaction ranges from strongly acid to extremely acid throughout the profile. Depth to bedrock is 24 to 40 inches. The sandstone, and in some places the siltstone, bedrock is fractured in the uppermost 2 feet, and the crevices contain mineral soil material.

The Dekalb soils are adjacent to, or are near, the well-drained, silty Muskingum and Gilpin soils, and in some places, the shallow Weikert and Ramsey soils. The Dekalb soils are less clayey than the nearby Latham and Keene soils, which are underlain by shale bedrock.

Dekalb sandy loam, 2 to 6 percent slopes (DkB).—This soil occupies small, irregularly shaped areas on rounded ridgetops and on high benches. This soil is less droughty than the other Dekalb sandy loams. A few fragments of sandstone are on the surface.

Included with this soil in mapping, on knobs and near ridgetops, were small areas of the well-drained, shallow Weikert and Ramsey soils.

Use of this soil for cultivated crops is limited by a moderate hazard of erosion. For many nonfarm uses, this soil is limited by shallowness to bedrock. (Capability unit IIe–4; woodland suitability group 3o1)

Dekalb sandy loam, 6 to 12 percent slopes (DkC).—This soil occupies elongated, irregularly shaped areas on hillsides and convex ridgetops. It has the profile described as typical for the Dekalb series.

Included with this soil in mapping were moderately eroded areas that have more fragments of stone on the surface than this soil. Also included in the mapping, on hilltops and ridgetops, were small areas of the shallow Ramsey soils and on lower slopes, small strips of the shallow Weikert soils. Other inclusions, on a north-south ridge near Battlesburg, were areas of soils that are neutral to weakly calcareous.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and shallowness to bedrock are limitations for many nonfarm uses. (Capability unit IIIe–3; woodland suitability group 3o1)

Dekalb sandy loam, 12 to 25 percent slopes, moderately eroded (DkE2).—This soil occurs on hillsides in moderately long bands that follow the contour of the hill. It has a lighter colored surface layer and more stones on the surface than the uneroded Dekalb sandy loams.

Included with this soil in mapping were small

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areas of the shallow Ramsey and Weikert soils. Also included in mapping, near Battlesburg and south of Waco, were areas of soils that are neutral to weakly calcareous.

A severe hazard of erosion and droughtiness are limitations to the use of this soil for cultivated crops. For most nonfarm uses, the slope and shallowness to bedrock are limitations. (Capability unit IVe–3; woodland suitability group 2r1 on north- and east-facing slopes, 3r1 on south- and west-facing slopes)

Dekalb sandy loam, 25 to 50 percent slopes, moderately eroded (DkF2).—This soil occurs on hillsides in strips that follow the contour of the hill. It is more droughty than the other Dekalb soils in the county. Bedrock generally is at a depth of 20 to 30 inches.

Included with this soil in mapping were severely eroded areas that have a few shallow gullies. Also included in mapping were small areas of the shallow Ramsey soils and, on the hillsides or at the base of the slopes, small areas of Latham and Keene soils. Other inclusions, near Battlesburg and south of Waco, were areas of soils that are neutral to weakly calcareous.

A very severe hazard of erosion and the slope are the major limitations to use of this soil. (Capabilitiy unit VIe–3; woodland suitability group 2r1 on north- and east-facing slopes, 3r1 on south- and west-facing slopes)

Edwards Series

In the Edwards series are very poorly drained, dark-colored organic soils that occur in depressional, swampy areas in the vicinity of Hartville. These soils formed from mixed plant material underlain by marl.

A typical Edwards soil is black muck in the uppermost 5 inches and is very dark grayish-brown and dark brown mucky peat to a depth of 28 inches. The underlying material is pale-yellow, strongly calcareous marl.

The Edwards soils have a moderately deep root zone when the water table is low. They have a high water table most of the year unless they are drained. The available moisture capacity is high.

These soils occur only in a small acreage in this county. Drained areas are used for truck crops. Undrained areas are swampy and have a cover of water-tolerant plants.

Typical profile of Edwards muck in a wooded area in Lake Township, section 15, T. 12 N., R. 8 W. (analytical data in table 10):

1—0 to 5 inches, black (N 2/0) muck; moderate, very fine, granular structure; friable; abundant roots; medium acid; clear, smooth boundary.

2—5 to 13 inches, very dark grayish-brown (10YR 3/2) mucky peat; massive (structureless); firm, tough, fibrous plant material; abundant roots; slightly acid; clear, wavy boundary.

3—13 to 24 inches, dark-brown (7.5YR 3/2) mucky peat; massive (structureless); firm, tough, fibrous plant material; abundant roots; earthworm activity, neutral; clear, wavy boundary.

4—24 to 28 inches, dark-brown (7.5YR 3/2) mucky peat; massive (structureless); firm, tough, fibrous plant material; common fine roots; few shells; few lenses of single-grained sand; mildly alkaline; abrupt, smooth boundary.

IICca—28 to 50 inches +, pale-yellow (5Y 7/3) marl; massive (structureless); friable; few fine roots; old root channels with prominent brownish-yellow (10YR 6/6) rinds; intersecting fissures, or old cracks, in marl with top 5 to 6 inches filled with black mucky peat; fissure faces are yellowish red (5YR 4/6) and reddish yellow (7.5YR 6/8); many shells 3 millimeters in diameter, and a few shells 5 to 7 millimeters in diameter; marl material extends to a depth of 84 inches with no change in color or effervescence; strongly calcareous.

The combined thickness of the mucky horizons over the marl ranges from 20 to 40 inches. The horizon of black muck ranges from 4 to 12 inches in thickness. The amount of woody material in the mucky horizons ranges from none to common. Reaction ranges from medium acid to neutral between depths of 13 and 24 inches.

The Edwards soils are commonly adjacent to, or are near, the Carlisle, Linwood, and Willette soils. Edwards soils are underlain by marl instead of mineral material, as are the Carlisle, Linwood, and Willette soils.

Edwards muck (0 to 2 percent slopes) (Ed).—This soil occurs as bands near the edges of swampy areas southwest of the village of Hartville. In a few cultivated areas the muck is shallow and the underlying marl is visible on the surface.

This soil is commonly next to Carlisle soils, and small areas of those soils were included in mapping. Also included in the mapping were areas of Linwood and Willette soils.

Wetness is the major limitation to the use of this soil for farming, but soil blowing is a concern in drained areas. Suitable drainage outlets are difficult to establish on this soil. (Capability unit IIIw–5; woodland suitability group not assigned)

Fitchville Series

The Fitchville series consists of somewhat poorly drained, nearly level to sloping soils on low stream terraces and along basins and drainageways on uplands. These soils formed mainly in silty sediments deposited by water.

In a typical profile the surface layer is silt loam about 12 inches thick. This layer is dark grayish brown in the upper part and is light brownish gray, mottled with yellowish brown, in the lower part. The subsoil is about 28 inches thick and is mottled with dark yellowish brown, grayish brown, strong brown, and dark brown. It is yellowish-brown silty clay loam in the uppermost 20 inches and is strong-brown silt loam below. At a depth of 40 inches is a layer of yellowish-brown silty clay loam mottled with grayish brown.

The Fitchville soils have a moderately deep to deep root zone and medium to high available moisture capacity. Permeability is moderately slow in the subsoil. These soils have a seasonal high water table. They are subject to ponding and to occasional flooding.

The Fitchville soils are extensive in this county. Most of the acreage is used for cultivated crops, and many acres have been artificially drained.

Typical profile of Fitchville silt loam, 0 to 2 per-

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cent slopes, in a meadow in Nimishillen Township, section 35, T. 19 N., R. 7 W. (analytical data in table 10):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; abundant roots; medium acid; abrupt, smooth boundary.

A2—9 to 12 inches, light brownish-gray (10YR 6/2) silt loam; common, medium, faint mottles of yellowish brown (10YR 5/5); weak, thick, platy structure that breaks to weak, fine, subangular blocky structure; friable; common roots; very strongly acid; gradual, wavy boundary.

B21tg—12 to 20 inches, yellowish-brown (10YR 5/4 to 5/6) silty clay loam; many, medium, distinct mottles of dark yellowish brown (10YR 4/4) and grayish brown (2.5Y 5/2); moderate, coarse, angular blocky structure; friable; common roots; light brownish-gray (10YR 6/2), medium, discontinuous clay films on ped surfaces; few, medium, black (N 2/0) ferromanganiferous concretions; very strongly acid; gradual, wavy boundary.

B22tg—20 to 32 inches, yellowish-brown (10YR 5/4 to 5/6) silty clay loam; many, medium, distinct mottles of grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/5); moderate, fine and medium, subangular blocky structure; firm; roots common; thick, discontinuous, olive-gray (5Y 5/2) clay films on horizontal ped faces, thick continuous clay films on vertical ped faces; strongly acid; clear, wavy boundary.

B23—32 to 40 inches, strong-brown (7.5YR 5/6) silt loam; many, medium, distinct mottles of grayish brown (2.5Y 5/2) and dark brown (7.5YR 4/4); weak, coarse, prismatic structure; firm; occasional roots; thick, discontinuous, gray clay films on ped surfaces; medium acid; clear, wavy boundary.

B&C—40 to 52 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium, distinct mottles of grayish brown (2.5Y 5/2); weak, coarse, prismatic structure that breaks to weak, thick, platy structure; prisms are 8 to 14 inches in diameter; firm; few roots; thick, continuous, dark-gray (N 4/0), vertical clay flows between prisms; few fine ferromanganiferous concretions; slightly acid.

In some places the B2tg horizon is heavy silt loam or clay loam, the matrix includes pale brown (10YR 6/3) and brown (10YR 5/3), and the mottles are gray (N 6/0). The lower part of the B2tg horizon commonly contains dark yellowish-brown, cemented nodules 1 to 3 inches in diameter. The clay content of the B2tg horizon ranges from 22 to 35 percent, and the clay films on the ped faces have chromas of 2 or less. Depth to calcareous material ranges from 60 to 100 inches. Coarse fragments in the B&C horizon make up from 0 to 10 percent of the soil mass. Reaction ranges from strongly acid to very strongly acid in the A2 horizon and from neutral to slightly acid in the B&C horizon.

The Fitchville soils are the somewhat poorly drained members of a drainage sequence that includes the very poorly drained Luray soils, the poorly drained Sebring soils, the moderately well drained Glenford soils, and the well drained Mentor soils. Fitchville soils are commonly adjacent to the Sebring and Glenford soils. They lack the fragipan that is typical for Ravenna soils and are not so compact and dense in their subsoil as those soils. The Fitchville soils have a less clayey subsoil than the Remsen soils.

Fitchville silt loam, 0 to 2 percent slopes (FcA).—This soil is in broad areas in valleys and in partly blocked drainageways on uplands in the glaciated part of the county. It has the profile described as typical for the series. This soil is very susceptible to surface crusting.

Included with this soil in mapping, in depressions and swales, were small areas of the poorly drained Sebring soils.

Ponding and seasonal wetness are the major limitations to use of the soil for most purposes. The underlying silt and clay material tends to be unstable. (Capability unit IIw–1; woodland suitability group 1w1)

Fitchville silt loam, 2 to 6 percent slopes (FcB).—This soil occurs on slack-water terraces and in drainageways. It occurs as elevated rises on broad, nearly level terraces.

This soil commonly is next to the moderately well drained Glenford soils, and small areas of those soils were included in mapping. Also included in mapping, in the lowest part of the drainageways, were small areas of the poorly drained Sebring soils.

Seasonal wetness is the major limitation to use of this soil, but sheet erosion is a hazard in some areas. Ponding is not likely, except in the included nearly level areas. This soil is unstable under heavy loads. (Capability unit IIw–1; woodland suitability group 1w1)

Fitchville silt loam, 6 to 12 percent slopes (FcC).—This soil occurs as narrow, convex strips on walls of basins and on sides of drainageways. It generally has a thinner surface layer than that in the profile described as typical for the Fitchville series.

This soil commonly is next to the moderately well drained Glenford soils, and areas of those soils were included in mapping. Also included in the mapping were spots of moderately eroded soils that are lighter colored than this soil.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The soil material is also unstable and is subject to slippage. (Capability unit IIIe–5; woodland suitability group 1w1)

Fitchville-Urban land complex (Fu).—This complex occurs along drainageways. It consists of areas of nearly level and gently sloping Fitchville soils and areas where the soil material has been altered by cutting and filling.

Wetness and instability of the soil material are the main limitations to use of this complex. Flooding and surface ponding are hazards in some low areas. Water moves through the Fitchville soils at a moderately slow rate, and runoff from adjacent areas is also a concern. (Capability unit not assigned; woodland suitability group 1w1)

Geeburg Series

The Geeburg series consists of moderately well drained, sloping to steep soils that occur in the northeastern corner of the county. These soils formed in silty clay glacial till of Wisconsin age.

In a typical profile the plow layer is dark grayish-brown silt loam about 7 inches thick. The subsoil, about 20 inches thick, is yellowish-brown silty clay in the uppermost 3 inches and is yellowish-brown and grayish-brown clay below. It is mottled with grayish brown and yellowish brown in the lower 13 inches. The underlying material is dark grayish-brown and light brownish-gray clay.

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The Geeburg soils have a moderately deep root zone and low available moisture capactiy. Permeability is very slow in the subsoil and the underlying material. Runoff is rapid.

These soils are not extensive in this county. Most of the acreage is woodland or is used for pasture.

Typical profile of Geeburg silt loam, 6 to 12 percent slopes, moderately eroded, in a meadow in Lexington Township, section 21, T. 19 N., R. 6 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, crumb structure; friable; abundant roots; very strongly acid; abrupt, smooth boundary.

B1—7 to 10 inches, yellowish-brown (10YR 5/5) silty clay; moderate, fine and medium, angular blocky structure; friable; common roots; few thin clay films; very strongly acid; gradual, wavy boundary.

B21t—10 to 14 inches, yellowish-brown (10YR 5/4) clay; moderate, fine and medium, angular blocky structure; friable when moist, sticky when wet; common roots; thin continuous clay films on ped faces; very strongly acid; gradual, wavy boundary.

B22t—14 to 18 inches, yellowish-brown (10YR 5/4) clay; few, fine, distinct mottles of grayish brown (2.5Y 5/2); strong, medium and coarse, angular blocky structure; sticky when wet; common roots; ligh' gray (10YR 6/1), thin, continuous clay films on ped faces; very strongly acid; gradual, wavy boundary.

B3t—18 to 27 inches, grayish-brown (2.5Y 5/2) clay; few, fine, distinct mottles of yellowish brown (10YR 5/4); strong, medium and coarse, angular blocky structure; sticky when wet; few roots; thin continuous clay films on ped faces; neutral; gradual, wavy boundary.

C—27 to 60 inches, dark grayish-brown (2.5Y 4/2) and light brownish-gray (2.5Y 6/2) clay; strong, fine and medium, angular blocky structure; sticky when wet; no roots; calcareous.

In the B21t and B22t horizons, the clay content ranges from 50 to 60 percent and the matrix ranges from dark brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/6). Mottles of grayish brown (2.5Y 5/2) or pale brown (10YR 6/3) occur at a depth of 12 to 16 inches. Texture of the C horizon includes silty clay loam and silty clay in some places. Depth to calcareous material ranges from 24 to 36 inches. Reaction ranges from strongly acid to extremely acid in the B1 and B2t horizons. Throughout the profile, only from 1 to 5 percent of the soil mass is coarse fragments.

The Geeburg soils are the moderately well drained members of a drainage sequence that includes the poorly drained Trumbull soils and the somewhat poorly drained Remsen soils. Unlike the Canfield and Rittman soils, Geeburg soils do not have a fragipan. The Geeburg soils have a more clayey subsoil and underlying material than the Rittman soils. They are more clayey in the upper part of the subsoil than the Licking soils and are more shallow to limy material.

Geeburg silt loam, 6 to 12 percent slopes, moderately eroded (GbC2).—This soil occurs along small drainageways and at the head of large drainageways. It has the profile described as typical for the Geeburg series.

This soil is commonly next to the somewhat poorly drained Remsen soils, and small areas of those soils were included in the mapping. Also included in the mapping, north of Alliance near Klingler Road, was an area of a Geeburg soil in which shale bedrock is at a depth of 4 feet. Other inclusions, on the upper part of slopes, were areas of slightly eroded Geeburg soils that make up as much as 50 percent of the area mapped, have fewer pebbles on the surface, and are darker colored than this soil.

A very severe hazard of erosion is the main limitation to the use of this soil for cultivated crops. Very slow permeability and the slope are limitations to some nonfarm uses. (Capability unit IVe–4; woodland suitability group 2c1)

Geeburg silt loam, 12 to 25 percent slopes, moderately eroded (GbE2).—This soil occupies areas along streams and drainageways. The slopes are short vertically, and they follow the direction of the streams and drainageways for relatively long distances. This soil has a thinner, lighter colored surface layer than Geeburg silt loam, 6 to 12 percent slopes, moderately eroded, which has the profile described as typical for the series.

Included with this soil in mapping were a few spots of severely eroded Geeburg soils that have more pebbles on the surface than this soil and in which the clayey subsoil is exposed and shallow gullies have formed.

This soil is better suited to hay or pasture than to cultivated crops. A severe hazard of erosion is the major limitation to use for farming. The slope and very slow permeability are limitations for many nonfarm uses. (Capability unit VIe–2; woodland suitability group 2c1)

Gilpin Series

The Gilpin series consists of well-drained, gently sloping to very steep soils that occur in the unglaciated southern part of the county. These soils formed on thin beds of acid siltstone, shale, and fine-grained sandstone (fig. 11).

In a typical profile the plow layer is brown silt loam about 9 inches thick. The subsoil, about 21 inches thick, is strong-brown, brownish-yellow and light yellowish-brown silt loam and heavy silt loam. Light yellowish-brown siltstone and sandstone are at a depth of about 30 inches.

The Gilpin soils have a moderately deep root zone and low available moisture capacity. Permeability is moderate in the subsoil. These soils generally are droughty.

The Gilpin soils are only moderately extensive in this county. They are used mainly for crops and pasture, but the steeper areas are wooded.

Typical profile of a Gilpin silt loam, 0.5 mile south of Waynesburg in Sandy Township, section 27, T. 17 N., R. 7 W.:

Ap—0 to 9 inches, brown (10YR 5/3) silt loam; moderate, fine, crumb structure; friable; abundant roots; few fragments of siltstone and sandstone as much as 2 inches across and ½ inch thick; strongly acid; abrupt, smooth boundary.

B21t—9 to 13 inches, strong-brown (7.5YR 5/6) silt loam; moderate, very fine, subangular blocky structure; friable; abundant roots; thin patchy clay films on ped surfaces; few fragments of siltstone and sandstone as much as 2 inches across and ½ inch thick; strongly acid; clear, smooth boundary.

B22t—13 to 18 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, fine and medium, subangular

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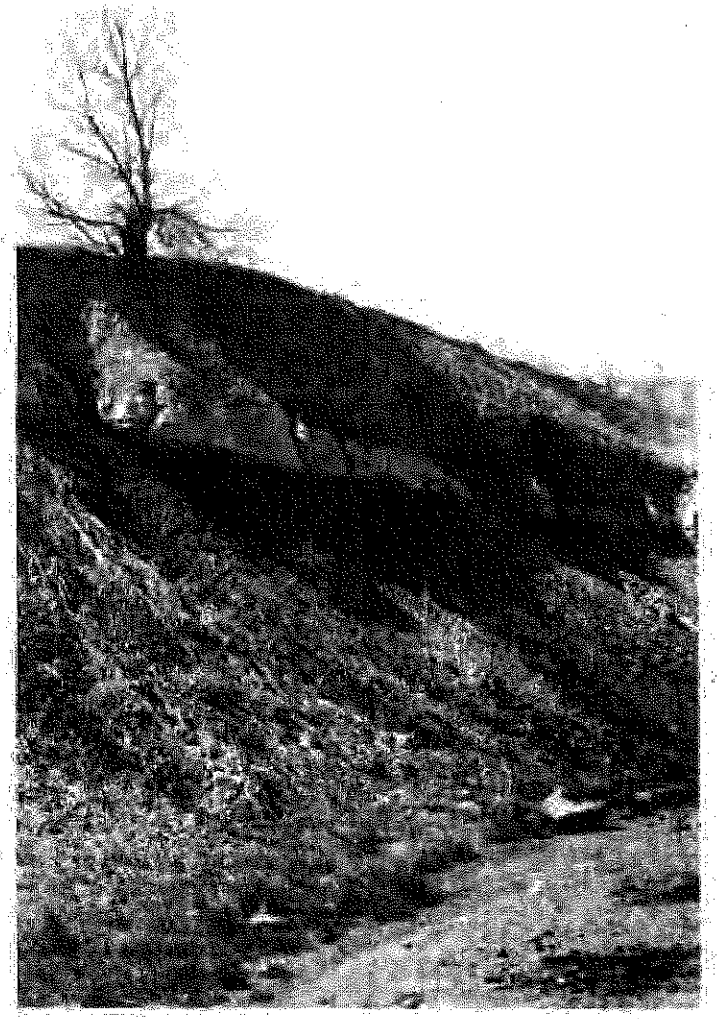

Figure 11.—An area of Gilpin soils that developed over sandstone.

blocky structure; friable; plentiful roots; thin discontinuous clay films on 50 percent of ped surfaces; strongly acid; clear, wavy boundary.

B23t—18 to 30 inches, heavy silt loam; brownish-yellow (10YR 6/8) ped interiors; light yellowish-brown (10YR 6/4) ped exteriors with black (N 2/0) ferromanganiferous stains on ped faces; moderate, fine and medium, subangular blocky structure; friable; plentiful roots; thin, continuous, light yellowish-brown (10YR 6/4) clay films on ped surfaces; few, thick, dark yellowish-brown (10YR 4/4) clay films; 5 percent, by volume, coarse skeletal material; strongly acid; abrupt, smooth boundary.

R—30 inches +, light yellowish-brown (10YR 6/4) siltstone and sandstone.

The B2t horizon ranges from silt loam to light silty clay loam or silty clay loam. It ranges from 9 to 22 inches in thickness but averages about 14 inches. In some places the B2t horizon is yellowish brown (10YR 5/6 to 5/8) or dark yellowish brown (10YR 4/4). Coarse fragments make up 5 to 30 percent of the B23t horizon. Reaction is very strongly acid or strongly acid throughout the profile. Depth to bedrock ranges from 20 to 36 inches.

The Gilpin soils are the well drained members of a drainage sequence that includes the moderately well drained Keene soils and the well drained Muskingum and Dekalb soils. The Gilpin soils contain more clay in their subsoil than the Muskingum soils. Unlike the Keene soils, Gilpin soils are not mottled, and they have a less clayey subsoil than those soils. The Gilpin soils have a less sandy surface layer and subsoil than the Dekalb soils.

Gilpin silt loam, 2 to 6 percent slopes (GdB).—This soil is on ridgetops, mainly in narrow strips that follow the crests of the ridges. In some places it occupies lower benchlike positions. The profile of this soil is generally deeper to bedrock but is otherwise similar to the one described as typical for the series.

Included with this soil in mapping were small areas of the moderately well drained Keene soils and small areas of the shallow, well drained Weikert soils.

A moderate hazard of erosion limits the use of this soil for cultivated crops. Shallowness to bedrock is a limitation for some nonfarm uses. (Capability unit IIe–4; woodland suitability group 3o1)

Gilpin silt loam, 6 to 12 percent slopes (GdC).—This soil occupies convex areas on ridgetops and areas on the upper part of hillsides.

Included with this soil in mapping were areas of the moderately eroded Gilpin soils that have a lighter colored surface layer than the uneroded soils. Also included in mapping were a few, small, severely eroded areas in which a few shallow gullies have formed. Other inclusions were small areas of the shallow Weikert soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. Shallowness to bedrock and the slope are limitations to use for some nonfarm purposes. (Capability unit IIIe–3; woodland suitability group 3o1)

Gilpin silt loam, 12 to 18 percent slopes (GdD) —This soil occurs as strips around the middle area of hillsides. Most of the cultivated areas are moderately eroded, and a few shallow gullies have formed in these areas.

Included with this soil in mapping were small areas of the shallow Weikert soils that have numerous channery fragments on the surface. Also included in mapping were small areas of the Latham soils.

Use of this soil for farming is limited mainly by a very severe hazard of erosion. The slope is a limitation to use for most nonfarm purposes. (Capability unit IVe–3; woodland suitability group 3o1)

Ginat Series

The Ginat series consists of poorly drained, level and nearly level soils that occur on terraces and outwash plains. These soils formed in gravelly sandy loam of Wisconsin age.

In a typical profile the plow layer is grayish-brown silt loam about 8 inches thick. The subsoil is about 28 inches thick. To a depth of about 26 inches, it is light olive-gray and light brownish-gray silt loam mottled with yellowish brown. Below this, and extending to a depth of 36 inches, is a light brownish-gray loam fragipan mottled with light olive brown, dark yellowish brown, and strong brown. The underlying material is light brownish-gray gravelly sandy loam mottled with light olive and strong brown.

The Ginat soils have a moderately deep root zone

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and medium available moisture capacity. Permeability is moderately slow in the subsoil and moderate in the underlying material. These soils have a seasonal high water table.

The Ginat soils are not extensive in this county. Most of the acreage is wooded or is used for pasture, but some areas have been drained and generally are used for cultivated crops.

Typical profile of the Ginat silt loam on slopes of 0 to 2 percent in a meadow in Lake Township, section 20, T. 12 N., R. 8 W.:

Ap—0 to 8 inches, grayish-brown (2.5Y 5/2) silt loam; moderate, fine, granular structure; friable; abundant roots; medium acid; abrupt, smooth boundary.

Blg—8 to 17 inches, light olive-gray (5Y 6/2) silt loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; friable; common roots; common very dark brown (10YR 2/2) ferromanganiferous concretions 3 to 5 millimeters thick; strongly acid; clear, wavy boundary.

B2tg—17 to 26 inches, light brownish-gray (2.5Y 6/2) silt loam; many, medium, distinct mottles of yellowish brown (10YR 5/6); weak, coarse, angular blocky structnre; friable; common roots; thin discontinuous clay films on ped surfaces; few dark-brown (7.5YR 4/4) ferromanganiferous concretions; medium acid; gradual, wavy boundary.

Bxg—26 to 36 inches, light brownish-gray (2.5Y 6/2) loam; many, medium, distinct mottles of light olive brown (2.5Y 5/4), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6); massive (structureless); weak fragipan; slightly brittle; few roots; thin clay films in pores and bridging between sand grains; few hlack (N 2/0) ferromanganiferous concretions 1 or 2 millimeters thick; pebbles less than 5 percent, by volume; medium acid; gradual, wavy boundary.

Cg—36 to 60 inches, ilght brownish-gray (2.5Y 6/2) gravelly sandy loam; common, medium, distinct mottles of light olive brown (2.5Y 5/4) and strong brown (7.5YR 5/8); massive; friable; no roots; dark-gray (N 4/0) vertical clay seams 1 or 2 millimeters thick; 15 to 20 percent coarse fragments, by volume; strongly acid.

The Ap horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) or grayish brown (2.5Y 5/2). In the B2 horizon the matrix is grayish brown (10YR 5/2) or light brownish gray (2.5Y 6/2), the clay content ranges from 20 to 30 percent, and the content of material coarser than very fine sand ranges from 18 to 45 percent. The Bxg horizon is 8 to 16 inches thick. Reaction is typically medium acid in the B2 horizon, but it ranges from strongly acid to slightly acid. Coarse fragments in the Cg horizon make up 10 to 50 percent of the horizon.

The Ginat soils are the poorly drained members of the drainage sequence that includes the somewhat poorly drained Weinbach soils and the well-drained Wheeling soils. Ginat soils are commonly next to the Weinbach soils and the well-drained Chili soils. The Ginat soils have a fragipan and are less clayey than the poorly drained Sebring soils. Unlike the Sebring soils, the Ginat soils are underlain by sandy and gravelly material.

Ginat silt loam (0 to 2 percent slopes) (Ge).—This soil occupies areas that vary in size and are scattered throughout the glaciated part of the county. These areas are below the Weinbach and Chili soils and are just above the very poorly drained Luray silt loam, gravelly subsoil variant. This soil is susceptible to surface crusting.

Included with this soil in mapping were small areas of soils that have a loam or silty clay loam surface layer. Also included in mapping, on low hummocks, were small areas of the somewhat poorly drained Weinbach soils and the moderately well drained Bogart soils.

Wetness is the major limitation to the use of this soil. Ponding and flooding are hazards in spring. (Capability unit IIIw–4; woodland suitability group 1w1)

Glenford Series

The Glenford series consists of moderately well drained, level to steep soils on slack water terraces and on uplands. These soils formed on silt and clay deposited by slack water.

In a typical profile the plow layer is dark grayish-brown silt loam about 8 inches thick. The subsoil, about 32 inches thick, is yellowish-brown silt loam in the uppermost 3 inches. Below this, and extending to a depth of 24 inches, is yellowish-brown silty clay loam that is mottled with grayish brown and brownish yellow in the lower 4 inches. The lower part of the subsoil is 16 inches of light olive-brown silt loam mottled with brownish yellow and grayish brown. The underlying material is mottled grayish-brown, brownish-yellow, light olive-brown, and dark-brown silt loam.

The Glenford soils have a deep root zone and high available moisture capacity. Permeability is moderately slow.

These soils are not extensive in this county. They are used primarily for cultivated crops.

Typical profile of Glenford silt loam, 2 to 6 percent slopes, in a meadow in Lake Township, section 33, T. 12 N., R. 8 W.:

Ap—0 to 8 inches, dark grayish-hrown (10YR 4/2) silt loam, weak, fine, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

B1—8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; friable; common roots; thin discontinuous clay films on ped faces; medium acid; clear, wavy boundary.

B21t—11 to 20 inches, yellowish-brown (10YR 5/5) silty clay loam; strong, medium and coarse, subangular blocky structure that breaks to weak, medium, subangular blocky structure; friable; common roots; medium, continuous, dark grayish-brown (10YR 4/2) clay films on ped surfaces; few, fine, very dark gray (10YR 3/1) ferromanganiferous stains; strongly acid; gradual, wavy boundary.

B22t—20 to 24 inches, yellowish-brown (10YR 5/5) silty clay loam; many, fine, distinct mottles of grayish brown (10YR 5/2) and brownish yellow (10YR 6/6); moderate, medium and coarse, subangular blocky structure; slightly firm; common roots; thin discontinuous clay films; few, fine and medium, very dark brown (10YR 2/2) stains, primarily on horizontal planes; strongly acid; gradual, wavy boundary.

B3t—24 to 40 inches, light olive-brown (2.5Y 5/4) silt loam; many, medium, distinct mottles of brownish yellow (10YR 6/6) and grayish brown (10YR 5/2); weak, coarse, subangular structure that breaks to weak, fine and medium, subangular blocky structure; friable; few roots; medium clay films on pores; medium, dark grayish-brown (10YR 4/2) clay flows; few, fine, very dark brown (10YR 2/2) ferro-

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manganiferous stains; strongly acid; gradual, diffuse boundary.

C—40 to 50 inches, mottled grayish-brown (10YR 5/2), brownish-yellow (10YR 6/6), light olive-brown (2.5Y 5/4), and dark-brown (10YR 3/3) silt loam; massive (structureless); slightly firm; few roots; strongly acid.

In some places the B1 horizon is brown (10YR 5/3) and the B21t and B22t horizons are heavy silt loam and dark yellowish brown (10YR 4/4) or yellowish brown (10YR 5/4 or 5/5). The clay content of the B21t and B22t horizons ranges from 25 to 35 percent. Mottles that have a chroma or 2 or less occur at depths ranging from 14 to 24 inches. Depth to calcareous material ranges from 50 to 80 inches. In some places reaction is strongly acid in the B1 horizon and is medium acid in the C horizon.

The Glenford soils are the moderately well drained members of the drainage sequence that includes the very poorly drained Luray soils, the poorly drained Sebring soils, the somewhat poorly drained Fitchville soils, and the well-drained Mentor soils. Glenford soils are commonly adjacent to the Mentor soils, the well drained, gravelly Chili soils, and the moderately well drained Canfield soils. Glenford soils are more silty and less clayey in their subsoil and underlying material than the Licking soils.

Glenford silt loam, 0 to 2 percent slopes (GfA).—This soil occurs in irregularly shaped areas on stream terraces and in areas of old glacial lakes. Runoff from this soil is slow. Surface crusting is likely. In some places thin seams of gravelly material 2 to 6 inches thick are below a depth of 30 inches.

Included with this soil in mapping, in spoon-shaped depressions and in small drainageways, were a few areas of the somewhat poorly drained Fitchville soils.

Limitations to use of this Glenford soil for cultivated crops are few or none. Moderately slow permeability is a limitation for some nonfarm uses. (Capability unit I–1; woodland suitability group 1o1)

Glenford silt loam, 2 to 6 percent slopes (GfB).—This soil occupies elongated areas below the well-drained Mentor soils and above the somewhat poorly drained Fitchville soils. It has the profile described as typical for the series. This soil is susceptible to surface crusting.

Included with this soil in mapping, in areas adjacent to Canfield soils, were a few areas of soils that are underlain by compact glacial till. Also included in the mapping, in narrow drainageways, were small areas of the somewhat poorly drained Fitchville soils.

A moderate hazard of erosion is a limitation to use of this soil for cultivated crops. The hazard of erosion and moderately slow permeability are limitations to use for some nonfarm purposes. (Capability unit IIe–1; woodland suitability group 1o1)

Glenford silt loam, 6 to 12 percent slopes (GfC).—This soil occupies rounded areas below the well-drained Mentor soils and above the somewhat poorly drained Fitchville soils. Because runoff is rapid, the hazard of erosion is severe. The surface layer of this soil is thinner and lighter colored than that in the profile described as typical for the series.

Included with this soil in mapping were small areas of moderately eroded Glenford silt loams. Also included in the mapping were small areas of Mentor soils.

A severe hazard of erosion limits use of this soil for cultivated crops. The slope and moderately slow permeability are limitations for many nonfarm uses. (Capability unit IIIe–5; woodland suitability group 1o1)

Glenford silt loam, 6 to 12 percent slopes, moderately eroded (GfC2).—This soil occurs in short, irregularly shaped areas at the head of drainageways, on stream terraces, and in old lake areas. On uplands, in areas next to the Canfield soils, this soil is underlain by glacial till. This soil has more gravel on the surface, and its surface layer is lighter colored than that of the uneroded Glenford soils. On this soil, past erosion has reduced the organic-matter content, and surface crusting and puddling are likely.

Included with this soil in mapping, on the upper part of slopes, were small areas of the well-drained Mentor soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope, the hazard of erosion, and moderately slow permeability are limitations for many nonfarm uses. (Capability unit IIIe–5; woodland suitability group 1o1)

Glenford silt loam, 12 to 18 percent slopes, moderately eroded (GfD2).—This soil occupies short slopes along valley sides of stream terraces and in areas of old glacial lakes. Its surface layer is about 4 inches thick, and it is lighter colored than that in the profile described as typical for the series. Depth to the underlying sand, silt, and clay is 30 inches. Because of past erosion, this soil is low in organic-matter content. Surface runoff is very rapid.

Included with this soil in mapping, on the upper part of slopes, were small areas of the well-drained Mentor soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and moderately slow permeability are limitations for most nonfarm uses. (Capability unit IVe–1; woodland suitability group 1o1)

Gravel Pits

Gravel pits (Gp) are open excavations from which sand and gravel have been removed. The gravel is generally in layers that vary in thickness and change in composition within short distances. Between the gravelly layers are sandy ones that contain variable amounts of silty and clayey material. (Capability unit not assigned; woodland suitability group not assigned)

Keene Series

The Keene series consists of moderately well drained, gently sloping to steep soils that occur in the unglaciated southern part of the county. These soils formed in residuum weathered from shale and thin beds of siltstone.

In a typical profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is about 26 inches thick and is mottled throughout. It is strong-brown and yellowish-brown silty clay loam in the uppermost 11 inches and is yellowish-brown and strong-brown silty clay below. The underlying mate-

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rial is mottled gray and brownish-yellow, weathered clay shale.

The Keene soils have a moderately deep or deep root zone and medium available moisture capacity. Permeability is moderately slow in the upper part of the subsoil and slow in the lower part.

These soils are relatively extensive in the southern part of the county. They are used for pasture, cultivated crops, and trees.

Typical profile of a Keene silt loam, 1.25 miles west of Magnolia, 100 feet north of Farber street, in Pike Township, section 25, T. 9 N., R. 8 W. (analytical data in table 10):

Ap—0 to 8 inches, dark-brown (10YR 4/4) silt loam; moderate, medium, granular structure; friable; abundant roots; very strongly acid; abrupt, smooth boundary.

B1—8 to 13 inches, strong-brown (7.5YR 5/6) silty clay loam; few, fine, distinct mottles of light olive brown (2.5Y 5/4) and yellowish red (5YR 4/6); moderate, fine, subangular blocky structure; slightly plastic when wet; plentiful roots; very strongly acid; gradual, wavy boundary.

B21t—13 to 19 inches, yellowish-brown (10YR 5/4) silty clay loam; many, fine, distinct mottles of light brownish gray (2.5Y 5/2) and yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; slightly plastic when wet; plentiful roots; few, thin, patchy clay films on ped surfaces; very strongly acid; gradual, wavy boundary.

IIB22t—19 to 25 inches, yellowish-brown (10YR 5/6) silty clay; common, medium, distinct mottles of gray (N 6/0) and strong brown (7.5YR 5/8); moderate, medium, subangular blocky structure; slightly plastic when wet; few roots; thin patchy clay films on vertical and horizontal ped faces; very strongly acid; gradual, wavy boundary.

IIB3—25 to 34 inches, strong-brown (7.5YR 5/6) silty clay; many, fine, distinct mottles of dark reddish brown (5YR 3/4), dark brown (7.5YR 4/4), grayish brown (10YR 5/2), and gray (N 6/0); moderate, medium and coarse, subangular blocky structure; slightly plastic when wet; no roots evident; flecks of coal and pieces of easily crushed weathered shale in lower part; very strongly acid; clear, smooth boundary.

IIIC—34 to 40 inches +, mottled gray (N 6/0) and brownish-yellow (10YR 6/8) weathered clay shale; massive; plastic when wet; no roots evident; thin soft coal blossoms at a depth of 35 inches; few dark-red (10R 3/6) mottles below a depth of 40 inches; very strongly acid.

Mottles of low chroma occur at depths between 12 and 24 inches. The matrix of the IIB22t horizon ranges from yellowish brown (10YR 5/4 to 5/6) or dark yellowish brown (10YR 4/4) to strong brown (7.5YR 5/6) but is dominantly yellowish brown (10YR 5/4). In the lower part of the B horizon, the clay content is 30 to 40 percent. The content of coarse fragments in the solum ranges from 5 to 15 percent. Reaction ranges from strongly acid to extremely acid throughout the solum. Depth to bedrock is 34 to 60 inches.

The Keene soils are in a toposequence with the well-drained Latham soils and are adjacent to those soils in many places. They are commonly adjacent to the well-drained Gilpin soils. Unlike the Gilpin soils, the Keene soils are mottled, and they are more clayey in the lower part of their subsoil. The Keene soils are less clayey than the Latham soils, and they have a thicker silt capping and are deeper to the clayey subsoil than those soils.

Keene silt loam, 2 to 6 percent slopes (KeB).—This soil occupies the uppermost part of ridgetops. The available moisture capacity is medium.

Included with this soil in mapping were small areas of wetter, somewhat poorly drained soils. Also included in the mapping were small areas of the well-drained Latham and Gilpin soils.

A moderate hazard of erosion is the major limitation to the use of this soil for cultivated crops. Moderately slow or slow permeability is a limitation for many nonfarm uses. (Capability unit IIe–5; woodland suitability group 3w1)

Keene silt loam, 6 to 12 percent slopes (KeC).—This soil occupies sloping hillsides and rounded hilltops. It is highly susceptible to surface crusting. Runoff is very rapid from this soil.

Included with this soil in mapping were a few small areas of somewhat poorly drained soils. Also included in mapping were a few small areas of moderately eroded soils that are lighter colored than is typical of Keene soils. Other inclusions, on the lower part of slopes, were a few areas of the well-drained Gilpin soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and moderately slow or slow permeability are limitations for some nonfarm uses. (Capability unit IIIe–6; woodland suitability group 3w2)

Keene silt loam, 6 to 12 percent slopes, moderately eroded (KeC2).—This soil is on the lower half of hillsides and on the convex crest of ridges. Its surface layer is thinner and lighter colored than that in the profile described as typical for the series. A few very shallow gullies have formed in places. Because this soil is lower in organic-matter content than the uneroded Keene soils, its surface tilth generally is not so good. Runoff is very rapid.

Included with this soil in mapping, on the lower part of slopes, were a few small areas of the well-drained Gilpin soils. Also included in mapping were small strips of the well-drained Latham soils.

A severe hazard of erosion is the main limitation to the use of this soil for cultivated crops. The slope and moderately slow or slow permeability are the major limitations to nonfarm uses. (Capability unit IIIe–6; woodland suitability group 3w2)

Keene silt loam, 12 to 18 percent slopes (KeD).—This soil occurs on hillsides below the breaks of ridgecrests, mainly in eroded and abandoned fields. Its surface layer is thinner than that in the profile described as typical for the series.

Included with this soil in mapping were a few spots of moderately eroded soils that are medium in size; they make up about 20 percent of each area. Also included in mapping were small areas of the Latham soils.

Because surface runoff from this soil is very rapid, a very severe hazard of erosion is the major limitation to use for cultivated crops. Moderately steep slopes and moderately slow or slow permeability are limitations for most nonfarm uses. (Capability unit IVe–4; woodland suitability group 3w2)

Keene silt loam, 12 to 18 percent slopes, moderately eroded (KeD2).—This soil occupies narrow strips around the contour of hillsides. Erosion has removed much of the original surface layer, and the profile of

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this soil is thinner to shale bedrock than that described as typical for the series. Shallow gullies are common. This soil is very low in organic-matter content, and good surface tilth is difficult to maintain. Runoff is very rapid.

Included with this soil in mapping were small areas of the well-drained Muskingum soils.

A very severe hazard of erosion is the main limitation to use of this soil for cultivated crops. The slope and slow permeability are major limitations for most nonfarm uses. (Capability unit IVe–4; woodland suitability group 3w2)

Keene silt loam, 18 to 25 percent slopes (KeE).—This soil is on hillsides, in long narrow strips that follow the contour of the hill. Most areas are wooded. This soil has a thinner surface layer than the one in the profile described as typical for the Keene series. There are a few stones on the surface in some places.

Included with this soil in mapping were eroded spots of moderate size and in some areas shallow and deep gullies have formed. Shale bedrock is visible at the bottom of a few of the deep gullies. Also included in the mapping were small areas of the well-drained Latham and Gilpin soils.

This soil is better suited to hay or pasture than to cultivated crops because of its slope. A severe hazard of erosion is the major limitation to its use, even for hay or pasture. The slope is a limitation to use for most nonfarm purposes. (Capability unit VIe–2; woodland suitability group 3w2)

Killbuck Series

The Killbuck series consists of alluvium recently deposited over dark-colored, very poorly drained, older soil material. These soils occur on level and nearly level flood plains and along drainageways.

In a typical profile the surface layer is dark grayish-brown silt loam about 4 inches thick. This layer is underlain by dark-gray, friable silt loam that extends to a depth of about 22 inches and is mottled with yellowish brown and dark brown. Below this is very dark gray light silty clay loam mottled with dark brown. It is about 14 inches thick and is underlain by about 5 inches of light brownish-gray loam glacial till mottled with light olive brown.

The Killbuck soils have a deep root zone when the water table is low. The water table is high in winter and spring. Permeability is moderately slow, and available moisture capacity is high. These soils are subject to ponding and to occasional flooding.

The Killbuck soils are not extensive in the county. Most of the acreage is pastured.

Typical profile of Killbuck silt loam on slopes of 0 to 2 percent, in a pasture in Plain Township, section 20, T. 11 N., R. 8 W.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; abundant roots; medium acid; gradual, wavy boundary.

B2—4 to 22 inches, dark-gray (10YR 4/1) silt loam; common, medium, distinct mottles of yellowish brown (10YR 5/4) and dark brown (10YR 3/4); weak, fine, angular blocky structure; friable; common roots; few, fine, black (N 2/0) ferromanganiferous concretions; slightly acid; abrupt, wavy boundary.

A1b—22 to 36 inches, very dark gray (10YR 3/1) light silty clay loam; few, fine, faint mottles of dark brown (7.5YR 4/4); massive (structureless) that breaks to weak, medium, angular blocky structure; friable; few roots; thin clay films in pores and root channels; slightly acid; clear, wavy boundary.

B2b—36 to 50 inches, light brownish-gray (2.5Y 6/2) loam; many, medium, distinct mottles of light olive brown (2.5Y 5/4); massive (structureless); friable; few roots; thin discontinuous clay films in root channels and pores; less than 5 percent skeletal material, by volume; slightly acid.

In some places the A1 horizon is very dark gray (10YR 3/1) or dark gray (10YR 4/1). Depth to the A1b horizon ranges from 20 to 36 inches. The A1b horizon is dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) in some places. Its texture includes silt loam. Coarse fragments make up 1 to 10 percent of the B2b horizon.

The Killbuck soils are adjacent to the very poorly drained Luray soils, but they are less clayey than those soils. Unlike the Luray soils, Killbuck soils contain a dark-colored buried soil. Killbuck soils formed in recent alluvium deposited over loam glacial till, whereas, the poorly drained Sloan and Wayland soils formed entirely in recent alluvium.

Killbuck silt loam (0 to 2 percent slopes) (Kk).—This soil occurs in drainageways on the glacial till plain and on bottom lands along small streams. It occupies small, irregular areas that are scattered throughout the northern half of the county.

Included with this soil in mapping were small areas of the somewhat poorly drained Fitchville soils.

Seasonal wetness is the major limitation to the use of this soil for farming and for nonfarm purposes. Ponding and flooding are severe limitations for most nonfarm uses. (Capability unit IIIw–3; woodland suitability group 2w1)

Latham Series

The Latham series consists of well-drained, gently sloping to very steep soils in the unglaciated southern part of the county. These soils formed on acid shale bedrock.

In a typical profile the plow layer is brown silt loam about 7 inches thick. The subsoil, about 27 inches thick, is yellowish-brown silty clay loam in the uppermost 6 inches. Below this, and extending to a depth of 20 inches, is yellowish-brown silty clay mottled with light brownish gray at a depth of 18 inches. The lower part of the subsoil is 14 inches of yellowish-brown and strong-brown clay mottled with light brownish gray, yellowish red, and grayish brown. The underlying material is light brownish-gray and brownish-yellow, shaly silty clay. Gray shale bedrock is at a depth of 38 inches.

The Latham soils have a moderately deep root zone in most places. Permeability is slow in the subsoil. The available moisture capacity is medium to low.

These soils are moderately extensive in this county. The gently sloping and sloping Latham soils are commonly used for cultivated crops, and the steeper areas are pastured or wooded.

Typical profile of Latham silt loam, 6 to 12 percent slopes, in an old meadow in Pike Township, section 5, T. 9 N., R. 8 W.:

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Ap—0 to 7 inches, brown (10YR 4/3) silt loam; moderate, medium, crumb structure; friable; abundant roots; few coarse fragments of sandstone; strongly acid; abrupt, smooth boundary.

B1t—7 to 13 inches, yellowish-brown (10YR 5/6) silty clay loam; weak and moderate, medium, subangular blocky structure; friable or firm when moist, slightly plastic when wet; common roots; thin discontinuous clay films on vertical ped faces; very strongly acid; gradual, wavy boundary.

IIB21t—13 to 20 inches, yellowish-brown (10YR 5/6) silty clay; few, fine, faint mottles of light brownish gray (10YR 6/2) at a depth of 18 inches; weak, medium, subangular blocky structure; plastic when wet; common roots; thin continuous clay films on ped faces; very strongly acid; gradual, wavy boundary.

IIB22t—20 to 31 inches, yellowish-brown (10YR 5/6) clay; common, fine, distinct mottles of light brownish gray (10YR 6/2) and yellowish red (5YR 5/6); weak, medium and coarse, subangular blocky structure; plastic when wet; few roots; thin, continuous light-gray (N 7/0) clay films on ped faces; very strongly acid; clear, wavy boundary.

IIB3—31 to 34 inches, strong-brown (7.5YR 5/6) clay; common, medium, distinct mottles of grayish brown (2.5Y 5/2) and yellowish red (5YR 5/6); weak, coarse, angular blocky structure; plastic when wet; few roots; thin, continuous, light-gray (N 7/0) clay films, primarily on vertical surfaces; extremely acid; clear, wavy boundary.

IIC—34 to 38 inches, light brownish-gray (10YR 6/2) and brownish-yellow (10YR 6/6) shaly silty clay; weak, coarse, blocky structure or weak platy structure; friable when moist, plastic when wet; no roots; vertical, light-gray (N 7/0) clay seams; highly weathered shale; extremely acid; clear, smooth boundary.

R—38 to 45 inches, gray, acid shale bedrock.

In some places the B1 horizon is silt loam and the B21t, B22t, and B3 horizons include silty clay loam. The matrix of the B21t and B22t horizons ranges from strong brown (7.5YR 5/6 to 5/8) or yellowish brown (10YR 5/6) to brownish yellow (10YR 6/6). The content of coarse fragments in the B horizon is less than 20 percent. Reaction in the solum ranges from strongly acid to extremely acid, but the pH value generally is below 5.0. Depth to shale bedrock ranges from 24 to 40 inches.

The Latham soils are in a toposequence with the moderately well drained Keene soils and in some places are adjacent to those soils. Latham soils are more clayey in the upper part of the subsoil than Keene soils.

Latham silt loam, 2 to 6 percent slopes (LaB).—This soil occurs on broad ridgetops and benchlike areas just below the ridgetops. Its surface layer is thicker than that in the profile described as typical for the series. Runoff is rapid.

Included with this soil in mapping were a few small areas of somewhat poorly drained soils that have slopes of 2 to 4 percent and are grayer in the upper part of the subsoil than are Latham soils. Also included in the mapping were small areas of the moderately well drained Keene soils.

Use of this soil for cultivated crops is limited mainly by a severe hazard of erosion. Slow permeability is a limitation for many nonfarm uses. (Capability unit IIIe–4; woodland suitability group 3c1)

Latham silt loam, 6 to 12 percent slopes (LaC).—This soil occupies slightly concave areas on hillsides. It has the profile described as typical for the series, but in some places the underlying bedrock has thin strata of siltstone or fine-grained sandstone and shale. Runoff is rapid.

Included with this soil in mapping were small areas of the moderately well drained Keene soils and small areas of the well drained Gilpin soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and the slowly permeable, clayey subsoil are limitations for many nonfarm uses. (Capability unit IVe–4; woodland suitability group 3c1)

Latham silt loam, 6 to 12 percent slopes, moderately eroded (LaC2).—This soil occurs in uniform areas on hillsides. It is one of the least extensive soils in the Latham series. This soil has lost part of its original surface layer through erosion, and its plow layer is partly clayey material from the subsoil. The present surface layer is lighter colored and thinner than that of the uneroded soil described as typical for the series, and it is more sticky and cloddy. Runoff is very rapid from this soil.

Included with this soil in mapping were small areas of the well-drained Gilpin soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope, the hazard of erosion, and the clayey, slowly permeable subsoil are limitations for many nonfarm uses. (Capability unit IVe–4; woodland suitability group 3c1)

Latham silt loam, 12 to 18 percent slopes (LaD).—This soil occupies the upper part of slopes that, in length, are short downhill but are several hundred feet on the contour of the hillside.

Included with this soil in mapping were small areas of the Gilpin soils.

This soil is generally too steep to be cultivated safely. It is subject to severe erosion, even when used for hay or pasture. Slope and slow permeability are the major limitations for most nonfarm uses. (Capability unit VIe–2; woodland suitability group 3c1)

Latham silt loam, 12 to 18 percent slopes, moderately eroded (LaD2).—This soil is on the lower part of narrow slopes that generally are 100 to 200 feet long on the contour of hillsides. It has a lighter colored, more sticky surface layer than that in the profile described as typical for the series. Runoff is very rapid.

Included with this soil in mapping were a few spots of severely eroded soils in which shallow gullies have formed. Also included in mapping were small areas of the Muskingum and Gilpin soils.

This soil is very poorly suited to cultivated crops. A severe hazard of erosion limits the use of this soil even for hay or pasture. The slope is the dominant limitation for most nonfarm uses. (Capability unit VIe–2; woodland suitability group 3c1)

Latham silt loam, 18 to 35 percent slopes (LaF).—This soil occurs as short, narrow strips along hillsides. Locally, it has lost much of its topsoil, and clayey spots occur in areas where the subsoil is exposed. Fragments of weathered shale are common on the surface, and depth to shale bedrock is 30 to 36 inches.

Included with this soil in mapping were small areas of the well-drained Muskingum and Gilpin soils. Also

included in mapping were severely eroded spots where a few shallow gullies have formed.

Steep slopes and a hazard of erosion are the major limitations to use of this soil for most purposes. (Capability unit VIe–2; woodland suitability group 3c1 on north- and east-facing slopes and 4c1 on south- and west-facing slopes)

Licking Series

The Licking series consists of moderately well drained, level to steep soils in the unglaciated south-central part of the county. These soils occur on old terraces along streams that flow southward but are above the present flood plains. They formed in silty clay or clay sediments.

In a typical profile the plow layer is dark-brown silt loam about 7 inches thick. The subsoil, about 57 inches thick, is yellowish-brown silt loam in the uppermost 13 inches. Below this is about 6 inches of yellowish-brown silty clay mottled with light brownish gray and yellowish brown. Between depths of 26 and 44 inches, the subsoil is olive-brown clay that is plastic when wet. Below 44 inches is a layer of light olive-brown, stratified clay, silty clay, and silt loam mottled with grayish brown and light olive brown.

The Licking soils have a deep root zone and high available moisture capacity. The movement of water is very slow below a depth of 20 inches, and during long wet periods the soil material is saturated in the top 20 inches.

These soils are used primarily for pasture and trees, but some of the acreage is used for crops.

Typical profile of Licking silt loam, 2 to 6 percent slopes, in an old meadow in Pike Township, section 17, T. 9 N., R. 8 W. (analytical data in table 10):

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; abundant roots; medium acid; clear, smooth boundary.

B1—7 to 15 inches, yellowish-brown (10YR 5/6) silt loam; moderate, fine and medium, subangular blocky structure; friable; common roots; thin patchy clay films on ped surfaces in lower part of horizon; strongly acid; clear, wavy boundary.

B21t—15 to 20 inches, yellowish-brown (10YR 5/8) heavy silt loam; few, medium, faint mottles of strong brown (7.5YR 5/6); strong, medium, subangular blocky structure; friable; common roots; thin discontinuous clay films on nearly all peds; strongly acid; gradual, wavy boundary.

IIB22t—20 to 26 inches, yellowish-brown (10YR 5/4) silty clay; many, medium, distinct mottles of light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/8) on rinds next to clay flows; moderate, coarse, angular blocky structure; plastic when wet, firm when moist; occasional roots; light yellowish-brown (2.5Y 6/4) clay flow coatings on primary peds; moderate continuous clay films on secondary peds; medium acid; clear, wavy boundary.

IIB31t—26 to 33 inches, olive-brown (2.5Y 4/5) clay; massive (structureless) but breaks to moderate, coarse, angular blocky structure; plastic when wet, firm when moist; occasional roots; light-gray (N 7/0) clay vertical flows; moderate, continuous, olive-gray (5Y 5/2) clay films on ped surfaces; few, fine, black (N 2/0) concretions 2 millimeters in diameter; medium acid; gradual, diffuse boundary.

IIB32t—33 to 44 inches, olive-brown (2.5Y 4/4) clay; massive (structureless) that breaks to moderate, coarse, angular blocky structure; plastic when wet, firm when moist; occasional roots; moderate, continuous, grayish-brown (2.5Y 5/2) and pale-olive (5Y 6/3) clay films on ped surfaces; few, fine, medium, black (N 2/0) concretions; slightly acid; clear, wavy boundary.

IIB&C—44 to 60 inches, light olive-brown (2.5Y 5/6) stratified clay, silty clay, and silt loam; massive (structureless) that breaks to weak, medium, platy structure; few, fine, faint mottles of grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4); no roots; few black (N 2/0) concretions; neutral.

The combined thickness of the Ap, B1, and B21t horizons ranges from 15 to 30 inches. Depth to gray mottling ranges from 15 to 24 inches. In some places the IIB31t and IIB32t horizons are silty clay and are yellowish brown (10YR 5/4) or light olive brown (2.5Y 5/6). Depth to calcareous material ranges from 30 to 80 inches. The B1 horizon is strongly acid or very strongly acid, but acidity decreases with depth.

The Licking soils commonly are adjacent to the lower lying, somewhat poorly drained Fitchville soils and poorly drained Sebring soils. They are also next to the moderately well drained Glenford soils in some places. The Licking soils are more clayey than the Glenford soils, and they have a less acid subsoil.

Licking silt loam, 0 to 2 percent slopes (LcA).—This soil occupies small areas on low-lying terraces. In the profile of this soil, the gray mottles and the clayey material generally are nearer the surface than in the profile described as typical for the series. This soil dries out more slowly in spring than the other Licking soils in the county.

Included with this soil in mapping, in drainageways, were areas of the poorly drained Sebring soils.

Seasonal wetness is the major limitation to use of this soil for cultivated crops. Very slow permeability and seasonal wetness are limitations for many nonfarm uses. Capability unit IIIw–1; woodland suitability group 2c1)

Licking silt loam, 2 to 6 percent slopes (LcB).—This soil occupies terraces in areas of old lakes. It has the profile described as typical for the series, but in some areas the subsoil contains lenses of gravelly material, 2 to 6 inches thick, between the layers of silt loam and the clayey layers. Surface runoff from this soil is rapid, and seep spots are common.

Included with this soil in mapping were small, slightly higher areas of the moderately well drained Glenford soils. Also included in the mapping, in narrow drainageways, were small strips of the poorly drained Sebring soils.

Use of this soil for cultivated crops is limited mainly by a severe hazard of erosion. Very slow permeability is the main limitation for nonfarm purposes. (Capability unit IIIe–5; woodland suitability group 2c1)

Licking silt loam, 6 to 12 percent slopes (LcC).—This soil occurs as bands along small drainageways and in areas next to steep hillsides.

Included with this soil in mapping, in the higher areas, were small areas of the moderately well drained Glenford soils. Also included in the mapping were spots of the moderately well drained Rainsboro soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. Very slow permeability and the slope are the main limita-

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tions for nonfarm uses. (Capability unit IVe–4; woodland suitability group 2c1)

Licking silt loam, 6 to 12 percent slopes, moderately eroded (LcC2).—This soil occupies small irregularly shaped areas adjacent to the larger drainage channels. Its surface layer is lighter colored than that in the profile described as typical for the series. This soil has lost some of its original surface soil through erosion, and its present surface layer is a mixture of the original surface soil and material from the subsoil. A few shallow gullies have formed, but generally they are overgrown with grass. The surface layer is very low in organic-matter content.

A very severe hazard of erosion is the primary limitation to the use of this soil for cultivated crops. The slope and very slow permeability are limitations for many nonfarm uses. (Capability unit IVe–4; woodland suitability group 2c1)

Licking silt loam, 12 to 25 percent slopes, moderately eroded (LcE2).—This soil occurs as long, narrow bands on terrace walls. Its surface layer is dark brown and is about 4 inches thick. Depth to the neutral silty clay or clay is about 30 inches. Gullies, 1 to 2 feet deep, are common in some places.

Included with this soil in mapping were a few small areas of the Rainsboro soils.

This soil is too steep to be used for cultivated crops. A severe hazard of erosion is a limitation to use for hay or pasture. Slope is the dominant limitation for most nonfarm uses. (Capability unit VIe–2; woodland suitability group 2c1)

Linwood Series

The Linwood series consists of very poorly drained, dark-colored, organic soils that occur in small, level and depressional areas in the glaciated part of the county. The native vegetation consists of tamarack, willow, reed, sedges, and other water-tolerant plants.

In a typical profile the uppermost 23 inches is black and dark reddish-brown muck. Below this is a layer of dark-gray silty clay loam about 2 inches thick. Below a depth of 25 inches is grayish-brown, mildly alkaline sandy loam mottled with yellowish brown.

The Linwood soils have a moderately deep root zone in most places when the water table is low. In undrained areas the water table is high most of the year. Permeability is variable, and the available moisture capacity is high.

These soils are not extensive in this county. Drained areas are used for vegetables and other special crops. Undrained areas are wooded or pastured.

Typical profile of Linwood muck on slopes of 0 to 2 percent in a cultivated field in Marlboro Township, section 6, T. 20 N., R. 7 W.:

I—0 to 10 inches, black (10YR 2/1) muck; moderate, fine and medium, granular structure; very friable; common roots; slightly acid; clear, wavy boundary.

2—10 to 23 inches, dark reddish-brown (5YR 2/2) muck; massive (structureless) in place, breaks to weak, thick, platy structure; friable; disintegrated peat; small amount of woody material; medium acid; clear, smooth boundary.

IIC1—23 to 25 inches, dark-gray (10YR 4/1) silty clay loam; massive (structureless); plastic when wet; neutral; clear, smooth boundary.

IIC2—25 to 50 inches, grayish-brown (2.5Y 5/2) sandy loam; common, medium, prominent mottles of yellowish brown (10YR 5/6); massive (structureless); some stratification of silt; few pebbles as much as ¼ inch in diameter; mildly alkaline.

The combined thickness of the muck, or organic layers, over the mineral material ranges from 20 to 40 inches. The lower 13 inches of the muck is black (10YR 2/1) or dark brown (7.5YR 3/2) in some places, and the reaction ranges from medium acid to neutral in this layer. In some places there is no IIC1 horizon, and the layers of muck occur immediately above the moderately coarse textured mineral material. From 10 to 50 percent of the IIC2 horizon consists of coarse fragments.

The Linwood soils are adjacent to the very poorly drained Carlisle and Willette soils. They are similar to the Willette soils but are underlain mainly by coarser textured material. The Linwood soils are shallower to the mineral material than the Carlisle soils.

Linwood muck (0 to 2 percent slopes) (Ld).—This soil occupies level and depressional areas that vary in size and shape. It occurs along small streams and on the outer edge of areas of Carlisle soils. This soil is difficult to drain, and in some areas natural drainage outlets are not available. In some areas the surface layer of this soil contains some mineral material that accumulated at the base of slopes.

Included with this soil in mapping were areas where the muck is less than 18 inches thick and a few areas where it is 40 inches thick.

Wetness limits the use of this soil for farming. The muck tends to subside in drained areas, and it is susceptible to destruction by fire during dry periods. Soil blowing is a hazard in cultivated areas. Wetness and unstable soil material are hazards to use for most nonfarm purposes. (Capability unit IIIw–5; woodland suitability group not assigned)

Lobdell Series

The Lobdell series consists of moderately well drained, nearly level soils on flood plains. These soils formed in recent alluvium that washed from the surrounding uplands.

In a typical profile the surface layer is dark grayish-brown silt loam about 11 inches thick. The subsoil, about 37 inches thick, is brown and very pale brown, friable silt loam mottled with brownish yellow in the lower 26 inches. The underlying material is stratified silt loam and loam.

The Lobdell soils have a deep root zone and high available moisture capacity. Permeability is moderate. These soils have a seasonal high water table for short periods, and they are subject to flooding.

These soils occupy a small total acreage in this county. They are used mostly for crops or pasture.

Typical profile of Lobdell silt loam, alkaline phase, on slopes of 0 to 2 percent in a meadow in Pike Township, section 29, T. 9 N., R. 8 W.:

A1—0 to 11 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and very fine, crumb structure; friable; abundant roots; mildly alkaline; clear, wavy boundary.

B21—11 to 16 inches, brown (10YR 5/3) silt loam; weak, fine and very fine crumb structure; friable; com-

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mon roots; mildly alkaline; diffuse, wavy boundary.

B22—16 to 22 inches, brown (10YR 5/3) silt loam; few, fine, faint mottles of light gray (10YR 7/2); weak, fine and very fine, crumb structure and subangular blocky structure; friable; common roots; neutral; diffuse, wavy boundary.

B3—22 to 48 inches, very pale brown (10YR 7/3) silt loam; common, fine, distinct mottles of brownish yellow (10YR 6/6); weak, very fine, subangular blocky structure; friable; common roots; few black (N 2/0) concretions; neutral.

C—48 to 60 inches, grayish-brown (2.5Y 5/2) stratified silt loam and loam; massive (structureless); friable; neutral.

The A horizon is dark brown (10YR 4/3) in some places. The C horizon contains stratified loam, silt loam, sandy loam, and light silty clay loam. Through the entire profile, the range in reaction is from medium acid to moderately alkaline.

The Lobdell soils in this county are more alkaline than is typical for the series.

The Lobdell soils are the moderately well drained members of the drainage sequence that includes the well drained Chagrin soils, the somewhat poorly drained Shoals soils, the poorly drained Wayland soils, and the very poorly drained Sloan soils. The Lobdell soils are generally next to the Shoals soils and the Chagrin soils. They contain less clay throughout the profile than do the Glenford soils.

Lobdell silt loam, alkaline phase (Le).—This soil occurs as narrow bands, primarily along the Tuscarawas River and Little Sandy Creek.

Included with this soil in mapping were slightly higher areas of sandy soils. Also included in the mapping, in the lower areas, were areas of the somewhat poorly drained Shoals soils and, in the higher areas, were areas of the well-drained Chagrin soils.

Flooding is the major limitation to the use of this soil for farming and for nonfarm purposes. (Capability Unit IIw–5; woodland suitability group 1o1)

Loudonville Series

The Loudonville series consists of moderately well drained and well drained, nearly level to very steep soils that occur mainly in the south-central part of the county. These soils formed in silt loam or loam glacial till underlain by sandstone and siltstone.

In a typical profile the surface layer is dark-brown and yellowish-brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. To a depth of about 14 inches, it is yellowish-brown and dark yellowish-brown silt loam. Below this, and extending to a depth of 23 inches, is dark yellowish-brown and dark-brown loam. The lower part of the subsoil is about 5 inches of dark yellowish-brown gravelly sandy loam. At a depth of about 28 inches is sandstone bedrock that is fractured and creviced in the uppermost 8 to 12 inches; brown loamy sand and dark yellowish-brown sandy loam fill the crevices, and roots penetrate the crevices.

The Loudonville soils have a moderately deep root zone and low to medium available moisture capacity. Permeability is moderate in the subsoil. Water penetrates the fractured sandstone. These soils dry out rapidly in spring, and they are droughty in midsummer.

The Loudonville soils are moderately extensive in this county. The gently sloping and sloping soils are used for cultivated crops, but the steeper soils are pastured or wooded.

Typical profile of Loudonville silt loam, 6 to 12 percent slopes, in an old meadow in Sugar Creek Township, section 29, T. 11 N., R. 10 W.:

A1—0 to 2 inches, dark-brown (10YR 4/3) silt loam with streaks and zones of very dark grayish brown (10YR 3/2) along roots; weak, fine, crumb structure; friable; common small fragments of sandstone; abundant roots; strongly acid; clear, wavy boundary.

A2—2 to 6 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; abundant roots; common small fragments of sandstone; very strongly acid; abrupt, smooth boundary.

B1—6 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; common roots; discontinuous grayish coats of silt on ped surfaces that indicate the removal of the clay; many small stones; very strongly acid; clear, wavy boundary.

B21t—10 to 14 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; moderately firm; common roots; thin discontinuous clay coats at and in structure breaks; many small stones; very strongly acid; gradual, wavy boundary.

B22t—14 to 19 inches, dark yellowish-brown (10YR 4/4) loam; moderate, medium and coarse, subangular blocky structure; moderately firm; few roots; thin discontinuous clay films; common pebbles and small stones; very strongly acid; gradual, wavy boundary.

B23t—19 to 23 inches, dark-brown (10YR 4/3) loam; weak, medium, subangular blocky structure; friable; few roots; thin patchy clay films; common pebbles and small stones; very strongly acid; abrupt, smooth boundary.

IIB3—23 to 28 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; massive (structureless); friable; disintegrated sandstone material surrounding many rock fragments that show horizontal bedding; very strongly acid; clear, smooth boundary.

IIR—28 to 56 inches, fractured, stratified sandstone in beds 2 to 5 inches thick. Variable disintegration of sandstone to brown (10YR 5/3) loamy sand and a few planes or strata of dark yellowish-brown (10YR 4/4) sandy loam; roots penetrate the fractured rock to bottom of cut.

The A horizon ranges from 2 to 20 inches in thickness. The B horizon is yellowish brown (10YR 5/6) or dark brown (7.5YR 4/4) in some places. Texture of the B1 and B2t horizons includes light silty clay loam. The B2t horizon ranges from 10 to 20 inches in thickness, but it averages about 15 inches. Reaction is strongly acid or very strongly acid in the B horizon. From 20 to 70 percent of the lower B horizon and the R horizon consists of coarse fragments. Depth to bedrock ranges from 20 to 40 inches.

The Loudonville soils are commonly next to the well drained Gilpin, Muskingum, and Wooster soils and the moderately well drained Canfield soils. The Loudonville soils are shallower to sandstone bedrock than the Wooster soils, and unlike those soils, they do not have a fragipan. Loudonville soils formed in glacial till over bedrock, but the Gilpin and Muskingum soils formed in residuum from sandstone and siltstone bedrock.

Loudonville silt loam, 2 to 6 percent slopes (LoB).—This soil occurs on high ridges and hilltops, in areas that vary in size and shape. It is well drained.

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Included with this soil in mapping were a few areas of moderately well drained nearly level Loudonville soils that are too small to map separately; these soils are grayer in the subsoil, and generally are deeper to bedrock than this soil. Also included in the mapping were small areas of the well-drained Muskingum and Gilpin soils.

A moderate hazard of erosion is the major limitation to the use of this soil for cultivated crops. Shallowness to bedrock is a limitation for some nonfarm uses. (Capability unit IIe–4; woodland suitability group 2o1)

Loudonville silt loam, 6 to 12 percent slopes (LoC).—This soil occurs mainly on the upper slopes of hillsides, but in some places it is in elongated areas on ridgetops. Most areas are 10 to 40 acres in size, and the slopes generally are no more than 500 feet long. This soil has the profile described as typical for the Loudonville series. Runoff is rapid from this soil.

Included with this soil in mapping were areas of the well-drained Muskingum and Gilpin soils that are generally shallower to bedrock than the Loudonville soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and shallowness to bedrock are limitations for nonfarm uses. (Capability unit IIIe–1; woodland suitability group 2o1)

Loudonville silt loam, 6 to 12 percent slopes, moderately eroded (LoC2).—This soil occupies convex areas on ridgetops and on the lower parts of long slopes. It has a lighter colored, thinner surface layer than that described as typical for the series. There are many pebbles and fragments of sandstone on the surface. Because of past erosion, this soil is very low in organic-matter content and has low available moisture capacity.

Included with this soil in mapping were spots of severely eroded soils in which shallow gullies have formed. Also included in mapping were areas of moderately well drained Loudonville soils that are not so brown as this soil and that contain gray mottles in the subsoil. Other inclusions were small areas of the well-drained Muskingum and Gilpin soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and shallowness to bedrock are limitations to use for many nonfarm purposes. (Capability unit IIIe–1; woodland suitability group 2o1)

Loudonville silt loam, 12 to 18 percent slopes (LoD).—This soil occupies elongated strips around hillsides and along small drainageways. Most areas are 10 to 20 acres in size. Because runoff is very rapid, the hazard of erosion is very severe.

Included with this soil in mapping were small areas of the well-drained Muskingum and Gilpin soils.

A very severe hazard of erosion limits the use of this soil for cultivated crops. The slope and depth to bedrock are limitations for most nonfarm uses. (Capability unit IVe–3; woodland suitability group 2o1)

Loudonville silt loam, 12 to 18 percent slopes, moderately eroded (LoD2).—This soil is on hillsides. Most areas are 10 to 40 acres in size. This soil has a surface layer 2 to 4 inches thick. It has more stone fragments on the surface than the uneroded Loudonville soils. Past erosion has lowered the available moisture capacity and the organic-matter content of this soil.

Included with this soil in mapping were small areas of severely eroded soils in which small gullies and a few deep gullies have formed; bedrock is commonly visible at the bottom of the deep gullies. Also included in mapping were small areas of the well-drained Muskingum and Gilpin soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope, droughtiness, and shallowness to bedrock are limitations to nonfarm uses. (Capability unit IVe–3; woodland suitability group 2o1)

Loudonville silt loam, 18 to 25 percent slopes, moderately eroded (LoE2).—This soil occupies the upper part of wooded hillsides. The slopes are slightly concave and are seldom more than 500 feet long. Most areas range from 10 to 30 acres in size. Erosion is a very severe hazard.

Included with this soil in mapping were spots and small areas of moderately eroded soils that have more fragments of stones on the surface and a thinner surface layer than this soil. Also included in mapping were small areas of the Muskingum and Gilpin soils.

This soil is too steep for cultivated crops, and very severe erosion is a continuous hazard. The slope and droughtiness are limitations to use for hay and pasture. The slope is the dominant limitation for nonfarm uses. (Capability unit IVe–3; woodland suitability group 2r1)

Loudonville silt loam, 25 to 35 percent slopes, moderately eroded (LoF2).—This soil is not extensive in this county. It occurs on hillsides and occupies elongated areas 5 to 10 acres in size. This soil has lost much of its original surface layer through erosion.

Included with this soil in mapping were some areas of very steep Loudonville soils. Also included in mapping were some eroded spots in which shallow gullies and a few deep gullies have formed; sandstone bedrock is visible in the bottom of the deep gullies. Other inclusions were small areas of the Muskingum and Gilpin soils.

Steep slopes and a severe hazard of erosion are the major limitations to most uses of this soil. (Capability unit VIe–3; woodland suitability group 2r1)

Loudonville-Urban land complex, undulating (LuB).—This complex consists of areas of relatively undisturbed Loudonville soils and of areas where the soil material has been disturbed by cutting and filling. Slopes range from 2 to 6 percent. Areas of this complex are well drained or moderately well drained. Sandstone bedrock is dominant in this complex, but shale is at a depth of 20 to 40 inches in places. Water moves through the soil at a moderate rate in areas underlain by sandstone, but it moves at a slow rate in areas where the bedrock is shale.

Shallowness to bedrock is a limitation to use of this complex. In areas underlain by sandstone, pollution of ground water is a danger where septic tanks have been installed. (Capability unit not assigned; woodland suitability group 2o1)

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Loudonville-Urban land complex, rolling (LuC).—This complex occurs mainly in south Canton. In about 75 percent of this complex the soil material has been so severely altered that the soil profile cannot be recognized. Bedrock of sandstone and shale is at a depth of 20 to 40 inches, but sandstone is dominant. Except in areas underlain by shale, water moves readily through the soil material.

On this complex, surface runoff is rapid, and the hazard of erosion is very severe in areas that have been used for construction. Shallowness to bedrock makes excavation difficult and limits the use of this complex for septic tank filter fields. (Capability unit not assigned; woodland suitability group 2o1)

Luray Series

The Luray series consists of very poorly drained, level and nearly level, dark-colored soils. These soils occupy level areas on broad valleys cut by small streams and areas in depressions and drainageways on uplands in the glaciated part of the county. They formed in silt and some clay and sand deposited by water.

A cultivated Luray soil has a very dark gray silty clay loam surface layer about 11 inches thick. The subsoil, about 27 inches thick, is gray and dark-gray silty clay loam mottled with strong brown, dark reddish brown, yellowish red, and dark brown. The underlying material is gray loam mottled with strong brown and light olive brown in the uppermost 10 inches and is dark yellowish-brown silt loam mottled with gray below.

The Luray soils have a deep root zone in drained areas. Available moisture capacity is high. Permeability is moderately slow in the subsoil. These soils have a seasonal high water table for long periods, and unless adequately drained, they are slow to dry out in spring.

The Luray soils are not extensive in this county. Drained areas are used for crops, and undrained areas are wooded or pastured.

Profile of a Luray soil that has a silty clay loam surface layer in an area of Luray silt loam, in cropland in Perry Township, section 24, T. 10 N., R. 9 W. (analytical data in table 10):

Ap1—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; weak, fine and medium, granular structure; friable; abundant roots; slightly acid; clear, wavy boundary.

Ap2—8 to 11 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, subangular blocky structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

B21tg—11 to 13 inches, gray (10YR 5/1) silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and dark reddish brown (5YR 3/4); moderate, medium, subangular blocky structure; firm; abundant roots; slightly acid; clear, wavy boundary.

B22tg—13 to 15 inches, dark-gray (10YR 4/1) silty clay loam; common, medium, distinct mottles of yellowish red (5YR 4/6) and dark brown (7.5YR 4/4); weak, coarse, prismatic structure that breaks to weak, medium, subangular blocky structure; firm; common roots; thin very patchy clay films on vertical ped faces; slightly acid; gradual, wavy boundary.

B23tg—15 to 23 inches, dark-gray (10YR 4/1) silty clay loam; common, medium, distinct mottles of dark brown (7.5YR 3/2) and strong brown (7.5YR 5/6); weak, coarse, prismatic structure that breaks to weak, coarse, angular blocky structure; firm; occasional roots; medium, patchy, dark-gray (N 4/0) clay films on horizontal and vertical ped faces; slightly acid; gradual, wavy boundary.

B24tg—23 to 30 inches, gray (5Y 5/1) silty clay loam; common, medium, prominent mottles of yellowish red (5YR 4/6) and strong brown (7.5YR 5/6); weak, coarse, prismatic structure that breaks to weak, coarse, angular blocky structure; firm; occasional roots; medium, patchy, dark-gray (N 4/0) clay films on horizontal and vertical ped faces; neutral; clear, wavy boundary.

B3tg—30 to 38 inches, dark-gray (10YR 4/1) silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/8); weak, coarse, angular blocky structure; friable; occasional roots; thin, patchy, light-gray (2.5Y 7/2) silt coatings, primarily on vertical ped faces; thin patchy clay films on vertical faces; few pebbles of sandstone; neutral; clear, wavy boundary.

IIC1—38 to 48 inches, gray (5Y 5/1) loam; common, medium, prominent mottles of strong brown (7.5YR 5/6) and light olive brown (2.5YR 5/4); massive (structureless); friable; occasional roots; medium, continuous, very dark gray (N 3/0) clay flows in old root channels; many pebbles as much as 1 inch in diameter; much disintegrated grayish and brownish sandstone; neutral; gradual, wavy boundary.

IIC2—48 to 60 inches. dark yellowish-brown (10YR 4/4) silt loam; many, medium, distinct mottles of gray (5Y 5/1); massive (structureless); friable; occasional roots; medium patchy clay films on horizontal ped faces; few fine pebbles; neutral.

In most places the A horizon is silt loam. It ranges from 11 to 15 inches in thickness. The Ap horizon includes very dark grayish brown (10YR 3/2) in some places. The B2tg horizon ranges from heavy silt loam to silty clay loam and clay loam. Coarse fragments in the lower part of the solum make up 1 to 10 percent of the soil mass. Depth to calcareous material is more than 50 inches. The C horizon is dominantly stratified silt loam, loam, and thin layers consisting of sand and some gravel, and in some places, glacial till.

The Luray soils are the very poorly drained members of the drainage sequence that includes the poorly drained Sebring soils, the somewhat poorly drained Fitchville soils, the moderately well drained Glenford soils, and the well drained Mentor soils. The Luray soils commonly are adjacent to the Sebring and Fitchville soils.

Luray silt loam (0 to 2 percent slopes) (Ly).—This soil occupies long, narrow strips, 5 to 10 acres in size, along drainageways throughout the glaciated part of the county. It also occurs in fairly round areas in low basins where some material is deposited from surrounding areas. This soil has a profile similar to the one described for the series except that it has a silt loam surface layer. It is subject to flooding and ponding, is soft when wet, and has unstable underlying material.

Included with this soil in mapping were areas of a Luray soil that has a silty clay loam surface layer.

Excessive wetness and a seasonal high water table are limitations to use of this soil for most purposes. Drained areas can be used for crops. (Capability unit IIw–6; woodland suitability group 2w1)

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Luray Series, Gravelly Subsoil Variant

In this county the gravelly subsoil variant of the Luray series is similar to typical Luray soils but is underlain by gravelly material at a depth of 25 to 40 inches.

The profile of the gravelly subsoil variant of the Luray series has a plow layer of very dark gray silty clay loam about 8 inches thick. The subsoil, about 26 inches thick, is dark-gray and gray silty clay loam mottled with light olive brown, olive yellow, and dark gray in the uppermost 10 inches. Below this, it is light olive-brown and yellowish-brown silt loam mottled with gray, olive gray, very dark gray, light olive brown, and light brownish gray. To a depth of about 44 inches, the underlying material is dark yellowish-brown gravelly loam mottled with grayish brown and gray. Below this is light brownish-gray very gravelly sandy loam.

Profile of a gravelly subsoil variant of the Luray series that has a silty clay loam surface layer in an area of Luray silt loam, gravelly subsoil variant, in Lake Township, section 20, T. 12 N., R 8 W.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine and very fine, subangular blocky structure; slightly firm when moist, slightly plastic when wet; abundant roots; neutral; abrupt, smooth boundary.

B21tg—8 to 11 inches, dark-gray (5Y 4/1) silty clay loam; few, medium, distinct mottles of light olive brown (2.5Y 5/4); moderate, medium, subangular blocky structure; slightly plastic when wet; common roots; medium continuous clay films on ped faces; slightly acid; clear, wavy boundary.

B22tg—11 to 18 inches, gray (5Y 5/1) silty clay loam; many, medium, distinct mottles of light olive brown (2.5Y 5/4), olive yellow (2.5Y 6/6), and dark gray (5Y 4/1); moderate, medium and coarse, subangular blocky structure; slightly plastic when wet; few roots; medium discontinuous clay films on ped faces; slightly acid; clear, wavy boundary.

B23tg—18 to 28 inches, light olive-brown (2.5Y 5/6) silt loam; many, medium, distinct mottles of gray (5Y 5/1), olive gray (5Y 5/2), and very dark gray (10YR 3/1); weak, coarse, angular blocky structure; friable; few roots; medium clay flows in root channels; thick dark-gray clay coatings in seams; few rounded pebbles; slightly acid; gradual, wavy boundary.

B3tg—28 to 34 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct mottles of gray (5Y 5/1), light olive brown (2.5Y 5/4), and light brownish gray (2.5Y 6/2); weak, coarse, angular blocky structure; friable; few roots; clay enriched nodules as much as 2 inches in diameter; thick continuous clay films on vertical ped faces; 10 percent coarse fragments; neutral; clear, wavy boundary.

IIC1—34 to 44 inches, dark yellowish-brown (10YR 5/6) gravelly loam; many, medium, distinct mottles of grayish brown (2.5Y 5/2) and gray (N 5/0); very weak, thick, platy structure; friable; few roots; 40 percent gravel, by volume; neutral; clear, wavy boundary.

IIC2—44 to 60 inches, light brownish-gray (10YR 6/2) very gravelly sandy loam; massive (structureless); loose; 70 percent coarse fragments; neutral.

In most places the A horizon is silt loam. Depth from the surface to the gravelly material ranges from 25 to 40 inches. Reaction of the B2 horizon is medium acid in some places.

Luray silt loam, gravelly subsoil variant (Lz).—This soil occurs in nearly level and slightly depressed areas on outwash plains and along small streams. Except that it has a silt loam surface layer, this soil has a profile similar to the one described as typical for the gravelly subsoil variant of the Luray series. This soil is soft when wet, but the underlying gravelly material is stable.

Included with this soil in mapping were areas of the gravelly subsoil variant that have a silty clay loam surface layer. Also included in mapping were areas that have only 6 to 10 inches of dark-colored material on the surface. This Luray soil is commonly next to areas of the Weinbach soils, and small areas of Weinbach soils were included in mapping.

Excessive wetness is the major limitation to the use of this soil for most purposes. Drained areas are suited to cultivated crops. (Capability unit IIw–6; woodland suitability group 2w1)

Made Land

Made land (Ma) consists of nearly level areas that have been filled with gravelly and sandy soil material from adjacent terraces and with bricks, cinders, concrete, wood, and other debris. About 75 to 90 percent of these areas have been used for residential and light industrial developments. In more than 90 percent of each area, the original surface layer, consisting of alluvium, has been covered by 3 feet or more of fill material. (Capability unit VIIIs–1; woodland suitability group not assigned)

Mentor Series

The Mentor series consists of well-drained, level to moderately steep soils on terraces and outwash plains. These soils formed in sediments deposited by water.

In a typical profile the plow layer is dark grayish-brown silt loam about 8 inches thick. The subsoil, about 36 inches thick, is dark yellowish-brown silt loam in the uppermost 10 inches. Below this, and extending to a depth of 35 inches, is dark-brown light silty clay loam. The lower part of the subsoil is 9 inches of dark-brown and yellowish-brown silt loam. The underlying material is yellowish-brown loam.

The Mentor soils have a deep root zone and high available moisture capacity. Permeability is moderate or moderately rapid in the subsoil.

These soils are not extensive in this county. Most of the acreage is used for cultivated crops.

Typical profile of Mentor silt loam, 6 to 12 percent slopes, in a meadow in Plain Township, section 10, T. 11 N., R. 8 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; abundant roots; neutral; abrupt, smooth boundary.

B1—8 to 11 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, thick, platy structure that breaks to weak, fine and very fine, subangular blocky structure; friable; common roots; medium acid; gradual, wavy boundary.

B21t—11 to 18 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, subangular blocky structure; friable; common roots; thin, patchy

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clay films on ped faces and thin clay films in pores and voids; strongly acid; gradual, wavy boundary.

B22t—18 to 31 inches, dark-brown (7.5YR 4/4) light silty clay loam; reddish-brown (5YR 4/4) coatings on some ped faces; moderate, medium, subangular blocky structure; friable; common roots; thin, continuous clay films on ped surfaces; strongly acid; gradual, wavy boundary.

B23t—31 to 35 inches, dark-brown (7.5YR 4/4) light silty clay loam; weak, medium and coarse, subangular blocky structure; friable; few, fine, distinct mottles of pale brown (10YR 6/2); clay seams surrounded by rinds of strong brown (7.5YR 5/8); thin continuous clay films on ped surfaces; medium films in voids and pores; few roots; strongly acid; gradual, wavy boundary.

B3—35 to 44 inches, dark-brown (7.5YR 4/4) and yellowish-brown (10YR 5/6) silt loam; massive (structureless); friable; discontinuous, light-gray (10YR 7/1) clay seams with layered rinds of pale brown (10YR 6/3) and strong brown (7.5YR 5/8); thin, dark-brown (7.5YR 3/2) clay films in voids and pores; few roots; strongly acid; gradual, wavy boundary.

C—44 to 50 inches, yellowish-brown (10YR 5/6) loam; massive (structureless); slightly firm; no roots; few light brownish-gray (2.5Y 6/2) clay seams with brownish-yellow (10YR 6/6) rinds; very few, medium, dark-brown (7.5YR 3/2) clay fillings in voids and pores; strongly acid.

The solum ranges from 40 to 60 inches in thickness. In some places the B horizon includes loam or very fine sandy loam. In the B2 horizon the matrix includes yellowish brown and the clay content ranges from 22 to 30 percent. Reaction ranges from slightly acid to very strongly acid in the B horizon and from strongly acid to slightly acid in the C horizon. Depth to calcareous material is more than 60 inches.

The Mentor soils are the well drained members of the drainage sequence that includes the moderately well drained Glenford soils, the somewhat poorly drained Fitchville soils, the poorly drained Sebring soils, and the very poorly drained Luray soils. The Mentor soils are adjacent to the Glenford soils and to the well-drained Chili and Wheeling soils. They formed in silty and some sandy material, whereas the Chili and Wheeling soils are underlain by gravelly and sandy material.

Mentor silt loam, 0 to 2 percent slopes (MeA).—This soil occupies elongated areas between the higher lying Chili soils and the Glenford soils on stream terraces and in lake-laid deposits. Its surface layer is thicker than that in the profile described as typical for the series. This soil is susceptible to crusting. Gravel commonly occurs at a depth of a little more than 4 feet.

Included with this soil in mapping, in spoon-shaped depressions and in small drainageways, were small areas of the somewhat poorly drained Fitchville soils.

This soil is well suited to cultivated crops. Limitations to farming and to most nonfarm uses are few or none. (Capability unit I–1; wodland suitability group 1o1)

Mentor silt loam, 2 to 6 percent slopes (MeB).—This soil is in rounded areas on stream terraces and in areas of water-laid deposits. In some places, on low rises near terraces and outwash plains, glacial till underlies a thick layer of silt. Seams of gravelly material are common below a depth of 4 feet.

Included with this soil in mapping, in small drainageways, were small areas of the somewhat poorly drained Fitchville soils.

On this soil, surface runoff is rapid and the hazard of erosion is moderate in cultivated areas. Limitations for nonfarm uses are few. (Capability unit IIe–1; woodland suitability group 1o1)

Mentor silt loam, 6 to 12 percent slopes (MeC).—This soil occupies crescent-shaped areas that occur at the head of small drainageways, and it is also in areas on the side slopes of drainageways that contain Fitchville soils. It has the profile described as typical for the Mentor series. Runoff is very rapid.

Included with this soil in mapping were small areas of the well-drained, gravelly Chili soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope limits use for nonfarm purposes. (Capability unit IIIe–5; woodland suitability group 1o1)

Mentor silt loam, 12 to 18 percent slopes (MeD).—This soil occupies short slopes along valley walls below the well-drained, gravelly Chili soils. In some areas glacial loam till is below a depth of 42 inches.

Included with this soil in mapping was a small acreage of moderately eroded Mentor soils. Also included in mapping were small areas of the well-drained Chili soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops, and erosion is difficult to control. The slope is the main limitation for most nonfarm uses. (Capability unit IVe–1; woodland suitability group 1o1)

Montgomery Series

The Montgomery series consists of very poorly drained, dark-colored, nearly level soils in low-lying areas throughout the glaciated part of the county. These soils formed in silty clay and clay material of Wisconsin age.

In a typical profile the surface layer is very dark grayish-brown silty clay loam about 5 inches thick. Below this is a layer of black silty clay about 4 inches thick. The subsoil, about 33 inches thick, is very dark gray and gray silty clay that is very sticky and plastic when wet. The underlying material is gray, mildly alkaline or moderately alkaline silty clay loam mottled with olive.

The Montgomery soils have a moderately deep root zone in most places. The available moisture capacity is high within the root zone. Permeability is very slow in the subsoil. The water table is at or near the surface in winter and late in spring.

These soils are not extensive in this county, but areas that have been drained are used mainly for cultivated crops. Undrained areas are pastured or wooded.

Typical profile of Montgomery silty clay loam, in a meadow in Washington Township, section 32, T. 18 N., R. 6 W. (analytical data in table 10):

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silty clay loam; moderate, very fine, subangular blocky structure; firm; abundant roots; slightly acid; clear, wavy boundary.

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A&B—5 to 9 inches, black (N 2/1) silty clay; strong, fine and medium, subangular blocky structure; firm; abundant roots; neutral; clear, wavy boundary.

B1tg—9 to 15 inches, very dark gray (N 3/0) silty clay; moderate, medium and coarse, subangular blocky structure; very plastic and sticky when wet, hard when dry; occasional roots; neutral; gradual, wavy boundary.

B21tg—15 to 26 inches, gray (N 5/0) silty clay; moderate, medium, prismatic structure that breaks to moderate, coarse, subangular blocky structure; very plastic and sticky when wet; occasional roots; root channels 2 millimeters thick and have rinds of yellowish brown (10YR 5/6) that grade to olive gray (5Y 5/2) away from roots; thin continuous clay films on all ped faces and some pressure faces; neutral; diffuse, wavy boundary.

B22tg—26 to 31 inches, gray (N 5/0) silty clay; weak, coarse, prismatic structure; very plastic and sticky when wet; occasional roots; yellowish-brown (10YR 5/4) grading to olive-gray (5Y 5/2) rinds 2 to 3 millimeters thick in root channels; thin continuous clay films on vertical prism faces; neutral; gradual, wavy boundary.

B3tg—31 to 42 inches, dark-gray (5Y 4/1) silty clay; massive (structureless); very plastic and sticky when wet; occasional roots; dark-brown (7.5YR 4/4) rinds in root channels; common black (N 2/0) organic stains; neutral; clear, wavy boundary.

Cg—42 to 60 inches, gray (5Y 5/1) silty clay loam; few, fine, faint mottles of olive (5Y 5/3); massive (structureless); sticky and slightly plastic when wet; no roots; mildly alkaline or moderately alkaline.

The A horizon includes very dark gray (10YR 3/1) and black in some places. There is a thin, black, mucky surface layer in some uncultivated areas. The B2 horizon generally is silty clay, but it is heavy silty clay loam or clay in some places. It ranges from gray (10YR 5/1) to very dark gray (10YR 4/1) to olive gray (5Y 5/2) in color and from 45 to slightly more than 55 percent in clay content. In some places the B3 and C horizons have thin strata of sandy and silty material. Reaction ranges from medium acid to neutral in the B horizon. Depth to calcareous material is 40 to 60 inches.

The Montgomery soils are the very poorly drained members of a drainage sequence that includes the poorly drained Canadice soils. They are adjacent to the Canadice, Carlisle, and Fitchville soils in many places. The Montgomery soils have a more clayey subsoil than the Luray soils. Unlike the Wallkill soils, which are underlain by muck, the Montgomery soils are underlain by mineral soil material.

Montgomery silty clay loam (0 to 2 percent slopes) (Mg).—This soil typically occupies depressions in valleys and swales and drainageways on uplands. It is subject to occasional flooding in spring in areas along the larger streams. Water is ponded in the swales and drainageways during long wet periods.

Included with this soil in mapping were areas of soils that have a silty clay and clay surface layer and are more sticky than this soil. Also included in the mapping were small areas of soils that have 4 to 10 inches of muck on the surface and areas where the dark colored soil material is less than 10 inches thick. Other inclusions were small areas of the Wallkill soils and, on low rises, areas of the light-colored, somewhat poorly drained Fitchville soils.

Excessive wetness is the major limitation to the use of this soil for most purposes. (Capability unit IIIw–6; woodland suitability group 2w1)

Muskingum Series

The Muskingum series consists of well-drained, gently sloping to very steep soils that occur in the unglaciated southern part of the county. These soils formed on sandstone, siltstone, and shale.

In a typical profile the plow layer is brown silt loam about 7 inches thick. To a depth of about 23 inches the subsoil is yellowish-brown silt loam. Below this is a layer of yellowish-brown fine sandy loam that is about 50 percent stone fragments. Beds of fractured sandstone and siltstone are at a depth of about 29 inches.

The Muskingum soils have a moderately deep root zone in most places. The available moisture capacity is low. Permeability is moderately rapid.

These soils are extensive in the southern part of the county. They are used primarily for pasture and trees.

A typical profile of Muskingum silt loam, 6 to 12 percent slopes, in an abandoned meadow in Sandy Township, section 17, T. 17 N., R. 7 W. (analytical data in table 10):

Ap—0 to 7 inches, brown (10YR 4/3) silt loam; weak, fine, crumb structure; very friable; abundant roots; 5 percent skeletal material, by volume; strongly acid; abrupt, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; 10 percent channery fragments, by volume; very strongly acid; diffuse, wavy boundary.

B2—12 to 17 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; patchy, thin accumulation of clay on upper surfaces of some sandstone fragments; 15 percent channery fragments, by volume; common roots; very strongly acid; diffuse, wavy boundary.

B3—17 to 23 inches, yellowish-brown (10YR 5/4) channery silt loam; weak, coarse, subangular blocky structure; friable; thin accumulation of clay on upper side of weathered stone fragments; 30 percent channery fragments, by volume; few roots, very strongly acid; gradual, wavy boundary.

C—23 to 29 inches, yellowish-brown (10YR 5/4) very channery fine sandy loam; weak, medium, subangular blocky structure; friable; thin clay films in some pores; 50 percent channery fragments, by volume; few roots; very strongly acid; clear, wavy boundary.

R—29 to 33 inches, very pale brown (10YR 6/3) beds of sandstone and siltstone 1 or 2 inches thick; fractures are 6 inches deep; vertical and horizontal cracks filled with soil material; no roots.

In uncultivated areas there is an A1 horizon 1 to 4 inches thick and an A2 horizon 3 to 6 inches thick. The B horizon includes loam in some places, and it is yellowish brown (10YR 5/4 to 5/6), dark yellowish brown (10YR 4/4), or strong brown (7.5YR 5/6). The matrix of the B2 and B3 horizons ranges from yellowish brown (10YR 5/4) to brown (7.5YR 4/4). The combined thickness of the B1, B2, and B3 horizons is 15 to 24 inches. Depth to bedrock ranges from 20 to 36 inches. Thin beds of sandstone, siltstone, and some shale occur at a depth of 20 to 36 inches.

The Muskingum soils are near or adjacent to the moderately well drained Tilsit soils and the well drained Wellston and Dekalb soils. The Muskingum soils are less clayey in the subsoil than the nearby Gilpin soils. They are deeper to bedrock and contain fewer stones than the Weikert soils.

Muskingum silt loam, 2 to 6 percent slopes (MsB).—This soil is on ridgetops, and in high benchlike areas,

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and in many places is adjacent to the sandy Dekalb and Ramsey soils. Areas are slightly convex, irregular, and small.

This soil is less droughty than the other Muskingum soils in the county. A moderate hazard of erosion is a limitation to use for cultivated crops. Use for some nonfarm purposes is limited by shallowness to bedrock. (Capabilty unit IIe–4; woodland suitability group 3o1)

Muskingum silt loam, 6 to 12 percent slopes (MsC).—This soil occurs on the crests of narrow ridgetops and on hillsides. It has the profile described as typical for the series.

Included with this soil in mapping were areas of moderately eroded Muskingum soils that have more stones on the surface and a lighter colored surface layer than the uneroded Muskingum soils. Also included in the mapping were a few small areas of severely eroded Muskingum soils that are about 24 inches deep to bedrock. This soil commonly is next to areas of the Dekalb soils and small areas of those soils were included in the mapping.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. Droughtiness is also a hazard. The slope and shallowness to bedrock are limitations for some nonfarm uses. (Capability unit IIIe–3; woodland suitability group 3o1)

Muskingum silt loam, 12 to 18 percent slopes (MsD).—This soil is extensive in the southern half of Osnaburg Township. It occupies elongated areas on hillsides. These areas vary in width.

Included with this soil in mapping were areas of moderately eroded Muskingum soils that are lighter colored and have more stones on the surface than the uneroded soils; there are a few gullies 1 to 3 feet deep in some places. Also included in mapping, in areas where thin strata of clay shale outcrops, were small areas of the moderately well drained Keene soils.

A very severe hazard of erosion and droughtiness are the major limitations to the use of this soil for cultivated crops. The slope and shallowness to bedrock limit use for most nonfarm purposes. (Capability unit IVe–3; woodland suitability group 3o1)

Muskingum and Gilpin silt loams, 18 to 25 percent slopes (MvE).—This mapping unit consists of Muskingum silt loam and Gilpin silt loam that were mapped together, though they do not occur together in all areas mapped. Any area may consist of either the Muskingum soil or the Gilpin soil. Elsewhere in this section, a profile of a Gilpin silt loam is described as typical for the Gilpin series.

The soils in this mapping unit occur as narrow strips that follow the contour of hillsides. The Muskingum soil generally is adjacent to the Dekalb soils. The Gilpin soil is next to the Keene, Latham, or Weikert soils, generally on concave slopes and at the base of slopes.

Included in mapped areas were small areas of the Keene and Weikert soils and areas of moderately eroded soils.

A very severe hazard of erosion and the slope are the major limitations to the use of the soils in this mapping unit for cultivated crops. Shallowness to bedrock and the slope are limitations for most other uses. (Capability unit IVe–3; woodland suitability group 2r1 on north- and east-facing slopes and 3r1 on south- and west-facing slopes)

Muskingum and Gilpin silt loams, 18 to 25 percent slopes, severely eroded (MvE3).—These soils occur on the lower part of hillsides. Any area may consist of either the Muskingum soil or the Gilpin soil. These soils are shallower to bedrock and have more stones on the surface and in the subsoil than is typical of either the Muskingum or Gilpin soils. Erosion has removed most of the original surface layer from the soils in this mapping unit. Shallow gullies are common, and a few deep gullies have formed in some places.

Included in mapped areas were small areas of Weikert soils.

The main limitations to the use of the soils in this mapping unit for farming are the hazard of erosion and the slope. These soils are too steep and droughty for cultivated crops. The slope and shallowness to bedrock are the major limitations to use for nonfarm purposes. (Capability unit VIe–3; woodland suitability group 2r1 on north- and east-facing slopes and 3r1 on south- and west-facing slopes)

Muskingum and Gilpin silt loams, 25 to 35 percent slopes (MvF).—This mapping unit occurs in long, narrow strips that are on the middle part of hillsides and follow the contour of the hill. Any area may consist of either the Muskingum soil or the Gilpin soil. The profiles of both soils are shallower to bedrock than those described as typical for their respective series.

Included in mapped areas were a few areas of moderately eroded and severely eroded Muskingum and Gilpin soils in which shallow gullies are fairly common. Also included in the mapping were small areas of Weikert soils.

The soils in this mapping unit are limited in use mainly by the slope and the hazard of erosion. (Capability unit VIe–3; woodland suitability group 2r1 on north- and east-facing slopes and 3r1 on south- and west-facing slopes)

Muskingum and Gilpin silt loams, 35 to 50 percent slopes (MvG).—These soils are in narrow areas that follow the contour of hillsides. Any area may consist of either the Muskingum soil or the Gilpin soil, but the Muskingum soil is dominant. A few shallow gullies have formed in some places.

Included in mapped areas, where shale outcrops, were small areas of the Latham soils.

A hazard of erosion, droughtiness, and steepness are the major limitations to the use of the soils in this mapping unit for farming and for nonfarm purposes. Because of the slope, the use of machines is difficult and dangerous. (Capability unit VIIe–2; woodland suitability group 2r1 on north- and east-facing slopes and 3r1 on south- and west-facing slopes)

Muskingum and Gilpin-Urban land complex, steep (MwF).—This complex consists of moderately steep and steep Muskingum and Gilpin soils and disturbed

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land. Runoff is very rapid from these soils, and erosion is a very severe hazard. The control of erosion is needed during and following construction so as to reduce siltation of the streams and storm sewers. About one-half of this complex is underlain by sandstone, and the rest is underlain by shale and siltstone. Depth to bedrock generally is 15 to 40 inches.

The slope and shallowness to bedrock are the major limitations to the use of these soils. The steeper areas are mostly wooded. (Capability unit not assigned; woodland suitability group 2r1 on north- and east-facing slopes and 3r1 on south- and west-facing slopes)

Plainfield Series

The Plainfield series consists of well-drained, level to moderately steep soils on terraces and outwash plains in the northwestern and southeastern parts of the county. These soils formed in sand and loamy sand deposited by water.

In a typical profile the plow layer is dark-gray loamy sand about 10 inches thick. The subsoil, about 24 inches thick, is brown and reddish-yellow sand. The underlying material is reddish-yellow gravelly coarse sand.

The Plainfield soils have a moderately deep root zone. Permeability is rapid in the subsoil and the underlying material, and the available moisture capacity is low. Water moves rapidly through these soils, and they dry out quickly in spring.

These soils are not extensive in this county. Except for an area near Bolivar Dam, most of the acreage is used for crops, The area near the dam is not used for farming, because it is subject to flooding when the level of water in the lake is high.

Typical profile of Plainfield loamy sand, 0 to 6 percent slopes, in an old meadow in Pike Township, section 30, T. 9 N., R. 8 W. (analytical data in table 10):

Ap—0 to 10 inches, dark-gray (10YR 4/1) loamy sand; weak, medium and fine, subangular blocky structure that breaks to single grain (structureless); very friable; abundant roots; strongly acid; abrupt, smooth boundary.

B2—10 to 22 inches, brown (7.5YR 4/4) sand; weak, fine and medium, subangular blocky structure that breaks to single grain (structureless); very friable; common roots; few reddish-brown (5YR 4/4) nodules of clay as much as ½ inch in diameter; clay bridging between sand grains; very strongly acid; gradual, wavy boundary.

B3—22 to 34 inches, reddish-yellow (7.5YR 6/8) sand; weak, medium, subangular blocky structure that breaks to single grain (structureless); very friable; occasional roots; very strongly acid; gradual, wavy boundary.

C—34 to 60 inches, reddish-yellow (7.5YR 6/8) gravelly coarse sand; single grain (structureless); loose; no roots; strongly acid.

The Ap horizon includes dark brown (7.5YR 3/2) and (10YR 4/3) and dark yellowish brown (10YR 4/4). The matrix of the B horizon includes strong brown (7.5YR 4/6) and yellowish brown (10YR 5/4 to 5/6), and that of the C horizon is yellowish brown (10YR 5/4) and pale brown (10YR 6/3) in some places. In the B horizon the content of sand ranges from 80 to 90 percent, and in some places the lower part contains few to common, strong-brown (7.5YR 5/6), weakly cemented clay nodules ½ inch to 2 inches in diameter. From 5 to 40 percent of the C horizon consists of coarse fragments. Depth to calcareous material is more than 60 inches.

The Plainfield soils are near the well-drained Conotton, Chili, Wheeling, and Arkport soils. Unlike the Chili, Conotton, and Wheeling soils, which have a silt loam or loam surface layer and subsoil, the Plainfield soils are loamy sand or sand throughout. Plainfield soils do not have alternating light-colored and dark-colored bands as do the Arkport soils, and they are generally more droughty than Arkport soils.

Plainfield loamy sand, 0 to 6 percent slopes (PlB).—This soil occupies small areas northeast of Canal Fulton, northeast of the Hartville Swamp, east of Bolivar Dam, and along Little Sandy Creek north of Waynesburg. It has the profile described as typical for the series, but in areas northeast of the Hartville Swamp, its surface layer and subsoil contain more gravel than do corresponding layers in the profile described as typical.

Included with this soil in mapping were small areas of Wheeling soils.

Droughtiness is a very severe limitation to the use of this soil for farming and for lawns and landscaping. (Capability unit IVs–1; woodland suitability group 2s1)

Plainfield loamy sand, 6 to 12 percent slopes (PlC).—This soil occurs on short, irregularly shaped slopes, mainly along streams and drainageways. Most areas are northeast of Canal Fulton, east of Bolivar Dam, and north of Waynesburg, and they range from 3 to 10 acres in size. This soil has a lighter colored surface layer than that in the profile described as typical for the series. In areas northeast of the Hartville Swamp its surface layer and subsoil contain more gravel than do corresponding layers in the profile described as typical.

Included with this soil in mapping were small areas of the gravelly Conotton soils and a few small areas of Plainfield soils that have slopes as much as 18 percent.

Droughtiness and the hazard of erosion are the major limitations to the use of this soil for farming. Slope, soil texture, and droughtiness are limitations for many nonfarm uses. (Capability unit IVs–1; woodland suitability group 2s1)

Quarries

Quarries (Qu) consist mainly of areas from which sandstone has been mined. Limestone is mined from a few small quarries. (Capability unit not assigned; woodland suitability group not assigned)

Rainsboro Series

The Rainsboro series consists of moderately well drained, gently sloping and sloping soils on terraces in the southern part of the county. These soils formed in silt loam and sandy loam over stratified lacustrine deposits of silty clay loam and silty clay.

In a typical profile the plow layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 40 inches thick. To a depth of about 29 in-

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ches, it is yellowish-brown silt loam mottled with pale brown and strong brown in the lower 12 inches. Below this, and extending to a depth of 48 inches, is a fragipan that is strong-brown silt loam mottled with light brownish gray in the upper part, is dark-brown gravelly loam mottled with grayish-brown in the middle part, and is dark yellowish-brown gravelly sandy loam in the lower part. Coarse fragments of sandstone and shale make up as much as 40 percent of the soil mass in the lower 14 inches of the fragipan. The underlying material is yellowish-brown silty clay loam mottled with gray.

The Rainsboro soils have a moderately deep root zone above the fragipan. The available moisture capacity is medium. Permeability is moderate in the upper part of the subsoil, moderately slow in the fragipan, and slow in the underlying material. These soils have a perched water table above the fragipan in winter and spring.

These Rainsboro soils are not extensive in this county, but most of their acreage is used for cultivated crops.

Typical profile of Rainsboro silt loam, 2 to 6 percent slopes, in a cultivated field in Sandy Township, section 18, T. 17 N., R. 7 W. (analytical data in table 10):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable; abundant roots; neutral; abrupt, smooth boundary.

B21t—8 to 17 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; common roots; medium acid; gradual, wavy boundary.

B22t—17 to 29 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct mottles of pale brown (10YR 6/3) and strong brown (7.5YR 5/8); moderate, medium and coarse, subangular blocky structure; firm; common roots; thin continuous clay flows in some root channels and pores; strongly acid; clear, wavy boundary.

Bx1—29 to 34 inches, strong-brown (7.5YR 5/8) silt loam; many, medium, distinct mottles of light brownish gray (2.5Y 6/2); massive (structureless); brittle; occasional roots; strongly acid; clear, wavy boundary.

IIBx2—34 to 41 inches, dark-brown (10YR 4/3) gravelly loam; many, medium, distinct mottles of grayish-brown (2.5YR 5/2); massive (structureless); brittle; occasional roots; clay bridging between sand grains; common black (N 2/0) stains; 30 percent coarse fragments of highly weathered sandstone and shale; strongly acid; gradual, irregular boundary.

IIBx3—41 to 48 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; massive (structureless); slightly brittle; no roots; clay bridging between sand grains; medium clay films, 3.5 millimeters in diameter, in vesicular pores; 40 percent coarse fragments of highly weathered sandstone and shale; medium acid; clear, smooth boundary.

IIIC—48 to 60 inches, yellowish-brown (10YR 5/6) silty clay loam; common, medium, distinct mottles of gray (N 6/0); stratified lacustrine sediments of silt, clay, and some fine sand; no pebbles; neutral.

In some places the B2t horizon includes silty clay loam, a hue of 7.5YR, and chromas of 4 and 6. The fragipan is at a depth of 22 to 30 inches and includes gravelly clay loam in some places. The C horizon includes silt loam and silty clay in some places. The range in reaction includes very strongly acid in the solum and mildly alkaline in the C horizon.

The moderately well drained Rainsboro soils are the only members of this drainage sequence. They are adjacent to the moderately well drained Glenford soils. Rainsboro soils have a more dense, compact subsoil than Glenford soils and are more gravelly below the subsoil than those soils.

Rainsboro silt loam, 2 to 6 percent slopes (RaB).—This soil occurs on old alluvial terraces, primarily along Pleasant Valley Run in the southeastern part of the county. It has the profile described as typical for the series, but in some places the fragipan is thicker or thinner than that described as typical. The fragipan ranges from 10 to 30 inches in thickness.

Included with this soil in mapping, in drainageways and depressions, were small areas of the poorly drained Sebring soils. Also included in mapping were areas of an unnamed, well-drained soil having slopes of 4 to 6 percent and profile characteristics that are similar to those of the Rainsboro soils.

A moderate hazard of erosion limits the use of this soil for cultivated crops. Seasonal wetness is a limitation for many other uses. (Capability unit IIe–2; woodland suitability group 3w1)

Rainsboro silt loam, 6 to 12 percent slopes (RaC).—This soil occupies elongated strips along small drainageways and at the base of hillsides.

This soil is next to the moderately well drained Glenford and Licking soils, and small areas of either or both of those soils were included in mapping. Also included in mapping were a few moderately eroded spots that have more fragments of sandstone and shale on the surface than the surrounding soils. Other inclusions were small areas of an unnamed, well-drained soil and some eroded areas in which gullies 1 to 3 feet deep have formed.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and seasonal wetness are limitations for many other uses. (Capability unit IIIe–2; woodland suitability group 3w1)

Ramsey Series

The Ramsey series consists of well-drained, sloping to very steep soils that occur in the unglaciated southern part of the county. These soils formed in material weathered from sandstone.

The profile of a typical wooded Ramsey soil has a thin layer of partly decomposed leaf litter on the surface. Below this the surface layer is gray channery sandy loam about 3 inches thick. The subsoil, about 16 inches thick, is strong-brown channery sandy loam in the uppermost 8 inches and is brown very channery sandy loam below. At a depth of 19 inches is light-gray and yellowish-brown, fractured, weathered sandstone that is hard and is very difficult to dig with a spade.

The Ramsey soils have a shallow root zone and very low available moisture capacity. Permeability is rapid. These soils are very droughty.

These soils are not extensive in this county. Most of the acreage is wooded or pastured.

Typical profile of Ramsey channery sandy loam, 18 to 25 percent slopes, moderately eroded, in woodland in Sandy Township, section 27, T. 17 N., R. 7 W.:

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02—½ inch to 0, partly decomposed leaf litter from deciduous oak and hickory.
A1—0 to 3 inches, gray (N 4/0) channery sandy loam; very weak, medium, crumb structure that breaks to single grain (structureless); friable; abundant roots; 40 percent skeletal material, by volume; extremely acid; clear, wavy boundary.
B2—3 to 11 inches, strong-brown (7.5YR 5/6) channery sandy loam; weak, medium, subangular blocky structure that breaks to single grain (structureless); loose and friable; abundant roots; very few, thin, patchy clay films; some weak bridging between sand grains; 50 percent skeletal material, by volume; very strongly acid; clear, wavy boundary.
B3—11 to 19 inches, brown (7.5YR 5/4) very channery sandy loam; weak, fine and medium, subangular blocky structure that breaks to single grain (structureless); loose and friable; common roots; very few clay films; some weak bridging between sand grains; 65 percent skeletal material, by volume; very strongly acid; clear, wavy boundary.
R—19 inches +, light-gray (N 7/0) and yellowish-brown (10YR 5/6) fractured, weathered sandstone; very strongly acid.

The A1 horizon ranges from 2 to 5 inches in thickness. It is very dark grayish brown (10YR 3/2) or black (10YR 2/1) in some places. In addition to 7.5YR the B horizon has a hue of 10YR in some places. Coarse fragments range from about 25 percent in the A horizon to more than 75 percent in the B2 horizon. Reaction ranges from extremely acid to strongly acid in the B horizon. Depth to bedrock ranges from 12 to 20 inches.

The Ramsey soils are adjacent to the well-drained Muskingum, Gilpin, Weikert, and Dekalb soils. They are more sandy than the Muskingum, Gilpin, and Weikert soils. Ramsey soils have more fragments of stones on the surface and in the subsoil than Dekalb soils, and they are shallower to bedrock.

Ramsey channery sandy loam, 6 to 12 percent slopes (RcC).—This soil occurs in convex areas on the top of rounded knolls and in convex, narrow, elongated areas on ridgetops. Its surface layer is thicker than that in the profile described as typical for the series.

This soil commonly is adjacent to the well-drained Muskingum, Gilpin, and Weikert soils, and small areas of those soils were included in mapping.

Use of this soil for farming is limited mainly by the erosion hazard and severe droughtiness. This soil is better suited to hay or pasture than to cultivated crops. Shallowness to sandstone is a limitation to most nonfarm uses. (Capability unit VIs–1; woodland suitability group 4d1 on north- and east-facing slopes, 5d1 on south- and west-facing slopes).

Ramsey channery sandy loam, 12 to 18 percent slopes (RcD).—This soil occupies areas below ridgetops. These areas are about 5 acres in size and are fairly rounded.

Included with this soil in mapping, where siltstone and shale outcrop in the hillsides, were small areas of the Muskingum and Gilpin soils.

The major limitations to the use of this soil for farming are a severe erosion hazard and severe droughtiness. This soil is better suited to hay or pasture than to cultivated crops. The slope and shallowness to bedrock are limitations for most nonfarm uses. (Capability unit VIs–1; woodland suitability group 4d1 on north- and east-facing slopes and 5d1 on south- and west-facing slopes)

Ramsey channery sandy loam, 18 to 25 percent slopes, moderately eroded (RcE2).—This soil occurs in small, irregularly shaped, uniform or slightly convex areas on hillsides. It has the profile described as typical for the series.

Included with this soil in mapping were areas of Ramsey soils that are only slightly eroded, have a less stony surface layer, and are slightly deeper to bedrock than the eroded soils. Also included in the mapping, in areas where outcrops of siltstone and shale occur, were areas of the nearby Muskingum, Gilpin, and Weikert soils.

A very severe hazard of erosion and steepness are the major limitations to use of this soil for all purposes. (Capability unit VIIs–1; woodland suitability group 4d1 on north- and east-facing slopes and 5d1 on south- and west-facing slopes)

Ramsey channery sandy loam, 25 to 50 percent slopes, moderately eroded (RcF2).—This soil occurs on hillsides. It is in strips that follow the contour of the slope.

Included with this soil in mapping were small areas of severely eroded Ramsey soils that have more stones on the surface than this soil. In these areas are a few shallow gullies in which bedrock is exposed. Also included in the mapping, where siltstone and shale outcrop, were areas of the Weikert, Muskingum, and Gilpin soils.

The very severe hazard of erosion and droughtiness are the major limitations to the use of this soil. (Capability unit VIIs-1; woodland suitability group 4d2 on north- and east-facing slopes and 5d1 on south- and west-facing slopes)

Ravenna Series

The Ravenna series consists of somewhat poorly drained, level to sloping soils that occur in broad areas in the glaciated part of the county. These soils formed in loam glacial till of Wisconsin age.

In a typical profile the surface layer is silt loam about 10 inches thick. It is dark grayish brown in the uppermost 8 inches and is grayish brown and mottled with dark yellowish brown in the lower 2 inches. The subsoil is 45 inches thick. To a depth of about 23 inches, it is yellowish-brown silt loam and heavy silt loam that is mottled with light brownish gray, gray, and strong brown and contains more clay than the surface layer. Below this, and extending to a depth of 43 inches, is a yellowish-brown and dark yellowish-brown, firm loam fragipan mottled with grayish brown and strong brown in the uppermost 7 inches. The lower part of the subsoil is 17 inches of yellowish-brown, firm loam.

The Ravenna soils have a moderately deep root zone above the fragipan. Permeability is moderately slow in the fragipan and the underlying glacial till. The available moisture capacity is medium. These soils have a seasonal high water table for significant periods, and unless adequately drained, they are slow to dry out in spring.

These soils are extensive in this county. Most of the acreage is used for cultivated crops, and many acres have been drained.

Typical profile of Ravenna silt loam, 0 to 2 percent

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slopes, in a cultivated field in Tuscarawas Township, section 17, T. 12 N., R. 10 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

A2—8 to 10 inches, grayish-brown (10YR 5/2) silt loam; few, fine, faint mottles of dark yellowish brown (10YR 4/4); weak, thin, platy structure; friable; abundant roots; few black concretions 1 to 3 millimeters in diameter; medium acid; clear, smooth boundary.

B21t—10 to 15 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct mottles of light brownish gray (10YR 6/2); light brownish-gray (10YR 6/2) silt coatings; weak, fine and medium, subangular blocky structure; friable; common roots; thin patchy clay films; very strongly acid; clear, wavy boundary.

B22t—15 to 23 inches, yellowish-brown (10YR 5/4) heavy silt loam; many, medium, distinct mottles of gray (10YR 5/1) and strong brown (7.5YR 5/6); moderate, medium and coarse, subangular blocky structure; friable; common roots; thin, discontinuous, grayish-brown (10YR 5/2) clay films on ped faces; light-gray (10YR 7/1) silt coatings on some ped faces; few dark-gray (N 4/0) clay veins in peds; few pebbles; very strongly acid; gradual, wavy boundary.

Bx1—23 to 30 inches, yellowish-brown (10YR 5/4) loam; many, medium, distinct mottles of grayish brown (10YR 5/2) and strong brown (7.5YR 5/6); weak, coarse, prismatic structure that breaks to moderate, medium, subangular blocky structure; firm, brittle; few roots; few pebbles and stones; thin, discontinuous, gray (10YR 6/1) clay films on ped surfaces and prism faces; dark-gray (N 4/0) clay flows in polygonal seams; very strongly acid; gradual, wavy boundary.

Bx2—30 to 43 inches, dark yellowish-brown (10YR 4/4) loam; weak, coarse, prismatic structure; light-gray (N 7/0) silt coatings on prism faces; dark-gray (N 4/0) clay flows between polygons; firm, brittle; few roots; black stains in prism interiors; few pebbles and stones; very strongly acid; gradual, wavy boundary.

B3—43 to 60 inches, yellowish-brown (10YR 5/4) loam; massive (structureless); firm; no roots; 5 percent, by volume, pebbles and stones; few black concretions 1 to 3 millimeters in diameter; few prisms from Bx2 horizon extend for several inches into this horizon; strongly acid.

Typically, the Ap horizon is dark grayish brown (10YR 4/2), but it ranges from dark gray (10YR 4/1) to dark brown (10YR 4/3). The B2t horizon ranges from 10 to 20 inches in thickness and from silt loam to silty clay loam in texture. The clay content of the B2t horizon is 20 to 30 percent. Depth to the top of the Bx1 horizon (fragipan) is 20 to 30 inches. The Bx1 and Bx2 (fragipan) horizons range from 15 to 30 inches in thickness and include silt loam or very fine sandy loam in some places. Coarse fragments make up 1 to 5 percent of the Bx1 and Bx2 horizons; the polygons range from 5 to 12 inches in diameter. Depth to calcareous material ranges from 60 to 100 inches or more.

The Ravenna soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Canfield soils and the well drained Wooster soils. Ravenna soils are commonly adjacent to the Canfield soils in many places. They have a less clayey subsoil and underlying glacial till than the Wadsworth soils, and they are deeper to limy material than those soils. Ravenna soils contain a dense, compact fragipan in the subsoil, which is lacking in the Fitchville soils.

Ravenna silt loam, 0 to 2 percent slopes (ReA).—This soil is in shallow drainageways and small basinlike depressions. It has the profile described as typical for the series.

Included with this soil in mapping were areas of a Ravenna soil that has more clay in the upper part of the subsoil than is typical of Ravenna soils. Also included, in drainageways, were small areas of a Ravenna soil that has a thicker, darker colored surface layer than that described as typical. Other inclusions were small areas of poorly drained Sebring silt loam, till substratum.

Seasonal wetness is the major limitation to the use of this soil for farming and nonfarm purposes. (Capability unit IIw-2; woodland suitability group 2w2)

Ravenna silt loam, 2 to 6 percent slopes (ReB).—This soil occupies large, irregularly shaped areas. Slopes are uniform and are mainly moderately long.

Included with this soil in mapping were areas of a soil that have more clay in the upper part of the subsoil than is typical of Ravenna soils. Also included, at the base of slopes, were a few small areas of soils that have a dark-colored surface layer 12 to 18 inches thick. This Ravenna soil is commonly next to the moderately well drained Canfield soils and, on convex slopes, small areas of those soils were included in the mapping.

The main limitation to the use of this soil is seasonal wetness, but erosion is a hazard in cultivated or other disturbed areas. (Capability unit IIw-2; woodland suitablilty group 2w2)

Ravenna-Urban land complex (Rn).—This complex occupies areas in cities and towns within the glaciated part of the county. Because the Ravenna soils in this complex have a dense, compact subsoil that restricts the movement of water, areas of this complex tend to dry out slowly in spring. Ponding is likely in the nearly level areas and in depressions. In the gently sloping areas of this complex the hazard of erosion is moderate during and following construction. Because water seeps along the top of the dense, compact subsoil of these soils, basements are wet and roadways are damaged by frost heaving. (Capability unit not assigned; woodland suitability group 2w2)

Remsen Series

The Remsen series consists of somewhat poorly drained, mainly nearly level to gently sloping soils on uplands in the extreme northeastern part of the county. These soils formed in silty clay glacial till of Wisconsin age.

In a typical profile the plow layer is dark grayish-brown silt loam about 7 inches thick. The subsoil, about 29 inches thick, is brown silty clay loam mottled with strong brown and yellowish brown in the upper part; is dark-brown clay mottled with strong brown, yellowish red, and dark red in the middle part; and is dark-brown and yellowish-brown silty clay mottled with strong brown, brown, and gray in the lower part. At a depth of about 36 inches is a layer of dark yellowish-brown silty clay about 10 inches thick. The underlying material is yellowish-brown silty clay glacial till.

The Remsen soils have a moderately deep root zone

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in most places. Permeability is very slow in the subsoil and the underlying glacial till. The available moisture capacity is medium. These soils have a seasonal high water table, and they are slow to dry out in spring.

These soils are not extensive in this county. Most of the acreage is not farmed. Some areas are woodland, and some are strip mined. Some areas north of Alliance are in community development.

Typical profile of a Remsen silt loam, 500 feet south of German Church Street and 220 feet east of Teel Road, 5 miles north of downtown Alliance, in Lexington Township, section 2, T. 19 N., R. 6 W. (analytical data in table 10):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak to moderate, fine and medium, granular structure; friable; many roots; very strongly acid; abrupt, smooth boundary.

B1—7 to 13 inches, brown (10YR 5/3) silty clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4); strong, fine and medium, subangular blocky structure; roots common; few stones 3 to 4 inches in diameter; very strongly acid; clear, wavy boundary.

B21—13 to 16 inches, dark-brown (7.5YR 4/4) clay; many, medium, prominent mottles of strong brown (7.5YR 5/8), yellowish red (5YR 4/8), and dark red (2.5YR 3/6); strong, fine and medium, prismatic structure that breaks to weak, fine and medium, angular blocky structure; sticky when wet; roots common; very strongly acid; clear, wavy boundary.

B22—16 to 24 inches, dark-brown (7.5YR 4/4) silty clay; many, medium, distinct mottles of strong brown (7.5YR 5/8), brown (7.5YR 5/4), and gray (N 6/1); moderate, medium and coarse, prismatic structure; sticky when wet; roots common; very strongly acid; gradual, wavy boundary.

B3t—24 to 36 inches, yellowish-brown (10YR 5/4) silty clay; grayish-brown (2.5Y 5/2) clay coatings; weak, coarse, prismatic structure, in place, that breaks to thick and very thick platy structure and to weak, medium and coarse, blocky structure; sticky when wet; few roots; slightly effervescent in lower part; slightly acid; diffuse, wavy boundary.

B3—36 to 46 inches, dark yellowish-brown (10YR 4/4) silty clay; grayish-brown (2.5Y 5/3) and gray (N 5/1) clay coatings; weak, coarse and very coarse, prismatic structure that breaks to weak, medium and coarse, blocky structure; sticky when wet; no roots; slightly effervescent; moderately alkaline; gradual, diffuse boundary.

C—46 to 72 inches, yellowish-brown (10YR 5/4) silty clay; gray (N 6/0) and grayish-brown (2.5Y 5/2) clay coatings on prism faces; weak, coarse, prismatic structure that breaks to thick and very thick, platy structure; no roots; moderately alkaline.

The Ap horizon ranges from 2 to 12 inches in thickness, and in some places, it is grayish brown (10YR 5/2) or dark gray (10YR 5/1). In many areas there is a thin A2 horizon 1 or 2 inches thick that has a hue of 2.5Y and chroma of 2 or 3. In addition to 10YR and 7.5YR, the B horizon has hues of 2.5Y and 5Y. The clay content of the B2 horizon ranges from 50 to 60 percent. The range in reaction includes strongly acid or extremely acid in the A horizon and the upper part of the B horizon and may be neutral or moderately alkaline in the lower part of the B horizon. Depth to calcareous soil material ranges from 28 to 46 inches.

The Remsen soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Geeburg soils. The Remsen soils are adjacent to the Wadsworth soils in some places, but they are more clayey in their subsoil and underlying till than those soils. Unlike Wadsworth soils, Remsen soils do not have a fragipan. Remsen soils are more clayey than the Fitchville soils.

Remsen silt loam, 0 to 2 percent slopes (RoA).—This soil occurs in depressions in some areas.

Included with this soil in mapping were areas of an unnamed soil that has gravelly material to a depth of 10 to 20 inches. Also included were a few small areas that are underlain by sandstone or shale bedrock at a depth of less than 48 inches. Other inclusions were small areas of the very poorly drained Montgomery soils.

Wetness is the major limitation to the use of this soil for cultivated crops. Seasonal wetness, a high shrink-swell potential, and very slow permeability are limitations for many nonfarm uses. (Capability unit IIIw-1; woodland suitability group 2w2)

Remsen silt loam, 2 to 6 percent slopes (RoB).—This soil occurs in large areas in the northeastern part of Lexington Township.

Included with this soil in mapping were a few small areas of an unnamed soil in which gravelly soil material extends to a depth of 10 to 20 inches. Also included in the mapping, in the vicinity of Klinger Road north of Alliance, were a few small areas in which the soil is underlain by shale bedrock at a depth of 4 or 5 feet. Other inclusions were some spots of a moderately eroded Remsen soil that has a more clayey surface layer than this soil and, in convex areas on knolls, were small areas of the moderately well drained Geeburg soils.

Seasonal wetness is the main limitation to use of this soil for farming, but the hazard of erosion is also a concern in cultivated areas, particularly on long slopes. Seasonal wetness, a high shrink-swell potential, and very slow permeability are limitations to nonfarm uses. (Capability unit IIIw-1; woodland suitability group 2w2)

Remsen-Urban land complex (Rr).—This complex occurs in the northern part of the city of Alliance. It consists of areas of nearly level and gently sloping Remsen soils and of areas where the soil material has been severely altered or disturbed by cutting and filling. In about 75 percent of the area, the soil profile cannot be recognized. The Remsen soils have a very slowly permeable, dense, clayey subsoil, are wet late in spring, and are ponded in some places. Their use for nonfarm purposes is severely limited by the clayey subsoil, a seasonal high water table, and high shrink-swell potential. (Capability unit not assigned; woodland suitability group 2w2)

Rittman Series

The Rittman series consists of moderately well drained, gently sloping and moderately steep soils that occur in the northeastern part of the county. These soil formed in silty clay loam and clay loam glacial till of Wisconsin age.

In a typical profile the plow layer is dark grayish-brown silt loam about 7 inches thick. The subsoil, about 42 inches thick, is mottled pale-brown, yellowish-brown, and brown silt loam in the uppermost 3

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inches. To a depth of about 22 inches is dark-brown and dark yellowish-brown clay loam. Below this, and extending to a depth of 41 inches, is a fragipan that is dark-brown clay loam in the upper part and is dark grayish-brown loam in the lower part. The lower part of the subsoil is 8 inches of dark-brown clay loam. The underlying material is olive-brown clay loam.

The Rittman soils have a moderately deep root zone in most places. The available moisture capacity is medium. Permeability is slow in the subsoil.

These soils are not extensive in this county. Most of the acreage is used for cultivated crops.

Typical profile of Rittman silt loam, 2 to 6 percent slopes, in a meadow, in Lexington Township, section 32, T. 19 N., R. 7 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, coarse, granular structure that breaks to weak, very fine, crumb structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

B1—7 to 10 inches, coarsely mottled pale-brown (10YR 6/3), yellowish-brown (10YR 5/4), and brown (7.5YR 4/4) silt loam; yellowish brown (10YR 5/4) when crushed; moderate, medium, subangular blocky structure; friable; slightly hard when dry; abundant roots; very thin, yellowish-brown (10YR 5/4) clay films on ped faces; 5 percent of horizon is pebbles; strongly acid; abrupt, smooth boundary.

B21t—10 to 17 inches, dark-brown (7.5YR 4/4) clay loam; many, fine, distinct mottles of dark grayish brown (10YR 4/2) and brown (7.5YR 5/4); strong, medium and coarse, angular blocky structure; very firm when moist, slightly plastic when wet; common roots on faces of smaller peds; medium, dark grayish-brown (10YR 4/2) clay films on ped faces; very strongly acid; gradual, wavy boundary.

B22t—17 to 22 inches, dark yellowish-brown (10YR 4/4) clay loam; strong, medium and coarse, angular blocky structure; very firm when moist, slightly plastic when wet; common roots; dark grayish-brown (10YR 4/2) clay films on vertical faces, and dark-brown (10YR 4/3), medium clay films on horizontal faces; black manganese stains on faces of small peds; 5 percent of horizon is pebbles; very strongly acid; gradual, wavy boundary.

Bx1—22 to 27 inches, dark-brown (10YR 4/3) clay loam; moderate, coarse and medium, angular blocky structure within weak coarse prisms; very firm (brittle); few roots; thin, continuous, dark grayish-brown (10YR 4/2) clay films on vertical ped faces, and discontinuous dark-brown (7.5YR 3/2) clay films on horizontal faces; many dark-colored manganese stains on ped faces; 5 percent of horizon is pebbles; very strongly acid; gradual, wavy boundary.

Bx2—27 to 34 inches, dark-brown (10YR 4/3) clay loam; moderate, coarse and medium, angular blocky structure inside of weak, coarse prisms; very firm (brittle) when moist, nonplastic when wet; few roots; thick, dark grayish-brown (10YR 4/2) clay films on vertical faces, and thick, dark-brown (7.5YR 3/2) clay films on horizontal faces; dark-colored manganese stains on horizontal faces; 5 percent of horizon is pebbles; strongly acid; clear, wavy boundary.

Bx3—34 to 41 inches, dark grayish-brown (10YR 4/2) loam; dark brown (10YR 4/3) when crushed; moderate, coarse, angular blocky structure within weak coarse prisms; very firm when moist, slightly plastic when wet; no roots; very thin clay films; many black manganese stains; 5 percent of horizon is pebbles; neutral; clear, smooth boundary.

B3—41 to 49 inches, dark-brown (10YR 4/3) clay loam; moderate, medium, angular blocky structure; firm; no roots; very thin, dark grayish-brown (10YR 4/2) clay films; 5 percent of horizon is pebbles; pieces of unweathered limestone; slightly effervescent; mildly alkaline; clear, wavy boundary.

C—49 to 78 inches, olive-brown (2.5Y 4/4) clay loam; massive (structureless); firm; no roots; gray and yellowish-brown vertical streaks and few clay seams in upper part of horizon; 5 percent of horizon is pebbles; calcareous.

The clay content of the B21t horizon ranges from 27 to 37 percent. Depth to the Bx1 (fragipan) horizon is 18 to 30 inches. In Bx1, Bx2, and Bx3 horizons the polygons range from 5 to 12 inches in diameter and the clay films have hues of 10YR, 7.5YR, and 2.5Y and chromas of 1, 2, and 3. The texture of the C horizon is clay loam, silt loam, or loam. Depth to calcareous material ranges from 36 to 75 inches or more.

The Rittman soils are the moderately well drained members of a drainage sequence that includes the somewhat poorly drained Wadsworth soils, and they are adjacent to those soils in many places. Along the boundary between soil associations 3 and 8, on the general soil map, Rittman soils are commonly adjacent to the moderately well drained Canfield soils. Rittman soils have a more clayey subsoil than Canfield soils and generally are more shallow to limy material.

Rittman silt loam, 2 to 6 percent slopes (RsB).—This soil is on the till plains in the northeastern part of the county, and it generally occurs in slightly convex areas. It has a perched water table late in winter and early in spring. Because runoff is rapid, the hazard of erosion is moderate. This soil has the profile described as typical for the series.

Included with this soil in mapping, on the upper part of slopes, were areas of moderately eroded soils that are lighter colored and contain more pebbles and stone fragments than the uneroded Rittman soils. Also included in mapping, near Woods Lake, were small areas of soils that have a loamy surface layer as much as 18 inches thick. Other inclusions, in small drainageways, were narrow strips of the poorly drained Sebring soils and, in nearly level or slightly concave areas, were small areas of the somewhat poorly drained Wadsworth soils.

A moderate hazard of erosion restricts the use of this soil for farming. Slow permeability and seasonal wetness are limitations for many nonfarm uses. (Capability unit IIe–7; woodland suitability group 1o1).

Rittman silt loam, 6 to 12 percent slopes (RsC).—This soil occupies elongated strips, 5 to 10 acres in size, on short slopes. It receives very little runoff from surrounding areas.

Included with this soil in mapping were a few areas of soils that have a loamy surface layer about 12 inches thick.

A severe hazard of erosion and wetness are the major limitations to use of this soil for farming and for many nonfarm purposes. (Capability unit IIIe-7; woodland suitablility group 1o1)

Rittman silt loam, 6 to 12 percent slopes, moderately eroded (RsC2).—This soil occupies convex areas along drainageways. Its surface layer is lighter colored and thinner than the one in the profile described as typical for the series. There are many pebbles and stone fragments on the surface in some areas where erosion has

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removed most of the original surface soil. This soil receives runoff from higher areas. The hazard of erosion is severe.

A severe hazard of erosion is the major limitation to the use of this soil for farming. The slope, the hazard of erosion, and slow permeability are limitations to many nonfarm uses. (Capability unit IIIe-7; woodland suitability group 1o1)

Rittman silt loam, 12 to 18 percent slopes, moderately eroded (RsD2).—This soil occupies elongated, narrow strips along streams and large drainageways. Its surface layer is only 4 or 5 inches thick.

Included with this soil in mapping were areas of severely eroded Rittman soils that have lost most or all of their original surface soil; in these areas a few U-shaped gullies occur in some places; the depth of the gullies is controlled by the hard, dense fragipan. Also included in mapping were a few wooded areas of uneroded Rittman soils. Other inclusions were a few small areas of well-drained, brown, silty soils.

Use of this soil for farming and for nonfarm purposes is limited mainly by the slope and a severe hazard of erosion. (Capability unit IVe-2; woodland suitability group 1o1)

Sebring Series

The Sebring series consists of poorly drained, nearly level soils on low stream terraces and along drainageways on uplands. These soils formed in sediments deposited by water.

In a typical profile the surface layer is silt loam about 7 inches thick. It is very dark gray in the uppermost 3 inches and is dark gray mottled with dark yellowish brown in the lower 4 inches. The subsoil is 33 inches thick and mottled with light yellowish brown, brown, yellowish brown, and pale olive. To a depth of 16 inches, it is grayish-brown silt loam. Below this is about 24 inches of grayish-brown and gray silty clay loam. The underlying material is gray silt loam mottled with light yellowish brown and yellowish brown.

The Sebring soils have a deep root zone when the water table is low. Permeability is moderately slow in the subsoil, and available moisture capacity generally is high. These soils have a seasonal high water table. They are subject to ponding and to occasional flooding.

These soils are extensive in this county. The drained areas are used for crops, but the undrained areas are commonly in pasture or trees.

Typical profile of Sebring silt loam on slopes of 0 to 2 percent in idle land in Sugar Creek Township, section 29, T. 11 N., R. 10 W.:

A1—0 to 3 inches, very dark gray (10YR 3/1) silt loam; moderate, medium and coarse, granular structure; friable; abundant roots; strongly acid; clear, smooth boundary.

A2—3 to 7 inches, dark-gray (10YR 4/1) silt loam; few, fine, faint mottles of dark yellowish brown (10YR 4/4); moderate, medium and coarse, granular structure; friable; abundant roots; very strongly acid; clear, smooth boundary.

B1g—7 to 16 inches, grayish-brown (2.5Y 6/2) silt loam; common, medium, faint mottles of light yellowish brown (2.5Y 6/4); moderate, medium, subangular blocky structure; friable; common roots; very strongly acid; clear, wavy boundary.

B21tg—16 to 24 inches, grayish-brown (2.5Y 6/2) light silty clay loam; common, medium, distinct mottles of yellowish brown (10YR 5/6) and brown (10YR 5/3); moderate, medium, subangular blocky structure; friable; few roots; thin discontinuous clay films on most ped faces; strongly acid; gradual, wavy boundary.

B22tg—24 to 30 inches, gray (5Y 5/1) silty clay loam; common, medium and coarse, distinct mottles of light yellowish brown (2.5Y 6/4) and yellowish brown (10YR 5/8); moderate, coarse, angular blocky structure; firm when moist, slightly sticky when wet; few roots; thin discontinuous clay films on ped faces; thin, dark-brown (7.5YR 4/4) stains on some ped faces; strongly acid; gradual, wavy boundary.

B3tg—30 to 40 inches, gray (5Y 5/1) light silty clay loam; many, medium and coarse mottles of yellowish brown (10YR 5/8) and pale olive (5Y 6/3); weak, medium, subangular blocky structure; firm; few roots; thin, patchy clay films on ped faces; medium acid; gradual, wavy boundary.

C—40 to 60 inches, gray (N 6/0) silt loam; common, medium, distinct mottles of light yellowish brown (2.5Y 6/3) and yellowish brown (10YR 5/6); massive (structureless); friable; no roots; few pebbles; neutral.

The A horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2) in uncultivated areas. It ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) or grayish brown (10YR 5/2) in cultivated areas. The matrix of the B horizon ranges from grayish brown (2.5Y 6/2) to gray (5Y 5/1, N 5/0, or N 6/0) or dark gray (5Y 4/1). The Bt horizon is at a depth of 14 to 30 inches and ranges from silt loam to silty clay loam. Typically, the clay content of the Bt horizon is about 30 percent, but it ranges from 27 to 35 percent. In some places the C horizon is stratified and ranges from fine silty clay loam to sandy loam. Reaction ranges from very strongly acid to medium acid or neutral in the B and C horizons.

The Sebring soils are the poorly drained members of a drainage sequence that includes the very poorly drained Luray soils, the somewhat poorly drained Fitchville soils, the moderately well drained Glenford soils, and the well drained Mentor soils. The Sebring soils are commonly next to the Fitchville soils throughout the county. Their subsoil is not so clayey as that of the Canadice soils. The Sebring soils are more silty in their subsoil and underlying material than are the poorly drained Ginat soils.

Sebring silt loam (0 to 2 percent slopes) (Sb).—This soil is on uplands in the glaciated part of the county. It occurs on outwash plains and in basinlike areas and blocked drainageways. This soil has the profile described as typical for the series.

Included with this soil in mapping, in low areas, were small areas of soils that have a silty clay loam surface layer and are slightly sticky. Also included in mapping were a few slightly higher areas of the somewhat poorly drained Fitchville soils.

Excessive wetness is the major limitation to the use of this soil for most purposes. (Capability unit IIIw–4; woodland suitability group 1w1)

Sebring silt loam, till substratum (Se).—This soil occurs in concave areas in shallow drainageways and in wide broad basinlike areas on the glacial till plain. Its profile is similar to the one described as typical for the series, but it contains loamy glacial till below a depth of 40 inches.

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Included with this soil in mapping were small areas of a soil that contains a weak fragipan and is better drained than this Sebring soil. Also included in the mapping were small areas of the moderately well drained Canfield soils.

Use of this soil for farming and for most nonfarm purposes is limited mainly by excessive wetness. (Capability unit IIIw–4; woodland suitability group 1w1)

Sebring-Urban land complex (Sg).—This complex occurs in drainageways and on low stream terraces. It consists of the poorly drained, nearly level Sebring soils and of disturbed land that includes some areas of dark-colored, very poorly drained soils and of areas in which the soil profile cannot be recognized.

Use of this complex for nonfarm purposes is limited mainly by a seasonal high water table and ponding. Buildings constructed on the Sebring soils have wet foundations unless adequate drainage is provided. (Capability unit not assigned; woodland suitability group 1w1)

Shoals Series

The Shoals series consists of somewhat poorly drained, level to gently sloping soils on bottom lands along the perennial streams and the Tuscarawas River. These soils formed in recent alluvium washed from the uplands.

In a typical profile the plow layer is dark-brown silt loam about 9 inches thick. The subsoil, about 33 inches thick and mottled with brownish yellow and dark gray, is light-gray silt loam in the uppermost 15 inches and is light-gray loam below. The underlying material is stratified silt loam, sandy loam, and light silty clay loam.

The Shoals soils have a deep root zone when the water table is low. The available moisture capacity is high. These soils have a seasonal high water table, mainly late in winter and in spring. They are subject to flooding.

These soils are the dominant soils on bottom lands in this county. Most of their acreage is used for cultivated crops and pasture, but some narrow areas along the perennial streams are used for woodlots or are pastured.

Typical profile of a Shoals silt loam on slopes of 0 to 2 percent in a cultivated field in Bethlehem Township, section 16, T. 9 N., R. 9 W.:

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, very fine and fine, crumb structure; friable; abundant roots; neutral; clear, smooth boundary.

B21g—9 to 24 inches, light-gray (10YR 7/2) silt loam; many, medium, distinct mottles of brownish yellow (10YR 6/6) and dark gray (10YR 4/1); weak, fine, subangular blocky structure that breaks to moderate, fine, crumb structure; friable; abundant roots; common black concretions; mildly alkaline; clear, wavy boundary.

B22g—24 to 42 inches, light-gray (10YR 7/2) loam; many, medium, distinct mottles of dark gray (10YR 4/1) and brownish yellow (10YR 6/6); weak, fine, subangular blocky structure; friable; few roots; common black concretions; mildly alkaline; gradual, wavy boundary.

C—42 to 60 inches, stratified silt loam, sandy loam, and light silty clay loam; mildly alkaline.

The A horizon includes dark grayish brown (10YR 4/2) and brown (10YR 4/3) in some places. In addition to light gray (10YR 7/2), the matrix of the B horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2) in some places. The content of coarse fragments in the B22g horizon generally is less than 5 percent but ranges from 1 to 10 percent. Reaction ranges from medium acid to moderately alkaline throughout the profile.

The Shoals soils are the somewhat poorly drained members of a drainage sequence that includes the well drained Chagrin soils, the moderately well drained Lobdell soils, the poorly drained Wayland soils, and the very poorly drained Sloan soils, and in some places they are adjacent to any one of those soils. The Shoals soils are less clayey throughout the profile than the somewhat poorly drained Fitchville soils.

Shoals silt loam (0 to 2 percent slopes) (Sh).—This soil occurs as long bands along the perennial streams. It lies just above the dark-colored Sloan soils and the Wayland soils.

Included with this soil in mapping were small areas of a soil that has a loam surface layer; these included areas were above the Shoals soils, and they occupy about 100 areas in the county. Also included in mapping, in depressions, were small areas of the poorly drained Wayland soils and small areas of the very poorly drained Sloan soils.

A hazard of flooding is the major limitation to the use of this soil for farming and for nonfarm purposes. (Capability unit IIw–3; woodland suitability group 2w2)

Sloan Series

The Sloan series consists of very poorly drained, nearly level, dark-colored soils on bottom lands. These soils formed in recent alluvium that washed from soils at a higher elevation.

In a typical profile the surface layer, about 17 inches thick, is very dark gray silt loam in the uppermost 13 inches and is dark-gray heavy silt loam mottled with light olive brown and yellowish brown below. The subsoil, about 21 inches thick, is dark grayish-brown heavy silt loam mottled with yellowish brown in the upper part and is light brownish-gray loam mottled with strong brown in the lower part. The underlying material is grayish-brown loam mottled with light olive brown.

The Sloan soils have a deep root zone when the water table is low. The available moisture capacity is high. The water table is high much of the year, and it is at or near the surface late in winter and in spring. These soils are subject to flooding.

In this county the Sloan soils are moderately extensive. Most of the acreage is used for pasture, trees, or an occasional crop.

Typical profile of a Sloan silt loam on slopes of 0 to 2 percent in a cultivated field in Bethlehem Township, section 22, T. 9 N., R. 9 W.:

A11—0 to 13 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; abundant roots; neutral; gradual, wavy boundary.

A12—13 to 17 inches, dark-gray (10YR 4/1) heavy silt loam; many, medium, distinct mottles of light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6); weak, medium, angular blocky structure that

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breaks to massive (structureless); friable; common roots; neutral; clear, wavy boundary.

B21g—17 to 25 inches, dark grayish-brown (2.5Y 4/2) heavy silt loam; many, medium, distinct mottles of yellowish brown (10YR 5/6); massive (structureless) but breaks to weak, coarse, subangular blocky structure; friable; common roots; neutral; gradual, diffuse boundary.

IIB22g—25 to 38 inches, light brownish-gray (2.5Y 6/2) loam; common, fine, distinct mottles of strong brown (7.5YR 5/8); massive (structureless); friable; occasional roots; few, fine, black (N 2/0) concretions; neutral; gradual, diffuse boundary.

IICg—38 to 50 inches, grayish-brown (10YR 5/2) loam; few, fine, faint mottles of light olive brown (2.5Y 5/4); massive (structureless); very friable; no roots; few black (N 2/0) concretions and stains; neutral.

The A11 horizon is very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), or black (10YR 2/1), and it ranges from 10 to 15 inches in thickness. The clay content of the A12 and B2 horizons is 20 to 30 percent. The C horizon is heavy silt loam and sandy loam in some places. Reaction ranges from medium acid to moderately alkaline.

The Sloan soils are the very poorly drained members of a drainage sequence that includes the well drained Chagrin soils, the moderately well drained Lobdell soils, the somewhat poorly drained Shoals soils, and the poorly drained Wayland soils. They are commonly adjacent to the Shoals soils. Sloan soils are similar to the Luray soils, but they occupy lower positions and are less clayey than those soils.

Sloan silt loam (0 to 2 percent slopes) (Sl).—This soil occupies slightly concave areas along most of the streams in the county. It occurs mainly in old oxbows and abandoned channels of the Tuscarawas River and its tributaries. Because of its low-lying position, this soil tends to accumulate soil material.

Included with this soil in mapping were a few areas of Sloan soils that have a sticky silty clay loam surface layer. Also included in mapping were small areas of the poorly drained Wayland soils.

Excessive wetness and the hazard of flooding are the major limitations to use of this soil. (Capability unit IIIw–3; woodland suitability group 2wl)

Strip Mine Spoil

Strip mine spoil consists of sandstone and shale material, acid clay shale material, and nonacid glacial till, sandstone, and limestone material. This material has been piled up during strip mine operations. These areas occur in the hilly parts of Stark County. The gradient in these areas is undulating, rolling, and steep. Little or no soil has developed on the unconsolidated material. The spoil varies in acidity; it is extremely acid and is toxic to plants in some areas.

Most areas of Strip mine spoil can be used for pasture, hay, or trees.

Strip mine spoil, sandstone and shale materials, undulating (SoC).—This spoil occurs in nearly level to sloping areas that have been strip mined. Some areas have been partly leveled. Runoff is rapid, and the hazard of erosion is severe unless a protective plant cover is established. This spoil contains a moderate amount of plant nutrients. In some areas the spoil has a pH value of less than 3.5 and is toxic to plants.

In most places this spoil is suited to the pasture and meadow plants that are commonly grown on the surrounding soils that are not strip mined. There are numerous stones in some small areas that may interfere with the use of machinery, and these areas are better suited to trees than to pasture and meadow. The main limitation to the use of this material is the hazard of erosion in bare areas. Establishing a cover of vegetation is the major concern of management. (Capability unit VIs–2; woodland suitability group not assigned)

Strip mine spoil, sandstone and shale materials, rolling (SoE).—This spoil is mainly moderately steep and steep, but a few areas are hummocky and have sharp peaks. Runoff is rapid in bare areas, and erosion is a severe hazard. This material contains a moderate amount of plant nutrients.

This material is suited to the pasture plants and trees commonly grown in the county, but the numerous stones that are on the surface of a few small areas hinder the operation of machinery. The main limitations to the use of this spoil are the severe hazard of erosion and the limited amount of fine material on the surface. Establishing pasture plants or trees is the main concern of management. (Capability unit VIs–2; woodland suitability group not assigned)

Strip mine spoil, sandstone and shale materials, steep (SoF).—This material occurs in very steep areas. Runoff is rapid, and erosion is a very severe hazard in bare areas. The spoil contains a moderate amount of plant nutrients. The pH value is 3.5 or lower in a few areas, and the spoil is toxic to plants.

This material is suited to pine and black locust trees. Steepness and a very severe hazard of erosion are the major limitations to use of this spoil. Establishing trees and controlling erosion are the main concerns of management. (Capability unit VIIs–2; woodland suitability group not assigned)

Strip mine spoil, acid clay shale materials, undulating (SsC).—This spoil material occurs in nearly level, gently sloping, and sloping areas. Cracks form in this clayey material when it is dry, and revegetation of this kind of spoil is more difficult than on any of the other spoil material in the county. About 50 percent of this spoil material has a pH value of less than 3.5 and is toxic. Only acid-tolerant plants are suited to this kind of spoil. The hazard of erosion is the main limitation to use of this kind of spoil. (Capability unit VIIs–2; woodland suitability group not assigned)

Strip mine spoil, acid clay shale materials, rolling (SsE).—This land type consists of moderately steep and steep, acid, clay shale material that contains a moderate amount of plant nutrients. This material is slow to dry, and cracks form when it is dry. In some places this spoil has a pH value of less than 3.5 and is toxic to plants. These areas make up about 15 percent of the area mapped.

The hazard of erosion is severe on this spoil material. Volunteer plants grow very slowly, and until a protective cover is established, erosion removes the surface material and the small plants growing on it. Trees and pasture can be established on this material.

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(Capability unit VIIs–2; woodland suitability group not assigned)

Strip mine spoil, acid clay shale materials, steep (SsF).—This land type consists of very steep spoil banks of acid clay shale material. Runoff is rapid, and erosion is a very severe hazard in bare areas. This spoil contains a moderate amount of plant nutrients. About 40 percent of the area mapped consists of material that has a pH value of less than 3.5 and is toxic to plants.

Steepness and a very severe hazard of erosion are the main limitations to use of this land. Establishing trees and controlling erosion on the spoil banks are main concerns of management.

Areas consisting of this kind of spoil can be revegetated by planting pine and black locust trees. (Capability unit VIIs–2; woodland suitability group not assigned)

Strip mine spoil, nonacid materials, undulating (StC).—The spoil banks that make up this land type consist of glacial till, sandstone, and siltstone material. The gradient ranges from nearly level to sloping. This spoil material is nonacid, has a moderate to high content of plant nutrients, and is not toxic to plants. Vegetation is more easily established on this kind of spoil than on the other spoil material in this county.

A hazard of erosion in bare areas is the major limitation to the use of this spoil material, and establishing a plant cover of any kind is the main concern of management.

This spoil material is moderately well suited to the pasture and meadow plants commonly grown in the county. (Capability unit VIs–2; woodland suitability group not assigned)

Strip mine spoil, nonacid materials, rolling (StD).—This land type consists of glacial till, sandstone, and limestone spoil material. The gradient is moderately steep or steep. There are some small, hummocky areas of glacial till on irregular slopes, and about 10 percent of the area mapped has very irregular slopes. This spoil material is nonacid and contains moderate amounts of plant nutrients. Runoff is rapid, and erosion is a severe hazard unless a cover of vegetation is maintained on the spoil banks.

This land type is moderately well suited to permanent pasture and trees. The pasture plants and the trees that are commonly grown in the county are suitable for planting. (Capability unit VIs–2; woodland suitability group not assigned)

Strip mine spoil, nonacid materials, steep (StF).—This land type occurs on the very steep part of strip mines. It consists of glacial till, sandstone, and limestone spoil material. This material is stony in some areas. Runoff is rapid, and erosion is a very severe hazard in bare areas. This spoil material is nonacid and has a moderate to high content of plant nutrients.

Controlling erosion and establishing trees are the main concerns in managing these strip-mined areas. Black locust and pines are suitable trees for planting. (Capability unit VIIs–2; woodland suitability group not assigned)

Tilsit Series

The Tilsit series consists of moderately well drained, sloping to moderately steep soils that occur in the unglaciated southeastern part of the county. These soils formed on stratified sandstone, siltstone, and shale.

In a typical profile the plow layer is dark-brown silt loam about 7 inches thick. The subsoil is about 34 inches thick. To a depth of about 23 inches, it is yellowish-brown silt loam and heavy silt loam. Below this, and extending to a depth of 34 inches, is a yellowish-brown silty clay loam fragipan that is mottled with grayish brown and yellowish red. The lower part of the subsoil is 7 inches of yellowish-brown silt loam mottled with light brownish gray and strong brown. The underlying material is brown silt loam that is mottled with gray and brownish yellow and contains coarse fragments. Stratified sandstone, siltstone, and shale is at a depth of 47 inches.

The Tilsit soils have a moderately deep root zone. The available moisture capacity is medium. Permeability is moderate in the upper and lower parts of the subsoil and in the underlying material, but it is slow in the fragipan. The water table is high late in winter and early in spring.

These soils are not extensive in this county. They are used primarily for cultivated crops.

Typical profile of Tilsit silt loam, 6 to 12 percent slopes, in a meadow in Paris Township, section 33, T. 17 N., R. 6 W.:

Ap—0 to 7 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, crumb structure; friable; abundant roots; strongly acid; abrupt, smooth boundary.

B1—7 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, subangular blocky structure; friable; abundant roots; few small fragments of stone; strongly acid; clear, wavy boundary.

B2t—12 to 23 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable when moist, slightly sticky when wet; common roots; thin discontinuous clay films on ped faces; few coarse fragments; strongly acid; clear, wavy boundary.

Bx—23 to 34 inches, yellowish-brown (10YR 5/6) silty clay loam; few, medium, distinct mottles of grayish brown (10YR 5/2) and yellowish red (5YR 4/6); moderate, medium and coarse, angular blocky structure; firm, slightly brittle; very few roots; thin discontinuous clay films on ped faces and in old root channels; some dark stains of manganese; few coarse fragments; strongly acid; gradual, wavy boundary.

B3—34 to 41 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct mottles of light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8); moderate, medium and coarse, angular blocky structure; firm; very few roots; few, thin, patchy clay films on some ped faces; many dark concretions of manganese; 15 percent, by volume, coarse fragments of siltstone and sandstone; strongly acid; clear, wavy boundary.

C—41 to 47 inches, brown (10YR 5/3) channery silt loam; common, fine and medium, distinct mottles of gray (10YR 6/1) and brownish yellow (10YR 6/6); weak, medium and coarse, angular blocky structure; friable; few dark stains of manganese on stone surfaces; no roots; 40 percent coarse fragments; strongly acid; clear, wavy boundary.

R—47 inches +, stratified sandstone, siltstone, and shale.

The silty mantle ranges from 1 to 2 feet in thickness. The

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fragipan occurs at depths ranging from 18 to 24 inches; it is weakly to moderately developed, but it is typically weak. The matrix of the B2t horizon ranges from strong brown (7.5YR 5/16) to yellowish brown (10YR 5/6) to dark yellowish brown (10YR 4/4). Reaction is very strongly acid or strongly acid in the solum. The coarse fragments in the upper part of the solum make up 5 to 10 percent of the soil mass. Depth to bedrock ranges from 3 to 5 feet.

The Tilsit soils are near, or adjacent to the well-drained Wellston, Muskingum, and Gilpin soils. Unlike the Keene soils, the Tilsit soils have a fragipan in their subsoil, and they are less clayey in their subsoil than those soils. The Tilsit soils formed in residuum derived from sandstone, siltstone, and shale, whereas the Canfield soils formed in glacial till.

Tilsit silt loam, 6 to 12 percent slopes (TlC).—This soil occupies elongated, small, concave areas at the base of steep hillsides. It has the profile described as typical for the series.

Included with this soil in mapping were areas of an unnamed, poorly drained soil. Also included in the mapping were small areas of gently sloping Tilsit soils that were too small to map separately.

A severe hazard of erosion is the major limitation to the use of this soil for farming. This soil also dries out slowly in spring. Slow permeability and the slope are the main limitations for many nonfarm uses. (Capability unit IIIe–2; woodland suitability group 3w2)

Tilsit silt loam, 12 to 18 percent slopes (TlD).—This soil occurs at the base of hillsides and in concave areas on uplands. Its surface layer generally is thinner than that in the profile described as typical for the series. Runoff is very rapid.

Included with this soil in mapping were areas of moderately eroded Tilsit soils. Also included in the mapping, on concave slopes, were small areas of the well-drained Wellston soils.

A very severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope is the dominant limitation to use for most nonfarm purposes. (Capability unit IVe–2; woodland suitability group 3w2)

Trumbull Series

The Trumbull series consists of poorly drained, nearly level soils on uplands in the northeastern part of the county. These soils formed in silty clay glacial till of Wisconsin age.

In a typical profile the surface layer is gray silt loam about 6 inches thick. The subsoil is about 36 inches thick. It is light-gray and pale-brown silty clay loam in the uppermost 6 inches. Below this, and extending to a depth of 42 inches, is light-gray, yellowish-brown, gray, brownish-yellow, dark-gray, and olive-gray, firm clay mottled with yellowish brown, gray, brownish yellow, grayish brown, light gray, and light yellowish brown. The underlying material is olive-gray, firm, mildly alkaline silty clay mottled with grayish brown and light yellowish brown.

The Trumbull soils have a moderately deep root zone in most places. The available moisture capacity is medium. Permeability is slow in the subsoil and the underlying glacial till. These soils have a seasonal high water table for fairly long periods, and they are slow to dry out in spring.

The Trumbull soils are not extensive in this county. Most of the acreage is woodland or is pastured (fig. 12).

Typical profile of Trumbull silt loam on slopes of 0 to 2 percent in a wooded area in Lexington Township, section 2, T. 19 N., R. 6 W.:

A11—0 to 3 inches, gray (10YR 5/1) silt loam; moderate, medium, granular structure; friable; abundant roots; dark-gray (10YR 4/1) organic leaf mulch; fine roots; extremely acid; gradual, wavy boundary.

A12—3 to 6 inches, gray (10YR 6/1) silt loam; moderate, medium and fine, subangular blocky structure; friable; common roots; extremely acid; gradual, wavy boundary.

B1g—6 to 12 inches, light-gray (N 6/0) and pale-brown (10YR 6/3) silty clay loam; gray (N 6/0), yellowish-brown (10YR 5/6), and brownish-yellow (10YR 6/8) mottles on ped interiors; moderate, medium and fine, subangular blocky structure; slightly plastic when wet; common roots; extremely acid; gradual, wavy boundary.

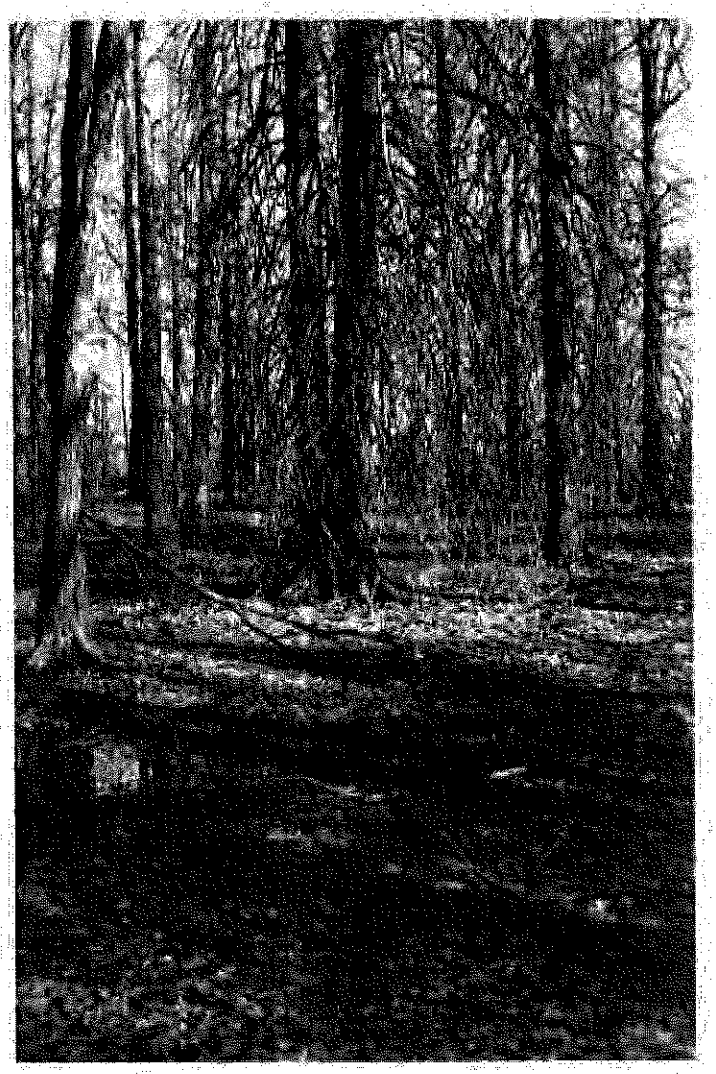

Figure 12.—Stand of pin oaks on Trumbull silt loam.

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B21tg—12 to 17 inches, light-gray (N 6/0) and yellowish-brown (10YR 5/4) clay; medium, distinct mottles of gray (N 6/0), yellowish brown (10YR 5/6), and brownish yellow (10YR 6/8) on ped interiors; strong, medium and coarse, angular blocky structure; firm when moist, plastic when wet; common roots; thin continuous clay films on ped faces; few pebbles; very strongly acid; gradual, wavy boundary.

B22tg—17 to 29 inches, gray (10YR 5/1) and brownish-yellow (10YR 6/6) clay; fine, distinct mottles of gray (10YR 5/1) and brownish yellow (10YR 6/6) on ped interiors; strong, medium and coarse, angular blocky structure; firm when moist, plastic when wet; common roots; thin continuous clay films on ped faces; pebbles 1 to 2 percent, by volume; medium acid; gradual, wavy boundary.

B23tg—29 to 33 inches, dark-gray (10YR 4/1) and gray (10YR 6/1) clay; fine, distinct mottles of grayish brown (10YR 5/2), yellowish brown (10YR 5/4), and light gray (10YR 6/1) on ped interiors; strong, medium, angular blocky structure; firm when moist, plastic when wet; few roots; few, thin, discontinuous clay films; pebbles 1 to 2 percent, by volume; neutral; clear, wavy boundary.

B24tg—33 to 42 inches, olive-gray (5Y 5/2) clay; many, medium, distinct mottles of light yellowish brown (2.5Y 6/4); strong, medium, angular blocky structure; firm when moist, plastic when wet; very few roots; thin discontinuous clay films on ped faces; rounded pebbles 1 to 2 percent, by volume; mildly alkaline in lower part; gradual, wavy boundary.

C—42 to 60 inches, olive-gray (5Y 5/2) silty clay; many, medium, distinct mottles of grayish brown (2.5Y 5/2) and light yellowish brown (2.5Y 6/4); weak, coarse, angular blocky structure; firm when moist, plastic when wet; no roots; rounded pebbles 1 to 2 percent, by volume; mildly alkaline.

The A11 horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) to gray (10YR 5/1), and the A12 horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) to gray (10YR 5/1 or 6/1). The clay content of the B2 horizon ranges from 50 to 60 percent. In some places the A horizon and the B1g horizon are very strongly acid and the B22tg horizon is neutral. Depth to calcareous material ranges from 36 to 48 inches. Coarse fragments make up from 1 to 5 percent of the soil mass.

The Trumbull soils are the poorly drained members of a drainage sequence that includes the somewhat poorly drained Remsen soils and the moderately well drained Geeburg soils. They are adjacent to the Remsen soils in many places. The Trumbull soils are more clayey than the Canadice soils, and unlike them, are not underlain by stratified silty clay loam, silt loam, sand, and gravel. Trumbull soils are more clayey in their subsoil and underlying material than Sebring soils.

Trumbull silt loam (0 to 2 percent slopes) (Tr).—This soil occurs in level and slightly concave areas. Soil material from higher areas tends to accumulate on this soil, and in some places its surface layer is darker colored than that in the profile described as typical for the series.

Included with this soil in mapping, on breaks along drainageways, were small areas of the moderately well drained Geeburg soils. Also included in the mapping, in depressions, were a few small areas of the very poorly drained Montgomery soils.

Excessive wetness is the major limitation to the use of this soil for farming and for nonfarm purposes. (Capability unit IVw-1; woodland suitability group 1w1)

Urban Land

Urban land (Ur) occurs in the central business districts of Canton, Massillon, and Alliance and in surrounding areas. It also occurs in large industrial complexes. This mapping unit consists of land used for buildings, streets, and sidewalks and of areas where soil material has been removed or the soil has been covered by fill material. In most areas cut and fill operations have so altered the original soils that the soil profile cannot be recognized. (Capability unit not assigned; woodland suitability group not assigned)

Wadsworth Series

The Wadsworth series consists of somewhat poorly drained, level to sloping soils on uplands in the northeastern part of the county. These soils formed in clay loam or silty clay loam glacial till of Wisconsin age.

In a typical profile the plow layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is about 35 inches thick. To a depth of about 20 inches, it is brownish-yellow and brown, friable silty clay loam mottled with gray. Below this, and extending to a depth of 31 inches, is a brown clay loam fragipan that is mottled with light gray. The lower part of the subsoil is 11 inches of brown clay loam mottled with light brownish gray. The underlying material also is brown clay loam mottled with light brownish gray.

The Wadsworth soils have a moderately deep root zone in most places. Permeability is slow in the fragipan. The available moisture capacity is low to medium. These soils have a seasonal high water table for fairly long periods, and unless adequately drained, they are slow to dry out in spring.

These soils are not extensive in this county, but many areas have been drained and are used for cultivated crops.

Typical profile of Wadsworth silt loam, 2 to 6 percent slopes, in a cultivated field in Marlboro Township, section 36, T. 20 N., R. 7 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, crumb structure; friable; abundant roots; no stones or pebbles; medium acid; abrupt, smooth boundary.

B1t—7 to 12 inches, brownish-yellow (10YR 6/5) silty clay loam; many, fine, faint mottles of light gray (10YR 7/1); moderate, fine and medium, subangular blocky structure; friable; medium, patchy, light-gray (10YR 7/2) and brownish-yellow (10YR 6/6) clay films on some ped faces; few stones in lower part of horizon; strongly acid; clear, wav boundary.

IIB2t—12 to 20 inches, brown (7.5YR 4/4) (ped interiors) silty clay loam; common, medium, prominent mottles of light brownish gray (10YR 6/2); moderate, medium and coarse, subangular blocky structure; slightly firm and somewhat brittle when moist slightly plastic when wet; nearly continuous, medium, light-gray (10YR 7/1) and grayish-brown (10YR 5/2) coats on horizontal and vertical ped faces; few stones; strongly acid; clear, wavy boundary.

IIBx—20 to 31 inches, brown (10YR 5/3) clay loam; many medium, faint mottles of light gray (10YR 7/2); weak, coarse, prismatic structure that breaks to weak, coarse, subangular blocky structure; very firm and somewhat brittle when moist, slightly

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plastic when wet; 60 percent of horizontal and vertical ped faces have light-gray (10YR 7/2) and brownish-yellow (10YR 6/6) rinds next to gray clay flows 4 millimeters thick; strongly acid; clear, wavy boundary.

IIB3—31 to 42 inches, brown (10YR 5/3) clay loam; many, medium, faint mottles of light brownish gray (2.5Y 6/2); weak, coarse, prismatic structure that breaks to weak, coarse, subangular blocky structure; slightly firm when moist, plastic when wet; no roots; thick, light brownish-gray (2.5Y 6/2) clay films on 30 percent of horizontal and vertical ped faces; clay flows 6 millimeters thick; few stones; slightly acid.

IIC—42 to 48 inches, brown (10YR 5/3) clay loam; common, medium, faint mottles of light brownish gray (2.5Y 6/2); massive (structureless); slightly firm; neutral.

The clay content of the IIB2t and IIBx horizons ranges from 27 to 35 percent. The matrix of the IIB2t horizon is dark brownish yellow (10YR 6/5), yellowish brown (10YR 5/4), brown (10YR 5/3), or dark brown (7.5YR 4/4). Depth to the top of the IIBx horizon (fragipan) ranges from 18 to 26 inches; the IIBx horizon ranges from 10 to 25 inches in thickness. Depth to calcareous soil material ranges from 36 to 60 inches or more. Below a depth of 60 inches, the glacial till is firm, is limy, and contains numerous pebbles and fragments of sandstone.

The Wadsworth soils are the somewhat poorly drained members of a drainage sequence that includes the moderately well drained Rittman soils. Along the boundary between soil associations 3 and 8, Wadsworth soils are commonly adjacent to Ravenna soils. The Wadsworth soils have a more clayey subsoil than the Ravenna soils and are more shallow to limy material.

Wadsworth silt loam, 0 to 2 percent slopes (WaA).—This soil occupies areas that vary in shape and size. In some places it occurs in depressions and is ponded. This soil commonly has a thicker surface layer and fragipan than corresponding layers in the profile described as typical for the series.

This soil commonly is next to areas of poorly drained Sebring soils, and small areas of Sebring soils were included in mapping.

Excessive wetness is the main limitation to the use of this Wadsworth soil for cultivated crops. For many nonfarm uses, it is limited by slow permeability and a seasonal high water table. (Capability unit IIIw–2; woodland suitability group 1w1)

Wadsworth silt loam, 2 to 6 percent slopes (WaB).—This soil generally occupies large areas in the northeastern part of the county. It has the profile described as typical for the series, but in many places the fragipan is thicker than that described as typical.

Included with this soil in mapping were areas of a Wadsworth soil that is heavy silt loam in the upper part of the subsoil. Also included were small areas of a moderately eroded Wadsworth soil that has a lighter colored and thinner surface layer than that described as typical. Other inclusions were small areas of the poorly drained Sebring soils.

Seasonal wetness is the major limitation to the use of this soil for farming. The hazard of erosion also is important and practices of erosion control are needed, particularly on slopes of 4 to 6 percent. Excessive wetness is the main limitation to most nonfarm uses. (Capability unit IIIw–2; woodland suitability group 1w1)

Wadsworth silt loam, 6 to 12 percent slopes (WaC).—This soil occupies narrow strips along drainageways. It is better drained than Wadsworth silt loam, 2 to 6 percent slopes, which has the profile described as typical for the series. The better drainage is indicated by colors that are browner and less gray than typical.

Included with this soil in mapping were a few areas of moderately eroded soils that have a thinner, lighter colored surface layer than is typical of Wadsworth soils.

A severe hazard of erosion is the primary limitation to the use of this Wadsworth soil for cultivated crops. Use for many nonfarm purposes is limited by the slope and slow permeability. (Capability unit IIIe–2; woodland suitability group 1w1)

Wadsworth silt loam, 6 to 12 percent slopes, moderately eroded (WaC2).—This soil occurs in narrow areas along drainageways and streams. Its surface layer is 3 to 5 inches thick and is lighter colored than that described as typical. This soil is more sticky and has more pebbles on the surface than the uneroded Wadsworth soils. It is somewhat better drained than Wadsworth silt loam, 2 to 6 percent slopes, which is the soil described as typical for the series. The better drainage is indicated by the colors that are less gray than typical in the upper part of the subsoil.

Use of this soil for cultivated crops is limited mainly by a severe hazard of erosion. Seasonal wetness, slow permeability, and the slope are limitations to use for nonfarm purposes. (Capability unit IIIe–2; woodland suitability group 1w1)

Wadsworth Series, Moderately Shallow Variant

The Wadsworth, moderately shallow variant, soils in this county are similar to normal Wadsworth soils but are thinner to bedrock.

The profile of the moderately shallow variant of the Wadsworth series has a dark grayish-brown silt loam plow layer about 8 inches thick. The subsurface layer is yellowish-brown, friable silt loam about 4 inches thick. The subsoil, about 28 inches thick, has a fragipan in the uppermost 12 inches. The fragipan is dark-brown silt loam distinctly mottled with yellowish brown. Below the fragipan is a layer of dark yellowish-brown silty clay loam mottled with gray and a layer of mottled dark yellowish-brown, gray, and dark-gray heavy silty clay loam to silty clay that contains many fragments of weathered shale. Dark-gray shale is at a depth of 40 inches.

Profile of Wadsworth silt loam, moderately shallow variant, 2 to 6 percent slopes, in Lexington Township, section 30, T. 20 N., R. 7 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

A2—8 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure; friable; common roots; light brownish-gray (10YR 6/2) silt coats; very strongly acid; clear, wavy boundary.

Bx1—12 to 24 inches, dark-brown (7.5YR 4/4) silt loam; common, medium, distinct mottles of yellowish

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brown (10YR 5/6); many grayish-brown (2.5Y 5/2) silty coats on platy surfaces; weak, coarse prismatic structure that breaks to moderate, medium, platy structure; slightly firm, brittle; strongly acid; clear, wavy boundary.

IIB2—24 to 32 inches, dark yellowish-brown (10YR 4/4) silty clay loam; common, medium, distinct mottles of gray (5Y 5/1); weak, medium and coarse, prismatic structure that breaks to weak, medium, subangular blocky structure; firm; thin discontinuous clay films of gray (5Y 6/1), primarily on vertical faces; very strongly acid; abrupt, smooth boundary.

IIB3—32 to 40 inches, mottled dark yellowish-brown (10YR 4/4), gray (5Y 5/1), and dark-gray (5Y 4/1) heavy silty clay loam to silty clay; massive (structureless); abundant dark-gray fragments of weathered shale; very strongly acid; clear, wavy boundary.

IIR—40 to 50 inches, dark-gray shale; very strongly acid.

Depth to the Bx1 horizon (fragipan) ranges from 12 to 20 inches. This horizon is 10 to 20 inches thick. Depth to bedrock ranges from 20 to 48 inches. The shale bedrock is shattered and partly weathered in the top 12 inches or more.

Wadsworth silt loam, moderately shallow variant, 2 to 6 percent slopes (WbB).—This soil occurs in the northeastern part of the county. It occupies long areas south of the Tannenhauf Golf Course and north of Marlington High School. The fragipan in this soil is weak in most places. Depth to bedrock ranges from 20 to 48 inches.

Included with this soil in mapping were small areas of soils that do not contain a fragipan and a few areas where slopes are less than 2 percent. Also included in mapping were small areas of the moderately well drained Rittman soils.

Excessive wetness is the major limitation to use of this Wadsworth soil for farming. For many nonfarm uses, this soil is limited by wetness and shallowness to shale. (Capability unit IIIw–2; woodland suitability group 1w1)

Wallkill Series, Clayey Subsoil Variant

The Wallkill, clayey subsoil variant, soils are dark colored and very poorly drained. These soils occur in the north-central part of the county. They formed in recent alluvium or lacustrine sediments over organic material. The clayey subsoil variant from the Wallkill series has a finer textured subsoil than normal Wallkill soils. These soils occupy spoon-shaped areas in depressions along drainageways and pockets on uplands.

A profile of the clayey subsoil variant from the Wallkill series has a very dark brown silt loam surface layer about 10 inches thick. The subsoil, about 15 inches thick, is grayish-brown silty clay in the uppermost 10 inches and is grayish-brown silty clay loam below. Below the subsoil is a layer of very dark brown muck 25 inches thick.

The Wallkill soils have a deep root zone and high available moisture capacity. Permeability is slow in the subsoil and is variable in the layer of muck. These soils have a high water table much of the year and, unless adequately drained, they are slow to dry out in spring. Flooding is a hazard.

These soils are not extensive in this county. Some areas have been drained and are used for corn, wheat, and hay. The undrained areas are commonly pastured.

Typical profile of Wallkill silt loam, clayey subsoil variant, in a meadow in Marlboro Township, section 28, T. 20 N., R. 7 W.:

Ap—0 to 10 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

B2tg—10 to 20 inches, grayish-brown (2.5Y 5/2) silty clay; common, medium, distinct mottles of light olive brown (2.5Y 5/6); weak, coarse, prismatic structure in place that breaks to moderate, medium and coarse, subangular blocky structure; very plastic when wet; common roots; thick, continuous, gray (N 5/0) clay films on vertical and horizontal ped faces; neutral; gradual, smooth bondary.

B3—20 to 25 inches, grayish-brown (10YR 5/2) silty clay loam; common, fine, faint mottles of brown (10YR 5/3), mainly around old root channels; massive (structureless); plastic when wet; common roots; 15 percent of mass is black (N 2/0) organic stains; neutral; abrupt, smooth boundary.

IIIb—25 to 50 inches, very dark brown (10YR 2/2) muck; weak, thick, platy structure; slightly fibrous; plant remains are visible; medium acid.

The B horizon includes silt loam in some places, and it ranges from grayish brown (10YR 5/2 and 2.5Y 5/2) to dark grayish brown (10YR 4/2) in color. Depth to the layer of muck is 20 to 40 inches. Reaction ranges from medium acid to neutral in the B horizon.

The Wallkill soils are most commonly adjacent to the very poorly drained Carlisle soils. In the Wallkill soils mineral material is over organic material, whereas in the Carlisle soils, organic material is over mineral soil. Other adjacent soils are alluvial very poorly drained Sloan soil over mineral material. The Wallkill soils are also next to the very poorly drained Luray and Sloan soils but, unlike those soils, Wallkill soils contain a layer of muck.

Wallkill silt loam, clayey subsoil variant (Wc).—This soil occupies pockets in drainageways and areas on uplands. In some places the layer of muck that is below the subsoil is, at a depth of more than 4 feet, underlain by mineral soil material.

Included with this soil in mapping were areas of soils, too small to map separately, that have a silty clay loam surface layer. Also included in mapping were small areas of soils that have only 12 inches of mineral soil material over the muck. Other inclusions were small areas of the poorly drained Canadice soils and small areas of the very poorly drained Montgomery soils.

Excessive wetness and the hazard of flooding are the major limitations to the use of this soil for farming. Wetness and unstable soil material are limitations for nonfarm uses. (Capability unit IIIw–3; woodland suitability group 2w1)

Wayland Series

The Wayland series consists of poorly drained, level and nearly level soils along the larger streams and rivers throughout the county. These soils formed in recent alluvium that washed from soils on uplands.

In a typical profile the surface layer is dark grayish-brown silt loam about 2 inches thick. The subsoil, about 19 inches thick, is gray and grayish-brown silt loam that is distinctly mottled with gray, yellowish red, and strong brown in the lower 11 inches. The underlying material is light brownish-gray silt loam

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mottled with yellowish brown, gray, and light olive brown.

The Wayland soils have a deep root zone when the water table is low. The available moisture capacity is high. The water table is at or near the surface for long periods.

These soils are moderately extensive in this county. Most of the acreage is woodland or is used for pasture.

Typical profile of Wayland silt loam in a pasture in Paris Township, section 31, T. 17 N., R. 6 W.:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, crumb structure; friable; abundant roots; slightly acid; clear, smooth boundary.

B1g—2 to 10 inches, gray (5Y 5/1) silt loam; grayish brown (2.5Y 5/2), yellowish red (5YR 4/6), and strong brown (7.5YR 5/6) rinds in root channels; weak, coarse, subangular blocky structure; friable; common roots; slightly acid; worm casts; diffuse, wavy boundary.

B21g—10 to 14 inches, grayish-brown (2.5Y 5/2) silt loam; many, fine, distinct mottles of gray (5Y 5/1), yellowish red (5YR 4/6), and strong brown (7.5YR 5/6); weak. very coarse, subangular blocky structure; friable; common roots; few, fine, distinct stains of very dark brown (10YR 2/2) ferromanganiferous stains on ped surfaces; few worm casts; slightly acid; diffuse, wavy boundary.

B22g—14 to 21 inches, grayish-brown (2.5Y 5/2) silt loam; many, fine and medium, distinct mottles of strong brown (7.5YR 5/6), yellowish red (5YR 4/6), and gray (5Y 5/1); weak, very coarse subangular blocky structure; friable; common roots; few, fine, black (N 2/0) stains on ped surfaces; few worm casts; slightly acid; diffuse, wavy boundary.

Cg—21 to 50 inches, light brownish-gray (2.5Y 6/2) silt loam; many, medium, distinct mottles of yellowish brown (10YR 5/6), gray (5Y 6/1), and light olive brown (2.5Y 5/6); massive (structureless); friable; few roots; few, fine, black (N 2/0) concretions; slightly acid.

The A horizon contains a layer of muck 2 to 5 inches thick in some places. In some places the A horizon is very dark gray and is as much as 10 inches thick. In some places the C horizon contains strata of sandy loam and silty clay loam and lenses and pockets of gravelly loamy sand. Reaction ranges from medium acid to mildly alkaline.

The Wayland soils are the poorly drained members of a drainage sequence that includes the well drained Chagrin soils, the moderately well drained Lobdell soils, the somewhat poorly drained Shoals soils, and the very poorly drained Sloan soils. The Wayland soils are generally adjacent to the Sloan and Shoals soils in some places. The Wayland soils are less clayey and have less profile development than the Sebring soils.

Wayland silt loam (0 to 2 percent slopes) (Wd).—This soil occupies old abandoned stream channels and other slightly depressed areas along streams.

Included with this soil in mapping were a few areas of soils that contain thin, mucky organic layers; these soils have a darker colored surface layer than is typical for Wayland soils. Also included in mapping, on the outer edge of Wayland soils, were small areas of Shoals soils. Other inclusions, near the center of depressions, were areas of Sloan soils.

The hazard of flooding is the major limitation to the use of this soil for farming. Wetness and flooding are limitations to nonfarm uses. (Capability unit IIIw–3; woodland suitability group 2w1)

Weikert Series

The Weikert series consists of well-drained, sloping to very steep soils that occur in the unglaciated southern part of the county. These soils formed in thin beds of residuum from siltstone, sandstone, and shale.

In a typical profile the plow layer is yellowish-brown channery silt loam about 7 inches thick. The subsoil, about 7 inches thick, is light yellowish-brown very channery silt loam. The underlying material also is light yellowish-brown very channery silt loam. Light yellowish-brown and light olive-brown, fractured siltstone bedrock is at a depth of 18 inches.

The Weikert soils have a shallow root zone. Available moisture capacity is very low. These soils are low in organic-matter content and are strongly acid.

These soils are moderately extensive in this county, and generally they are not suited to cultivated crops. Most of the acreage remains wooded or is used for pasture.

Typical profile of Weikert channery silt loam, 18 to 25 percent slopes, moderately eroded, in a pastured field in Sandy Township, section 27, T. 17 N., R. 7 W.:

Ap—0 to 7 inches, yellowish-brown (10YR 5/4) channery silt loam; moderate, fine and medium, crumb structure; friable; abundant roots; fragments of siltstone 15 percent, by volume; very strongly acid; abrupt, smooth boundary.

B2—7 to 14 inches, light yellowish-brown (10YR 6/4) very channery silt loam; weak, fine and very fine, subangular blocky structure; friable; common roots; very few, thin, patchy clay films on ped surfaces and on skeletal material; 70 percent skeletal material of siltstone; very strongly acid; clear, smooth boundary.

C—14 to 18 inches, light yellowish-brown (10YR 6/4) very channery silt loam; massive (structureless); friable; few roots; 90 percent skeletal material; soil material between stones; thin, patchy clay films on flat stones; strongly acid; clear, smooth boundary.

R—18 to 24 inches, light yellowish-brown (10YR 6/4) and light olive-brown (2.5Y 5/4) fractured siltstone bedrock; some weathered material on surfaces in upper part; strongly acid.

In wooded areas the A horizon ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2). The B horizon is from 50 to 80 percent skeletal material. Reaction ranges from very strongly acid to medium acid in the B horizon. Depth to bedrock is 12 to 20 inches. The bedrock contains variable amounts of siltstone and shale.

The Weikert soils are adjacent to or near the well drained Muskingum and Gilpin soils and the moderately well drained Keene soils. They contain more coarse fragments in their subsoil than the Gilpin or Muskingum soils, and they are shallower to bedrock. The Weikert soils have a less clayey subsoil than the Keene soils, and they contain more stone fragments throughout the profile.

Weikert channery silt loam, 6 to 12 percent slopes (WeC).—This soil occupies narrow, rounded ridgetops near areas of the Gilpin and Keene soils. It is less droughty than any other Weikert soil in the county.

Included with this soil in mapping, in small saddles on ridges, were small areas of the well-drained Gilpin soils. Also included in mapping, in areas where clay shale crops out, were narrow, horizontal strips of the moderately well drained Keene soils.

Shallowness to bedrock and a very severe hazard of erosion are the major limitations to the use of this

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soil for farming. Shallowness to bedrock is the main limitation to nonfarm uses. (Capability unit VIs–1; woodland suitability group 4d1)

Weikert channery silt loam, 12 to 18 percent slopes (WeD).—This soil occurs on breaks between slopes and on upper slopes near the Muskingum, Gilpin, and Keene soils.

Included with this soil in mapping, in small concave draws, were small areas of Muskingum and Gilpin soils. Also included in mapping, along outcrops of acid clay shale, were nearly horizontal strips of Keene soils.

Shallowness to bedrock and the hazard of erosion limit the use of this soil for farming and for nonfarm purposes. (Capability unit VIs–1; woodland suitability group 4d1 on north- and east-facing slopes and 5d1 on south- and west-facing slopes)

Weikert channery silt loam, 18 to 25 percent slopes, moderately eroded (WeE2).—This soil occupies areas on the upper part of hillsides near the Dekalb, Muskingum, Gilpin, and Latham soils. It has the profile described as typical for the series.

Included with this soil in mapping, in areas of sandstone outcrops, were areas of the Dekalb soils. Also included in the mapping, in small concave ravines, were areas of the Muskingum and Gilpin soils. Other inclusions, in areas where acid clay shale outcrops, were horizontal strips of Latham soils.

The main limitations to the use of this soil are shallowness to bedrock, droughtiness, and the hazard of erosion. Because of the slope the use of heavy machinery is dangerous. (Capability unit VIIs–1; woodland suitability group 4d1 on north- and east- facing slopes and 5d1 on south- and west- facing slopes)

Weikert channery silt loam, 25 to 50 percent slopes, moderately eroded (WeF2).—This soil occurs on hillsides. Its surface layer is only 2 inches thick. The profile of this soil contains more skeletal material and is shallower to bedrock than that described as typical for the series.

This soil is commonly near, or adjacent to, the well-drained Ramsey, Muskingum, Gilpin, and Dekalb soils, and areas of those soils were included in mapping. These inclusions make up about 20 percent of each area mapped.

The use of this soil for farming and for nonfarm purposes is limited by steepness and, in cleared areas, by a hazard of erosion. (Capability unit VIIs–1; woodland suitability group 4d2 on north- and east- facing slopes and 5d1 on south- and west- facing slopes)

Weinbach Series

The Weinbach series consists of somewhat poorly drained, level to sloping soils on stream terraces. These soils formed in silt loam and light silty clay loam glacial outwash that is underlain by sandy and gravelly material.

In a typical profile the plow layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 30 inches thick. To a depth of about 19 inches, it is pale-brown silt loam and light brownish-gray silty clay loam distinctly mottled with grayish brown and strong brown. Below this, and extending to a depth of about 30 inches, is a strong-brown, very firm sandy loam fragipan that is mottled with pinkish gray. The lower part of the subsoil is 8 inches of strong-brown gravelly sandy loam distinctly mottled with gray. The underlying material is dark-brown, gravelly coarse loamy sand. In the lower part of this profile coarse fragments make up about 40 percent of the soil mass.

The Weinbach soils have a moderately deep root zone. The available moisture capacity is medium. Permeability is moderately slow in the fragipan and is moderate to moderately rapid below. These soils have a high water table late in winter and early in spring.

These soils are only moderately extensive in this county, but many acres have been drained and are used for cultivated crops.

Typical profile of Weinbach silt loam, 0 to 2 percent slopes, in a meadow in Lake Township, section 28, T. 12 N., R. 8 W. (analytical data in table 10):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, crumb structure; friable; abundant roots; few stones as much as 4 inches on long axis; slightly acid; abrupt, smooth boundary.

B1g—8 to 13 inches, pale-brown (10YR 6/3) silt loam; common, medium, distinct mottles of grayish brown (2.5Y 5/2); weak, fine, subangular blocky structure; friable; abundant roots; few stones; very strongly acid; clear, smooth boundary.

B2tg—13 to 19 inches, light brownish-gray (10YR 6/2) silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6); moderate, fine and medium, subangular blocky structure; friable; common roots; few stones; very strongly acid; clear, wavy boundary.

IIBx—19 to 30 inches, strong-brown (7.5YR 5/8) sandy loam; common, medium, distinct mottles of pinkish gray (7.5YR 6/2); massive (structureless); weakly developed fragipan; very firm, brittle; few roots; continuous grayish-brown (2.5Y 5/2) clay flows on vertical surfaces; thin silt coatings between clay flows; dark ferromanganiferous stains; oxidized root channels; few large stones; strongly acid; clear, wavy boundary.

IIIB3—30 to 38 inches, strong-brown (7.5YR 5/8) gravelly sandy loam; few, medium, distinct mottles of gray (N 6/0); massive (structureless); slightly firm; no roots; grayish-brown clay flows terminate in this horizon as 2- or 3-inch, clay-enriched nodules; material appears to be weakly cemented; 40 percent coarse fragments; medium acid; gradual, wavy boundary.

IIIC—38 to 60 inches, dark-brown (7.5YR 4/4), gravelly coarse loamy sand; massive (structureless); compacted and very weakly cemented; no roots; some cobblestones as much as 6 inches in diameter; 40 percent, by volume, coarse fragments; neutral.

In the B2 horizon the matrix is light olive gray (5Y 6/2), light brownish gray (10YR 6/2), or gray (10YR 6/2), and the clay content ranges from 24 to 32 percent. Typically, depth to the top of the IIBx horizon (fragipan) is about 23 inches, but it ranges from 18 to 30 inches. The IIBx horizon is weakly developed in most places, but its development ranges from weak to moderate. Coarse fragments make up 1 to 10 percent of the upper part of the B horizon and from 30 to 60 percent of the lower part of the B horizon and the upper part of the C horizon. Reaction ranges from slightly acid to mildly alkaline in the IIIC horizon.

The Weinbach soils are the somewhat poorly drained members of a drainage sequence that includes the poorly drained Ginat soils and the well-drained Wheeling soils. Weinbach soils are adjacent to the Ginat and Bogart soils

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in many places. Unlike the Fitchville soils the Weinbach soils contain a fragipan. The Weinbach soils are underlain by sandy and gravelly outwash material, whereas the Ravenna soils are underlain by loam glacial till.

Weinbach silt loam, 0 to 2 precent slopes (WhA).—This soil occupies areas that vary in size. The profile of this soil is that described as typical for the series.

Included with this soil in mapping were a few small areas of soils that have a dark-colored surface layer 8 to 16 inches thick. Also included in mapping were small bumps of the moderately well drained Bogart soils and spots, in depressions, of the poorly drained Ginat soils. Other inclusions were a few small areas of Weinbach soils that are underlain by loam glacial till at a depth of 30 to 40 inches.

Wetness is the major limitation to the use of this soil for farming. Moderately slow permeability and seasonal wetness are limitations for many nonfarm uses. (Capability unit IIw–2; woodland suitability group 2w2)

Weinbach silt loam, 2 to 6 percent slopes (WhB).—This soil occupies broad, undulating areas on outwash plains and smooth, uniform areas on the walls of shallow depressions and at the base of valley walls.

This soil is commonly next to the moderately well drained Bogart soils and the well drained Chili soils, and small areas of those soils were included in the mapping. Also included, at the base of slopes, were a few small areas of soils that have a dark-colored surface layer. Other inclusions were a few small areas of Weinbach soils that are underlain by loam glacial till at a depth of 30 to 40 inches.

Wetness is the main limitation to the use of this soil for farming. The hazard of erosion is also a concern, and practices of erosion control are needed, particularly on slopes of 4 to 6 percent. Moderately slow permeability and seasonal wetness are limitations to many nonfarm uses. (Capability unit IIw–2; woodland suitability group 2w2)

Weinbach-Urban land complex (Wk).—This complex occupies a large area southwest of the Mahoning River in the northern part of Alliance, areas in North Canton that are 10 to 30 acres in size, and smaller areas in the cities, towns, and villages throughout the county. This complex consists of the somewhat poorly drained Weinbach soils and disturbed land. Most areas are nearly level.

Seasonal wetness is the major limitation to the use of this complex for nonfarm purposes. Buildings constructed in areas of this complex are likely to have wet foundations and basements in winter and spring unless adequate drainage is provided. In wet periods, trafficability is generally poor during construction. (Capability unit not assigned; woodland suitability group 2w2)

Wellston Series

The Wellston series consists of well-drained, gently sloping and sloping soils on uplands in the unglaciated southern part of the county. These soils formed in stratified material underlain by sandstone, siltstone, and shale.

In a typical profile the plow layer is dark yellowish-brown silt loam about 7 inches thick. The subsoil, about 24 inches thick, is yellowish-brown silt loam in the upper part, strong-brown heavy silt loam in the middle part, and reddish-yellow heavy silt loam in the lower part. The underlying material is light yellowish-brown very channery silt loam that is about 80 percent coarse fragments of siltstone. Light olive-brown, bedded siltstone is at a depth of 38 inches. In some places the bedrock is fractured in the uppermost 12 inches.

The Wellston soils have a moderately deep or deep root zone and medium available moisture capacity. Permeability is moderate in the subsoil.

These soils are not extensive in this county. Most of the acreage is used for cultivated crops.

Typical profile of Wellston silt loam, 2 to 6 percent slopes, in an old meadow in Canton Township, section 20, T. 10 N., R. 8 W:

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, fine and medium, crumb structure; friable; common roots; no stones or fragments; medium acid; abrupt, smooth boundary.

B1t—7 to 12 inches, yellowish-brown (10YR 5/6) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; thin discontinuous clay films on horizonal and vertical ped faces; no coarse fragments; very strongly acid; clear, wavy boundary.

B21t—12 to 20 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable when moist, slightly sticky when wet; occasional roots; medium discontinuous clay films on ped faces; few fragments of siltstone; very strongly acid; clear, wavy boundary.

B22t—20 to 31 inches, reddish-yellow (7.5YR 6/8) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable; occasional roots; medium discontinuous clay films on ped faces; 10 percent, by volume, light brownish-gray (2.5Y 6/2) fragments of siltstone; very strongly acid; clear, wavy boundary.

C—31 to 38 inches, light yellowish-brown (2.5Y 6/4) very channery silt loam; very weak, medium and coarse, subangular blocky structure; friable; 80 percent coarse fragments of siltstone; strongly acid; gradual, wavy boundary.

R—38 to 50 inches, light olive-brown (2.5Y 5/4), bedded siltstone bedrock.

In some places there is a mantle of silt that is 12 to 20 inches thick and that contains only a few, if any, coarse fragments. The Bt horizon ranges from 18 to 30 inches in thickness. The matrix of the B21t and B22t horizons is yellowish brown (10YR 5/5 to 5/8), strong brown (7.5YR 5/6), or reddish yellow (7.5YR 6/6 to 6/8). Reaction in the B horizon is very strongly acid or strongly acid.

The Wellston soils are the well drained members of a drainage sequence that includes the moderately well drained Tilsit soils. The Wellston soils are commonly adjacent to the Tilsit, Muskingum, and Gilpin soils. They have more clay and less stone fragments in the subsoil than the Muskingum or Gilpin soils. The Wellston soils formed in material deposited over bedrock by the wind, whereas, the Loudonville soils formed in thin deposits of glacial till underlain by bedrock.

Wellston silt loam, 2 to 6 percent slopes (WlB).—This soil occurs on ridgetops and on benches or saddles below the ridgetops. It has the profile described as typical for the series, but there are small areas that

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are underlain by nearly impervious clay shale. A few stones are on the surface in some areas.

Included with this soil in mapping were small areas of the moderately well drained Tilsit soils. This soil is next to the moderately well drained Keene soils in some places, and small areas of those soils were inclued in mapping.

A moderate hazard of erosion limits the use of this soil for cultivated crops. Shallowness to bedrock is a limitation to nonfarm uses. (Capability unit IIe–1; woodland suitability group 2o1)

Wellston silt loam, 6 to 12 percent slopes (WlC).—This soil occupies areas just below the ridgetops and a few areas on narrow ridgetops. It also occurs at the base of slopes of hillsides.

Included with this soil in mapping were a few small areas of moderately eroded Wellston soils that have a lighter colored surface layer and a profile that is shallower to bedrock than the profile of this soil. Also included in mapping, in areas where clay shale outcrops, were small areas of the moderately well drained Keene soils.

A severe hazard of erosion is the major limitation to the use of this soil for farming. The slope and shallowness to bedrock are limitations for some nonfarm uses. (Capability unit IIIe–1; woodland suitability group 2o1)

Wheeling Series

The Wheeling series consists of well-drained, level to steep soils on stream terraces, outwash plains, and kames. These soils formed in silt loam glacial material of Wisconsin age that is underlain by gravelly and sandy outwash material.

In a typical profile the plow layer is dark grayish-brown silt loam about 8 inches thick. The subsoil, about 33 inches thick, is yellowish-brown silt loam in the uppermost 3 inches and is dark-brown heavy silt loam and silt loam below. Below the subsoil is about 9 inches of dark yellowish-brown very gravelly fine sandy loam that is underlain by dark-brown, very gravelly loamy coarse sand at a depth of about 50 inches.

The Wheeling soils have a moderately deep or deep root zone. The available moisture capacity is medium to high. Permeability is moderate in the subsoil and is rapid in the underlying material. These soils dry out fairly early in spring. They have very little, if any, gravel in the subsoil.

The Wheeling soils are extensive in this county. Most of the acreage is used for cultivated crops.

Typical profile of Wheeling silt loam, 2 to 6 percent slopes, in a cultivated field in Jackson Township, section 16, T. 11 N., R. 9 W. (analytical data in table 10):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine and medium, granular structure; friable; abundant roots; common wormholes; medium acid; abrupt, smooth boundary.

B1—8 to 11 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, platy structure; friable; abundant roots; common wormcasts; medium acid; clear, wavy boundary.

B21t—11 to 21 inches, dark-brown (7.5YR 4/4) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable; common roots; thin discontinuous clay films on peds; few, fine, dark, discontinuous ferromanganiferous stains; very strongly acid; gradual, wavy boundary.

B22t—21 to 32 inches, dark-brown (7.5YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; friable; common roots; thin, discontinuous clay films; few, fine, dark ferromanganiferous stains; very strongly acid; clear, wavy boundary.

B23t—32 to 41 inches, dark-brown (7.5YR 4/4) silt loam; weak, medium and coarse, subangular blocky structure; friable; common roots; thin patchy clay films on ped faces; yellowish-brown (10YR 5/4), patchy silt coatings; few, thin, flat, sedimentary stones as much as 2 inches in diameter; very strongly acid; abrupt, wavy boundary.

IIC1—41 to 50 inches, dark yellowish-brown (10YR 4/4) very gravelly fine sandy loam; massive (structureless); firm; few roots; dark stains on some stone surfaces; 70 percent coarse fragments, by volume; very strongly acid; abrupt, smooth boundary.

IIC2—50 to 70 inches, dark-brown (7.5YR 4/4) very gravelly loamy coarse sand; loose; few roots; strongly acid.

The A horizon is loam in some places. The clay content of the B2 horizon ranges from 18 to 30 percent. In the B21t, B22t, and B23t horizons, the matrix ranges from dark brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4). Depth to the C horizon is 30 to 50 inches. In this county the sand content in the Wheeling silt loams is less than is typical for those soils elsewhere.

The Wheeling soils are the well-drained members of a drainage sequence that includes the poorly drained Ginat soils and the somewhat poorly drained Weinbach soils. The Wheeling soils are commonly next to the Weinbach soils, the well-drained Chili soils, and the moderately well drained Bogart soils. They are underlain by glacial outwash material at a depth of 50 inches or less.

Wheeling loam, 0 to 2 percent slopes (WmA).—This soil is on terraces along streams and rivers. It occupies areas that are irregular in size and shape. This soil is more sandy throughout than the Wheeling silt loams, and it is less susceptible to surface crusting.

This soil commonly is adjacent to areas of the Chili and Plainfield soils, and small areas of those soils were included in the mapping. Also included in the mapping were areas of soils that have a surface layer of sandy loam or silt loam.

This soil has few or no limitations to use for farming or for nonfarm purposes. (Capability unit I–1; woodland suitability group 2o1)

Wheeling loam, 2 to 6 percent slopes (WmB).—This soil occupies terraces along the Tuscarawas River and other large streams in the county. Its profile is coarser textured than that of Wheeling silt loam, 2 to 6 percent slopes, which has the profile described as typical for the series. This soil is much less susceptible to surface crusting than Wheeling silt loam.

This soil is adjacent to areas of Arkport, Chili, and Plainfield soils, and small areas of those soils were included in mapping. Also included in mapping, in drainageways, were small areas of the moderately well drained Bogart soils. Other inclusions were areas of soils that have a surface layer of sandy loam or silt loam.

A moderate hazard of erosion is the major limitation to the use of this soil for cultivated crops. Limitations to nonfarm uses are few or none. (Capability unit IIe–1; woodland suitability group 2o1)

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Wheeling loam, 6 to 12 percent slopes, moderately eroded (WmC2).—This soil is near the Arkport and Chili soils. It occurs in convex areas along the Tuscarawas River and in higher areas of kames, primarily in Lawrence Township. The slopes are generally short and irregular. This soil is more sandy throughout than the Wheeling silt loams, and it is much less susceptible to surface crusting.

Included with this soil in mapping were a few small areas of Chili soils.

A severe hazard of erosion is the main limitation to the use of this soil for cultivated crops. The slope is the dominant limitation for many nonfarm uses. (Capability unit IIIe–5; woodland suitability group 2o1)

Wheeling silt loam, 0 to 2 percent slopes (WrA).—This soil occupies areas that vary in size. Soil material has accumulated in some slightly depressed areas, and in these areas the surface layer is thicker than that in the profile described as typical for the series. This soil is susceptible to surface crusting.

Included with this soil in mapping, in drainageways and depressions, were small areas of the moderately well drained Bogart soils.

Limitations to use of this soil for farming and for most nonfarm purposes are few or none. (Capability unit I–1; woodland suitability group 2o1)

Wheeling silt loam, 2 to 6 percent slopes (WrB).—This soil occurs on terraces and in broad areas on outwash plains. Some areas are 40 to 50 acres in size. The profile of this soil is that described as typical for the series.

Included with this soil in mapping were a few areas of the Chili soils. On this soil, runoff is rapid, and the hazard of erosion is moderate in cultivated areas. The slope is a slight limitation to some nonfarm uses. (Capability unit IIe–1; woodland suitability group 2o1)

Wheeling silt loam, 6 to 12 percent slopes (WrC).—This soil occupies areas along the base of slopes and rolling areas on kames.

This soil commonly is next to areas of Chili soils, and areas of those soils were included in mapping. Also included in mapping were areas of soils that contain loam glacial till at a depth of 40 inches or more and that are less permeable than is typical of Wheeling silt loam. Other inclusions were small areas of the Wooster soils.

Because runoff is very rapid from this soil, the hazard of erosion is severe in cultivated areas. The slope and the hazard of erosion are limitations for some nonfarm uses. (Capability unit IIIe–5; woodland suitability group 2o1)

Wheeling silt loam, 6 to 12 percent slopes, moderately eroded (WrC2).—This soil occupies convex slopes of knolls. Its surface layer is lighter colored and thinner than that in the profile described as typical for the series, and the gravelly and sandy underlying material is about 30 inches from the surface. This soil is more droughty than the uneroded Wheeling soils.

Included with this soil in mapping were areas of soils that contain loam glacial till at a depth of 40 inches or more and that are less permeable than is typical of Wheeling silt loam. Also included in mapping were some areas of the Chili soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope is the main limitation for many nonfarm uses. (Capability unit IIIe–5; woodland suitability group 2o1)

Wheeling soils, 12 to 18 percent slopes, moderately eroded (WsD2).—These soils occur on short slopes of rounded knolls and at the head of drainageways. The surface layer is loam, silt loam, or sandy loam. It is lighter colored than that in the profile described as typical for the series, and the gravelly and sandy underlying material is 30 inches from the surface.

Included with this soil in mapping were small areas of the Chili soils.

The use of this soil for cultivated crops is limited mainly by a very severe hazard of erosion. The slope severely limits use for most nonfarm purposes. (Capability unit IVe–1; woodland suitability group 2o1)

Willette Series

The Willette series consists of very poorly drained, dark-colored, level and nearly level, organic soils that occur in the glaciated part of the county. These soils formed in moderately thick organic material over mineral material. The native vegetation consisted of tamarack, willows, reeds, sedges, and other water tolerant plants.

A typical Willette soil is very dark brown and mucky to a depth of 26 inches. Below 26 inches is gray, calcareous heavy clay loam mottled with yellowish brown.

The Willette soils have a moderately deep root zone in most places. Available moisture capacity is high. Permeability is variable in the muck and is moderately slow in the underlying mineral material. The water table is high most of the year.

These soils are not extensive in this county. Drained areas are used for vegetables and other special crops. Undrained areas are wooded or are pastured.

Typical profile of Willette muck on slopes of 0 to 2 percent, in a cultivated field in Marlboro Township, section 28, T. 20 N., R. 7 W.:

1—0 to 10 inches, very dark brown (10YR 2/2) muck; moderate, fine and medium, granular structure; very friable; abundant roots; medium acid; clear, wavy boundary.

2—10 to 26 inches, very dark brown (10YR 2/2) muck; massive (structureless) that breaks to weak, thick, platy structure; decomposed peat; some woody material; very friable; common roots; medium acid; clear, smooth boundary.

IIC—26 to 50 inches, gray (N 5/0) heavy clay loam; few, fine, distinct mottles of yellowish brown (10YR 5/4); massive (structureless); firm; no roots; calcareous.

The uppermost organic horizon is black (10YR 2/1) in some places. Depth to the IIC horizon ranges from 20 to 40 inches. The IIC horizon is silty clay loam, silty clay, or clay in some places. Reaction ranges from strongly acid to slightly acid in the lower part of the organic horizon.

The Willette soils are adjacent to the very poorly drained Carlisle and Linwood soils. Willette soils are similar to Linwood soils but are underlain by finer textured mineral material. The Willette soils have thinner layers of organic material than the Carlisle soils.

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Willette muck (0 to 2 percent slopes) (Wt).—This soil is in nearly level and depressional areas that vary in size and shape. Its muck surface layer is soft, spongy, and extremely dark colored. Undrained areas are generally swampy.

Included with this soil in mapping were small areas that have less than 18 inches of muck over mineral material. This soil is commonly next to areas of the Carlisle soils, and small areas of those soils were included in mapping.

Excessive wetness is a main limitation to the use of this soil for farming. Soil blowing and fire are hazards during dry periods, particularly in drained areas. The muck is likely to subside and oxidize in drained areas. This soil is unstable if used as sites for buildings and for other nonfarm purposes. (Capability unit IIIw–5; woodland suitability group not assigned)

Wooster Series

The Wooster series consists of well-drained, gently sloping to very steep soils on uplands in the glaciated part of the county. These soils formed in loam glacial till of Wisconsin age.

In a typical profile the surface layer is silt loam about 10 inches thick that is dark grayish brown in the uppermost 7 inches and is yellowish brown below. The subsoil is about 40 inches thick. To a depth of about 21 inches, it is yellowish-brown, friable heavy loam. Below this, and extending to a depth of 40 inches, is a dark yellowish-brown, very firm and brittle loam fragipan. The lower part of the subsoil is 10 inches of dark yellowish-brown, slightly firm light loam.

The Wooster soils have a deep root zone in most places. The available moisture capacity is high. Permeability is moderate in the fragipan layers. These soils dry out fairly early in spring.

The Wooster soils are extensive in this county. Most of the acreage is used for cultivated crops.

Typical profile of Wooster silt loam, 6 to 12 percent slopes, in a meadow in Perry Township, section 9, T. 10 N., R. 9 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, crumb structure; friable; abundant roots; medium acid; abrupt, smooth boundary.

A2—7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; common roots; few pebbles; very strongly acid; clear, wavy boundary.

B2t—10 to 21 inches, yellowish-brown (10YR 5/4) heavy loam; moderate, medium, subangular blocky structure; friable; common roots; thin discontinuous clay films on ped faces; common dark-brown (7.5YR 3/2) ferromanganiferous stains on some ped faces and pebbles; very strongly acid; clear, wavy boundary.

Bx1—21 to 30 inches, dark yellowish-brown (10YR 4/4) loam; moderate, very coarse, prismatic structure that breaks to weak, medium and coarse, subangular blocky structure; very firm, brittle; few roots; nearly vertical polygonal seams of yellowish brown (10YR 5/4) in upper part of horizon and of very pale brown (10YR 7/4) in lower part; thin patchy clay films on ped faces; 10 percent pebbles; abundant dark-brown (7.5Y 3/2) stains on ped faces; strongly acid; gradual, wavy boundary.

Bx2—30 to 40 inches, dark yellowish-brown (10YR 4/4) loam; moderate, very coarse, prismatic structure that breaks to weak, thick, platy structure; very firm, brittle; few roots; very dark brown (10YR 2/2) stains on platy faces; coats of very pale brown (10YR 7/4) and gray (10YR 5/1) on prism faces; thin clay flows between prisms; thin patchy clay films on ped faces; 20 percent pebbles; strongly acid; gradual, diffuse boundary.

B3—40 to 50 inches, dark yellowish-brown (10YR 4/4) light loam; weak, medium, angular blocky structure; slightly firm; no roots; thin clay films in pores and voids; few concretions of ironstone; 20 percent pebbles; strongly acid.

The clay content of the B horizon ranges from 18 to 27 percent. In the B2t horizon the matrix ranges from strong brown (7.5YR 5/6) to yellowish brown (10YR 5/4 to 5/6). The matrix of the Bx horizons (fragipan) includes yellowish brown (10YR 5/6) in some places. Depth to the Bx1 horizon (fragipan) ranges from 20 to 36 inches. The content of gravel in the profile ranges from 1 to 30 percent. Typically, calcareous material is at a depth of more than 60 inches, but it ranges from 60 to 100 inches.

The Wooster soils are the well drained members of a drainage sequence that includes the moderately well drained Canfield soils, the somewhat poorly drained Ravenna soils, and the poorly drained Sebring, till substratum, soils. The Wooster soils are adjacent to the Canfield soils in many places, and they commonly are next to the Loudonville soils. The Wooster soils are deeper to bedrock than the Loudonville soils; they contain a fragipan, which is lacking in the Loudonville soils.

Wooster silt loam, 2 to 6 percent slopes (WuB).—This soil occupies convex areas on uplands. In most areas the slopes are short. This soil receives little or no runoff from surrounding soils. It has a thicker surface layer than that in the profile described as typical for the series. In some areas this soil does not contain a fragipan, and in these areas the soil is more permeable than is typical of Wooster soils. Sandstone bedrock or sandy and gravelly material commonly is at a depth of 4 to 6 feet.

Included with this soil in mapping, on concave slopes of 2 to 4 percent, were small areas of the moderately well drained Canfield soils.

A moderate hazard of erosion is the main limitation to the use of this soil for cultivated crops. Moderate permeability and the slope are limitations for some nonfarm uses. (Capability unit IIe–1; woodland suitability group 1o1)

Wooster silt loam, 6 to 12 percent slopes (WuC).—This soil occupies areas that vary in size and shape. It has the profile described as typical for the series, but in a few areas the profile does not contain a fragipan like that described as typical. In these areas water moves through the soil at a more rapid rate. Depth to sandstone bedrock is 5 to 8 feet.

Included with this soil in mapping, on slopes of 10 to 12 percent, were a few, small, moderately eroded areas that have more pebbles and stone fragments on the surface than the surrounding Wooster soils. Also included in mapping, in small drainageways, were areas of the somewhat poorly drained Ravenna soils.

A severe hazard of erosion is the major limitation to the use of this soil for cultivated crops. The slope and restricted permeability limit use for many nonfarm purposes. (Capability unit IIIe–1; woodland suitability group 1o1)

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Wooster silt loam, 6 to 12 percent slopes, moderately eroded (WuC2).—This soil occurs mainly in long, convex areas, but it is also on short, irregular slopes along drainageways. Its surface layer is 3 to 5 inches thick and is lighter colored than that in the profile described as typical for the series. As a result of erosion, this soil is more droughty than Wooster silt loam, 6 to 12 percent slopes, which has the profile described as typical for the series. Numerous pebbles and stones are on the surface of this soil. In a few places the profile does not contain a fragipan.

This soil commonly is next to areas of the well-drained Chili soils and, in areas adjacent to streams, small areas of those soils were included in mapping. Also included in mapping were areas of somewhat poorly drained Ravenna soils.

Use of this soil for cultivated crops is limited mainly by a severe hazard of erosion. The slope and restricted permeability are limitations for many nonfarm uses. (Capability unit IIIe–1; woodland suitability group 1o1)

Wooster silt loam, 12 to 18 percent slopes, moderately eroded (WuD2).—This soil occurs in long, narrow strips along drainageways and in areas at the head of drainageways. Its surface layer is thinner and lighter colored than that in the profile described as typical for the series. This soil has more stones and pebbles on the surface than the uneroded Wooster soils. In some areas its profile does not contain a fragipan. Depth to sandstone bedrock or to sand and gravel commonly is 5 to 10 feet.

Included with this soil in mapping were small areas of Chili soils.

A very severe hazard of erosion is the major limitation to the use of this soil for farming. The slope, a hazard of erosion, and restricted permeability are limitations to most nonfarm uses. (Capability IVe–1; woodland suitability group 1o1)

Wooster silt loam, 18 to 25 percent slopes, moderately eroded (WuE2).—This soil occupies long, narrow strips, mainly along streams. Erosion has removed most of the original surface layer from this soil and, in most areas, has cut shallow gullies and a few deep gullies. Many fragments of sandstone and shale are on the surface of this soil.

This soil commonly is next to areas of the well-drained Chili soils, and small areas of those soils were included in mapping. Also included in mapping were areas of a Wooster soil that has a loam surface layer.

Use of this Wooster soil for most purposes is limited mainly by steep slopes and a severe hazard of erosion. (Capability unit VIe–1; woodland suitability group 1r1)

Wooster silt loam, 25 to 50 percent slopes, moderately eroded (WuF2).—This soil occupies a small acreage in the county. It occupies narrow strips, mainly along streams. Its surface layer is thinner and lighter colored than that in the profile described as typical for the series. Also, there are more pebbles and fragments of stones on the surface.

Included with this soil in mapping were small severely eroded areas in which shallow gullies and a few deep gullies have formed.

A severe hazard of erosion and the steep slope are the main limitations to the use of this soil for farming and for nonfarm purposes. (Capability unit VIe–1; woodland suitability group 1r1)

Wooster-Urban land complex, steep (WvD).—This mapping unit is in the glaciated part of the county, and it consists of areas of Wooster soils and disturbed land that are used mainly for community development. About 50 to 75 percent of the area has been severely altered by cut and fill operations. The hazard of erosion is very severe during and following construction; open ditches are susceptible to washouts and severe gullying. The use of this complex for most nonfarm purposes is severely limited by the slope. (Capability unit not assigned; woodland suitability group 1o1)

Formation and Classification of Soils

In this section the factors that affected the formation of the soils in Stark County are discussed. Then the current system of soil classification is explained, and the soil series are placed in some classes of that system and in great soil groups of an older system. The soil series in the county, including a profile typical for each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soils are natural bodies that are the products of the factors of soil formation. The five major factors of soil formation are parent material, relief, climate, time, and living organisms, primarily vegetation.

Climate and living organisms, particularly vegetation, are the most active factors of soil formation in Stark County. Their effect on parent material is influenced by topography and by the length of time the parent material has been in place. The relative importance of each factor differs from place to place. The interaction of all of the factors determines the kind of soil that develops in any given place.

Parent material

The soils of Stark County formed in residuum, in alluvium, and in material transported by glacial action. The most extensive soils in the county are those that formed in glacial till, or drift, outwash material transported by glacial melt water, and sediments deposited on the bottom of old glacial lakes. Most of the glacial till, or drift, in the county is of Wisconsin age, but glacial drift of Illinoian age covers a narrow belt in the east-central part of the county. The Chili, Conotton, and other sandy and gravelly soils that formed in glacial outwash occupy a hummocky, V-shaped area that extends northward from the city of Canton (fig. 13). The Carlisle, Linwood, Willette, and other poorly drained, organic soils occur as pockets within this area. The silty Fitchville and Sebring soils in this area developed in material deposited by slack water in old

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glacial or postglacial lakes. Soils that formed in sediments deposited in ponded water also occur in areas near the boundary between the glaciated part of the county and the unglaciated part. These areas extend from Canton southwest to Brewster.

The parent material of the soils in the northeastern quarter of Lexington Township is clayey glacial till in which the clay content ranges from 50 to 60 percent. Formed in it are the Geeburg and Remsen soils. The content of clay in the till ranges from about 27 to 35 percent in the Rittman and Wadsworth soils, but that of the Ravenna and Wooster soils averages less than 27 percent. The soils formed in clay loam or loam till have a dense, compact subsoil or contain a fragipan. The Canfield and Ravenna soils in the east-central and western parts of the county have a fragipan. Throughout the county, the wave action of the glacial lakes or of glacial melt water has reworked and modified the till to some extent. In some places the Wooster and Canfield soils are underlain by stratified soil material.

The Chili and Wheeling soils formed on glacial outwash terraces that contain sand and gravel. These broad, benchlike terraces occur along the Tuscarawas River and other streams that flow southward.

In the unglaciated southeastern part of the county, the soils formed in residuum weathered from acid, gray sandstone, siltstone, or shale and, in small areas, from limestone. The Muskingum, Gilpin, and Weikert soils formed in silty material weathered from siltstone and shale. The Dekalb and Ramsey soils are sandy because they formed from weathered sandstone. The Latham and Keene soils developed in residuum from clay shale. The Tilsit and Wellston soils also developed in residuum from siltstone and shale bedrock. These soils have a mantle of silty material deposited partly by the wind. The Brooke soils occupy a few benches near the hilltops in areas underlain by limestone.

The Lobdell, Chagrin, Shoals, Wayland, and Sloan soils occupy bottom lands along streams throughout the county. These soils formed in recent alluvium washed from soils in higher areas.

Figure 13.—An area northwest of Canton. The soils are a Chili gravelly loam and a Conotton gravelly loam.

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Relief

Relief has affected soil formation in this county, mainly through its effect on the movement of water and the degree of erosion. To a lesser extent, relief, by affecting soil temperature, influences the plant and animal life on and in the soil.

In the hilly southeastern part of the county runoff is rapid on the steep slopes, and in these areas, soil material is washed away almost as fast as it is formed. In this county the Muskingum, Gilpin, Dekalb, Ramsey, and Weikert soils are strongly affected by relief. Near the glacial border, east of Canton, the smoothing effect of the glacier on the landscape can be observed to the north. To the south, the strongly dissected, unglaciated hills can be observed.

Relief is favorable for the formation of soils in the rolling, glaciated part of the Allegheny Plateau. In the north-central part of the county hummocky areas consist of sandy and gravelly material deposited by glaciers. Water that runs off or moves through these sandy and gravelly, sloping soils tends to collect in the low areas where the soils are wet for long periods. Soils of this kind are in the Carlisle, Willette, and Fitchville series.

Climate

Climate has a dynamic effect on the formation and future development of soils. It influences the rate of plant growth, removal of plant nutrients by leaching, removal of soil material by water or wind, and the temperature of the soils. Stark County has a humid, temperate, continental climate. Climatic data for the county are given in the section "General Nature of the County."

The climate is fairly uniform throughout the county. There are, however, microclimate differences that have influenced the soils. For example, soils in the Wooster, Canfield, and Ravenna series are similar except for differences in natural drainage that result in differences in soil climate. These differences cause differences in the color and in the degree of mottling of these soils. The well drained Wooster soils contain few or no gray mottles, but the moderately well drained Canfield soils are mottled with gray within about 24 inches of the surface. The somewhat poorly drained Ravenna soils are dominantly gray. The gray colors and mottles of the Trumbull, Sebring, and other poorly drained soils reflect a wet environment and fluctuating water table. Because organic matter decomposes slowly in wet soils, the very poorly drained Luray and Montgomery soils have a thick, dark-colored surface layer.

Locally, climatic factors are interrelated with relief and the kinds of vegetation and, on a regional basis, affect the development of the soils.

Plant and animal life

The native vegetation in Stark County consisted mainly of hardwoods. Red oak, white oak, sugar maple, and American beech commonly grew on the glacial till plains. Pin oak, shagbark hickory, red maple, American elm, and white ash were dominant on the somewhat poorly drained to very poorly drained soils. The muck soils were covered by willow, tamarack, tag alder, and water-tolerant reeds and sedges. Tulippoplar, basswood, dogwood, wild cherry, white oak, and hickory were common in the southern part of the county, which is on the unglaciated Allegheny Plateau.

Most hardwoods use large amounts of calcium and other bases available in the soils. Soils that are normally high in bases remain so under a cover of hardwoods because a large part of the bases is returned to the soil each year when the leaves fall. When the leaves decompose, the bases reenter the soil and are again used by plants. Thus, a forest tends to conserve plant nutrients. Most of the soils in Stark County, however, have always been low in plant nutrients. Because of the humid climate, a large part of the bases has been leached away.

Man has changed the direction and rate of development of the soils by clearing the original forests and using the land for different purposes. Important changes were brought about by cultivating the soils; by introducing new kinds of plants; by accelerating loss of soil material through erosion, which resulted from improper practices; by draining large areas causing a change in the effective microclimate; and by applying lime and fertilizer, which has improved the percentage of the base saturation of the soils in some areas. Man's activity continues to affect the development and use of the soils in the county and will do so in the future.

Time

Time is required for the formation of soils. The length of time the parent material has been in place and exposed to the active forces of climate and plant and animal life is important in the development of soils. The soils in the glaciated part of the county are much younger geologically than those that formed in residuum in the unglaciated areas. Relief, however, has so affected soil development in many of the residual soils that their profiles are less developed than those of some younger soils. In the soils in the glaciated areas, carbonates have been leached to depths ranging from 3 feet to more than 5 feet. Most of the residual soils were originally acid and free of carbonates.

The effects of time on the development of soils can best be observed by comparing the soils on flood plains with those on uplands. Geologically, the deposits of soil material on the flood plains are young. Compared with the soils on uplands, where the soil-forming processes have been active for a considerable period, most of the soils on the flood plains have little profile development. They developed in recently deposited material, and they receive new material in periodic floods. On these soils profile development is interrupted by the next deposition of sediments.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole

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environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland, in developing residential, industrial, and recreational areas, in engineering work, and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and later revised (*12*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 (*10, 14*). It is under continual study. Therefore, readers interested in developments of this system should refer to the latest literature available. In table 9, the soils series of Stark County are placed in some categories of the current system and in the great soil groups of the older system.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and

TABLE 9.—*Soil series classified according to the current system of classification and the 1938 system with later revisions*

Series	Current Classification [1]			1938 classification with later revisions
	Family	Subgroup	Order	Great soil group
Arkport	Coarse-loamy, mixed, mesic	Psammentic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Bogart	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Brooke	Fine, mixed, mesic	Mollic Hapludalfs	Alfisols	Sols Bruns Acides.
Canadice	Fine, illitic, mesic	Typic Ochraqualfs	Alfisols	Low-Humic Gley soils.
Canfield	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils.
Carlisle	Euic, mesic	Typic Medisaprists	Histosols	Bog soils.
Chagrin	Fine-loamy, mixed, mesic	Dystric Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Chili	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Conotton	Loamy-skeletal, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Dekalb	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols	Bog soils.
Fitchville	Fine-silty, mixed, mesic	Aeric Ochraqualfs	Alfisols	Gray-Brown Podzolic soils.
Geeburg	Fine, illitic, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Gilpin [2]	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Ginat	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols	Low-Humic Gley soils.
Glenford	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Keene	Fine-silty, mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Killbuck	Fine-loamy, mixed, nonacid, mesic	Fluventic Haplaquepts	Inceptisols	Alluvial soils.
Latham	Clayey, mixed, mesic	Aquic Hapludults	Ultisols	Gray-Brown Podzolic soils.
Licking	Fine, mixed, mesic	Aquic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Linwood	Loamy, euic, mesic	Terric Medisaprists	Histosols	Gray-Brown Podzolic soils.
Lobdell	Fine-loamy, mixed, mesic	Aquic Fluventic Eutrochrepts.	Inceptisols	Alluvial soils.
Loudonville	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Luray	Fine-silty, mixed, noncalcareous, mesic.	Typic Argiaquolls	Mollisols	Humic Gley soils.
Luray, gravelly subsoil variant.	Fine-silty, mixed, mesic	Udollic Ochraqualfs	Alfisols	Humic Gley soils.
Mentor	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Montgomery	Fine, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols	Humic Gley soils.
Muskingum	Fine-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Plainfield	Mixed, mesic	Typic Udipsamments	Entisols	Gray-Brown Podzolic soils.
Rainsboro	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils.
Ramsey	Loamy, siliceous, mesic	Lithic Dystrochrepts	Inceptisols	Sols Bruns Acides.
Ravenna	Fine-loamy, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Gray-Brown Podzolic soils.
Remsen	Fine, illitic, mesic	Aeric Ochraqualfs	Alfisols	Gray-Brown Podzolic soils.
Rittman	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils.
Sebring	Fine-silty, mixed, mesic	Typic Ochraqualfs	Alfisols	Low-Humic Gley soils.
Shoals	Fine-loamy, mixed, nonacid, mesic	Aeric Fluventic Haplaquents.	Inceptisols	Alluvial soils.
Sloan	Fine-loamy, mixed, noncalcareous, mesic.	Fluventic Haplaquolls	Mollisols	Alluvial soils.
Tilsit	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols	Gray-Brown Podzolic soils.
Trumbull	Fine, illitic, mesic	Typic Ochraqualfs	Alfisols	Low-Humic Gley soils.
Wadsworth	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Gray-Brown Podzolic soils.
Wallkill	Fine-loamy, mixed, nonacid, mesic	Thapto-Histic Haplaquepts.	Inceptisols	Humic Gley soils.
Wayland	Fine-silty, mixed, nonacid, mesic	Fluventic Haplaquepts	Inceptisols	Alluvial soils.
Weikert	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols	Sols Bruns Acides.

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TABLE 9.—*Soil series classified according to the current system of classification and the 1938 system with later revisions*—Continued

Series	Current Classification [1]			1938 classification with later revisions
	Family	Subgroup	Order	Great soil group
Weinbach	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols	Gray-Brown Podzolic soils.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Wheeling [3]	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols	Gray-Brown Podzolic soils.
Willette	Clayey, euic, mesic	Terric Medisaprists	Histosols	Bog soils.
Wooster	Fine-loamy, mixed, mesic	Typic Fragiudalfs	Alfisols	Gray-Brown Podzolic soils.

[1] Placement of some series in the current system of classification, particularly in families and subgroups, may change as more precise information becomes available.

[2] According to test data, the Gilpin soils have a higher base saturation than is permitted in the Gilpin series; this high base saturation is typical for all the Gilpin soils in Stark County. In the more recent correlations, soils similar to these have been named Westmoreland.

[3] This soil is a taxadjunt to the series. The Wheeling silt loams in this county contain less sand than Wheeling soils elsewhere.

series. In this system soil properties that are observable and measurable are used as a basis for classification. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped together. The classes that make up the current system are briefly defined in the folowing paragraphs.

ORDER: Ten soil orders are recognized in this system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions are the Entisols and Histosols, which occur in many different climates. Six of the soil orders are represented in Stark County. They are Entisols, Inceptisols, Mollisols, Alfisols, Ultisols, and Histosols.

Entisols are recent soils in which there has been little, if any, horizon development.

Inceptisols are mineral soils in which horizons have started to develop but do not have an accumulation of illuvial clay.

Mollisols are mineral soils that have a dark-colored surface layer 10 inches or more thick and a base saturation of more than 50 percent.

Alfisols are mineral soils that have horizons of clay accumulation and a base saturation of more than 35 percent.

Ultisols are mineral soils that have horizons of clay accumulation and a base saturation of less than 35 percent.

Histosols are organic soils that formed in peat or muck. The order Histosols has not been completely defined, but in Stark County Carlisle muck, Edwards muck, Linwood muck, and Willette muck are Histosols.

SUBORDER: Each order is divided into suborders, primarily on the basis of those soil characteristics that produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP: Suborders are separated into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons. The horizons used to make separations are those in which clay, iron, or humus has accumulated or those that have pans that interfere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 9, because it is the last word in the name of the subgroup.

SUBGROUP: Each great group is subdivided into subgroups. One of these subgroups represents the central, or typic, segment of a group, and the others, called intergrades, contain those soils that have properties mostly of one great group, but also one or more properties of soils in another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Laboratory Data

The physical and chemical analysis reported in table 10 were made of selected soils in Stark County by the Ohio Agricultural Research and Development Center, Ohio State University. Except for Wooster silt loam, detailed descriptions of the soils sampled, including locations of the profiles described, are given in alphabetical order in the section "Descriptions of the Soils." A profile description for the Wooster soil is given in this section; it is not typical of the Wooster series but is within the range for that series.

In addition to the data given in table 10, laboratory data are available for soils in the following series: Bogart, Canfield, Geeburg, Ravenna, Wadsworth, and Weikert. These data are on file at Columbus, Ohio, at the Soils Department, Ohio State University; the Ohio Department of Natural Resources, Division of Lands and Soil; and the State Office, Soil Conservation Service.

CDF013499

TABLE 10.—*Physical and chemical*

[Analyses made at Ohio Agricultural Research and Development Center,

Soil and site number	Depth	Horizon	Particle-size distribution					
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.5 mm.)	Silt (0.05 to 0.002 mm.)
	Inches		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Arkport fine sandy loam (SK–17).	0–9	Ap	1.8	7.3	14.4	28.2	14.4	27.5
	9–15	B21	.8	6.0	12.7	38.6	18.8	20.1
	15–18	B22t	.9	5.2	10.9	37.4	18.0	18.5
	18–21	B23	.6	5.2	11.4	41.7	18.6	16.8
	21–22	B24t	.9	5.8	12.4	40.6	16.7	15.1
	22–25	B25	1.4	6.2	12.9	42.4	17.5	14.6
	25–26	B26t	2.5	7.6	14.5	38.7	15.7	12.1
	26–31	B31	2.7	11.3	22.5	38.3	13.7	9.1
	31–32	B27t	2.8	11.6	24.0	33.6	10.6	8.8
	32–36	B32	2.4	11.4	30.3	37.8	10.0	6.6
Carlisle muck (SK–16).	0–9	1						
	9–22	2						
	22–60	3						
Chili silt loam (SK–8).	0–9	Ap	2.0	3.9	4.7	6.2	5.5	65.8
	9–12	B1	.9	2.6	3.5	5.1	4.8	64.2
	12–19	B2t	1.5	3.9	4.8	6.6	6.7	54.7
	19–29	IIB3t	9.2	25.5	17.5	11.6	3.1	13.9
	36–60	IIIC	6.3	30.7	25.0	14.3	10.2	9.4
Dekalb sandy loam (SK–22).	0–7	Ap	1.4	12.2	22.5	23.3	4.7	26.8
	7–15	B1	.4	14.0	30.5	23.9	5.2	15.6
	15–25	B2	.7	10.4	21.6	32.4	6.7	17.5
	25–34	B and C	.3	17.7	32.6	22.3	6.5	12.1
Edwards muck (SK–19).	0–5	1						
	5–13	2						
	13–24	3						
	24–28	4						
	28–42	IICca						
Fitchville silt loam (SK–9).	0–9	Ap	1.5	3.3	2.6	4.6	4.7	66.5
	9–12	A2	2.7	3.2	3.7	3.4	3.5	62.1
	12–20	B21tg	.9	1.3	1.4	2.4	3.2	58.7
	20–32	B22tg	.4	.5	.4	1.2	5.2	62.9
	32–40	B23	.6	.4	.2	.6	5.5	67.9
	40–52	B and C	.4	.7	.5	.7	1.6	61.8
Gilpin silt loam (SK–25).	0–9	Ap	1.4	2.4	3.5	11.4	5.6	60.4
	9–13	B21t	1.4	2.0	2.3	5.2	3.6	60.1
	13–18	B22t	.7	1.8	2.3	4.9	4.2	55.3
	18–30	B23t	1.6	2.6	1.3	2.8	4.4	55.4
Keene silt loam (SK–27).	0–8	Ap	4.6	5.1	2.2	2.6	2.6	61.2
	8–13	B1	3.9	3.4	1.2	1.2	1.6	61.3
	13–19	B21t	3.2	3.4	1.0	1.0	1.6	60.1
	19–25	IIB22t	1.4	2.4	.9	1.0	1.8	57.1
	25–34	IIB3	4.3	6.2	2.1	2.4	3.8	44.7
	34–40	IIIC	.2	.3	.2	.7	.8	32.4
Licking silt loam (SK–29).	0–7	Ap	.4	1.6	1.6	3.1	3.2	73.5
	7–15	B1	.2	1.3	1.2	2.3	3.0	67.6
	15–20	B21t	.3	1.1	1.1	2.2	3.1	65.7
	20–26	IIB22t	.1	.2	.5	1.2	1.5	50.4
	26–33	IIB31t	0	0	.1	.3	.6	37.3
	33–44	IIB32t	0	.1	.1	.3	.3	33.2
	44–60	IIB and C	0	.1	.2	.9	5.1	56.2
Luray silt loam (SK–10).[3]	0–8	Ap1	.4	.8	1.0	2.2	4.6	62.6
	8–11	Ap2	.2	.9	1.0	2.1	4.2	63.3
	11–13	B21tg	.1	.5	.8	1.8	3.0	60.3
	13–15	B22tg	.5	1.7	2.1	3.3	5.0	51.5
	15–23	B23tg	.7	2.0	2.0	3.1	4.8	55.8
	23–30	B24tg	.1	.7	1.2	2.6	4.1	56.1
	30–38	B3tg	.5	1.0	1.4	2.4	4.9	62.9
	38–48	IIC1	3.8	7.9	6.0	8.7	17.7	37.0
	48–60	IIC2	.5	.8	1.2	1.4	5.9	66.6

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data for selected soils

Ohio State University. Absence of data indicates determination was not made]

Clay (less than 0.002 mm.)	Reaction	Organic matter	Exchangeable cations (meq. per 100 grams of soil)					Base saturation	$CaCO_3$ equivalent
			H^1	Ca	Mg	K	Cation exchange capacity (sum)		
Percent	*pH*	*Percent*						*Percent*	*Percent*
6.4	5.7	1.9	4.6	3.1	0.5	0.28	8.5	46	
3.4	6.3	.1	1.9	1.6	.2	.17	3.9	51	
9.1	5.8	.2	3.6	2.6	.5	.20	6.9	48	
5.7	5.5		2.3	1.3	.4	.20	4.2	45	
8.5	5.1		4.1	1.9	.6	.13	6.7	39	
5.0	5.0		2.8	1.3	.6	.15	4.9	43	
8.9	5.0		4.1	2.0	.5	.13	6.7	39	
2.4	5.2		1.8	1.0	.4	.13	3.3	45	
8.6	5.2		2.7	2.1	.8	.15	5.8	53	
1.5	5.3		1.5	.7	.4	.09	2.7	44	
	4.8	92.0	87.9	45.6	3.7	.56	137.8	36	
	4.0	91.1	90.4	17.6	3.2	.70	111.9	19	
	4.8	98.6	69.9	21.1	3.8	1.1	95.9	27	
11.9	5.2	2.2	8.8	3.6	1.1	.49	14.0	37	
18.9	4.9	.7	6.6	3.4	1.4	.31	11.7	44	
21.8	4.9	.3	7.2	4.8	1.6	.31	13.9	48	
19.2	4.7	.2	7.1	4.4	1.3	.26	13.1	46	
4.1	5.2	.1	2.5	1.5	.7	.08	4.8	48	
9.1	4.5		6.0	.1	.2	.11	6.4	6	
10.4	4.5		4.7	.1	.2	.14	5.1	9	
10.7	5.4		2.5	2.0	.5	.15	5.1	51	
8.5	5.6		1.7	1.6	.4	.13	3.8	56	
	4.7	86.9	54.3	60.9	4.3	.18	119.7	55	
	5.1	79.1	43.5	64.4	8.8	.13	116.8	63	
	5.0	77.8	42.9	50.4	7.2	.12	100.6	57	
	5.9	57.4	25.6	83.0	8.5	.23	117.3	78	
	7.5	8.3							86
16.8	5.2	2.6	9.2	5.2	1.6	.13	16.1	43	
21.4	4.6	.7	8.7	3.2	1.3	.15	13.4	35	
32.1	4.6	.5	8.1	6.3	3.1	.26	17.8	54	
29.4	5.0	.3	11.8	8.3	5.1	.33	25.5	54	
24.8	5.7		4.3	8.9	4.9	.28	18.4	77	
34.3	6.0		5.7	12.1	6.2	.40	24.4	77	
15.3	5.6		7.1	3.3	.9	.31	11.6	[2] 39	
25.4	5.4		4.6	4.8	1.2	.22	10.8	[2] 57	
30.8	5.0	.2	7.3	5.7	1.9	.26	15.2	[2] 52	
31.9	5.1	.2	9.1	5.8	3.6	.30	18.8	[2] 52	
21.7	4.8		12.1	1.1	.7	.41	14.3	15	
27.4	4.9		11.3	1.5	.6	.32	13.7	18	
39.7	4.7		11.4	1.8	1.2	.29	14.7	22	
35.4	4.7		15.3	1.9	1.2	.29	18.7	18	
36.5	4.5		16.1	.9	1.2	.24	18.4	13	
65.4	4.1		21.4	.8	2.4	.36	25.0	14	
16.6	4.8		11.9	1.5	.2	.57	14.2	16	
24.4	4.8		12.2	2.2	1.2	.49	16.1	24	
26.5	4.8		12.0	2.6	1.5	.41	16.5	27	
46.1	4.7		13.9	3.3	3.5	.31	21.0	34	
61.7	4.7		13.0	7.2	10.0	.31	30.5	57	
66.0	5.3		9.9	4.3	6.8	.29	21.3	53	
37.5	6.0		4.9	6.3	7.2	.20	18.6	74	
28.4	6.0	5.3	9.4	17.5	3.8	.36	31.1	70	
28.3	6.2	4.6	7.5	18.4	3.8	.29	30.0	75	
33.5	6.3	1.2	5.2	16.3	4.0	.31	25.8	80	
35.9	6.4	1.1	6.1	17.5	4.0	.36	28.0	78	
31.6	6.5	.8	6.6	16.8	4.4	.36	28.2	77	
35.2	6.8	.8	5.4	17.9	3.5	.43	27.2	80	
26.9	6.6		4.5	12.4	3.9	.33	21.1	79	
18.9	6.7		2.6	7.2	2.1	.13	12.0	78	
23.6	7.0		2.4	7.7	2.2	.15	12.5	81	

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TABLE 10.—*Physical and chemical*

Soil and site number	Depth	Horizon	Particle-size distribution					
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.5 mm.)	Silt (0.05 to 0.002 mm.)
	Inches		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Montgomery silty clay loam (SK–20).[1]	0–5	A1	.3	.4	.5	1.5	1.7	39.9
	5–9	A and B	.1	.2	.2	.7	1.3	29.8
	9–15	B1tg	0	.1	.1	.3	.8	31.6
	15–26	B21tg	0	.2	.1	.3	.3	23.8
	26–31	B22tg	0	.1	.1	.3	.4	25.8
	31–42	B3tg	.9	1.4	1.4	3.7	2.7	39.2
	42–48	Cg	.2	.2	.2	.4	.5	63.2
Muskingum silt loam (SK–26).	0–7	Ap	.9	6.6	9.4	24.5	6.6	40.8
	7–12	B1	.9	5.4	8.7	21.6	5.9	41.7
	12–17	B2	1.2	5.2	9.7	24.2	6.6	37.7
	17–23	B3	1.2	5.7	11.1	29.8	9.2	28.4
	23–29	B and C	1.1	5.7	12.3	33.1	9.6	25.5
Plainfield loamy sand (SK–23).	0–10	Ap	.6	24.8	36.4	17.7	3.2	10.7
	10–22	B2	.6	21.2	42.4	22.8	3.2	5.5
	22–34	B3	.7	22.0	38.1	23.6	3.3	7.2
	34–46	C	5.3	53.1	26.5	6.8	1.2	3.0
Rainsboro silt loam (SK–21).	0–8	Ap	1.7	2.6	2.6	5.4	3.7	66.7
	8–17	B21t	.8	2.0	3.7	9.1	6.1	55.2
	17–29	B22t	1.0	2.3	4.8	13.9	10.0	46.8
	29–34	IIBx1	15.4	15.2	11.8	14.7	6.7	21.8
	34–41	IIBx2	14.3	17.7	14.6	17.6	5.9	18.5
	41–48	IIBx3	9.2	15.0	14.5	21.1	5.3	17.4
	48–60	IIIC	0	.1	.1	.3	.5	60.6
Remsen silt loam (SK–11).	0–7	Ap	.6	2.7	3.1	4.6	3.4	61.6
	7–13	B1t	.4	.7	.9	1.7	2.0	44.2
	13–16	B21t	.3	.5	.7	1.3	1.8	37.1
	16–24	B22t	.4	.6	.7	1.5	1.8	39.4
	24–36	B3t	.4	.8	.9	1.6	1.8	40.5
	36–46	B3–C1	.5	.8	.8	1.5	1.6	41.1
	46–56	C1	.4	1.1	1.1	2.2	2.3	42.6
	56–66	C1–C2	.7	1.0	1.0	2.0	2.1	41.6
	66–72	C2–C3	.3	.7	.8	1.6	2.0	48.2
Weinbach silt loam (SK–14).	0–8	Ap	1.2	1.8	2.7	3.2	3.5	73.7
	8–13	B1g	.4	1.6	2.5	2.8	3.2	65.1
	13–19	B21tg	1.0	1.7	1.7	2.1	2.9	61.7
	19–30	IIBx	3.2	13.4	18.2	14.5	5.6	31.5
	30–38	IIIB3	9.4	23.9	22.5	10.5	4.4	13.0
	38–60	IIIC	14.0	28.5	21.7	12.1	4.8	13.7
Wheeling silt loam (SK–7).	0–8	Ap	.3	.8	.8	1.4	4.6	76.2
	8–11	B1	.2	.6	.7	1.0	3.4	71.4
	11–21	B21t	.1	.2	.5	.8	3.8	69.6
	21–32	B22t	.1	.5	.9	1.8	5.7	70.4
	32–41	B23t	.1	.5	1.2	2.1	6.7	71.3
	41–50	IIC1	3.2	9.5	14.5	24.4	8.9	27.7
	50–70	IIC2	27.9	41.8	11.3	3.9	2.3	8.4
Wooster silt loam (SK–13).	0–8	Ap	.9	2.8	4.3	6.5	5.5	64.4
	8–15	B1	2.5	5.2	7.6	12.5	7.7	42.8
	15–22	B2t	4.7	8.2	11.3	17.7	10.0	30.5
	22–30	Bx	4.7	9.1	11.6	17.8	10.2	31.4
	30–39	B3	3.6	9.0	12.6	21.0	10.9	31.5
	39–51	C1	3.2	6.7	10.7	18.5	10.1	37.5
	51–62	C2	2.7	6.5	11.6	2.2	10.1	36.9

[1] Exchangeable acidity.
[2] Higher than is normal for Gilpin soils in other parts of the country but is common for Ohio for those soils.

CDF013502

data for selected soils—Continued

Clay (less than 0.002 mm.)	Reaction	Organic matter	Exchangeable cations (meg. per 100 grams of soil)					Base saturation	CaCo3 equivalent
			H[3]	Ca	Mg	K	Cation exchange capacity (sum)		
Percent	*pH*	*Percent*						*Percent*	*Percent*
55.7	6.5		17.1	31.1	5.5	.82	54.5	69	
67.7	6.7		11.5	39.8	6.1	.51	57.9	80	
67.1	6.9		9.1	35.6	6.8	.56	52.1	83	
75.3	7.1		7.4	37.1	6.6	.56	51.7	86	
73.3	7.1		7.8	36.8	6.4	.51	51.5	85	
50.7	7.2		5.7	31.3	5.8	.46	43.3	87	
35.3	7.7								29
11.2	4.5		7.5	.1	.3	.19	8.1	7	
15.8	4.9		6.3	1.2	.4	.15	8.0	22	
15.0	5.1		5.3	2.1	.6	.18	8.2	35	
14.6	5.0		5.0	1.4	.3	.15	6.8	27	
12.7	4.9		5.4	1.4	.4	.15	7.3	27	
6.6	5.3		7.6	1.0	.5	.13	9.2	18	
4.5	5.2		2.2	.3	.2	.10	2.8	21	
5.1	5.1		2.2	.7	.4	.09	3.4	35	
4.1	5.1		2.0	.5	.3	.09	2.9	31	
17.3	7.2		3.7	9.5	3.0	.18	16.4	77	
23.1	5.0		7.9	4.0	1.8	.17	13.9	43	
21.2	4.8		8.5	2.9	1.5	.14	13.0	35	
14.4	5.1		8.6	2.8	1.6	.14	13.1	35	
11.4	5.5		7.2	2.7	1.3	.13	11.3	36	
17.5	5.3		9.2	3.9	3.1	.15	16.3	44	
38.4	7.0		4.0	6.2	9.0	.23	19.4	79	
24.0	4.4	3.4	16.0	.9	1.1	.20	18.2	12	
50.1	4.5	1.0	17.0	2.3	4.6	.28	24.2	30	
58.3	4.4	.9	18.8	2.6	6.4	.33	28.1	33	
55.6	4.5	.8	15.0	2.5	7.8	.31	25.6	41	
54.0	6.7	.6	4.3	4.0	10.6	.26	19.2	78	
53.7	8.0	.7							5
50.3	7.9								3
51.6	7.8								2
46.4	7.6								3
13.9	6.4	2.6	5.2	7.6	.5	.82	14.1	63	
24.4	4.8	.4	7.5	7.1	.9	.32	15.8	53	
28.9	4.8	.5	11.1	8.1	1.8	.31	21.3	48	
13.6	5.3	.3	4.4	4.5	1.7	.15	10.8	59	
16.3	5.7		5.1	6.0	2.4	.18	13.7	63	
5.2	7.7								1
15.9	5.9	3.1	7.2	6.3	1.6	.20	15.3	53	
22.7	5.7	.5	5.3	5.7	2.2	.23	13.4	60	
25.0	4.4	.4	9.3	4.4	1.7	.26	15.7	41	
20.6	4.6	.3	8.1	4.1	2.6	.26	15.1	46	
18.1	4.6	.3	8.2	3.3	2.6	.26	14.4	43	
11.8	4.7	.1	4.8	1.9	1.8	.15	8.7	45	
4.4	5.2	.1	3.4	1.9	1.0	.08	6.4	47	
15.6	6.9	3.4	4.3	10.4	.4	.15	15.3	72	
21.7	6.7	.8	4.5	9.1	.3	.18	14.1	68	
17.6	4.8	.4	7.6	3.0	.3	.18	11.1	32	
15.2	4.8		7.2	2.4	.3	.13	10.0	28	
11.4	4.8		5.4	2.2	.2	.20	8.0	33	
13.3	5.0		5.2	3.0	.8	.10	9.1	43	
12.0	5.6		3.2	4.4	1.1	.08	8.8	64	

[3] The surface layer of this Luray soil has about 1.5 percent more clay than is the maximum for silt loam.
[4] In Stark County the Montgomery soils generally have a B horizon that is 50 to 60 percent clay.

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Laboratory methods.—The data on particle-size distribution shown in table 10 were obtained by the sieve analysis and by the pipette method outlined by Steele and Bradfield (*11*), but using sodium hexametaphosphate as the dispersing agent. The silt and clay were determined by sedimentation. The reaction was determined with a glass electrode and a soil-water ratio of 1.1. The percentage of organic matter was determined by wet combustion; the procedure was a modification of the Walkley-Black method (*7*).

The exchangeable acidity (H) was measured by the method described in the USDA Circular 757 (*7*). The exchangeable calcium (Ca), magnesium (Mg), and potassium (K) were determined by extraction with a neutral solution of ammonium acetate. The potassium in the ammonium acetate solution was determined by using a flame photometer. Calcium and magnesium were determined by the EDTA method outlined by Barrows and Simpson (*4*), and the cation exchange capacity by the summation of exchangeable cations. The calcium carbonate equivalent was determined by measuring the volume of carbon dioxide emitted from soil that was treated with concentrated hydrochloric acid (*8*).

Profile of a Wooster silt loam (SK–13) in Lake Township, NE¼ of section 36 (analytical data in table 10):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; many roots; pH 6.9; abrupt, smooth boundary.

B1—8 to 15 inches, strong-brown (7.5YR 5/6) silt loam; yellowish brown (10YR 5/6) crushed; strong, fine and medium, angular blocky structure; firm; roots common; sedimentary, igneous, and metamorphic pebbles as much as 5 percent, by volume; pH 6.7; clear, wavy boundary.

B2t—15 to 22 inches, dark yellowish-brown (10YR 4/4) light clay loam; patchy black (7.5YR N 2/0) stains on platy faces; massive (structureless) in place, but breaks to weak, very thick, platy structure; firm; roots common; thin, patchy clay films on horizontal ped surfaces; pebbles 5 to 10 percent, by volume; pH 4.8; gradual, wavy boundary.

Bx—22 to 30 inches, dark yellowish-brown (10YR 4/4) heavy loam; weak, medium and coarse, subangular blocky structure; firm; roots common; thin, patchy clay films on horizontal ped surfaces; pebbles 10 percent, by volume; pH 4.8; gradual, wavy boundary.

B3—30 to 39 inches, dark yellowish-brown (10YR 4/4) sandy loam; massive (structureless) in place, but breaks to weak, coarse, subangular blocky structure; firm; roots common; 10 percent, by volume; pH 4.8; diffuse, wavy boundary.

C1—39 to 51 inches, dark yellowish-brown (10YR 4/4) loam; massive (structureless); firm; few roots; pebbles 5 to 10 percent, by volume; pH 5.0; diffuse, wavy boundary.

C2—51 to 62 inches, dark yellowish-brown (10YR 4/4) loam; massive (structureless); firm; few roots; pebbles 5 to 10 percent, by volume; pH 5.6; diffuse, wavy boundary.

General Nature of the County

This section provides general information about Stark County. It discusses climate, physiography and drainage, geology, and natural resources of the county.

Climate [5]

The climate of Stark County is continental. Data on temperature and precipitation for the county are given in table 11 and are from the records kept at the Akron-Canton Airport. Except for snow cover, the data are fairly representative of the county. Because of the influences of Lake Erie, the annual snowfall averages about 48 inches in the northern part of the county and only about 33 inches in the southern part. Precipitation varies from year to year, but it is normally abundant, and it is ordinarily well distributed through-

[5] By MARVIN E. MILLER, State climatologist, Weather Bureau, ESSA, U.S. Department of Commerce.

TABLE 11.—*Temperature and precipitation data*

[Data from Akron-Canton Airport]

Month	Average temperature				Precipitation				
	Daily maximum	Daily minimum	Monthly maximum	Monthly minimum	Average monthly total	One year in 10 will have—		Average monthly snowfall	Average number of days with 1 inch or more of snow cover
						Less than—	More than—		
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*	*Number*
January	35.6	20.9	56	−3	2.86	1.08	5.15	10.0	3
February	36.6	20.7	58	1	2.30	.99	3.57	8.7	3
March	46.3	27.5	69	10	3.32	1.54	5.63	9.6	3
April	59.6	37.8	79	22	3.34	1.59	5.00	2.7	1
May	71.2	48.1	85	32	3.85	1.85	5.88	.2	0
June	80.6	58.2	92	43	4.26	1.72	6.38	0	0
July	83.2	61.9	92	50	3.77	1.88	6.56	0	0
August	82.0	61.0	91	47	3.11	1.41	6.12	0	0
September	75.1	52.7	89	37	2.62	1.06	5.45	0	0
October	63.3	42.5	81	29	2.48	.73	4.25	.6	(1)
November	48.6	32.9	70	15	2.25	.99	4.08	5.5	2
December	37.4	23.5	60	2	2.27	1.07	4.11	10.3	3
Year	60.0	40.6	94	−6	36.43	29.66	44.88	47.6	15

[1] Less than one-half day.

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out the year. During the growing season, precipitation occurs mostly in showers and thunderstorms. Most thunderstorms occur in the period May through August. During a 10-year period, more than 1.2 inches of rain can be expected to fall each week on about 8 days in April, 11 days in May, and 12 days in June. Because most crops generally are planted from late in April through the middle of June and the fields have little plant cover, the heaviest rains delay field operations and cause considerable soil loss in some places.

Soil moisture varies during the year. It is lowest in October, but winter and early in spring is the recharge season when soil-moisture reserves are replenished, because not much of the moisture is then being used. Rainfall generally is sufficient to meet the needs of crops until July and August, when the need for moisture is greatest and its use by plants normally exceeds rainfall. The soils become progressively drier in summer and fall.

The length of the growing season varies considerably within the county. These variations are related to the terrain, which is gently rolling to hilly. The elevation ranges from 900 feet to 1,350 feet. Table 12 shows the probability of freezing temperatures on or after given dates in spring and on or before given dates in fall. The data were estimated from averages obtained from records kept at the Akron-Canton Airport, and at Canfield, Chippewa Lake, Millport, and Wooster. However, light frost can occur when the temperature of the air is above freezing or is as much as 36° F.

In this county the relative humidity is lowest in summer and highest in winter. It varies during the day and generally decreases with increasing temperatures, and it ranges from 50 to 60 percent on hot summer afternoons. The average relative humidity throughout the year is about 78 percent at 1 a.m., 82 percent at 7 a.m., 60 percent at 1 p.m., and 66 percent at 7 p.m.

In an average year, there are about 74 clear days, 103 partly cloudy days, and 188 cloudy days in Stark County. The cloud cover is 0 to 30 percent on clear days, 30 to 70 percent on partly cloudy days, and is more than 70 percent on cloudy days. Heavy fogs occur about 30 times each year and are most frequent during the warmer half of the year.

In this county the prevailing winds are from the south. The average windspeed is about 10 miles per hour, but it is slightly stronger in winter than in summer. Winds that blow at a rate of 35 to 80 miles per hour sometimes accompany thunderstorms and cause damage in some areas. Thunderstorms occur on an average of 40 days a year, and most of them occur in the period May through August. Only four tornadoes have passed over Stark County since 1900.

Physiography and Drainage

Stark County is in the Appalachian Plateau Physiographic Province. The northern two-thirds of the county lies in the glacial part of the Appalachian Plateau, and the rest of the county is in the unglaciated part (*6*).

The elevations range from a little less than 900 feet above sea level near Bolivar in the southern part of Bethlehem Township to about 1,350 feet northeast of Paris in the northern part of Paris Township.

The unglaciated part of the county appears as a maturely dissected peneplain, but the apparent peneplain was not caused by peneplanation but by nearly level, resistant strata that capped the Plateau. The topography is hilly and steep and variations in relief average about 200 feet within one-half mile.

The glaciated part of the county is undulating and rolling, and the average relief varies less than 100 feet within a mile.

Most of Stark County is in the Ohio River watershed. Lexington Township, the eastern part of Marlboro Township, and the northern part of Washington Township are drained by the Mahoning River and its tributaries, Deer Creek and Beech Creek. The northern part of Lake Township and the northwestern part of Marlboro Township are drained by Congress ditch, which flows into the Lake Erie watershed (*5*).

Most of the streams in the county roughly parallel the Tuscarawas River, which flows southward. Sandy Creek flows westward into the Tuscarawas River at Bolivar. The headwaters of Bear Run, Limestone Creek, Pleasant Valley Run, and Indian Run are on the uplands near the boundary that separates the unglaciated part of the county and the Wisconsin glacial till area. The headwaters of Sugar Creek, Nimishillen Creek, Little Sandy Creek, Black Run, and

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[Based on data at Akron-Canton Airport, Canfield, Chippewa Lake, Millport, and Wooster]

Probability	Dates for given probability at temperature of—			
	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:				
1 year in 10 later than	April 18	May 1	May 15	May 29
2 years in 10 later than	April 14	April 26	May 10	May 24
5 years in 10 later than	April 2	April 15	April 28	May 14
Fall:				
1 year in 10 earlier than	October 24	October 9	September 28	September 18
2 years in 10 earlier than	October 29	October 15	October 2	September 23
5 years in 10 earlier than	November 11	October 31	October 13	October 5

Hugle Run, however, are in the glaciated part of the county. Little Sandy Creek, Black Run, and Hugle Run have cut narrow gorges through the highlands; they flow onto and cross the unglaciated part of the county and empty into Sandy Creek. The most notable gorge is along Nimishillen Creek in an area between North Industry and Howenstein.

Although the county is moderately well drained, there are numerous swampy areas. Some of these areas are as much as 700 acres in size.

Geology

The bedrock underlying Stark County consists mainly of sandstone, siltstone, shale, coal, and limestone, all of which formed from sediments laid down during the Pennsylvanian period (*5*). The oldest rocks are the Sharon conglomerate and sandstone of the Pottsville formation that occur in the western part of the county. The remaining members of the Pottsville formation and all of the members of the overlying Allegheny formation and the younger Lower Mahoning member of the Conemaugh formation underlie the eastern part of the county.

Before glaciation, the topography of all of the area that is now Stark County was the same as that in Sandy and Pike Townships and the eastern part of Bethlehem Township, which are in the unglaciated part of the county. However, this area was invaded by a succession of glaciers, and glacial erosion and deposition modified the topography in direct relationship to the intensity of glaciation. The county was invaded by several glaciers of both the Illinoian and the Wisconsin age. The glaciers transported material from the Lake Simcoe area of Canada and from other areas to the north. Most of the drift laid down by the Illinoian glaciers, however, was either swept away or buried by the advance of the Wisconsin glaciers (*5*). Today, only a few hilltops and ridges are thinly covered by till deposited by the Illinoian glaciers. These areas are 1 or 2 miles wide and are south of the boundary that separates the glaciated and unglaciated parts of the county. The Illinoian till and the Wisconsin till are similar and, in these areas, the soils from the same series are mapped on both.

The various advances made by Wisconsin ice sheets were divided into two lobes; the Killbuck lobe covered the entire western half of the county, and the Grand River lobe covered most of the glaciated area in the eastern part. Because the advances within the two lobes did not take place simultaneously, the zone of overlap and outwash is terminated as an interlobate area that extends from Canton northward toward Uniontown.

Natural Resources

Soil, water, and soft coal are among the most valuable natural resources of Stark County. Clay, shale, sand, gravel, and limestone for cement are other important natural resources in this county.

Water is adequate for most farm uses throughout the county. It is also adequate for many industrial uses in some areas.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capactiy.

Bench terrace. A shelflike embankment of earth that has a level or nearly level top and a steep or nearly vertical downhill face, constructed along the contour of sloping land or across the slope to control runoff and erosion. The downhill face of the bench may be made of rocks or masonry, or it may be planted to vegetation.

Calcareous soil. A soil that contains enough lime or calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial drift. Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash. Cross-bedded gravel, sand, and silt deposited by melting water as it flows from glacial ice.

Glacial till. Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Kame (geology). A short ridge, hill, or mound of stratified glacial drift deposited by glacial meltwater.

Lacustrine deposits (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching, soil. The removal of soluble materials from soils or other material by percolating water.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural soil drainage. Refers to moisture conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottling below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Parent material. The disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter) *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Soil variant. A soil having properties sufficiently different from those other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizonal), *columnar* (prism with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) single grain (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces inteuded mainly for drainage have a deep channel that is maintained in permanent sod.

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Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silt clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficulty to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Weathering, soil. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

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GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. For complete information about a capability unit read both the description of the unit and also the introduction to the section in which the unit is described. For information about the suitability of soils as woodland and as wildlife habitat, read the introduction to these sections and refer to the tables in each section. Other information is given in tables as follows:

Estimated yields, table 1, p. 20.
Uses of soils in engineering, tables 4, 5, and 6, pp. 38 through 67.
Use of soils in town and country planning, table 7, p. 72.
Acreage and extent, table 8, p. 91.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
Ad	Alluvial land	92	VIIIw-1	19	---
An	Alluvial land-Urban land complex	92	---	--	---
ArB	Arkport fine sandy loam, 0 to 6 percent slopes	93	IIe-6	11	2s1
ArC	Arkport fine sandy loam, 6 to 12 percent slopes	93	IIIe-1	13	2s1
ArD	Arkport fine sandy loam, 12 to 18 percent slopes	93	IVe-1	16	2s1
BgA	Bogart loam, 0 to 2 percent slopes	94	IIs-1	12	1o1
BgB	Bogart loam, 2 to 6 percent slopes	94	IIe-3	10	1o1
BoA	Bogart silt loam, 0 to 2 percent slopes	94	IIs-1	12	1o1
BoB	Bogart silt loam, 2 to 6 percent slopes	94	IIe-3	10	1o1
BoC	Bogart silt loam, 6 to 12 percent slopes	94	IIIe-1	13	1o1
Bu	Bogart-Urban land complex	94	---	--	1o1
By	Borrow pits	95	---	--	---
BwC2	Brooke silty clay loam, 4 to 12 percent slopes, moderately eroded	95	IIIe-3	13	3c1
BwE2	Brooke silty clay loam, 12 to 25 percent slopes, moderately eroded	95	VIe-2	18	3c1 1/; 4c1 2/
Ca	Canadice silt loam	96	IVw-1	17	1w1
CdA	Canfield silt loam, 0 to 2 percent slopes	97	IIw-4	12	1o1
CdB	Canfield silt loam, 2 to 6 percent slopes	97	IIe-2	10	1o1
CdC	Canfield silt loam, 6 to 12 percent slopes	97	IIIe-2	13	1o1
CdC2	Canfield silt loam, 6 to 12 percent slopes, moderately eroded	97	IIIe-2	13	1o1
CdD	Canfield silt loam, 12 to 18 percent slopes	97	IVe-2	16	1o1
CdD2	Canfield silt loam, 12 to 18 percent slopes, moderately eroded	98	IVe-2	16	1o1
CeB	Canfield-Urban land complex, undulating	98	---	--	1o1
CeC	Canfield-Urban land complex, rolling	98	---	--	1o1
CfB	Canfield silt loam, moderately shallow variant, 2 to 6 percent slopes	98	IIe-4	10	1o1
CfC	Canfield silt loam, moderately shallow variant, 6 to 12 percent slopes	99	IIIe-3	13	1o1
Ch	Carlisle muck	99	IIIw-5	15	---
Ck	Chagrin loam, alkaline phase	100	IIw-5	12	1o1
Cm	Chagrin silt loam, alkaline phase	100	IIw-5	12	1o1
CnA	Chili loam, 0 to 2 percent slopes	101	IIs-1	12	1o1
CnB	Chili loam, 2 to 6 percent slopes	101	IIe-3	10	1o1
CoC	Chili gravelly loam, 6 to 12 percent slopes	101	IIIe-1	13	1o1
CoC2	Chili gravelly loam, 6 to 12 percent slopes, moderately eroded	101	IIIe-1	13	1o1
CoD2	Chili gravelly loam, 12 to 18 percent slopes, moderately eroded	101	IVe-1	16	1o1
CoE2	Chili gravelly loam, 18 to 25 percent slopes, moderately eroded	102	VIe-1	18	2r1
CpA	Chili silt loam, 0 to 2 percent slopes	102	IIs-1	12	1o1
CpB	Chili silt loam, 2 to 6 percent slopes	102	IIe-3	10	1o1
CpC	Chili silt loam, 6 to 12 percent slopes	102	IIIe-1	13	1o1
CpC2	Chili silt loam, 6 to 12 percent slopes, moderately eroded	102	IIIe-1	13	1o1
CuB	Chili-Urban land complex, undulating	102	---	--	1o1

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Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
CuC	Chili-Urban land complex, rolling	102	----------	--	1o1
CuF	Chili-Urban land complex, steep	102	----------	--	3f1
CvF2	Chili and Conotton gravelly loams, 25 to 50 percent slopes, moderately eroded	102	VIIe-1	19	3f1
CwA	Conotton loam, 0 to 2 percent slopes	103	IIIs-1	16	3f1
CyB	Conotton gravelly loam, 2 to 6 percent slopes	103	IIIs-1	16	3f1
CyC	Conotton gravelly loam, 6 to 12 percent slopes	103	IIIs-1	16	3f1
CyD2	Conotton gravelly loam, 12 to 18 percent slopes, moderately eroded	103	VIe-1	18	3f1
CyE2	Conotton gravelly loam, 18 to 25 percent slopes, moderately eroded	103	VIIe-1	19	3f1
Cz	Cut and fill land	104	VIIIs-1	19	---
DkB	Dekalb sandy loam, 2 to 6 percent slopes	104	IIe-4	10	3o1
DkC	Dekalb sandy loam, 6 to 12 percent slopes	104	IIIe-3	13	3o1
DkE2	Dekalb sandy loam, 12 to 25 percent slopes, moderately eroded	104	IVe-3	17	2r1 1/; 3r1 2/
DkF2	Dekalb sandy loam, 25 to 50 percent slopes, moderately eroded	105	VIe-3	18	2r1 1/; 3r1 2/
Ed	Edwards muck	105	IIIw-5	15	---
FcA	Fitchville silt loam, 0 to 2 percent slopes	106	IIw-1	11	1w1
FcB	Fitchville silt loam, 2 to 6 percent slopes	106	IIw-1	11	1w1
FcC	Fitchville silt loam, 6 to 12 percent slopes	106	IIIe-5	14	1w1
Fu	Fitchville-Urban land complex	106	----------	--	1w1
GbC2	Geeburg silt loam, 6 to 12 percent slopes, moderately eroded	107	IVe-4	17	2c1
GbE2	Geeburg silt loam, 12 to 25 percent slopes, moderately eroded	107	VIe-2	18	2c1
GdB	Gilpin silt loam, 2 to 6 percent slopes	108	IIe-4	10	3o1
GdC	Gilpin silt loam, 6 to 12 percent slopes	108	IIIe-3	13	3o1
GdD	Gilpin silt loam, 12 to 18 percent slopes	108	IVe-3	17	3o1
Ge	Ginat silt loam	109	IIIw-4	15	1w1
GfA	Glenford silt loam, 0 to 2 percent slopes	110	I-1	9	1o1
GfB	Glenford silt loam, 2 to 6 percent slopes	110	IIe-1	9	Io1
GfC	Glenford silt loam, 6 to 12 percent slopes	110	IIIe-5	14	1o1
GfC2	Glenford silt loam, 6 to 12 percent slopes, moderately eroded	110	IIIe-5	14	1o1
GfD2	Glenford silt loam, 12 to 18 percent slopes, moderately eroded	110	IVe-1	16	1o1
Gp	Gravel pits	I10	----------	--	---
KeB	Keene silt loam, 2 to 6 percent slopes	111	IIe-5	10	3w1
KeC	Keene silt loam, 6 to 12 percent slopes	11I	IIIe-6	14	3w2
KeC2	Keene silt loam, 6 to 12 percent slopes, moderately eroded	111	IIIe-6	14	3w2
KeD	Keene silt loam, 12 to 18 percent slopes	111	IVe-4	17	3w2
KeD2	Keene silt loam, 12 to 18 percent slopes, moderately eroded	111	IVe-4	17	3w2
KeE	Keene silt loam, 18 to 25 percent slopes	112	VIe-2	18	3w2
Kk	Killbuck silt loam	112	IIIw-3	15	2w1
LaB	Latham silt loam, 2 to 6 percent slopes	113	IIIe-4	13	3c1
LaC	Latham silt loam, 6 to 12 percent slopes	113	IVe-4	17	3c1
LaC2	Latham silt loam, 6 to 12 percent slopes, moderately eroded	113	IVe-4	17	3c1
LaD	Latham silt loam, 12 to 18 percent slopes	I13	VIe-2	18	3c1
LaD2	Latham silt loam, 12 to 18 percent slopes, moderately eroded	113	VIe-2	18	3c1
LaF	Latham silt loam, 18 to 35 percent slopes	113	VIe-2	18	3c1 1/; 4c1 2/
LcA	Licking silt loam, 0 to 2 percent slopes	114	IIIw-1	14	2c1
LcB	Licking silt loam, 2 to 6 percent slopes	114	IIIe-5	14	2c1
LcC	Licking silt loam, 6 to 12 percent slopes	114	IVe-4	17	2c1
LcC2	Licking silt loam, 6 to 12 percent slopes, moderately eroded	115	IVe-4	17	2c1

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Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
LcE2	Licking silt loam, 12 to 25 percent slopes, moderately eroded	115	VIe-2	18	2c1
Ld	Linwood muck	115	IIIw-5	15	---
Le	Lobdell silt loam, alkaline phase	116	IIw-5	12	1o1
LoB	Loudonville silt loam, 2 to 6 percent slopes	116	IIe-4	10	2o1
LoC	Loudonville silt loam, 6 to 12 percent slopes	117	IIIe-1	13	2o1
LoC2	Loudonville silt loam, 6 to 12 percent slopes, moderately eroded	117	IIIe-1	13	2o1
LoD	Loudonville silt loam, 12 to 18 percent slopes	117	IVe-3	17	2o1
LoD2	Loudonville silt loam, 12 to 18 percent slopes, moderately eroded	117	IVe-3	17	2o1
LoE2	Loudonville silt loam, 18 to 25 percent slopes, moderately eroded	117	IVe-3	17	2r1
LoF2	Loudonville silt loam, 25 to 35 percent slopes, moderately eroded	117	VIe-3	18	2r1
LuB	Loudonville-Urban land complex, undulating	117	----------	--	2o1
LuC	Loudonville-Urban land complex, rolling	118	----------	--	2o1
Ly	Luray silt loam	118	IIw-6	12	2w1
Lz	Luray silt loam, gravelly subsoil variant	119	IIw-6	12	2w1
Ma	Made land	119	VIIIs-1	19	---
MeA	Mentor silt loam, 0 to 2 percent slopes	120	I-1	9	1o1
MeB	Mentor silt loam, 2 to 6 percent slopes	120	IIe-1	9	1o1
MeC	Mentor silt loam, 6 to 12 percent slopes	120	IIIe-5	14	1o1
MeD	Mentor silt loam, 12 to 18 percent slopes	120	IVe-1	16	1o1
Mg	Montgomery silty clay loam	121	IIIw-6	16	2w1
MsB	Muskingum silt loam, 2 to 6 percent slopes	121	IIe-4	10	3o1
MsC	Muskingum silt loam, 6 to 12 percent slopes	122	IIIe-3	13	3o1
MsD	Muskingum silt loam, 12 to 18 percent slopes	122	IVe-3	17	3o1
MvE	Muskingum and Gilpin silt loams, 18 to 25 percent slopes	122	IVe-3	17	2r1 1/; 3r1 2/
MvE3	Muskingum and Gilpin silt loams, 18 to 25 percent slopes, severely eroded	122	VIe-3	18	2r1 1/; 3r1 2/
MvF	Muskingum and Gilpin silt loams, 25 to 35 percent slopes	122	VIe-3	18	2r1 1/; 3r1 2/
MvG	Muskingum and Gilpin silt loams, 35 to 50 percent slopes	122	VIIe-2	19	2r1 1/; 3r1 2/
MwF	Muskingum and Gilpin-Urban land complex, steep	122	----------	--	2r1 1/; 3r1 2/
PlB	Plainfield loamy sand, 0 to 6 percent slopes	123	IVs-1	17	2s1
PlC	Plainfield loamy sand, 6 to 12 percent slopes	123	IVs-1	17	2s1
Qu	Quarries	123	----------	--	---
RaB	Rainsboro silt loam, 2 to 6 percent slopes	124	IIe-2	10	3w1
RaC	Rainsboro silt loam, 6 to 12 percent slopes	124	IIIe-2	13	3w1
RcC	Ramsey channery sandy loam, 6 to 12 percent slopes	125	VIs-1	18	4d1 1/; 5d1 2/
RcD	Ramsey channery sandy loam, 12 to 18 percent slopes	125	VIs-1	18	4d1 1/; 5d1 2/
RcE2	Ramsey channery sandy loam, 18 to 25 percent slopes, moderately eroded	125	VIIs-1	19	4d1 1/; 5d1 2/
RcF2	Ramsey channery sandy loam, 25 to 50 percent slopes, moderately eroded	125	VIIs-1	19	4d2 1/; 5d1 2/
ReA	Ravenna silt loam, 0 to 2 percent slopes	126	IIw-2	11	2w2
ReB	Ravenna silt loam, 2 to 6 percent slopes	126	IIw-2	11	2w2
Rn	Ravenna-Urban land complex	126	----------	--	2w2
RoA	Remsen silt loam, 0 to 2 percent slopes	127	IIIw-1	14	2w2
RoB	Remsen silt loam, 2 to 6 percent slopes	127	IIIw-1	14	2w2
Rr	Remsen-Urban land complex	127	----------	--	2w2

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Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
RsB	Rittman silt loam, 2 to 6 percent slopes	128	IIe-7	11	1o1
RsC	Rittman silt loam, 6 to 12 percent slopes	128	IIIe-7	14	1o1
RsC2	Rittman silt loam, 6 to 12 percent slopes, moderately eroded	128	IIIe-7	14	1o1
RsD2	Rittman silt loam, 12 to 18 percent slopes, moderately eroded	129	IVe-2	16	1o1
Sb	Sebring silt loam	129	IIIw-4	15	1w1
Se	Sebring silt loam, till substratum	129	IIIw-4	15	1w1
Sg	Sebring-Urban land complex	130	----------	--	1w1
Sh	Shoals silt loam	130	IIw-3	12	2w2
Sl	Sloan silt loam	131	IIIw-3	15	2w1
SoC	Strip mine spoil, sandstone and shale materials, undulating	131	VIs-2	18	---
SoE	Strip mine spoil, sandstone and shale materials, rolling	131	VIs-2	18	---
SoF	Strip mine spoil, sandstone and shale materials, steep	131	VIIs-2	19	---
SsC	Strip mine spoil, acid clay shale materials, undulating	131	VIIs-2	19	---
SsE	Strip mine spoil, acid clay shale materials, rolling	131	VIIs-2	19	---
SsF	Strip mine spoil, acid clay shale materials, steep	132	VIIs-2	19	---
StC	Strip mine spoil, nonacid materials, undulating	132	VIs-2	18	---
StD	Strip mine spoil, nonacid materials, rolling	132	VIs-2	18	---
StF	Strip mine spoil, nonacid materials, steep	132	VIIs-2	19	---
TlC	Tilsit silt loam, 6 to 12 percent slopes	133	IIIe-2	13	3w2
TlD	Tilsit silt loam, 12 to 18 percent slopes	133	IVe-2	16	3w2
Tr	Trumbull silt loam	134	1Vw-1	17	1w1
Ur	Urban land	134	----------	--	---
WaA	Wadsworth silt loam, 0 to 2 percent slopes	135	IIIw-2	14	1w1
WaB	Wadsworth silt loam, 2 to 6 percent slopes	135	IIIw-2	14	1w1
WaC	Wadsworth silt loam, 6 to 12 percent slopes	135	IIIe-2	13	1w1
WaC2	Wadsworth silt loam, 6 to 12 percent slopes, moderately eroded	135	IIIe-2	13	1w1
WbB	Wadsworth silt loam, moderately shallow variant, 2 to 6 percent slopes	136	IIIw-2	14	1w1
Wc	Wallkill silt loam, clayey subsoil variant	136	IIIw-3	15	2w1
Wd	Wayland silt loam	137	IIIw-3	15	2w1
WeC	Weikert channery silt loam, 6 to 12 percent slopes	137	VIs-1	18	4d1
WeD	Weikert channery silt loam, 12 to 18 percent slopes	138	VIs-1	18	4d1 1/; 5d1 2/
WeE2	Weikert channery silt loam, 18 to 25 percent slopes, moderately eroded	138	VIIs-1	19	4d1 1/; 5d1 2/
WeF2	Weikert channery silt loam, 25 to 50 percent slopes, moderately eroded	138	VIIs-1	19	4d2 1/; 5d1 2/
WhA	Weinbach silt loam, 0 to 2 percent slopes	139	IIw-2	11	2w2
WhB	Weinbach silt loam, 2 to 6 percent slopes	139	IIw-2	11	2w2
Wk	Weinbach-Urban land complex	139	----------	--	2w2
WlB	Wellston silt loam, 2 to 6 percent slopes	139	IIe-1	9	2o1
WlC	Wellston silt loam, 6 to 12 percent slopes	140	IIIe-1	13	2o1
WmA	Wheeling loam, 0 to 2 percent slopes	140	I-1	9	2o1
WmB	Wheeling loam, 2 to 6 percent slopes	140	IIe-1	9	2o1
WmC2	Wheeling loam, 6 to 12 percent slopes, moderately eroded	141	IIIe-5	14	2o1
WrA	Wheeling silt loam, 0 to 2 percent slopes	141	I-1	9	2o1
WrB	Wheeling silt loam, 2 to 6 percent slopes	141	IIe-1	9	2o1
WrC	Wheeling silt loam, 6 to 12 percent slopes	141	IIIe-5	14	2o1
WrC2	Wheeling silt loam, 6 to 12 percent slopes, moderately eroded	141	IIIe-5	14	2o1
WsD2	Wheeling soils, 12 to 18 percent slopes, moderately eroded	141	IVe-1	16	2o1
Wt	Willette muck	142	IIIw-5	15	---
WuB	Wooster silt loam, 2 to 6 percent slopes	142	IIe-1	9	1o1
WuC	Wooster silt loam, 6 to 12 percent slopes	142	IIIe-1	13	1o1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
WuC2	Wooster silt loam, 6 to 12 percent slopes, moderately eroded	143	IIIe-1	13	1o1
WuD2	Wooster silt loam, 12 to 18 percent slopes, moderately eroded	143	IVe-1	16	1o1
WuE2	Wooster silt loam, 18 to 25 percent slopes, moderately eroded	143	VIe-1	18	1r1
WuF2	Wooster silt loam, 25 to 50 percent slopes, moderately eroded	143	VIe-1	18	1r1
WvD	Wooster-Urban land complex, steep	143	----------	--	1o1

1/ On north- and east-facing slopes.

2/ On south- and west-facing slopes.

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