Golder Associates Inc.

305 Fellowship Road, Suite 200
Mt. Laurel, NJ USA 08054
Tel: (609) 273-1110
Fax (609) 273-0778

Golder Associates

EPA Region 5 Records Ctr.
238516

EASTERN PLUME/DNAPL INVESTIGATION REPORT NEASE SITE, SALEM, OHIO

Prepared For:

RÜTGERS Organics Corporation
201 Struble Road
State College, Pennsylvania

DISTRIBUTION:

3 Copies	US Environmental Protection Agency
2 Copies	Ohio Environmental Protection Agency
2 Copies	Black & Veatch
2 Copies	RÜTGERS Organics Corporation
2 Copies	Golder Associates Inc.

August 1998

Project No.: 933-6154

Golder Associates Inc.

305 Fellowship Road, Suite 200
Mt. Laurel, NJ USA 08054
Tel: (609) 273-1110
Fax (609) 273-0778

Golder Associates

August 4, 1998

Project No.: 933-6154

Mr. Anthony Rutter
USEPA Region 5
Waste Management Division
Office 4, Superfund
77 West Jackson Boulevard
Chicago, IL 60604

Mr. Joseph E. Trocchio
Ohio Environmental Protection Agency
Div. of Emergency and Remedial Response
Northeast District Office
2110 East Aurora Road
Twinsburg, OH 44087

RE: EASTERN PLUME/DNAPL INVESTIGATION REPORT
NEASE SITE, SALEM, OHIO

Gentlemen:

On behalf of RÜTGERS Organics Corporation (ROC), Golder Associates Inc. (Golder Associates) is pleased to forward herewith the Final Eastern Plume/DNAPL Investigation Report for the Nease Site, Salem, Ohio. We hope that this Final Report has addressed Agency comments on the August 7, 1997 Eastern Plume/DNAPL Report, captioned in USEPA letters dated December 18, 1997 and April 1, 1998, and OEPA letter dated December 29, 1997.

If you have any questions about this report, please do not hesitate to call.

Very truly yours,

GOLDER ASSOCIATES INC.

Todd H. Rees, Ph.D., P.E.
Senior Environmental Engineer and Associate

Ramesh Venkatakrishnan, Ph.D., P.G.
Associate, Consultant - Geology

Florin Gheorghiu, P.G.
Project Director and Principal

THR/bjb
G:\PROJECTS\933-6154\EASTPL.RPT\CVRLTR.DOC

TABLE OF CONTENTS

Cover Letter

Table of Contents i

SECTION PAGE

1. INTRODUCTION 1
   1.1 Site Location 2
   1.2 Objectives 3

2. RESULTS OF TASK ACTIVITIES 5
   2.1 Screening Level Activities (Task 1) 5
      2.1.1 Soil Vapor Survey (Task 1a) 5
      2.1.2 Downhole Video Survey (Task 1b) 6
      2.1.3 Re-Evaluation of Existing Rock Core (Task 1c) 7
   2.2 Monitoring Well Installation and Development (Task 2) 7
      2.2.1 Shallow Groundwater System 9
      2.2.2 Transition Groundwater System 10
      2.2.3 Deep Groundwater System (MKS) 10
   2.3 Groundwater Sampling and Analysis (Task 3) 12
      2.3.1 Shallow Groundwater System 13
      2.3.2 Transition Groundwater Aquitard 13
      2.3.3 Deep Groundwater System 14
      2.3.4 Municipal Water Supply Well Sample 14
   2.4 Hydrogeologic Testing (Task 4) 14
   2.5 Miscellaneous Work (Task 5) 15
      2.5.1 Well Decommissioning (Task 5a) 15
      2.5.2 Residential Well Sampling (Task 5b) 15
      2.5.3 Feeder Creek Temporary Piezometers (Task 5c) 15
   2.6 Seep Piezometer Sampling 16

3. SITE CONCEPTUAL MODEL 19
   3.1 Site Geology 19
      3.1.1 Overburden 19
      3.1.2 Bedrock 21
   3.2 Site Hydrogeology 22
      3.2.1 Groundwater Flow Direction/Horizontal Hydraulic Gradients 23
      3.2.2 Vertical Hydraulic Gradients 24
      3.2.3 Hydraulic Conductivity of Overburden 25
      3.2.4 Groundwater Flow Velocity 25
   3.3 Groundwater Chemistry 26
      3.3.1 Pond 2 Plume (East/Northeast Flowing Groundwater Regime) 26
      3.3.2 Discrete Impacts in Southeastern Portion of Site 29
   3.4 Discussion of DNAPL Source Area - Pond 2 30
   3.5 Discussion of Potential Contaminant Transport Pathways 33
      3.5.1 DNAPL Distribution in the Overburden Units 33
      3.5.2 DNAPL Distribution in the Transition Zone/Shallow Bedrock 34

TABLE OF CONTENTS (Cont'd)

4. CONCLUSIONS AND RECOMMENDATIONS 35
4.1 Conclusions 35
4.2 Recommendations 36
4.2.1 Residential Well Sampling Plan 36
4.2.2 Crane-Deming Seep 38

5. REFERENCES 39

In Order
Following
Page 39

LIST OF TABLES

Table 1 Borehole Summary
Table 2 Summary of VOC/SVOC Concentrations- Round 3, 1996 Seep Investigation, and Eastern Plume/DNAPL Investigation
Table 3 Solubility/ Concentration Comparison
Table 4a Pond 2 Area Soil Boring Chemistry
Table 4b Pond 3 Area Soil Boring Chemistry
Table 4c Pond 4 Area Soil Boring Chemistry
Table 4d Pond 7 Area Soil Boring Chemistry

LIST OF FIGURES

Figure 1 Site Location Map
Figure 2 Composite Groundwater Contour Map of Overburden Wells - April 1997
Figure 3 Interpreted Groundwater Contours Middle Kittaning Sandstone
Figure 4 Isoconcentration Contours Vapor Phase TCE in the Shallow Overburden
Figure 5 Downhole Video Log Well RW-1
Figure 6 Monitoring Well and Cross Section Locations
Figure 7 Top of Bedrock Contour Map
Figure 8 Sections A-A' and B-B'
Figure 9 Interpreted Isoconcentration Contours- Total VOCs- Overburden- Pond 2 Plume
Figure 10 Interpreted Isoconcentration Contours- Total SVOCs- Overburden- Pond 2 Plume
Figure 11 Interpreted Isoconcentration Contours- Total VOCs- Southeastern Overburden
Figure 12 Interpreted Isoconcentration Contours- Total SVOCs- Southeastern Overburden
Figure 13 Interpreted Isoconcentration Contours- Total VOCs- Middle Kittaning Sandstone
Figure 14 Interpreted Isoconcentration Contours- Total SVOCs- Middle Kittaning Sandstone
Figure 15 Potential Areal Extent of NAPL Compounds in Southeastern Overburden
Figure 16 Potential Areal Extent of NAPL Compounds in Overburden- Pond 2 Plume
Figure 17 Potential Areal Extent of NAPL Compounds in Middle Kittaning Sandstone
Figure 18 Site Conceptual Model
Figure 19 Residential Well Sampling Location Plan

TABLE OF CONTENTS (Cont'd)

LIST OF APPENDICES

Appendix A Agency Comments on Eastern Plume/DNAPL Investigation Work Plan
Appendix B Results of Soil Gas Survey
Appendix C Downhole Video Survey of Well RW-1
Appendix D Soil Boring Logs
Appendix E Well Installation Logs
Appendix F Groundwater Analytical Results
Appendix G Data Validation Narrative
Appendix H Results of Hydrogeologic Testing
Appendix I HydroPunch Installation Logs
Appendix J HydroPunch Analytical Results
Appendix K Seep Piezometer Analytical Results

1. INTRODUCTION

Golder Associates Inc. (Golder Associates) has been retained by RÜTGERS Organics Corporation (ROC) to prepare the report entitled "Eastern Plume/DNAPL Investigation Report, Nease Site, Salem, Ohio." This document reports on the results of investigation activities conducted at the Nease Site (Site) as proposed in the "Eastern Plume/DNAPL Investigation Work Plan, Nease Site, Salem, Ohio (Work Plan)," and conditionally approved by the U.S. Environmental Protection Agency (USEPA) and the Ohio Environmental Protection Agency (OEPA) in a letter dated November 13, 1996. In a letter dated March 24, 1997, the Agencies formally commented on the Work Plan (Agency letter is provided in Appendix A). With Agency approval, the Work Plan was not revised; but instead, responses to the Agency comments were addressed, and subsequently incorporated into this report where appropriate.

As described in the Work Plan (Golder Associates, 1996a), the investigation was to address outstanding issues at the Site that were identified as Remedial Investigation (RI) follow-up activities, and gather information on outstanding issues at the Site in order to support Feasibility Study (FS) and Remedial Design (RD) needs, as noted in the Agencies Comment Letter on the RI and in Section 6.5.4 of the Final RI (ROC, 1996). The specific objectives of the Work Plan were to:

- Evaluate the two primary shallow groundwater pathways in the overburden sediments above bedrock that travel in both a southeasterly direction from the Site (formerly referred to as the "Eastern Plume") and in an easterly direction towards Allen Road, and the deeper groundwater pathway in the Middle Kittaning Sandstone (MKS) traveling east from the Site; and,

- Evaluate the impact that the presence of Dense Non-aqueous Phase Liquids (DNAPLs) may have on the migration of constituents of concern at the Site.

The Work Plan proposed five tasks that were to address the two main objectives listed above, as follows:

- Task 1 - Screening Level Investigations;
- Task 2 - Monitoring Well Installation and Development;
- Task 3 - Groundwater Sampling and Analysis;
- Task 4 - Hydrogeologic Testing; and,
- Task 5 - Miscellaneous Work.

In addition to these Work Plan elements, the report was also to document the results of the Seep Piezometer sampling conducted during July 1996 and May 1997. These piezometers were installed and initially sampled to investigate the quantity and quality of potential seep water in the vicinity of the existing monitoring well S-13 and adjacent to the area known as the "Crane-Deming Swamp". These activities were conducted pursuant to the approved 1996 IRM Seep Investigation and Fabric Barrier Work Plan-Revision 1 (Golder Associates, 1996b). Additionally, to better quantify the seasonal variability of the groundwater chemistry conditions that exist in this area, ROC conducted a second round of sampling in May 1997, as described in a letter to the Agencies dated April 25, 1997.

This report is organized as follows: Section 1 provides an introduction to the work performed under the Work Plan; Section 2 provides results from the individual task activities; Section 3 provides an updated Site Conceptual Model including geology, hydrogeology, groundwater and soil chemistry and potential DNAPL source areas and migration pathways; and Sections 4 and 5 present Conclusions and References, respectively.

1.1 Site Location

The Site is located northwest of the City of Salem, Ohio, in northern Columbiana County, near the southern border of Mahoning County (Figure 1), situated on the north side of State Route 14, and west of Allen Road. Conrail railroad tracks traverse the Site.

The Site covers approximately 44 acres, surrounded by lightly developed land on three sides and bordered by an industrial plant (Crane-Deming Company) on the northeast side. The Site is located on the northeastern flank of a local topographic high (the axis of which runs northwest and southeast) with the majority of the Site sloping to the northeast and draining towards the Middle Fork of Lower Beaver Creek (MFLBC).

An inactive municipal landfill is located approximately 1,200 feet east of the Site along the west bank of the MFLBC. This inactive municipal landfill, which was operated by the City of Salem, extends from the MFLBC to the east side of Allen Road. The landfill area is presently covered with vegetation. The Salem Waste Water Treatment Plant (SWWTP) is located approximately 2,400 feet southeast of the Site (Figure 1). There are a few homes immediately southeast, southwest, and west of the Site with a total of forty-five (45) residences within a one-half mile

radius. A large wooded area is present to the north of the Site and open fields and woods are located to the south of the Site, beyond State Route 14.

1.2 Objectives

As indicated by the main objectives of the Work Plan, two areas of investigation at the Site had not conclusively been interpreted at the time of the submission of the Final RI in January 1996. These included the nature and extent of groundwater degradation along a flow path emanating from the Site, and potentially traveling in a generally southeasterly direction towards Allen Road subparallel to State Route 14, and the nature and extent of DNAPL compounds in the subsurface.

The southeasterly, shallow groundwater pathway has been previously referred to as the "Eastern Plume". However, though groundwater conditions (as defined by the water elevation contours, see Figure 2) indicate a hydraulic gradient is present, this does not necessarily mean that a contaminant "plume" is present. The possible conditions along this pathway had been tentatively established based on RI groundwater data (Rounds 1 and 2) from the wells lying along the southern property boundary (e.g. A-S and B-S, Figure 2), and a single round of sampling performed at three residential wells along State Route 14. Prior to initiating any groundwater investigation off-Site along this potential pathway, it was the intent of the approved Work Plan to perform a more detailed investigation on-Site. This work included the installation of six new monitoring wells along the southern property line of the Site, transecting this flow direction (PZ-3S, PZ-3M, PZ-3B, PZ-4S, PZ-4M and PZ-4B). The data obtained combined with previous data (RI data, plus the results of Round 3 sampling performed in September, 1995 and reported as Round 3 Groundwater Sampling Results (Golder Associates, 1996c) was then to be used to refine the Site conceptual model for this potential groundwater pathway.

Regarding the second main objective, observations made during the RI indicated that DNAPLs are present at the Site. These observations included the detection of compounds in groundwater whose concentrations exceed one percent of that compound's solubility (the USEPA indicates that dissolved contaminant concentration in excess of 1% of the aqueous solubility are highly suggestive of NAPL presence; Cohen and Mercer, 1993), and the visual observations of separate phase product in certain wells during Site groundwater sampling. Due to the presence of DNAPL at the Site, it is important to adequately define the nature and extent of DNAPL in order to 1) support a Feasibility Study, and 2) to implement an effective Site remedial design. Since DNAPL migration is controlled mainly by the Site geology, the Work Plan focused on the three

stratigraphic horizons at the Site where the potential for DNAPL occurrence has been identified during previous investigations. These stratigraphic horizons are designated the shallow groundwater system of the overburden glacial sediments; the transition groundwater system consisting of the low transmissivity, basal overburden clay-silt sediments and the uppermost bedrock units (defined as the Washingtonville Shale and associated coal seams and under clay units); and the upper bedrock groundwater system consisting of the upper portion of the MKS.

Observations of DNAPL and DNAPL compounds detected at greater than 1% of their solubility have been made in the overburden in an area between Pond 2 and Allen Road and to the East of Allen Road at monitoring well GUB (see Figure 3), though there is some uncertainty related to monitoring well GUB as it lies adjacent to property (Dunlap Disposal) that has been shown to have chlorinated organic contamination as evidenced during OEPA sampling of the Dunlap Disposal Well in the early 1980's. None the less, this area of degraded groundwater will be referred to as the Pond 2 Plume. The groundwater flow pathway in the area of Pond 2 is shown on Figure 2, and the groundwater concentration plume downgradient of Pond 2 is shown on Figure 9 and Figure 10. Prior to performing the Feasibility Study, it was the intent of the approved Work Plan to perform a more detailed investigation of the Pond 2 Plume area. This work included the installation of five HydroPunches (temporary shallow groundwater sampling locations) along the railroad tracks and the installation of three new monitoring wells along the potential migration pathway between Pond 2 and the Crane-Deming facility (PZ-6B-U, PZ-6B-M and PZ-6B-L). The data obtained, combined with previous data (RI data, plus the results of Round 3; Golder Associates, 1996c) was then used to refine the Site conceptual model for this groundwater pathway.

This report will focus on using the results of the Work Plan investigation activities to refine the understanding of the Eastern Plume and DNAPL characteristics at the Site.

2. RESULTS OF TASK ACTIVITIES

2.1 Screening Level Activities (Task 1)

Non-intrusive investigations were performed at the Site in order to obtain screening level information necessary to further direct the more intrusive investigations of Tasks 2 through 5. These included the following:

- A soil vapor survey to identify potential "hot spots" in the area of well B-S and elsewhere along the eastern and southern boundaries of the Site (Task 1a); and,
- A downhole video survey of existing well RW-1 to look for pathways of DNAPL migration and investigate the MKS for fracture density and orientation (Task 1b).

The Work Plan further called for a re-examination of existing MKS rock core still stored on-Site to look for fracture type and density (Task 1c). This task was not performed during the investigation since the type of information sought was gathered instead during Task 1b (downhole video of a large diameter borehole). The downhole video survey identified fractures and structural orientations in the MKS satisfying the objectives of Task 1c.

2.1.1 Soil Vapor Survey (Task 1a)

The soil vapor investigation was performed as the first activity of the field program. As described in Section 2.1, this activity was performed primarily to check for potential source areas and hence refine the drilling program of Task 2. The locations for soil vapor samples are shown in Figure 4. The survey points are arranged in a rectangular grid with one axis (Rows A through O) parallel to the eastern border of the Site and the second axis (Rows 1 through 15) essentially parallel to the southwest border of the Site and State Route 14. The survey point spacing was 50-feet in "critical" areas as shown in Figure 4. These areas were tentatively identified as areas with groundwater concentrations potentially greater than 1% solubility of the DNAPL compounds present, thus identifying these areas as potential DNAPL source areas. The maximum spacing between survey points was 100 feet. A total of 74 locations were sampled.

The sampling locations were staked out and surveyed by a licensed surveyor prior to sampling. No offsets from the surveyed locations due to surface or subsurface obstructions were required.

The investigation was performed using the EMFLUX Soil-Gas Detection System. Detailed information on this system was included in the Work Plan. The main component of the system is

a collector, which absorbs volatile organic compounds (VOCs). The collector is buried in the subsurface at a depth of approximately 3 to 6 inches, and then, after 72 hours, it is retrieved and sent to a laboratory for analysis. The soil-gas survey was performed in accordance with the Work Plan and the results of the analyses (reported in nanograms) are contained in Appendix B of this report document.

Figure 4 also shows the results of the soil gas survey. Only TCE concentrations were contoured since TCE was the compound most frequently detected in the survey (complete analytical results are provided in Appendix B). Note that there are two areas of elevated (defined at the nanogram level) TCE concentrations in the near surface soils. The first is a concentrated, localized area at survey point L-10. This indicated a possible contamination in the overburden, and hence, a revised location for monitoring well cluster PZ-3 was selected located immediately downgradient of L-10. The location of PZ-3 was thus moved from that originally proposed in the Work Plan, to an area between survey point L-10 and the Site boundary along a potential off-Site flowpath (further detail on the selection of the PZ-3 well location is provided in Section 2.2).

The second area of elevated TCE concentration in near surface soils is in an area about survey points L-6, K-2, and I-2. To further investigate this area, an additional monitoring well (PZ-7) was constructed slightly downgradient of the center of mass of this area of contamination. The location and installation of this additional monitoring well was performed with Agency approval.

2.1.2 Downhole Video Survey (Task 1b)

Well RW-1 was investigated with a downhole video camera. A copy of the video survey is contained in Appendix C. A graphical summary of the video survey is shown in Figure 5. The goal of this survey was to identify the locations and extent of fractures within the MKS and the Washingtonville shale and to identify potential DNAPL source zones. The direct video camera observation provided an indication of the current migration depth of the DNAPL. The following observations were made from the video survey:

- The borehole splits into two overlapping boreholes at a depth of 62.5 ft. feet below ground surface (ft bgs). It is not known why the borehole splits at depth. Though not indicated on the original borehole log, a possible reason might include deviation from vertical during original drilling;

- Small black oil-like droplets appear on the wall of the borehole from a depth of 45 ft to 60 ft bgs.

- There are fracture zones in the shale from 57.5 to 60.5 ft bgs and 65 to 67 ft bgs. The upper zone appears to have DNAPL within it and it is possible that the lower zone may have DNAPL within it; and,
- There is approximately 6.5 feet of sediment and DNAPL at the bottom of the borehole.

The results of the downhole video survey confirmed the presence of DNAPL in the MKS, a thinly bedded to massive sandstone with horizontal fractures and fracture zones lying along bedding.

2.1.3 Re-Evaluation of Existing Rock Core (Task 1c)

The objectives of this task where the identification of fractures, fracture angles, fracture density, fracture aperture and continuity, and porous rock sections in upper bedrock, primarily in the vicinity of previous DNAPL observations (monitoring wells S18, T2 and RW1). The only relevant rock core currently stored at the Site and available for re-evaluation was from well RW1. Since well RW1 was surveyed using the downhole video, providing better information on in-situ conditions than could be obtained by surveying potentially damaged core; further re-evaluation of rock core was not performed.

2.2 Monitoring Well Installation and Development (Task 2)

In order to evaluate the potential DNAPL and/or contaminated groundwater migration pathways at and adjacent to the Site (and to provide long-term sentinel monitoring along the western boundary of the Site that previously had no monitoring wells) four multi-level monitoring well clusters and one single monitoring well were constructed along potential pathways, for a total of 14 new monitoring wells at the Site. The individual screened sections were installed in the shallow sand zones of the overburden (e.g. PZ-3S), the lower sand zones of the overburden (e.g. PZ-4M), the Washingtonville Shale transitional zone (PZ-5T), and the first bedrock aquifer, the MKS (e.g. PZ-4B). Soil descriptions and well construction details are presented on the soil boring logs (Appendix D) and well installation logs (Appendix E). The surveyed locations of the monitoring wells are presented on Figure 6.

Golder Associates and its drilling subcontractor, Sprowls Drilling Co. of Sunbury, Ohio, mobilized to the Site on November 18, 1996. As results from the screening level investigation (Task 1) became available, it was necessary to alter the location of cluster PZ-3. In consultation

with the Agencies, cluster PZ-3 (originally proposed for a location near node L-13 of the soil gas survey, see Figure 10 of the Work Plan) was moved approximately 250 feet south to a location near soil gas survey nodes N8 and N9. This modified PZ-3 cluster location was determined based on:

- Previous cone penetrometer testing (CPT) results (Golder Associates, 1996b) which showed that a location near nodes N8/N9 would likely have both upper and lower water-bearing sand horizons present so as to permit installation of a piezometer. CPT data in the vicinity of node L-10 did not indicate the presence of both sand horizons;

- CPT results (Golder Associates, 1996b) which indicate that the lateral extent of sands is of the order 50 ft to 100 ft thus making correlations beyond these distances difficult; and,

- A location that was spatially located between the localized and very low concentration soil vapor TCE detect at node L-10 and well B-S, a well with relatively high groundwater concentrations and a focus of the proposed work.

Thus, by locating cluster PZ-3 near nodes N8 and N9, it was possible to intercept both sand horizons with some certainty and to be able to correlate the results of groundwater sampling with that at well B-S, while still locating these new wells along a pathway from soil vapor node L-10. Additionally, an overburden monitoring well, PZ-7, was placed approximately midway between clusters PZ-4 and PZ-5 and within the area of soil vapor detects. These modifications were made with the concurrence of the Agencies' and their representatives. Monitoring well installation and development activities were essentially complete, and the drilling subcontractor demobilized, by December 19, 1996.

Note that three of the monitoring wells, PZ-6B-U, PZ-6B-M and PZ-6B-L, were not installed on Site property, but on the adjacent property owned by the Crane-Deming Pump Co. of Salem, Ohio. A representative of the Crane-Deming Pump Co. was present during the majority of all work performed on this property.

A summary of borehole information for the recently installed wells, and other existing Site wells is provided in Table 1.

2.2.1 Shallow Groundwater System

A total of seven monitoring wells were installed in the shallow groundwater system at the Site as part of the present investigation. Six of the wells were arranged in shallow/deep sand (overburden) pairs in three separate well clusters (PZ-3 through PZ-5) and the seventh well (PZ-7) was an individual well. Well cluster PZ-3 was located in a potential DNAPL source area, as identified from previous groundwater sampling (e.g. monitoring well B-S). The other clusters, PZ-4 and PZ-5, were located at the edges of the ROC property not to investigate potential source areas but to serve as sentinels for any potential constituent migration. Monitoring well PZ-7 was installed to enable sampling of groundwater in an area where the soil gas survey indicated a local potential source area.

During drilling, continuous split-spoon sampling was undertaken and head-space analysis was conducted on each of the split spoon samples. Head space analyses were performed using a photo-ionization detector (PID) and results (parts per million total VOCs) were recorded on the soil boring logs (Appendix D). At location PZ-3, elevated PID readings were recorded in the shallow overburden, and so monitoring well PZ-3, located in the deeper sandy zone, was double-cased to minimize potential cross-contamination from the shallow sandy zone. In this case, 6-inch diameter steel casing was installed through hollow stem augers approximately 3.7 feet into the confining unit between the two sandy zones. The annular space between the steel casing and the borehole wall was then pressure grouted via a side-discharge tremie pipe and allowed to set overnight. The well installation was then completed by drilling through the casing using hollow stem auger methods.

All wells were completed using 2-inch ID, Type 304 stainless steel casing and screen with water-tight Teflon-taped joints. The well screen length was 5 feet or 10 feet, depending on soil horizon thickness, with a slot size of 0.010 inch (No. 10 slot). Well casings were extended to approximately 2 feet above the ground surface. A sand pack, comprised of clean No. 5 quartz sand, was placed around each well screen and extended approximately 2 feet to 3 feet above the well screen. A bentonite chip seal approximately 3 feet thick was placed above the sand pack and hydrated with potable water. A cement/bentonite grout (6 percent to 10 percent bentonite) mixture was then pressure grouted with a tremie pipe (side discharge) from above the bentonite seal to the ground surface. A protective steel casing with a locking cap was set approximately 3 feet below ground surface (bgs) and extended approximately 30 inches above ground surface.

Wells were developed using dedicated polyethylene hand bailers or (in the case of PZ-5M only) a suction pump. Well development continued until the discharge was visibly free of turbidity, except in the case monitoring wells PZ-3M, PZ-4S, and PZ-5S, which quickly bailed dry and recovered slowly. These wells were bailed periodically over the course of a week-long period. (The Agencies have recommended in an OEPA letter to ROC dated December 29, 1997 and noted herein, that future low yielding wells be developed first by purging and then by bailing or pumping.) Development water was contained in United States Department of Transportation (US DOT) approved 55-gallon drums and was transferred to the on-Site storage tank pending disposal.

2.2.2 Transition Groundwater System

Well PZ-5T was screened in the Washingtonville Shale (described in Section 3.2.2 of the Work Plan as the Transition Groundwater Aquitard) at the location shown in Figure 6. Elevated PID readings were recorded while drilling through the lower overburden, thus the monitoring well was double cased to minimize potential cross-contamination from the overburden sandy zones. Six-inch diameter steel casing was installed through hollow stem augers 3 feet into the Washingtonville Shale; pressure grouted and allowed to set overnight. The well installation was completed by drilling through the 6-inch casing using air-rotary methods to the top of the MKS. The hole was then be backfilled with approximately 2 feet of bentonite chips to isolate the well from the MKS. The well was completed using 2-inch stainless steel screen and casing in the same manner as the wells in the shallow groundwater system.

After installation, this well was developed using a dedicated polyethylene bailer until visibly free of turbidity. Development water was contained as described above.

2.2.3 Deep Groundwater System (MKS)

A total of six wells were installed in the deep groundwater system at the Site. Three of the wells were installed in the upper portion of the MKS at clusters PZ-3, PZ-4 and PZ-5 and designated PZ-3B, PZ-4B and PZ-5B, respectively. The other three wells were installed as a multi-level well cluster screened at the top, middle and bottom of the MKS, and designated PZ-6B-U, PZ-6B-M and PZ-6B-L, respectively.

Well cluster PZ-3 was located in an area that was identified as a potential DNAPL source based on previous groundwater sampling, and the results of the soil gas survey. Clusters PZ-4 and PZ-5 were

located along the western boundary of the ROC property. PZ-6 will be used to determine the vertical distribution of contaminant concentrations in the MKS along a potential migration pathway.

Well PZ-3B was triple-cased to minimize potential cross-contamination from the overburden sand zones and the Washingtonville Shale. Ten-inch diameter steel casing was installed through augers 4 feet into the confining unit between the two overburden sandy zones, pressure grouted in place and allowed to set overnight. The next phase of the boring was completed by drilling through the casing using hollow stem auger methods 2 feet into the top of the MKS. Six-inch diameter steel casing was then set 2 feet into the MKS; pressure grouted and allowed to set overnight. The final phase of the boring was completed by drilling through the 6-inch casing using air-rotary methods to a depth approximately 15 feet into the MKS. The well was completed using 2-inch stainless steel screen and casing in the same manner as the wells in the shallow groundwater system.

Wells PZ-4B and PZ-5B were double-cased to minimize potential cross-contamination from the overburden sandy zones and the Washingtonville Shale. Six-inch diameter steel casing was set using hollow stem auger and air rotary methods 3 feet into the top of the MKS; pressure grouted and allowed to set overnight. The final phase of the boring was completed by drilling using air-rotary methods through the casing 15 feet into the MKS. The wells were completed using 2 inch-stainless steel screen and casing as described above.

All three wells in cluster PZ-6 were double-cased to minimize potential cross-contamination. At PZ-6B-U, 6-inch diameter steel casing was installed 5 feet into the MKS using hollow stem auger and air-rotary methods, grouted and allowed to set overnight. The next phase of the boring was completed by drilling through the 6-inch casing, using air-rotary methods, approximately 15 feet into the top of the MKS.

At PZ-6B-M, 10-inch diameter steel casing was installed 7 feet into the MKS using hollow stem auger and air-rotary methods, grouted and allowed to set overnight. The next phase of the boring was completed by drilling through the 10-inch diameter casing, using air-rotary methods, approximately 34 feet into the top of the MKS, which is approximately the center of the sandstone unit.

At PZ-6B-L, 6-inch diameter steel casing was installed 34 feet into the MKS using hollow stem auger and air-rotary methods, grouted and allowed to set overnight. The next phase of the boring

was completed by drilling through the 6-inch casing, using air-rotary methods, approximately 1.6 feet into the top of the Columbiana Shale below the MKS (which corresponds to 46.8 feet below the top of the MKS). The borehole was then backfilled to 41 feet with bentonite chips to isolate the well screen from the Columbiana Shale.

All three wells at well cluster PZ-6 were completed using 2 inch-stainless steel screen and casing as described above.

After installation, each well was developed using a dedicated polyethylene bailer until visibly free of turbidity. Development water was contained as described above.

2.3 Groundwater Sampling and Analysis (Task 3)

Upon satisfactory development, the wells were sampled with dedicated Teflon bailers and new polyethylene rope on December 19 and 20, 1996. The samples were analyzed for TCL VOCs (CLP SOW 7/88), TCL semivolatile organic compounds (SVOCs) (CLP SOW 2/88), TAL Total and Dissolved Metals (CLP SOW 7/88), Mirex, Photomirex and Kepone (Ruetgers-Nease Method, see Approved RI Work Plan, ROC 1990). Quality control (QC) samples consisted of a duplicate sample collected from well PZ-6B-L (labeled DUP), a field blank prepared with distilled water (labeled FB), and a sample of the municipal water supply to the Site (labeled MUNY) collected from the faucet near the decontamination pad. The analyte list for the QC samples was the same as for the monitoring wells with the exception of sample MUNY, which in addition to the above listed analytes was analyzed for pesticides and dioxin/furans. All analyses were performed by Centre Analytical Laboratories (CAL) of State College, Pennsylvania with the exception of the dioxin/furan samples, which were sent to Southwest Laboratories of Oklahoma (SLO) of Broken Arrow, Oklahoma.

The following sections summarize the results for each of the three hydrogeologic units sampled during the Eastern Plume/DNAPL Work Plan activities. The analytical results for all three groundwater systems sampled are contained in Appendix F. The results were validated in accordance with the requirements of the Work Plan, and the resulting data validation narrative is contained in Appendix G. Interpretation of the results is provided in Section 3.

2.3.1 Shallow Groundwater System

Wells sampled in the shallow overburden groundwater system comprise PZ-3S, PZ-4S, PZ-5S, and PZ-7 in the shallow sand horizons and PZ-3M, PZ-4M, and PZ-5M in the deeper sand horizons.

In the shallow sand horizons, PZ-3S (in the area of the elevated soil vapor survey results, and near existing well B-S) had reported VOC concentrations of 2,600 ppb vinyl chloride, 3,600 ppb total 1,2-dichloroethene, 34 ppb chloroform, 4,900 ppb 1,2-dichloroethane, 6,400 ppb trichloroethene, 19 ppb 1,1,2-trichloroethane, 580 ppb toluene, 130 ppb 1,1,2-tetrachloroethane, and 680 ppb chlorobenzene. These results are fairly consistent with those reported for well B-S in the three previous rounds of RI sampling.

At the second potential source area identified in the soil vapor survey, results from well PZ-7 show VOC concentrations of 14 ppb vinyl chloride, 6 ppb 1,1-dichloroethene, 190 ppb total 1,2-dichloroethene, 120 ppb chloroform, 1,300 ppb 1,2-dichloroethane, 11 ppb carbon tetrachloride, 2,700 ppb trichloroethene, 37 ppb 1,1,2-trichloroethane, 33 ppb benzene, 3,200 ppb tetrachloroethene, 10 ppb toluene, 1,900 ppb 1,1,2,2-terachloroethane, 590 ppb chlorobenzene, and 6 ppb total xylene.

Wells PZ-4S had no VOCs reported, and well PZ-5S had only a single compound reported, qualified, as an estimated 2 ppb total xylenes.

No SVOCs were reported in any shallow system well. Mirex and photomirex were reported only in well PZ-4S at 0.142 ppb and 0.03 ppb, respectively.

2.3.2 Transition Groundwater Aquitard

Well PZ-5T, screened across the Washingtonville Shale (the transitional groundwater aquitard), was sampled during Site activities. No VOC or SVOC detects were reported for this sample. Mirex was reported at 0.031 ppb. Along with results from existing monitoring well I-Shale (no VOC or SVOC detects in Rounds 1, 2, and 3 groundwater sampling and 0.023 ppb - Mirex in only Round 3), these data provide upgradient groundwater concentration control for the transitional groundwater aquitard. Further downgradient, there are no monitoring wells in the shale as it thins and pinches out in the area of the Crane-Deming building. (Further discussion on the Washingtonville Shale aquitard is provided in Section 3.1.2.)

2.3.3 Deep Groundwater System

Wells sampled in the deep MKS groundwater system comprised PZ-3, PZ-4B, PZ-5B, PZ-6BU, PZ-6BM, and PZ-6BL.

Results indicate that for MKS wells along the southern (PZ-3B and PZ-4B) and western (PZ-5B) boundaries of the Site, MKS groundwater is not impacted, with no detects reported in any of these three wells.

For MKS wells located along the flow path of the Pond 2 Plume (wells PZ-6BU, PZ-6BM, and PZ-6BL), the MKS groundwater has been shown to be impacted in the uppermost MKS (PZ-6BU) with total VOC concentrations of 289,704 ppb. Concentrations are significantly less at depth with total VOC concentrations of 860 ppb in the middle MKS (PZ-6BM), and 8,304 ppb in the lower MKS (PZ-6BL). The list of VOC constituents is similar to those previously identified in Pond 2 Plume area such as at wells T-2 and D-12 (ROC, 1996).

No SVOC compounds were reported for the PZ-6 cluster wells. Mirex and photomirex were reported in PZ-6BU (0.459 ppb and 0.106 ppb) and PZ-6BM (0.141 ppb and 0.123 ppb, respectively). Mirex and photomirex were not reported in the lowermost MKS well PZ-6BL.

2.3.4 Municipal Water Supply Well Sample

A sample of the municipal water supply to the Site was collected from a faucet near the Site decontamination pad and sent to Southwest Laboratories for dioxin/furan analysis. 1,2,3,4,6,7,8-HpCDF was reported at 2.642 pg/L, qualified XB, indicating possible blank contamination.

2.4 Hydrogeologic Testing (Task 4)

To test the hydraulic characteristics of the transition zone, a rising head slug test was performed in well PZ-5T on May 28, 1997. The analysis sheets and tables of data collected during the field program are presented in Appendix H. The data were analyzed using methods outlined in Hvorslev (1951), and yielded a hydraulic conductivity for the Washingtonville Shale of 3.1×10^{-5} cm/s (0.087 ft./day).

2.4×10^{-5}
in Appx H

2.5 Miscellaneous Work (Task 5)

2.5.1 Well Decommissioning (Task 5a)

Wells T1 and T2 were decommissioned on November 19, 1996 as part of this project. The well decommissioning was monitored by a Golder Associates geologist/engineer. Well RW-1 was proposed to be decommissioned in the Work Plan. After its use during the downhole video survey, it was felt at that time, RW-1 should not be decommissioned, but left open for potential future investigations such as retrofitting with multi-level piezometers. However, as discussed at the January 22, 1998 meeting with the Agencies, ROC will decommission RW-1 in the Fall of 1998. Wells T1 and T2 were decommissioned using the following procedure:

- The well depth was measured;
- No inner risers or screens were noted, so a tremie tube was inserted to the bottom of each well and both were pressure grouted to the surface as the tremie tube was removed; and
- A suction pump was used to draw off the water displaced by the rising grout and transfer it into drums for containerization.

The following day, the grout level in T-2 was found to have dropped approximately 10 feet, so grout was added to the top of the casing again. Where applicable, this work was conducted using the same procedures as previous well decommissioning work performed at the Site in December, 1994, and described in the associated work plan for that work, "Supplemental Well Closure Plan Production Wells P1, P2 and P3, Nease Chemical Site, Salem, Ohio, Revision #1 (Golder, 1994).

2.5.2 Residential Well Sampling (Task 5b)

The Work Plan indicated that, based on the results of this investigation, sampling of appropriate residential wells would be conducted. A plan is presented in Section 4 for this residential well sampling.

2.5.3 Feeder Creek Temporary Piezometers (Task 5c)

Identification of the presence or absence of DNAPL migration across the top of the Washingtonville Shale towards the Feeder Creek provides important information necessary during the Feasibility Study at the Site. Hence, to investigate if DNAPL was present in the subsurface at the head of the Feeder Creek, five HydroPunch temporary piezometers were installed on December 13, 1996 at the eastern edge of the railroad tracks between Pond 2 and

Pond 3 (see Figure 6). These temporary piezometers were installed along a transect along the strike of the bedrock (see Figure 7) and perpendicular to the direction of groundwater flow (see Figure 2). This arrangement was selected to maximize the likelihood of intercepting any discrete sand lenses/preferential pathways that might be present in this localized area of the Site not previously investigated by drilling or CPT work.

The stainless steel HydroPunches were driven to bedrock (HydroPunch refusal) by hand because of the lack of vehicle access. Appendix I presents installation logs for the HydroPunches. After one week, groundwater samples were taken from the HydroPunches in order to visually evaluate whether DNAPL was present on the surface of the shale. Three of the five Temporary piezometers were dry. These results are not inconsistent with the somewhat random nature of sand lenses/preferential pathways in overburden sediments observed in previous CPT investigations (Golder Associates, 1996b). One of the HydroPunches contained a measurable amount of groundwater with an oily sheen, but not enough to sample. A sample was obtained from HP-04 and the sample was analyzed for VOCs/SVOCs. Due to the small quantity of groundwater available, a sample for mirex could not be taken. The analytical results are contained in Appendix J and indicate that total VOCs are present at 156,907 ppb, with tetrachloroethene (59,000 ppb), 1,2-dichloroethene (38,000 ppb), chloroform (32,000 ppb) and benzene (20,000 ppb) in greatest concentration. Total SVOCs were reported at 16,400 ppb, with benzoic acid (15,000 ppb) in greatest concentration. (A more detailed discussion of the impacts of these results is provided in Section 3.5.1.)

As recommended by the Agencies in their comments on the Work Plan letter dated March 24, 1997, ROC plans to install a permanent well at the location of HP-04 to monitor the presence DNAPL in this area. A suitable hydrophobic dye such as SUDAN IV will be used to test drill cuttings for the presence of DNAPL. Well screen length will be maximized in the overburden and, to the extent practical, a sump, augered into the shale, will be provided at the base of the well. Note, however, that due to physical access limitation, this monitoring well must be installed using a handheld auger, and as such, the depth to which a sump can be installed may be limited.

2.6 Seep Piezometer Sampling

To further investigate both the quantity and quality of the potential seep water, ROC proposed in the 1996 IRM Seep Piezometer and Fabric Barrier Work Plan (Golder Associates, 1996b) to install a line of 1-1/4 inch piezometers across the "face" of the non-flowing seep in the vicinity of

existing well S-13. The program of piezometer installation, groundwater quality sampling and groundwater elevation monitoring was to enable ROC to evaluate this potential seep with regard to the containment; conveyance and/or treatment of collected waters.

Each borehole was augered to the top of bedrock, a depth of about four to six feet in this area. A piezometer was then installed in each borehole according to the construction proposed in the Work Plan. Upon completion, each piezometer was developed using a hand bailer until the color of the bailed water became clear. Upon satisfactory development, five the piezometers (SP-1 through SP-5) were sampled for TCL VOCs (CLP SOW 2/88), TCL SVOCs (CLP SOW 2/88), TAL Total and Dissolved Metals (CLP SOW 7/88), Mirex, Photomirex and Kepone (Ruetgers-Nease Method, see Approved RI Work Plan). Piezometer SP-6 did not have water present and was therefore not sampled. Additionally, a surface water sample was taken from the adjacent area of the Crane-Deming swamp. Results of these analyses are provided in Appendix K, and summarized below. Additionally, the piezometers have been used as part of the monthly water elevation monitoring program at the Site, and this data has been reported to the Agencies in the Monthly Progress Reports, since August 1996.

As described in the 1996 IRM Work Plan, if adequate information was available (especially the determination of design maximum flows, critical to the design of collection and conveyance systems), ROC was to proceed with the implementation of treatment and/or disposal options in the Fall of 1996. However, due to the seasonal variation in the water table and water quality in this area, and its control of the presence of and flux of groundwater to this area, additional information was determined to be necessary. Hence, in May 1997 a second round of groundwater sampling from piezometers SP-1 through SP-6 was performed. This data is provided in Appendix K and summarized below.

The results of the two rounds of sampling indicate that the groundwater potentially emanating from the seep area into the Crane-Deming swamp area is impacted primarily with VOCs, ranging in concentration from 3,867 ppb-Total VOCs to 25,259 ppb-Total VOCs in July 1996, and from 2,122 ppb-Total VOCs to 25,667 ppb Total-VOCs in May 1997. The principle constituents were trichloroethene, 1,2-dichloroethane, tetrachloroethene, 1,1,2,2-tetrachloroethane, benzene and acetone. The average Total VOC concentration for all seep piezometers was 12,212 ppb in July 1996 and 8,240 ppb in May 1997.

Total SVOCs ranged from 210 ppb-Total SVOCs to 1,508 ppb-Total SVOCs in July 1996, and from 16 ppb-Total SVOCs to 7,614 ppb Total-SVOCs in May 1997. The principle constituents were 1,2-dichlorobenzene and benzoic Acid.

Mirex was detected once in twelve samples, at 0.051 ppb in well SP-5 during July 1996. Photomirex and kepone were not detected.

3. SITE CONCEPTUAL MODEL

3.1 Site Geology

The geology at the Site can be generally described as consisting of glacial till overburden deposits of the Kent Moraine lying above various sedimentary bedrock units consisting of, in descending order, the Washingtonville Shale (and associated coal seam and underclay) and the MKS. The deeper bedrock units beneath the Site include the Columbiana Shale, Putnam Hill Shale/Vanport Limestone, various coal seams and sandstones. The Putnam Hill Shale/Vanport Limestone, Clarion Coal, and Tionesta Sandstone units were investigated during RI activities and the three rounds of groundwater sampling (1992, 1993 and 1995). Based on the results of these investigations, these deeper bedrock units appear to be hydraulically isolated from the MKS by the intervening Columbiana Shale that appears to be acting as an aquitard, and thus have not been the focus of further remedial investigation. A description of the glacial till overburden and MKS units, highlighting aspects relative to potential contaminant migration, is provided below.

3.1.1 Overburden

The Site is located within the limits of the Kent Moraine, which is characteristically a "fine-grained" glacial drift. At the Site this glacial till predominantly has a clayey and silty character with very little gravel and is interspersed with locally discrete zones of sandier material. While some of these sand zones at first appeared to be correlatable, large amounts of CPT data (Golder Associates, 1996b) has demonstrated that the sands are laterally discontinuous, and therefore do not provide laterally continuous pathways available for contaminant migration nor recovery. The sandy material zones were found to generally grade into the surrounding mass of sandy silts, silts and clays within the glacial till. Hydraulic testing of these sandy zones (see Section 3.2.3) has verified their discrete, discontinuous character, as groundwater yields were significantly limited.

As stated previously, based upon the results of previous investigations, the likely sources of DNAPL compounds at the Site are the former neutralization ponds (1,2,3, 4, and 7), Exclusion Area A and B, and the general vicinity of the former facility production area.

Although the glacial till overlying bedrock is sandier in the southwestern portion of the Site in the vicinity of the Site entrance and to a lesser degree in the southeastern portion of the Site, in the majority of the Site the sands become less prevalent and the overburden is comprised mostly of clays and silts. Particularly, in the northern portion of the Site, near Pond-7, the CPTs, and the

glacial till did not intercept sands till is dominated by clay and silts ranging in thickness from 7 feet to 9 feet.

In the area of Pond 3, RI borings showed that at all locations sampled, a relatively thin sludge layer (1 to 4 foot thickness) is underlain by till deposits consisting of silty clay interbedded with discontinuous sand seams with the silty clays ranging in thickness from 5 feet to 9 feet. In the area of Pond 4, soil borings indicate the pond is generally underlain by a dry, clay horizon, ranging in thickness from 6 feet to 9 feet in the southern and western portions of the pond, with as much as 39 feet of native clays and silts in the deepest area of Pond 4 along the eastern edge of the pond.

In the Pond 1 and 2 area, data from 1985 pond borings (SMC, 1986), RI soil borings and CPTs indicate that a clay till forms the majority of the subbase, averaging about 3 feet in thickness and resting directly on the Washingtonville Shale. Where present, this clayey horizon likely serves to retard (if not prevent) vertically downward migration of DNAPLs into bedrock). However, these data also indicate that there are sandier materials locally present lying directly atop bedrock that could serve to pass DNAPLs to the transitional groundwater system.

In Exclusion Area A and former facility production area, CPT data indicate that the majority of these areas are underlain by a predominately clay-silt till, 20 feet to 35 feet thick, with occasional sandier horizons. It is important to note that these discrete sandy horizons appear to be hydraulically isolated from the sands that occur in and around the Pond 1 and 2 area (see Section 3.2). This is of particular importance in identifying potential sources associated with the observed contamination at wells PZ-3S and B-S (i.e., it is difficult, if not impossible to correlate the contamination in upper sands at B-S and PZ-3S with contamination emanating from the Pond 1 and 2 source area).

In summary, the geology of the overburden till deposits indicates that Pond 2 is the main source of DNAPL contamination of the upper bedrock units (i.e. Washingtonville Shale and MKS). This is based on the presence of much thinner, occasionally sandy till deposits that underlay Pond 2. All the other potential DNAPL sources (i.e. Ponds 3, 4 and 7, Exclusion Area A) are underlain by much thicker clayey tills that would effectively prevent the downward migration of DNAPL.

3.1.2 Bedrock

The bedrock surface is highest in the western portion of the Site. Over the majority of the Site area, the bedrock surface slopes steeply away from the Site in an east/northeast direction towards the MFLBC. In the extreme southern portion of the Site, the bedrock surface slopes steeply to the south/southeast. Figure 7 shows the topography of the bedrock surface (an approximate contact location between the Washingtonville Shale and the MKS is provided on Figure 7, indicating the portions of the top of bedrock which are Washingtonville Shale, to the west of the contact, or MKS, to the east).

The Washingtonville Shale and associated coal seam and underclay are the uppermost bedrock unit below the Site. This unit is present over the majority of the Site area at thicknesses ranging up to approximately 35 feet (monitoring well ILB). The Washingtonville Shale unit is weathered, highly fractured, thinly bedded, and generally displays poor rock quality (RQD) indices (i.e. less than 25%) in its upper portion. The Washingtonville Shale exhibits a dip of approximately 2.5 feet in 100 feet, towards the south. While the Washingtonville Shale is highly fractured at the surface, the deeper portions of the shale are less fractured and exhibit properties of more competent rock (see, for example, borehole logs from monitoring wells ILB and RW-1 (Appendix E, Volume 3, Final RI, ROC, 1996) that clearly show the upper 2 to 8 feet of the Washingtonville Shale are more weathered and fractured than lower portions of this unit).

At or near the base of the Washingtonville Shale lies the Middle Kittaning Coal. This unit is continuous beneath the Washingtonville Shale and underlies most of the ROC Site area. The Middle Kittaning Coal exhibits a slight dip (less than 1 foot in 100 feet) towards the south. Directly beneath the coal lies a massive underclay that has a thickness of 1 to 2 feet; however, there are discrete locations where the underclay is not encountered. The more competent portions of the Washingtonville Shale, the Middle Kittaning Coal and the underclay, where present together with the overburden glacial till clays beneath Pond 2, act as a physical barrier reducing the potential downward migration of DNAPL. Where these units are not present together, a potential for downward migration of DNAPL exists. It is notable that the overburden glacial till clays and the Washingtonville Shale lie under the non-native soils in the Pond 2 area that is believed to be the major source of DNAPL constituents in groundwater. In this area the bedrock units above the MKS are approximately 16 to 23 feet thick (see Figure 8), and thus include the more competent lower portions as shown in wells RW-1 and ILB.

The Washingtonville Shale unit directly underlies the glacial overburden over much of the Site. Based on borehole data (ROC, 1996), the Washingtonville Shale appears to have been eroded east of the Conrail right-of-way and the MKS unit has become the uppermost bedrock unit underling the glacial overburden. The erosional contact between the Washingtonville Shale and the MKS appears to be in the vicinity of the Crane-Deming building. The exact location is unknown, though it is possible that the MKS is exposed directly to overburden sediments in the Crane-Deming swamp area (that area roughly between seep piezometers 1 through 6 and the Crane-Deming building) providing a potential overburden-to-MKS groundwater pathway.

No outcrops of bedrock are present anywhere in the Site area, although bedrock is present within a few feet of the ground surface in the area east of the Conrail right-of-way near monitoring well S-13 where the overburden was historically excavated for the construction of the Crane-Deming building. Beneath the location of Pond 2, the bedrock surface (Washingtonville Shale) is generally flat and lies about 20 feet bgs.

3.2 Site Hydrogeology

The following provides a brief summary and refinement of the salient features of the existing conceptual hydrogeologic Site model. It should be noted that the conceptual model presented below is a synthesis of numerous Site investigations performed over several years of RI activities. The results of these activities are reported in detail in the Final RI (ROC, 1996), the Removal Action Work Plan Addendum (Golder Associates, 1995a), Status Report on Implementation of Tasks, RAWPA (Golder Associates, 1995b), and the 1996 IRM Seep Investigation and Fabric Barrier Work Plan (Golder Associates, 1996b). These reports and work plans provide the results from borehole drilling, slug tests, pumping tests, and cone penetrometer tests instrumental in developing the following conceptual model.

In broad terms, the hydrogeologic units in the Site area consist of the following:

- Overburden (inclusive of fill, clayey/silty glacial till with discrete, discontinuous sand zones);
- Transition bedrock aquitard (Washingtonville Shale and associated coal seam and underclay); and,
- The upper bedrock MKS aquifer.

As demonstrated by the results from aquifer testing in the area of EW-4 and EW-5 (Figure 7), the overburden (glacial till), including the discrete, discontinuous sand zones, has an overall low net permeability and yields finite volumes of water (Golder Associates, 1995b). The glacial till dominates the overburden units (see cross-sections A-A' through E-E' of Figures 2 and 3 of Golder Associates, 1996b) and the variably thick mantle of overburden overlies the surface of the Washingtonville Shale and associated coal seam and underclay that is broadly defined as the "transition zone aquitard" (Figure 8 of this Report). This transition zone aquitard provides a low permeability unit that reduces, but does not eliminate, the potential downward migration of DNAPL. The MKS underlies the transition zone over most of the Site, except where the transition zone is absent east of the Conrail right-of-way.

3.2.1 Groundwater Flow Direction/Horizontal Hydraulic Gradients

Overburden

Groundwater within overburden at the Site is clearly separated into two flow regimes: one primary regime in which groundwater flows towards the east/northeast toward MFLBC, and a second, less significant regime in the southern portion of the Site (south of the treatment building), where groundwater flow within the overburden is towards the south/southeast. The groundwater contours are locally influenced by variations in land surface topography, the topography of the bedrock surface, and surface water drainageways. The sharp separation between the east/northeast flow and the south/southeast flow directions is consistent with the change in bedrock and land surface topography in the southern portion of the Site near the treatment plant building.

Horizontal hydraulic gradients in the east/northeast flow regime are steep, coincident with the steep topographic contours immediately downgradient of the Pond 2 area and the Conrail right-of-way (approximately 0.04 ft/ft). This area of the Site is also the area where the phreatic surface is nearest to the ground surface. In fact, the swamp adjacent to the Crane-Deming building is a result of the outcropping of the phreatic surface. In the south/southeast flow regime, horizontal hydraulic gradients are also steep (approximately 0.06 ft/ft) immediately south of the Site where the surface topography is steep. These gradients, reflective of topographic control, emphasize the sharp divide between the two overburden flow regimes.

Bedrock

Groundwater flow within the MKS is similar to flow directions in the overburden system though groundwater flow in the MKS is not nearly as strongly influenced by local variations in land surface and bedrock topography or surface water drainageways. There is a slight separation of groundwater flow directions in the vicinity of the treatment plant (somewhat similar to the overburden flow directions), however; the predominant flow direction of groundwater within the MKS is eastward.

As shown on Figure 8, key elements in understanding contamination reported in the overburden sediments contained within the MFLBC river valley is the direct connection between the MKS and these sediments. The valley fill sediments occupy an eroded glacial valley that has removed the upper bedrock unit (Washingtonville Shale) that underlies most of the Site. Within the valley fill sediments, a hydrologic pathway from the MKS beneath the Site to the lower horizons of the overburden exists and it is therefore not necessary to account for valley fill overburden contamination via an overburden, shallow groundwater pathway.

3.2.2 Vertical Hydraulic Gradients

In general, there appears to be a transition from downward hydraulic gradients (ranging from about -0.002 ft/ft to -0.5 ft/ft) between the overburden and MKS units in the western portion of the Site (including the area around Ponds 1 and 2) to generally upward hydraulic gradients east of the Site (ranging from about 0.007 ft/ft to 0.43 ft/ft). The upward gradients are particularly prominent near Allen Road, and within cluster wells installed in the buried bedrock valley of the MFLBC. At the central portion of the Site (within the general location of the Feeder Creek and areas west and north of the Crane-Deming Plant) the vertical hydraulic gradients are relatively flat. It is in this "generally flat" area that the Washingtonville Shale pinches out and the MKS is in direct contact with the overburden sediments. In the southern portion of the Site, vertical gradients are downward between discrete sand horizons of the overburden (ranging from about -0.74 ft/ft to -0.44 ft/ft). At wells PZ-3 and PZ-4, groundwater appears to be perched in the shallow sand horizons (see Figure 8). At PZ-3, groundwater contamination is confined to just the upper sands (PZ-3M is non-detect), and it appears then that the intervening clayey till is acting as an aquitard to deeper groundwater contamination.

3.2.3 Hydraulic Conductivity of Overburden

Based on slug tests performed at the Site, hydraulic conductivities for the overburden unit are controlled by the lithologic character of the glacial till. The clay and silt fractions in the glacial till predominate in the overburden unit as a whole, although loose, laterally discontinuous, and poorly consolidated sandy zones (sand lenses or sand units as defined in the RI) are commingled within the glacial till. Although the sand horizons (previously identified as "Sand 2") have an average hydraulic conductivity of about 10^{-4} cm/sec, the clay and clayey-silt portion which surrounds the sandy horizons in the glacial till displays hydraulic conductivities of about 10^{-7} cm/sec, thus serving hydraulically as an aquitard, and yielding little groundwater. This hydraulically tight behavior has been documented in the RAWPA Task 5 (Golder Associates, 1995) which presented the results of a pumping test showing the lack of hydraulic connection, and response to pumping between closely spaced piezometers and monitoring wells. The step drawdown test (Golder Associates, 1995) further showed that to a large extent, groundwater pumped during the test was essentially from borehole storage, with marginal increases in well yield as drawdown approached local sandy or silty-sand horizons. Furthermore, these tests also showed that the sand horizons were isolated from each other by the clay and clayey-silt matrix which surrounds the sandy horizons, because during the pumping of well S-7, adjacent wells did not respond. The isolation of the sand horizons within the clay and clayey-silt matrix of the clay is also documented in the trench logs presented in Attachment- B, RAWPA Task-5 (Golder Associates, 1995).

3.2.4 Groundwater Flow Velocity

Based on RI data, average groundwater flow velocities in overburden sediments range from about 1 ft/yr to 30 ft/yr across most of the Site. Only at two monitoring wells (S-15 and EVF-1) did slug test results indicate more transmissive sand bodies, both of which are in the area of Allen Road where overburden groundwater contamination is not greatly impacted.

For the MKS, the average groundwater flow velocity is about 65 feet per year, based on an effective porosity of 20%. This equates to a water travel time within the MKS from beneath the Site to the lower horizons of the buried valley fill sediments east of Allen Road on the order of 20 years. This calculation does not include any estimate of how long groundwater moving vertically downward from the overburden takes to reach the MKS.

3.3 Groundwater Chemistry

Figures 9 through 14 provide isoconcentration contours for VOCs and SVOCs in the Pond 2 Plume, southern portion of the Site and MKS, respectively. These contours were constructed using the recent sampling of newly constructed wells and the most recent groundwater data, (Round 3) for wells not formally investigated as part of this Work Plan (see Table 2). Based on the results of the recent and historic investigation there exists one predominant area of groundwater impact at the Site. This area originates in the vicinity of Pond 1/Pond 2 and, as such is referred to as the Pond 2 Plume and impacts occur in both the overburden and MKS. Other and less significant groundwater quality impacts have been identified in small, discrete areas in the extreme southern portion of the Site and are restricted mainly to the near surface overburden. These areas are clearly separate and unrelated to the Pond 2 plume and are referred to as the "southern area of groundwater impacts;" the extent of impacts shown on Figure 11 is based on both the groundwater and soil gas data. The groundwater quality impacts and their potential sources are discussed separate below.

3.3.1 Pond 2 Plume (East/Northeast Flowing Groundwater Regime)

Potential DNAPL constituents in groundwater (as a dissolved phase) which have been detected at 1% of their aqueous solubility at the Site are listed in Table 3. This table includes some LNAPL compounds, such as benzene, which also may exist in a separate phase from groundwater. These constituents share common chemical and physical characteristics and are relatively volatile in the atmosphere. Their inherent surface tension creates a pronounced interface between water and the non-aqueous phase that changes the manner in which these compounds are transported through water or through wet soils. Some of these potential DNAPL compounds have a significant solubility in water, although not to the extent that would allow rapid or efficient cleanup using traditional pump-and-treat methods from impacted water.

Historically, constituents in groundwater were evaluated for their potential to form DNAPL and a comparison of the historical data to one percent and ten percent of their respective aqueous solubilities was made. However, constituent concentrations exceeding these solubility benchmarks are not necessarily indicative of the presence of free DNAPL. Rather, exceedance of these solubility benchmarks was previously used to assess potential areas of the Site that might contain DNAPL in order to focus subsequent investigations. Visual observations of DNAPL have only been made in the immediate vicinity of Pond 2.

Furthermore, while DNAPL might be present within a given media, its availability to migrate in a free separate phase form can be restricted as a result of it being physically trapped within fractures and depressions, bound by surface tension within soil pore spaces, adsorbed onto fine grain particles, and otherwise bound up into the matrix. In these cases, the DNAPL, while being a separate phase liquid is not available for subsequent migration or recovery.

A better indication of DNAPL that is not bound within a matrix and has a potential to migrate further is the visual observation of DNAPL in boreholes. Figures 15 and 16 outline the estimated extent of the dissolved phase plume that has DNAPL (and some LNAPL) compounds at 1% of their solubility within the overburden and show borings and monitoring points where free DNAPLs have been observed. Figure 17 outlines the estimated extent of the dissolved phase plume that has DNAPL (and some LNAPL) compounds at 1% of their solubility within the bedrock and shows where free DNAPL have been observed within bedrock. Though the dissolved phase plume is somewhat extensive, based on the observational data, free DNAPL appears to be limited to the vicinity of Pond 2 and immediately downgradient in both the overburden and bedrock[1].

The low permeability of the overburden (discussed in previous sections) appears to have restricted lateral migration of groundwater impacts such that they are generally confined to the vicinity of Pond 2. The eastward migration within the overburden appears to be a result of both advective transport of dissolved phase constituents as well as physical migration of free DNAPL eastward near and along the surface of the Washingtonville Shale. The visual observations of DNAPL in HP-04, elevated concentrations detected in the SP series piezometers, and elevated concentrations in sediment sample RC-01 located adjacent to HP-04 appear to correspond with the location where the Washingtonville Shale subcrops close to the ground surface and is consistent with this mechanism of DNAPL migration.

The overburden groundwater contaminant plumes shown on Figure 9 (VOC isoconcentration contours) and Figure 10 (SVOC isoconcentration contours) are predominantly elongated in an easterly direction and, to a lesser extent, in a southerly direction. This is consistent with a mechanism whereby DNAPL within the saturated portions of the overburden in the vicinity of Pond 2 dissolves into the slow moving groundwater as it moves eastward. Because groundwater

[1] While free DNAPLs may be available for migration in a separate phase, recovery of such materials is often technically impractical due to physical limitations inherent within the matrix; hydraulic containment is the generally accepted and most common method of addressing DNAPL impacts.

velocities are low, sufficient time is available for the DNAPL constituents to reach and exceed 1% of their aqueous solubility in groundwater as a dissolved phase, and hence elongated contours are apparent to the east.

The southern elongation of the isoconcentration contours within the overburden is believed due to two primary mechanisms. First, the dip of the Washingtonville Shale bedding plane is somewhat to the south/southeast. Some free DNAPL may have migrated from Pond 2 along the bedding plane elongating the Pond 2 source area slightly to the south and east, as is suggested by the observations of free DNAPL is well RW-01. Subsequently, DNAPL dissolves into the slowly flowing groundwater and elongated isoconcentrations are apparent to the south and east. A second possible course of the southern elongation of the isoconcentration is attributable to remnants of historic Site impacts in Exclusion Area A. Any source materials present in this area would tend to elongate the isoconcentration contours centered within the Pond 2 source area to the south. It is worth noting, however, that no free DNAPL visual observations were made in this area and thus it is expected that if any source material exists it is not freely migrating, rather it is likely bound within the matrix. Though the data is limited somewhat (e.g., by vertical differences in overburden screen sections at wells T-1 and S-8, wells used to delineate the southern elongation), the relative distribution of concentrations generally fits with the hydrogeologic conceptual model and the location of known sources. If greater definition of the overburden plume is necessary for the Remedial Design, further investigations could be performed during the Pre-Design Investigation (PDI) stage.

The eastern elongation of the isoconcentration contours in the overburden is limited because the thickness of the overburden decreases immediately east of the Site where the groundwater and bedrock surface nears and/or outcrops at the ground surface such that constituents in the overburden groundwater discharge to the ground surface and surface water west of the Crane-Deming building. The limited eastern elongation of groundwater constituent isoconcentrations in the overburden is also likely due to the low permeability of the overburden and subsequent low potential for horizontal flow as well as natural attenuation mechanisms such as volatilization, adsorption, and biodegradation (within the saturated and vadose zones as well as at the ground surface).

The groundwater constituent isoconcentration contours in the MKS system are elongated further toward the east than the isoconcentration contours in the overburden. Similar to the overburden,

the isoconcentration contours of the MKS system originate and are centered in the vicinity of the Pond 2 source area.

As discussed in Section 3.2.1, groundwater flow in the MKS system is predominantly eastward. The source of groundwater impacts in the MKS is expected to be primarily from the vertical leakage of impacted overburden groundwater and DNAPL into the MKS as well as dissolution of DNAPL within the MKS fractures in the vicinity of Pond 2. Because groundwater moves slowly through the fractured MKS system, sufficient time is available for DNAPL compounds to dissolve into groundwater and accumulate elevated concentrations while passing the source. The physical and hydraulic limitations to constituent migration as well as the natural attenuation mechanisms that limit the migration of overburden groundwater contaminants are not as pronounced in the MKS system. As a result, the eastern elongation of the isoconcentration contours is greater in the MKS.

3.3.2 Discrete Impacts in Southeastern Portion of Site

As discussed in Section 3.2.1, a separate and less prominent groundwater flow regime exists in the extreme southern portion of the Site. Historically, a single area of groundwater impact was detected in this area of the Site. A soil gas survey (see Section 2.1.1) was conducted for the purpose of assessing the location of possible groundwater contamination source areas and areas of potential groundwater impacts. The soil gas survey identified two small discrete areas of potential concern. Only seven of about 75 soil gas monitoring points detected any VOCs. As a result, additional groundwater investigations were conducted in these two small areas.

A summary of the groundwater investigation of the two areas is presented below:

- VOCs and SVOCs were detected in two small discrete areas in the southernmost portion of the Site far south of the groundwater flow divide between the east/northeastern and southeasterly flow regimes, in the vicinity of PZ-3S/B-S and PZ-7, respectively. Constituents detected at these two locations are not related to the constituents detected in the Pond 2 plume for the following reasons:

  - ◊ the clear separation of the groundwater flow regimes (a groundwater mound separates the two flow regimes), thus limiting advective-dispersive contaminant migration from Pond 2 into this southeastern portion of the Site;
  - ◊ the absence of detections of VOC in soil gas north of the two discrete areas between Pond 2 and the southeastern plume;

- ◊ the elevation of screen interval of piezometer PZ-3S (and B-S) where the highest levels of groundwater constituents were detected, is above the water table surface of the nearest wells located in the Pond 2 plume;
- ◊ sand horizons which could transmit contaminants are not laterally connected over such distances based on extensive CPT data. If indeed DNAPL were able to migrate via gravity flow from Pond 2 towards the southeastern area of the Site, the lower sands should be contaminated as opposed to the upper sand horizons in the southeast.
- ◊ only the upper sand horizons which are above the elevation of the Pond 2 contaminated zone are impacted at the locations of PZ-3 and PZ-7. Any contaminants migrating from the Pond 2 area would be expected to affect the lower sands at PZ-3M and PZ-4M which are not impacted; and
- ◊ the constituent fingerprint of Pond 2 plume contamination (as monitored at wells S-7, S-6, and S-8) and that of well B-S and PZ-3S is markedly different with elevated concentrations of vinyl chloride and the absence of PCE, TCE, and pesticides in wells S-6 and S-8.

- The constituent fingerprint between wells B-S/PZ-3S and well PZ-7 is different with elevated tetrachloroethene concentrations in well PZ-7 compared to the near absence of tetrachloroethene in the B-S/PZ-3S wells.

- Both the aerial and vertical extent of impacts in the two areas is limited. No groundwater constituents were detected in PZ-3M, which is screened below PZ-3S. No groundwater impacts were detected in wells S-9, PZ-4S, PZ-4M and all the PZ-5 wells, indicating a limited aerial extent of impacts in the two areas.

- DNAPL for the Pond 2 area is not migrating in the direction of the two discrete areas as evidenced by the lack of groundwater impacts at PZ-3M, which is screened directly on top of the MKS bedrock surface.

The exact source of groundwater impacts in these two areas is unknown. However, it is expected that the source(s) is a small remnant of historic Site operations that have possibly left discrete amounts of source material in the near surface overburden. DNAPL has not been visually observed in any of the several boreholes advanced in this area. For these reasons, it is believed that these impacts do not constitute a "Plume" (certainly not the type of contaminant plume that emanates from the Pond 2 area) but areas of discrete impacts from near surface soil contamination.

3.4 Discussion of DNAPL Source Area - Pond 2

The chemistry of Ponds 1, 2, 3, 4 and 7 is described in detail in the Remedial Investigation Report (ROC, 1996). Pond 1 (directly adjacent to Pond 2) has been partially excavated, and due to its proximity should essentially be classified (from a risk standpoint) as part of the Pond 2 feature.

The chemical conditions from the non-native soil boring materials from Pond 2 are summarized in Table 4. Table 4 further summarizes Pond 2 soil chemistry by depth. In addition to the information provided in the RI, other soil borings (SMC Martin, 1986) were used to conceptualize the subsurface conditions at Pond 2. These observations include:

- Depth to groundwater is approximately 6 ft bgs;
- Depth of pond fill/sludge ranges from about 12 ft bgs to 18 ft bgs;
- There does not appear to be a continuous sludge layer within the pond. Sludge may have accumulated in the ponds in a heterogeneous manner or may have been disturbed from previous restoration activities;
- The sludge thickness in Pond 2 is variable. "Sludge" was not observed in borings SB-19, SB-21, and SB-31, but was observed to be as thick as about 8 feet in boring SB-20. Similar to Pond 1, fill material was observed below sludge in places.
- The sludge thickness in the Pond 1 portion ranged from not present (RI boring SB-18 toward the northwest) to about 3.0 feet (RI boring SB-17) toward the southeast. The sludge in Pond 1 was observed to be intermixed with non-native fill materials;
- A thick layer (7 to 9 feet) of native soil (silty/sandy clay, clayey sand, sand and gravel) was observed in the Pond 1 portion beneath the sludge and fill soils. Oil sheens and free oil were observed in the sandier portions within the native soil at a depth of about 13 to 14 feet bgs;
- In both ponds higher OVA/HNU readings were generally observed at depth. Higher concentrations of VOCs and SVOCs were generally detected at depth, in particular between 9 and 15 feet, and in places below the sludge and silty clay native soil. Elevated constituent levels were detected as deep as 20 feet;
- In Pond 2, oil sheens and free oil appear to have accumulated in the sandier portions of the native soils below the sludge/fill. Higher and more frequent elevated OVA/HNU readings (1000+/500+) were also observed within the native soil at depth; and,
- In places, sandier native soils (clayey sand, sand seams, and some gravel) were observed below native silty clay soils above the bedrock and contained oil and/or sheens.

The bedrock surface beneath the ponds (weathered shale) was observed to lie about 16 to 22 feet bgs at Pond 2. The native soils directly overlying the bedrock appeared to contain silty clays with lesser amounts of sand seams, sands and gravels. SMC (1986) projected a fairly continuous layer of clay till above the shale ranging in thickness from about 1 to 7 feet with most of the clay till thicknesses being greater than 3 feet (see Section 3.1.1). The RI borings and CPT results indicate that discrete areas of coarser material lie above the shale at some locations.

Therefore, while the fine grained native soils below Pond 2 provide some containment of the DNAPL, some DNAPL appears to have migrated vertically downward through and accumulated within the more porous strata at the base of the Pond 2.

Based on these observations, there appears to be an accumulation of VOCs and SVOCs at depth, especially for DNAPL compounds such as tetrachloroethene (PCE), trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE) and 1,1,2,2-tetrachloroethene (1,1,2,2-PCA). It is reasonable to conclude that there exists interstitial amounts of DNAPL, mostly laying between about 15 to 20 feet below the surface of Pond 2.

It is very important to note, however, that the entire amount of free phase NAPL present is not available to migrate. In fact, it is fully anticipated that most of the contaminants are trapped within the soil/fill pore spaces, adsorbed onto fine particles, physically or otherwise bound into the matrix. As a result, the amount of "free" NAPL is expected to be only a small portion of the total mass.

However, in an effort to provide a gross estimate of the total amount of constituents present in Pond 2, the following functional relationship was used:

$$\text{Mass} = AC * D * A * RHO * K1 * K2$$

where,

AC	=	Average concentration (of five samples) of a particular compound measured within a sample interval (ug/kg);
D	=	Thickness of Interval Sampled (ft);
A	=	Area of Pond 2 (= 48,000 ft^2);
RHO	=	Average density of soil (assumed.1900 kg/m^3);
K1	=	Conversion Factor for ft^3 to m^3 (0.023817); and,
K2	=	Conversion Factor for ug to lb ($2.2x10^{-9}$).

From this analysis, it is estimated that there is about 560,800 lbs of VOCs and SVOCs contained within Pond 2, of which 55% is PCE, 12% is 1,2-DCB, 10% Diphenyl Sulfone, 10% is 1,1,2,2-PCA, 6% is Benzene, 3% is TCE, with the remaining 4% composed primarily of mirex, toluene, methoxyclor and chlorobenzene (see Table 4a). Similar analyses for Ponds 3, 4, and 7 are provided in Tables 4b, 4c, and 4d, respectively, showing an estimated 902 lbs of VOCs and SVOCs and mirex contained in Pond 3, 725 lbs of VOCs and SVOCs and mirex in Pond 4 and 9,919 lbs of VOCs and SVOCs and mirex in Pond 7.

3.5 Discussion of Potential Contaminant Transport Pathways

For the overburden sediments, DNAPL and DNAPL constituents have migrated from the Site via a combination of advective flow and dispersion through a poorly connected, laterally discontinuous series of sand bodies. The intervening silts and clays that predominate in the overburden sediments have low hydraulic conductivity and have acted to retard much of the potential DNAPL migration. To the south, contaminant migration in the area of wells PZ-3 and B-S is not believed to be associated with the Pond 2 area, but to emanate from residual soil contamination migrating within near surface sandier horizons, and traveling a tenuous path through a perched groundwater system.

In the area of Pond 2 and the former production facility, the transition zone, comprised of the Washingtonville Shale and underlying coal and clay seams generally acts as a barrier to vertical downward migration of DNAPL.

For the MKS, DNAPL and DNAPL constituents have migrated from Pond 2 into the MKS by one or more of the following mechanisms: over the edge of the Washingtonville Shale subcrop; through discrete windows in the highly fractured Washingtonville Shale where the underclay is absent and potentially through boreholes historically installed in the MKS.

Finally, a connection exists between the overburden and MKS groundwater systems in the vicinity of the buried valley east of the Site. In this area, the transition zone of Washingtonville Shale and coal and clay seams is absent, and the MKS directly contacts the lower valley fill sediments.

3.5.1 DNAPL Distribution in the Overburden Units

DNAPL migration through overburden units is mainly downward with minimal lateral migration through poorly interconnected sand lenses. Vertical hydraulic gradients are very low and therefore have minimal impact on DNAPL migration although it should be noted that DNAPL can migrate under gravity in the absence of vertical gradients. Given the extremely low hydraulic conductivity of the clayey matrix in between the "sand" horizons, DNAPL migration in undisturbed, natural glacial till is anticipated to be minimal. In addition, as discussed in Section 3.1.1, previous investigations indicate that a clay till, averaging 3 feet thickness, forms the majority of the subbase of Pond 2, with only sparse areas where sandier material lies directly on bedrock. These conditions should limit, but can not fully prevent, downward migration of DNAPLs. The probable presence of DNAPL in shallow hydropunch HP-04 close to the head of

Feeder Creek suggests that a local pathway to this surface drainageway may be present. Analytical data presented in the Feeder Creek Report (Golder Associates, 1996d) indicates elevated VOC concentrations in sediment in this area, although concentrations are rapidly attenuated downstream.

3.5.2 DNAPL Distribution in the Transition Zone/Shallow Bedrock

A review of the logs of borehole intercepting shallow bedrock shows that the upper portion of the shale unit is quite weathered, highly fractured, thinly bedded, and generally displays poor rock quality (RQD indices less than 25). At or near the base of the Washingtonville Shale lies the Middle Kittaning Coal. This unit is continuous beneath the Washingtonville Shale and underlies most of the ROC Site area. The Middle Kittaning Coal exhibits a slight dip (< 1' in 1000') towards the southwest. The coal is shown in the logs for boreholes C-UBA, D-2, D-11, D-~~12, D-~~13, I-UBA, RW-1 and T-2. Directly beneath the coal lies an underclay that has a thickness of 1 to 2 feet. This clay is massive and potentially acts as a hydraulic barrier to downward migrating contaminants, limiting but not fully preventing downward migration of DNAPL.

Downward vertical gradients between the overburden and the transition zone/shallow bedrock range between -0.10 and -0.83 ft/ft, suggesting that recharge may occur from the overburden into the transition zone/shallow bedrock. Within the area of the Site, concentrations of contaminants indicative of DNAPL presence are generally observed to be localized in the lower portion of the overburden, within the transition zone, except in areas where the bedrock surface is in close proximity to former Site activities, such as near Pond 2, where the contamination appears to have penetrated the shallow bedrock. Though former production wells P1, P2, P3, and proposed extraction well T-2 have been decommissioned, the historical existence of these open production wells through the transition zone aquitard to the MKS also represents a potential pathway of DNAPL migration to the MKS. The lithologic characteristics of the geologic units, their hydrostratigraphic designation and their relationship to potential migration pathways are presented in a Site Conceptual Model on Figure 18.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

As presented in Section 1, the objectives of the Work Plan were to:

- Evaluate the two primary shallow groundwater pathways in the overburden sediments above bedrock that travel in a southeasterly direction from the Site and in an easterly direction towards Allen Road, and the deeper groundwater pathway in the Middle Kittaning Sandstone (MKS) traveling east from the Site; and,

- Evaluate the impact that the presence of Dense Non-aqueous Phase Liquids (DNAPLs) may have on the migration of constituents of concern at the Site.

Based on the results of the investigation, a revised Site Conceptual Model has been developed that specifically addressed these objectives. The model is presented in detail in Section 3 and may be summarized as follows:

- The geology at the Site can be generally described as consisting of glacial till overburden deposits lying above various sedimentary bedrock units consisting of, in descending order, the Washingtonville Shale (and associated coal seam and underclay) and the MKS (see Figure 7). The deeper bedrock units beneath the MKS include the Columbiana Shale, Putnam Hill Shale/Vanport Limestone, various coal seams and sandstones.

- The hydrogeologic units at the Site area consist of the overburden (inclusive of fill, clayey/silty glacial till with discrete, discontinuous sand zones), transition bedrock aquitard (Washingtonville Shale and associated coal seam and underclay) and the upper bedrock MKS aquifer;

- Groundwater within overburden at the Site is separated into two flow regimes: one primary regime in which groundwater flows towards the east/northeast toward MFLBC, and a second, less significant, regime in the southern portion of the Site where groundwater flow within the overburden is towards the south/southeast;

- Groundwater flow within the MKS is similar to flow directions in the overburden system though groundwater flow in the MKS is not nearly as strongly influenced by local variations in land surface and bedrock topography or surface water drainageways;

- The principal source of NAPL compounds at the Site is Pond 2, which is roughly estimated to contain approximately 560,800 lbs of VOCs and SVOCs. Additional, much less significantly impacted soils appear to be present to the southeast of the area of the former production facility;

- Groundwater impacts in the overburden of the southern area of the Site are likely a result of localized residual soil contamination, with separate sources associated with the PZ-3/B-S wells area and the PZ-7 well area;

- Groundwater impacts to the overburden in the Pond 2 Plume occur by two mechanisms: dissolving of DNAPL into slow moving groundwater as it moves eastward; and DNAPL migration along the overburden/transition zone contact;

- Groundwater impacts in the overburden valley fill sediments east of the Site are likely a result of MKS contaminated groundwater that is hydrostratigraphically in contact with these sediments in an area where the transition zone shale/coal/clay is absent;

- Pond 2 is the main source of DNAPL contamination of the upper bedrock units (i.e. Washingtonville Shale and MKS). This is based on the presence of much thinner, occasionally sandy, till deposits that underlay Pond 2.

- Other potential source areas (i.e. Ponds 3, 4 and 7, Exclusion Area A) contain significantly less contaminants (see Section 3.4) and are underlain by much thicker clayey tills that would effectively prevent the downward migration of any DNAPL as shown on Figures 4c and 4d of the Final RI (ROC, 1996); and,

- The mechanism for groundwater impacts to bedrock is primarily from the vertical leakage of impacted overburden groundwater and DNAPL into the MKS, dissolution of DNAPL within the MKS fractures in the vicinity of Pond 2, and downdip migration of DNAPL within the Washingtonville Shale. A potential pathway may also exist between the overburden and the MKS in the area of the Crane-Deming swamp, where the MKS may be directly in contact with overburden sediments.

It is considered that the revised Site Conceptual Model and associated data is adequate to support development of the Feasibility Study.

4.2 Recommendations

4.2.1 Residential Well Sampling Plan

The Site Conceptual Model and associated data suggests that there is little likelihood of contamination of residential wells originating from the Site and this has been confirmed by the absence of detected compounds in wells PZ-3B, PZ-4B, and PZ-5B, and previous residential well sampling. However, because of the elapsed time since the most recent sampling event (1990), ROC plans to conduct a round of residential well sampling at those residences along State Route 14 downgradient of the Site. ROC proposes that this sampling will be conducted in 1998. Wells to be sampled in this program (see Figure 19) include residential wells on the following properties:

- 1222 Benton Road;
- 1210 Benton Road;
- 1202 Benton Road;
- 1201 Benton Road;

- 1200 Benton Road; and,
- 1288 Benton Road, upgradient of the Site.

All wells will be sampled for TCL VOCs (CLP SOW 2/88), TCL SVOCs (CLP SOW 2/88), Mirex, Photomirex and Kepone (Ruetgers-Nease Method). Sampling will be conducted using procedures outlined in the Sampling and Analysis Plan included in the Approved Remedial Investigation (RI) Work Plan (ROC, 1990). The existing site-specific "Health and Safety Plan" included in the Approved RI Work Plan will apply to all work conducted pursuant to this sampling event. All chemical analyses will be performed by Centre Analytical Laboratories of State College, PA. Subject to satisfactory resolution of access issues, sampling is tentatively scheduled to begin in the fall of 1997.

At this time, additional residential well sampling along Allen Road and Beechwood Road is not deemed necessary. Existing RI wells D7, D8, G-UB, H-UB, and RI well clusters "D", "E", "F", "J", and "K" are in the vicinity of these properties and provide adequate characterization of groundwater quality. For Allen Road, three possible wells have been located, at 1390 Allen Road, at 1453 Allen Road, and at 1456 Allen Road (the Dunlap Disposal Well). All of these addresses are commercial facilities and are indicated to be on city water. In the area of Beechwood Road (greater than 0.5 miles from the site and across the MFLBC), data indicates that the residents on Beechwood Road are using city water, with only two residential wells having been identified (see Residential Well Survey, Appendix I, Volume 3, Final RI). These wells are screened in the Tionesta Sandstone, a deep sandstone aquifer separated from the Middle Kittaning Sandstone Aquifer that underlies the site by approximately 80 feet to 100 feet of intervening shale (see Plate 1, Volume 1A, Final RI). Additionally, as evidenced by the water level measurements at monitoring well D-16 (a Tionesta Sandstone monitoring well near the MFLBC), artesian conditions exist, indicating upward gradients from the Tionesta. There is therefore, strong evidence that wells along Beechwood Road are not hydraulically downgradient from the site and could not be influenced by the site. Therefore, ROC believes that the survey proposed adequately meets the objective of a second round of residential well sampling at the site and does not warrant expansion.

4.2.2 Crane-Deming Seep

Since July 1994, ROC has reported to the Agencies the presence of a non-flowing seep adjacent to the Crane-Deming Swamp. Observations have indicated that discharge of water at the surface has been intermittent and is primarily a reflection of a water table elevation approximately coincident with the water elevation of the Crane-Deming Swamp itself. Three years of monitoring this seep indicates that the "system" is essentially static and water that does discharge to the swamp area is impounded in this slight topographic depression, entering the Feeder Creek during times of high runoff. Analysis of two rounds of groundwater sampling has shown that the near surface groundwater in the area has principally VOC contamination ranging from approximately 2,000 ppb total VOCs to 25,000 ppb total VOCs. A single sample (of twelve taken) has recorded mirex at 0.051 ppb.

Based on these findings, ROC proposed to continue monitoring this area while the Feasibility Study is conducted. ROC believes that this area will be addressed as part of the Remedial Design for the overall Site cleanup. However, at this time, several issues make implementing temporary control measures difficult or unnecessary. To collect and treat shallow groundwater would involve installing leachate lines underneath the Conrail tracks to transfer water to the existing on-site treatment plant. This would require substantial engineering effort since the railroad line is in continuous use and securing access would likely be complex. In terms of risk to human health and the environment, previous Feeder Creek and MFLBC sampling (Final RI, ROC, 1996) results show no residual VOC or SVOC contamination beyond the area of the Crane-Deming swamp. Seep piezometer data (Appendix K, within) showed only one mirex detect (at 51 ppt) in the twelve samples taken. Based on these findings, and the limited exposure to this isolated area, there appears to be no imminent or substantial risk. As a result, it seems prudent to defer addressing this issue until a Site-wide remedy is selected by the Agencies.

5. REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley-CRC Press, Boca Raton, Florida.

Golder Associates Inc., 1994, Supplemental Well Closure Plan-Revision #1

Golder Associates Inc., 1995a, Removal Action Work Plan Addendum, December 1995.

Golder Associates Inc., 1995b, Status Report on Implementation of Task 5, RAWPA, April 1995.

Golder Associates Inc., 1996a, Eastern Plume/DNAPL Investigation Work Plan, October 1994.

Golder Associates Inc., 1996b, 1996 IRM Seep Investigation and Fabric Barrier Work Plan, August, 1996.

Golder Associates Inc., 1996c, Round 3 Groundwater Sampling Results, June 1996.

Golder Associates Inc., 1996d. Feeder Creek and State Route 14 Sediment Sampling Report, May 1996.

ROC, 1990. Remedial Investigation and Feasibility Study Work Plan-Revision 4, submitted to USEPA and Ohio EPA on February 28, 1990.

ROC, November 1996. Final Remedial Investigation Work Plan, Volumes 1-4, submitted to USEPA and Ohio EPA on January 31, 1996.

SMC-Martin, 1986. Hydrogeologic Conditions at the Ruetgers-Nease Chemical Company Site, Salem, Ohio, submitted September 1986 to OEPA and USEPA.

g:\projects\933-6154\eastdnap.rpt\jul98txt.doc

BLE 1
SUMMARY OF BOREHOLE INFORMATION
NEASE SITE, SALEM, OHIO

Well/ Borehole ID	Ground Surface Elevation ft MSL	Top of Casing Elevation ft MSL	Depth to Water 4/24/97	GW Elevation 4/24/97	SCREEN Top ft. BGS	SCREEN Bottom ft. BGS	SCREEN Top ft MSL	SCREEN Bottom ft MSL	Top of Washingtonville Shale1 ft. BGS	Top of Washingtonville Shale1 ft. MSL	Top of Middle Kittaning Coal ft. BGS	Top of Middle Kittaning Coal ft. MSL	Top of Washingtonville Shale2 ft. BGS	Top of Washingtonville Shale2 ft. MSL	Top of Middle Kittaning Sandstone ft. BGS	Top of Middle Kittaning Sandstone ft. MSL	Highest PID ft. BGS	Fracture Zones ft. BGS	Comments
AUBA	1194.10	1196.31	23.15	1168.16	44.00	58.50	1150.10	1135.60	44.50	1149.60	NP	NP	NP	NP	45.50	1148.60	11'	46'-52'	
A-S	1193.90	1195.31	9.15	1186.16	7.00	21.00	1186.90	1172.90									11'	NONE	
B-S	1196.20	1198.23	8.30	1189.93	8.50	20.50	1187.70	1175.70									11'	NONE	
B-1	1159.60								NP	NP	NP	NP	NP	NP	7.50	1152.10	NONE	NONE	
B-2	1169.50								NP	NP	NP	NP	NP	NP	17.00	1152.50	NONE	NONE	
B-3	1157.30								NP	NP	NP	NP	NP	NP	31.00	1126.30	NONE	NONE	
B-4	1174.10								NP	NP	NP	NP	NP	NP	28.50	1145.60	NONE	NONE	
B-5	1159.70								NP	NP	NP	NP	NP	NP	17.50	1142.20	NONE	NONE	
B-6	1181.80								NP	NP	NP	NP	NP	NP	28.50	1153.30	NONE	NONE	
B-7	1173.10																NONE	NONE	
B-8	1157.10								NP	NP	NP	NP	NP	NP	23.00	1134.10	NONE	NONE	
B-9	1159.70								NP	NP	NP	NP	NP	NP	16.50	1143.20	NONE	NONE	
B-10	1166.50								NP	NP	NP	NP	NP	NP	18.00	1148.50	NONE	NONE	
C-S	1189.60	1191.85	6.17	1185.68	11.50	21.50	1178.10	1168.10									17'	NONE	
CLBA	1189.50	1191.79	16.27	1175.52	110.00	120.00	1079.50	1069.50	NP	NP	39.00	1150.50	42.00	1147.50	44.50	1145.00	NONE	42'-44.5', 111'-114'	UNDERCLAY 39.5' - 42'
CUBA	1189.00	1192.00	9.45	1182.55	42.00	52.00	1147.00	1137.00	42.00	1147.00	39.00	1150.00	42.00	1147.00	44.50	1144.50	NONE	NONE	UNDERCLAY 39.5' - 42'
CD-I-1	1146.20				34.50	46.00	1111.70	1100.20	NP	NP	NP	NP	NP	NP	43.50	1102.70	7.5'	NONE	
CD-I-2	1149.50				10.00	15.00	1139.50	1134.50	NP	NP	NP	NP	NP	NP	13.50	1136.00	NONE	NONE	
CD-S-2	1152.20				5.00	10.00	1147.20	1142.20									NONE	NONE	
CD-U-1	1151.40				27.50	45.00	1123.90	1106.40	NP	NP	NP	NP	NP	NP	13.00	1138.40	NONE	29'	
CD-I-3	1148.10				17.00	22.00	1131.10	1126.10	NP	NP	NP	NP	NP	NP	20.00	1128.10	NONE	NONE	
CD-S-1	1149.50				5.00	10.00	1144.50	1139.50									NONE	NONE	
D-1	1198.40	1200.28	22.03	1178.25	46.00	51.00	1152.40	1147.40	35.50	1162.90	NP	NP	NP	NP	44.50	1153.90	NONE	NONE	UNDERCLAY 44-44.5'
D-2	1180.60	1182.88	23.74	1159.14	48.00	53.00	1132.60	1127.60	20.00	1160.60	26.00	1154.60	28.00	1152.60	37.00	1143.60	NONE	NONE	CHEMICAL ODOR
D-3	1167.50	1169.58	9.77	1159.81	28.50	33.50	1139.00	1134.00	NP	NP	NP	NP	NP	NP	26.00	1141.50	NONE	NONE	
D-4	1179.70	1181.95	20.64	1161.31	38.50	43.50	1141.20	1136.20	29.00	1150.70	NP	NP	NP	NP	33.50	1146.20	NONE	NONE	
D-5	1211.70	1214.48	30.30	1184.18	82.50	87.50	1129.20	1124.20	19.00	1192.70	NP	NP	NP	NP	66.00	1145.70	NONE	73.5-88	
D-6	1189.10	1189.99	21.54	1168.45	19.00	25.00	24.00	1164.10	21.50	1167.60							NONE	NONE	ORGANIC ODOR
D-7	1158.80	1158.72	3.07	1155.65	25.70	30.70	1133.10	1128.10	NP	NP	NP	NP	NP	NP	23.70	1135.10	NONE	NONE	
D-8	1157.50	1157.48	1.70	1155.78	32.00	37.00	1125.50	1120.50	NP	NP	NP	NP	NP	NP	29.00	1128.50	NONE	29-35.5	
D-9	1157.50	1159.10	14.43	1144.67	66.60	71.60	1090.90	1085.90	44.50	1113.00	NP	NP	NP	NP	55.00	1102.50	NONE	67-71, 50-55	
D-10	1160.80	1162.57	10.00	1152.57	93.60	101.00	1067.20	1059.80	NP	NP	NP	NP	NP	NP	93.00	1067.80	NONE	NONE	CHANNEL IN MKS
D-11	1182.60	1184.47	23.08	1161.39	56.00	61.00	1126.60	1121.60	16.00	1166.60	25.60	1157.00	26.60	1156.00	38.00	1144.60	NONE	50-62	ORGANIC ODOR
D-12	1180.40	1182.56	22.03	1160.53	47.00	52.00	1133.40	1128.40	15.50	1164.90	26.80	1153.60	28.50	1151.90	42.50	1137.90	NONE	26.8-28.5	CHEMICAL ODOR
D-13	1182.30	1184.97	29.77	1155.20	105.00	110.00	1077.30	1072.30	16.00	1166.30	26.70	1155.60	32.50	1149.80	37.00	1145.30	NONE	26.7-32.5, 37-65.5	UNDERCLAY 28-32.5, CHEMICAL ODOR
D-14	1163.20	1163.93	6.32	1157.61	112.00	142.00	1051.20	1021.20	NP	NP	NP	NP	NP	NP	8.50	1154.70	NONE	75-81, 82-94, 126-128, 140-142	
D-15	1161.60	1164.12	6.48	1157.64	44.50	54.50	1117.10	1107.10	NP	NP	NP	NP	NP	NP	9.50	1152.10	NONE	23	FRACTURE ZONE AT 1141
D-16	1146.60	1149.00	0.00	1149.00	138.00	163.00	1008.80	983.80	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
D-17	1160.70	1161.33	4.17	1157.16	9.00	14.00	1151.70	1146.70	NP	NP	NP	NP	NP	NP	13.00	1147.70	NONE	NONE	
DLBA	1137.00	1140.52	-4.15	1144.67	53.50	59.00	1083.50	1078.00	NP	NP	NP	NP	NP	NP	NP	NP	39.5'	NONE	SHALE/COAL 36-37
DVF3	1137.00	1140.23	3.12	1137.11	22.00	27.00	1115.00	1110.00			NP	NP	NP	NP	NP	NP	3'	NONE	
D-S (DVF3)	1137.10	1139.53			5.00	15.00	1132.10	1122.10			NP	NP	NP	NP	NP	NP	3.0'	NONE	
ELBA	1146.30	1148.84	1.69	1147.15	79.00	89.00	1067.30	1057.30	NP	NP	NP	NP	NP	NP	NP	NP	37'	85-85.5	BLACK LIMESTONE 85-85.5
EVF1	1146.80	1149.10	7.03	1142.07	6.00	11.00	1140.80	1135.80	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
EVF2	1147.00	1149.47	9.34	1140.13	19.00	29.00	1128.00	1118.00	NP	NP	NP	NP	NP	NP	NP	NP	31'	NONE	

T.. _E 1
SUMMARY OF BOREHOLE INFORMATION
NEASE SITE, SALEM, OHIO

Well/ Borehole ID	Ground Surface Elevation ft MSL	Top of Casing Elevation ft MSL	Depth to Water 4/24/97	GW Elevation 4/24/97	SCREEN Top ft. BGS	SCREEN Bottom ft. BGS	SCREEN Top ft MSL	SCREEN Bottom ft MSL	Top of Washingtonville Shale1 ft. BGS	Top of Washingtonville Shale1 ft. MSL	Top of Middle Kittaning Coal ft. BGS	Top of Middle Kittaning Coal ft. MSL	Top of Washingtonville Shale2 ft. BGS	Top of Washingtonville Shale2 ft. MSL	Top of Middle Kittaning Sandstone ft. BGS	Top of Middle Kittaning Sandstone ft. MSL	Highest PID ft. BGS	Fracture Zones ft. BGS	Comments
EVF3	1146.90	1149.66	5.15	1144.51	31.00	41.00	1115.90	1105.90	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
EVF4	1146.90	1148.52	4.16	1144.36	45.00	50.00	1101.90	1096.90	NP	NP	NP	NP	NP	NP	NP	NP	37'	NONE	
FLBA	1160.70	1163.48	10.21	1153.27	117.50	127.50	1043.20	1033.20	NP	NP	NP	NP	NP	NP	NP	NP	13'	97.5, 101.5, 112, 121	SILTSTONE 128.5-130, LIMESTONE VEINS IN SHALE
FVF3	1160.40	1162.74	12.63	1150.11	42.00	52.00	1118.40	1108.40	NP	NP	NP	NP	NP	NP	NP	NP	13'	NONE	
FVF4	1161.10	1163.46	13.41	1150.05	56.00	66.00	1105.10	1095.10	NP	NP	NP	NP	NP	NP	NP	NP	27'	NONE	
FVF6	1160.80	1163.18	10.53	1152.65	81.50	92.00	1079.30	1068.80	NP	NP	NP	NP	NP	NP	NP	NP	13'	NONE	
GUBA	1156.70	1158.97	3.40	1155.57	34.00	44.00	1122.70	1112.70	NP	NP	NP	NP	NP	NP	31.00	1125.70	3'	NONE	COAL LAYERS 40-46
HP-01	1174.60	1176.53	DRY		8.00	10.40	1166.60	1164.20									NA	NA	
HP-02	1174.10	1176.42	DRY		7.40	9.80	1166.70	1164.30									NA	NA	
HP-03	1172.50	1173.87			5.60	8.00	1166.90	1164.50									NA	NA	
HP-04	1173.60	1174.74			5.80	8.20	1167.80	1165.40									NA	NA	
HP-05	1177.40	1180.95			9.40	11.80	1168.00	1165.60									NA	NA	
H-S	1169.70	1172.14	4.03	1168.11	6.00	11.00	1163.70	1158.70									13'	NONE	
HUBA	1170.00	1172.04	16.52	1155.52	34.00	43.00	1136.00	1127.00	NP	NP	NP	NP	NP	NP	27.00	1143.00	NONE	34-34.6, 42.7-42.9	
HVF1	1169.40	1172.42	16.94	1155.48	16.00	21.00	1153.40	1148.40									NONE	NONE	
HVF2										0.00						0.00			
I-SHALE	1207.75	1209.96	15.86	1194.10	32.50	52.50	1175.25	1155.25	25.50	1182.25							NONE	31-33, 36-38	
LBA	1207.45	1210.01	43.57	1166.44	134.00	144.00	1073.45	1063.45	25.50	1181.95	52.00	1155.45	54.00	1153.45	60.00	1147.45	208'	135-136	SS/SHALE/COAL BELOW 203.5
I-S	1208.05	1210.01	15.88	1194.13	16.00	26.00	1192.05	1182.05	25.50	1182.55							NONE	NONE	
IUBA	1207.95	1210.16	27.33	1182.83	62.50	72.50	1145.45	1135.45	25.50	1182.45	52.00	1155.95	54.00	1153.95	60.00	1147.95	NONE	31-33	COAL 52'-52.5'
LBA	1144.30	1146.61	4.55	1142.06	64.00	74.00	1080.30	1070.30	NP	NP	NP	NP	NP	NP	NP	NP	56.5'	62-64, 71-73	
LVF2	1143.30	1143.80	11.75	1132.05	10.00	15.00	1133.30	1128.30	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
LVF3	1145.10	1147.45	10.25	1137.20	20.00	30.00	1125.10	1115.10	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
LVF4	1145.40	1147.81	7.40	1140.41	36.00	46.00	1109.40	1099.40	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
KLBA	1136.70	1140.99	0.00	1140.99	54.50	64.50	1082.20	1072.20	NP	NP	NP	NP	NP	NP	NP	NP	51'	43-45.5, 53-54.5, 58.5-59	UNDERCLAY 45.5-46
K-S (KVF2)	1135.70	1137.41	0.00	1137.41	5.00	15.00	1130.70	1120.70	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
K V (KVF4)	1135.00	1139.68	3.13	1136.55	30.00	40.00	1106.00	1096.00	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	UNDERCLAY 45.5-46
LLBA	1138.40	1170.61	22.01	1148.60	86.00	96.00	1082.40	1072.40	NP	NP	NP	NP	NP	NP	NP	NP	NONE	67.5-71.5, 86-86.5, 94.5-95.5	UNDERCLAY 72-81
LVF1	1169.00	1171.83	8.72	1163.11	15.00	20.00	1154.00	1149.00	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
LVF2	1166.00	1170.20	17.84	1152.36	33.00	43.00	1135.00	1125.00	NP	NP	NP	NP	NP	NP	NP	NP	NONE	NONE	
P-1L	1192.70	1195.35	32.45	1162.90	247.00	252.00	945.70	940.70	?	?	?	?	?	?	?	?	NA	NA	
P-1U	1192.70	1195.35	38.13	1157.22	173.00	178.00	1019.70	1014.70	?	?	?	?	?	?	?	?	NA	NA	
P-2L	1198.10	1200.85	42.80	1158.06	198.00	203.00	1000.10	995.10	?	?	?	?	?	?	?	?	NA	NA	
P-2U	1198.10	1200.86	30.15	1170.71	143.00	148.00	1055.10	1050.10	?	?	?	?	?	?	?	?	NA	NA	
P-3	1186.60	1189.83	NA	NA	29.00	100.00	1157.60	1086.60	?	?	?	?	?	?	?	?	NA	NA	DECOMMISSIONED
PZ-3S	1197.00	1199.48	9.13	1190.35	10.00	20.00	1187.00	1177.00	46.00	1151.00							NA	15.00	
PZ-3M	1197.00	1199.47	21.63	1177.84	27.00	37.00	1170.00	1160.00									NA	15.00	
PZ-3B	1197.00	1199.04	30.97	1168.07	58.00	63.00	1139.00	1134.00	46.00	1151.00							NA	15.00	
PZ-4S	1191.50	1193.78	10.5	1183.28	7.40	12.40	1184.10	1179.10									NA	NONE	
PZ-4M	1191.20	1193.71	17.24	1176.47	22.60	27.60	1168.60	1163.60	42.40	1148.80							NA	NONE	
PZ-4B	1191.30	1194.56	26.44	1168.12	55.00	60.00	1136.80	1131.80	42.40	1149.40							NA	NONE	
PZ-5S	1197.30	1199.22	3.3	1195.92	7.80	17.80	1189.50	1179.50									NA	33.00	
PZ-5M	1197.20	1199.27	14.81	1184.46	23.20	33.20	1174.00	1164.00	32.60	1164.60							NA	33.00	
PZ-5T	1197.30	1199.14	14.81	1184.33	43.00	48.00	1154.30	1149.30	32.60	1164.70	NP	NP	NP	NP	50.00	1147.30	NA	33.00	
PZ-5B	1197.20	1199.25	16.43	1182.82	60.00	65.00	1137.20	1132.20	32.60	1164.60	NP	NP	NP	NP	50.00	1147.20	NA	33.00	
PZ-6B-U	1172.00	1174.08	15.54	1158.54	32.00	37.00	1140.00	1135.00	8.70	1163.30	NP	NP	NP	NP	22.00	1150.00	NA	25.00	
PZ-6B-M	1171.10	1173.25	14.71	1158.54	51.00	56.00	1120.10	1115.10	8.70	1162.40	NP	NP	NP	NP	22.00	1149.10	NA	25.00	

TABLE 1
SUMMARY OF BOREHOLE INFORMATION
NEASE SITE, SALEM, OHIO

Well/ Borehole ID	Ground Surface Elevation ft MSL	Top of Casing Elevation ft MSL	Depth to Water 4/24/97	GW Elevation 4/24/97	SCREEN Top ft. BGS	SCREEN Bottom ft. BGS	SCREEN Top ft MSL	SCREEN Bottom ft MSL	Top of Washingtonville Shale1 ft. BGS	Top of Washingtonville Shale1 ft. MSL	Top of Middle Kittaning Coal ft. BGS	Top of Middle Kittaning Coal ft. MSL	Top of Washingtonville Shale2 ft. BGS	Top of Washingtonville Shale2 ft. MSL	Top of Middle Kittaning Sandstone ft. BGS	Top of Middle Kittaning Sandstone ft. MSL	Highest PID ft. BGS	Fracture Zones ft. BGS	Comments
PZ-6B-L	1170.10	1172.34	13.82	1158.52	57.00	62.00	1113.10	1108.10	8.70	1161.40	NP	NP	NP	NP	22.00	1148.10	NA	25.00	
PZ-7	1190.90	1192.54	6.8	1185.74	10.00	15.00	1180.90	1175.90	38.00	1152.90							NA	NONE	
RW-1	1182.60	1184.55	24.23	1160.32	30.00	83.00	1152.60	1099.60	12.00	1170.60	28.00	1154.60	29.00	1153.60	34.00	1148.60	28.5'	28-28, 56, 78-83	UNDERCLAY 29-31
S-1	1172.90	1175.59	15.10	1160.49	27.00	37.00	1145.90	1135.90									NR	NONE	
S-2	1167.70	1170.06	7.66	1162.40	8.00	13.00	1159.70	1154.70	13.00	1154.70							NONE	NONE	
S-3	1167.50	1169.31	4.64	1164.67	14.50	19.50	1153.00	1148.00									NONE	NONE	
S-4	1179.40	1181.18	4.13	1177.05	12.00	17.00	1167.40	1162.40									NONE	NONE	
S-5	1205.60	1206.51	12.83	1193.68	8.00	13.00	1197.60	1192.60	12.00	1193.60							NONE	NONE	
S-6	1188.70	1191.09	4.98	1186.11	8.50	13.50	1180.20	1175.20									NONE	NONE	ORGANIC ODOR
S-7	1181.30	1183.34	4.51	1178.83	4.50	9.50	1176.80	1171.80									NONE	NONE	ORGANIC ODOR
S-8	1190.30	1192.12	5.11	1187.01	8.00	13.00	1182.30	1177.30									NONE	NONE	
S-9	1198.90	1200.76	13.35	1187.40	18.00	23.00	1180.90	1175.90									NONE	NONE	
S-10	1201.20	1202.89	8.41	1194.48	16.00	21.00	1185.20	1180.20	20.50	1180.70							NONE	NONE	
S-11	1196.40	1197.96	6.13	1191.83	11.00	16.00	1185.40	1180.40									NONE	NONE	
S-12	1180.20	1182.05	3.46	1178.59	7.80	12.80	1172.40	1167.40									NONE	NONE	SWEET CHEMICAL ODOR
S-13	1166.70	1168.94	4.92	1164.02	4.50	9.50	1162.20	1157.20	6.50	1160.20							NONE	NONE	
S-14	1158.80	1158.70	2.93	1155.77	9.10	14.10	1149.70	1144.70									NONE	NONE	
S-15	1157.30	1156.07	2.11	1153.96	17.60	22.60	1139.70	1134.70									NONE	NONE	
S-16	1157.30	1159.28	12.44	1146.84	26.60	31.60	1130.70	1125.70									NONE	NONE	SWEET CHEMICAL ODOR
S-17	1157.40	1157.14	1.52	1155.62	23.80	28.80	1133.60	1128.60	NP	NP	NP	NP	NP	NP	29.40	1128.00	NONE	NONE	
S-18	1184.90	1187.05	7.20	1179.85	13.00	18.00	1171.90	1166.90	17.00	1167.90							NONE	NONE	
S-19	1151.80	1154.18	0.00	1154.18	29.00	34.00	1122.80	1117.80	NP	NP	NP	NP	NP	NP	35.00	1116.80	NONE	NONE	
SP-1	1164.10	1167.95	4.81	1163.14	1.20	2.70	1162.90	1161.40	2.70	1161.40							NA	NONE	
SP-2	1164.10	1167.69	4.57	1163.12	1.30	2.80	1162.80	1161.30	2.80	1161.30							NA	NONE	
SP-3	1163.90	1167.88	4.52	1163.36	1.00	3.50	1162.90	1160.40	3.50	1160.40							NA	NONE	
SP-4	1163.80	1168.08	4.61	1163.47	1.30	3.30	1162.50	1160.50	3.30	1160.50							NA	NONE	
SP-5	1163.30	1167.68	4.36	1163.32	1.20	3.20	1162.10	1160.10	3.20	1160.10							NA	NONE	
SP-6	1162.60	1166.24	4.56	1161.68	0.90	2.40	1161.70	1160.20	2.40	1160.20							NA	NONE	
T-1	1189.10	1190.60			8.50	18.50	1180.60	1170.60									NONE	NONE	DECOMMISSIONED
T-2	1183.70	1185.93			25.00	75.00	1158.70	1108.70	19.50	1164.20	29.50	1154.20	31.00	1152.70	35.50	1148.20	NONE	NONE	DECOMMISSIONED
PZ-1	1185.80	1188.72	11.22	1177.50	12.50	17.50	1173.30	1168.30	19.00	1166.80							NONE	NONE	
PZ-2	1186.40	1189.44	19.63	1169.81	12.50	17.50	1173.90	1168.90	20.00	1166.40							NONE	NONE	
EW-5	1184.30	1187.41			11.00	16.00	1173.80	1168.80	20.00	1164.80							NONE	NONE	
EW-4	1185.50	1188.41			10.00	15.00	1175.50	1170.50	20.00	1165.50							NONE	NONE	

NP NOT PRESENT

NR NOT REACHED

NA NOT AVAILABLE

NONE NO HIGHEST PID READING

? Due to the nature of the 1962 boring logs for these wells, exact elevations can not be obtained

TABLE 2
SUMMARY OF VOC/SVOC CONCENTRATIONS
ROUND 3, 1996 SEEP INVESTIGATION, AND EP/DNAPL INVESTIGATION
NEASE SITE, SALEM, OHIO

Well	Total VOCs	Total Semi-VOCs
Shallow Wells:		
PZ-3M	2	0
PZ-3S	24,618	9,224
PZ-4M	0	0
PZ-4S	0	0
PZ-5M	0	74*
PZ-5S	2	0
PZ-7	10,123	943
HP-4	157,934	58,140
SP-0	2,250	100
SP-1	3,888	210
SP-2	17,230	1,050
SP-3	5,022	530
SP-4	9,684	1,508
SP-5	25,259	1,479
A-S	1,325	0
B-S	20,328	9,500
C-S	7	400*
H-S	4	570*
H-VF1	0	5*
I-S	0	0
S-2	18	19
S-3	0	0
S-6	26,880	22,000
S-8	6,139	1,900
S-9	0	0
S-10	0	0
S-11	25	0
S-12	64,254	100,000
S-13	21,939	NS
S-14	4	NS
S-15	12	0
T-1	28,257	6,100

Well	Total VOCs	Total Semi-VOCs
Deep Wells:		
PZ-3B	0	0
PZ-4B	0	2
PZ-5B	0	0
PZ-6-BL	8,304	163
PZ-6-BM	860	0
PZ-6-BU	289,704	12,334
A-UB	160	0
C-UB	0	63*
D-1	1	560*
D-2	59	91
D-3	313	37
D-5	2	5*
D-6	9,599	700
D-7	1,218	160
D-8	5,358	1,300
D-11	22,131	510
D-12	58,535	26,000
D-15	7,043	1,100
D-17	1,300	270
G-UB	5,572	310
H-UB	0	38*
I-UB	0	15*
S-16	307	0
S-17	4,590	680
S-19	3,713	NS

* Indicates possible laboratory contamination.

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
TETRACHLOROETHENE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS ROUND 1	ROUND 2	1995/1996 SAMPLING[2]	MONITORING WELL	FORMATION
200,000	20,000	2,000	ND	12,000	ND	S6	Overburden "Sand 1"
			5,300J	5,600	13,000	S12	Overburden "Sand 2"
			23,000	32,000	NA	S18	Overburden "Sand 2"
			9,900	17,000	12,000	D11	Middle Kittanning Sandstone
			27,000	38,000	35,000	D12	Middle Kittanning Sandstone
			66,000	100,000	110,000	T2	Middle Kittaning Coal/ Middle Kittanning Sandstone
			NA	NA	3,200	PZ-7	Overburden "Sand 1"
			NA	NA	59,000	HP-4	Overburden "Sand 1"
			NA	NA	170,000	PZ-6B-U	Middle Kittanning Sandstone
			77,000	92,000	68,000	RW1	Washingtonville Shale/ Middle Kittanning Sandstone

-Exceeds 1% of Solubility

-Exceeds 10% of Solubility

NOTES:

- All units are in ug/l.
- ND = Not Detected
- NA = Not Available

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
1,1,2,2-TETRACHLOROETHANE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS			MONITORING WELL	FORMATION
			ROUND 1	ROUND 2	1996 SAMPLING[2]		
2,900,000	290,000	29,000	46,000	60,000	NA	S18	Overburden "Sand 2"

[ ] -Exceeds 1% of Solubility

NOTES:

- All units are in ug/l.
- NA = Not Available

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
1,2-DICHLOROBENZENE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS ROUND 1	ROUND 2	1996 SAMPLING[2]	MONITORING WELL	FORMATION
100,000	10,000	1,000	670J	**1,500J**	**22,000**	S6	Overburden "Sand 1"
			3,500	670	**9,500**	B-S	Overburden "Sand 1"
			4,900J	**2,700**	**6,100**	T1	Overburden "Sand 1"
			950	630	**1,900**	S8	Overburden "Sand 1"
			NA	NA	**9,100**	PZ-3S	Overburden "Sand 1"
			NA	NA	**42,000**	HP-4	Overburden "Sand 1"
			NA	NA	**1,500**	SP-4	Overburden "Sand 1"
			NA	NA	**1,400**	SP-5	Overburden "Sand 1"
			R	**36,000**	NA	S18	Overburden "Sand 2"
			950	660	**1,300**	D8	Middle Kittanning Sandstone
			31,000J	**28,000**	**26,000**	D12	Middle Kittanning Sandstone
			900	940	**1,100**	D15	Middle Kittanning Sandstone
			NA	NA	**12,000**	PZ-6B-U	Middle Kittanning Sandstone
			12,000	**8,000**	**5,800**	T2	Middle Kittaning Coal/ Middle Kittanning Sandstone
			14,000	**16,000**	**10,000**	RW1	Washingtonville Shale/ Middle Kittanning Sandstone

-Exceeds 1% of Solubility

-Exceeds 10% of Solubility

NOTES:

- All units are in ug/l.
- NA = Not Available
- R = Unreliable Result - Analyte may or may not be present in the sample.

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
TRICHLOROETHENE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS			MONITORING WELL	FORMATION
			ROUND 1	ROUND 2	1996 SAMPLING[2]		
1,100,000	110,000	11,000	NA	NA	32,000	HP-4	Overburden "Sand 1"
			19,000	20,000	NA	S18	Overburden "Sand 2"
			17,000	19,000	29,000	T2	Middle Kittaning Coal/ Middle Kittanning Sandstone

-Exceeds 1% of Solubility

NOTES:

- All units are in ug/l.
- NA = Not Available

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
TOTAL-1,2-DICHLOROETHENE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1,2]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS			MONITORING WELL	FORMATION
			ROUND 1	ROUND 2	1996 SAMPLING[3]		
6,300,000	630,000	63,000	**64,000**	19,000	3,880	S6	Overburden "Sand 1"
			8,400	11,000	2,539	B-S	Overburden "Sand 1"
			15,400	12,000	21,935	T1	Overburden "Sand 1"
			NA	NA	38,000	HP-4	Overburden "Sand 1"
			NA	NA	8,400	SP-2	Overburden "Sand 1"
			NA	NA	15,000	SP-5	Overburden "Sand 1"
			1,600	460	10,323	S13	Overburden "Sand 2"
			8,000	5,800	5,018	G-UB	Middle Kittanning Sandstone

[ ]-Exceeds 1% Solubility

NOTES:

- All units are in ug/l.
- NA = Not Available

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] Solubility for Trans-1,2-dichloroethene is used

[3] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
BENZENE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS			MONITORING WELL	FORMATION
			ROUND 1	ROUND 2	1996 SAMPLING[2]		
1,780,000	178,000	17,800	NA	NA	**20,000**	SP-2	Overburden "Sand 2"
			30,000 J	**22,000**	17,000	S12	Overburden "Sand 2"
			45,000	**45,000**	NA	S18	Overburden "Sand 2"

[ ] -Exceeds 1% of Solubility

NOTES:

- All units are in ug/l.
- NA = Not Available

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

TABLE 3
SOLUBILITY/CONCENTRATION COMPARISON
TOLUENE
NEASE SITE, SALEM, OHIO

AQUEOUS SOLUBILITY[1]	10% OF SOLUBILITY	1% OF SOLUBILITY	SAMPLING RESULTS			MONITORING WELL	FORMATION
			ROUND 1	ROUND 2	1996 SAMPLING[2]		
535,000	53,500	5,350	7,200	7,500	NA	S18	Overburden "Sand 2"

[ ]-Exceeds 1% of Solubility

NOTES:

- All units are in ug/l.
- NA = Not Available

[1] From "Aquatic Fate Process Data for Organic Priority Pollutants", Final Report 1982 USEPA, Washington D.C. EPA 440/4-81-014.

[2] 1995/1996 Sampling includes Round 3 Sampling Event, Seep Investigation, and Eastern Plume/DNAPL Investigation

LE 4a
POND 2 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-17 [ug/kg]	SB-18 [ug/kg]	SB-19 [ug/kg]	SB-20 [ug/kg]	SB-21 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
0-3	Benzene	4,900		6,600	33,000	630	4/5	0 - 33,000	9,026		
	Chlorobenzene	8,300		9,400	39,000	99	4/5	0 - 39,000	11,360		
	1,2-Dichloroethane	980				190	1/5	0 - 190	234		
	DCE						0/5	0	0		
	1,1,2,2-PCA	6,700	13	14,000	120,000	1,100	5/5	13 - 120,000	28,363		
	PCE	51,000	23	33,000	270,000	2,900	5/5	23 - 270,000	71,385		
	TCE	2,200	5	7,500	33,000	450	5/5	5 - 33,000	8,631		
	Toluene	7,500		17,000	96,000	250	4/5	0 - 96,000	24,150		
	1,2-DCB	840,000	130	140,000	640,000		4/5	0 - 840,000	324,026		
	DPS	370,000	670	720,000	750,000		4/5	0 - 720,000	368,134		
	Methoxyclor	1,500	830		43,000	21,100	4/5	0 - 43,000	13,286		
	Mirex	389	3.28	19,400	223,000	297,000	5/5	3 - 297,000	107,958		
	SUM OF MEAN CONCENTRATIONS								**966,552**	**6.312**	**13,919**
3-6	Benzene	6,000		2,500	11,000	830,000	4/5	0 - 830,000	169,900		
	Chlorobenzene	10,000		3,200	15,000	300,000	4/5	0 - 300,000	65,640		
	1,2-DCA					47,000	1/5	0 - 47,000	9,400		
	DCE						0/5	0	0		
	1,1,2,2-PCA	67,000	8	11,000	60,000	120,000	5/5	8 - 120,000	51,602		
	PCE	110,000	30	31,000	130,000	1,600,000	5/5	30 - 1,600,000	374,206		
	TCE	2,400	3	2,500	13,000	47,000	5/5	3 - 47,000	12,981		
	Toluene	12,000	1	5,700	32,000	210,000	5/5	1 - 210,000	51,940		
	1,2-DCB	280,000	71	550,000	430,000		4/5	0 - 550,000	252,014		
	DPS	100,000	640	690,000	2,600,000		4/5	0 - 2,600,000	678,128		
	Methoxyclor	9,200		19,000	26,400	20,400	4/5	0 - 26,400	15,000		
	Mirex	297	269	54,800	938,000	249,000	5/5	269 - 938,000	248,473		
	SUM OF MEAN CONCENTRATIONS								**1,929,284**	**12,600**	**27,783**

POND 2 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-17 [ug/kg]	SB-18 [ug/kg]	SB-19 [ug/kg]	SB-20 [ug/kg]	SB-21 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
6-9	Benzene			9,000	230,000	24,000	3/5	0 - 230,000	52,600		
	Chlorobenzene		1,300	4,700	95,000	5,800	4/5	0 - 95,000	21,360		
	1,2-DCA			970	14,000		2/5	0 - 14,000	2,994		
	DCE						0/5	0	0		
	1,1,2,2-PCA			14,000	400,000	52,000	3/5	0 - 400,000	93,200		
	PCE		2,500	67,000	1,300,000	140,000	4/5	0 - 1,300,000	301,900		
	TCE			17,000	96,000	68,000	3/5	0 - 96,000	36,200		
	Toluene			23,000	8,900	71,000	3/5	0 - 89,000	20,580		
	1,2-DCB		7,500	350,000	3,000,000		3/5	0 - 3,000,000	671,500		
	DPS		5,800	340,000	7,200,000		3/5	0 - 7,200,000	1,509,160		
	Methoxyclor		3,500	41,000	22,900		3/5	0 - 41,000	13,480		
	Mirex		5,380	210,000	776,000	9,810	4/5	0 - 776,000	200,238		
	SUM OF MEAN CONCENTRATIONS								**2,923,212**	**19,091**	**42,096**
9-12	Benzene	25,000	1,700	41,000	300,000	2,300	5/5	1,700 - 300,000	74,000		
	Chlorobenzene	17,000	14,000	51,000	150,000		4/5	0 - 150,000	46,400		
	1,2-DCA	21,000			38,000	3,000	3/5	0 - 38,000	12,400		
	DCE						0/5	0	0		
	1,1,2,2-PCA	16,000	1,700	55,000	660,000	960	5/5	960 - 660,000	146,732		
	PCE	110,000	22,000	430,000	1,600,000	6,100	5/5	6,100 - 1,600,000	433,620		
	TCE	3,500	1,100		120,000	490	4/5	0 - 120,000	25,018		
	Toluene	18,000	290	23,000	150,000	250	5/5	250 - 150,000	38,308		
	1,2-DCB	800,000	560,000	2,700,000	2,400,000	16,000	5/5	16,000 - 2,700,000	1,295,200		
	DPS	200,000	150,000	1,300,000	1,100,000	28,000	5/5	28,000 - 1,300,000	555,600		
	Methoxyclor	280,000	24,000	34,000	46,400		4/5	0 - 280,000	76,880		
	Mirex	21,400	6,550	263,000	290,000	3,550	5/5	3,550 - 290,000	116,900		
	SUM OF MEAN CONCENTRATIONS								**2,821,058**	**18,424**	**40,625**

POND 2 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-17 [ug/kg]	SB-18 [ug/kg]	SB-19 [ug/kg]	SB-20 [ug/kg]	SB-21 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
12-15	Benzene	12,000	250	67,000	340,000	1,800	5/5	250 - 340,000	84,210		
	Chlorobenzene	8,900	280	27,000	140,000	940	5/5	280 - 140,000	35,424		
	1,2-DCA	9,400		19,000	90,000	1,200	4/5	0 - 90,000	23,920		
	DCE						0/5	0	0		
	1,1,2,2-PCA	16,000		160,000	2,000,000	3,700	4/5	0 - 2,000,000	435,940		
	PCE	37,000		1,100,000	6,800,000	29,000	4/5	0 - 6,800,000	1,593,200		
	TCE	6,100	250	55,000	570,000	9,000	5/5	250 - 570,000	128,070		
	Toluene	8,300		20,000	140,000	630	4/5	0 - 140,000	33,786		
	1,2-DCB	700,000	130,000	2,600,000	550,000	45,000	5/5	45,000 - 2,600,000	805,000		
	DPS	120,000	10,000	720,000	350,000	30,000	5/5	10,000 - 720,000	246,000		
	Methoxyclor	250,000	580	83,000	26,200	2,990	5/5	580 - 250,000	72,554		
	Mirex	12,700	1,530	291,000	194,000	3,870	5/5	1,530 - 291,000	100,620		
	SUM OF MEAN CONCENTRATIONS								**3,558,724**	**23,241**	**51,247**
15-20	Benzene		7	500,000	4,700,000	57,000	4/5	0 - 4,700,000	1,051,401		
	Chlorobenzene		5		110,000	28,000	3/5	0 - 110,000	27,601		
	1,2-DCA		36				1/5	0 - 36	7		
	DCE						0/5	0	0		
	1,1,2,2-PCA			1,700,000	7,200,000	360,000	3/5	0 - 7,200,000	1,852,000		
	PCE		50	16,000,000	38,000,000	1,500,000	4/5	0 - 38,000,000	11,100,010		
	TCE		84	510,000	2,200,000	120,000	4/5	0 - 2,200,000	566,017		
	Toluene		2	170,000	550,000	27,000	4/5	0 - 550,000	149,400		
	1,2-DCB		8,100	3,000,000	260,000	130,000	4/5	0 - 3,000,000	679,620		
	DPS		8,900	1,400,000	420,000	110,000	4/5	0 - 1,400,000	387,780		
	Methoxyclor		9,200	270,000	20,500	14,200	4/5	0 - 270,000	62,780		
	Mirex		3,030	133,000	554,000	169,000	4/5	0 - 554,000	171,806		
	SUM OF MEAN CONCENTRATIONS								**16,048,423**	**174,683**	**385,175**
	TOTAL									**254,351**	**560,844**

Note: Samples taken during 1990 Remedial Investigation (RI) activities

TABLE 4b
POND 3 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-26 [ug/kg]	SB-27 [ug/kg]	SB-28 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
0-3	Benzene			26	1/3	0 - 26	9		
	Chlorobenzene				0/3	0	0		
	1,2-Dichloroethane			30	1/3	0 - 30	10		
	DCE				0/3	0	0		
	1,1,2,2-PCA			4	1/3	0 -4	1		
	PCE	4	16	310	3/3	4 - 310	110		
	TCE	4	35	26	3/3	4 - 35	22		
	Toluene				0/3	0	0		
	1,2-DCB				0/3	0	0		
	DPS	960	210	98	3/3	98 - 960	423		
	Methoxyclor			400	1/3	0 - 400	133		
	Mirex	4,150	2,120	4,050	3/3	2,120 - 4,150	3,440		
	SUM OF MEAN CONCENTRATIONS						**4,148**	**95**	**209**
3-7	Benzene	10	580	70	3/3	10 - 580	220		
	Chlorobenzene		13		1/3	0 - 13	4		
	1,2-DCA	24	680	89	3/3	24 - 680	264		
	DCE				0/3	0	0		
	1,1,2,2-PCA		26		1/3	0 - 26	9		
	PCE		280		1/3	0 - 280	93		
	TCE		520		1/3	0 - 520	173		
	Toluene		10		1/3	0 - 10	3		
	1,2-DCB				0/3	0	0		
	DPS	1,300	12,000		2/3	0 - 12,000	4,433		
	Methoxyclor		61		1/3	0 - 61	20		
	Mirex	1	8	11	3/3	1 - 11	7		
	SUM OF MEAN CONCENTRATIONS						**5,228**	**159**	**351**

POND 3 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-26 [ug/kg]	SB-27 [ug/kg]	SB-28 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
7-10	Benzene	770	1,100	160	3/3	160 - 1,100	677		
	Chlorobenzene		250		1/3	0 - 250	83		
	1,2-DCA	520	730	180	3/3	180 - 730	477		
	DCE				0/3	0	0		
	1,1,2,2-PCA			1	1/3	0 - 1	0		
	PCE	11	12,000		2/3	0 - 12,000	4,004		
	TCE	32	2,900	160	3/3	32 - 2,900	1,031		
	Toluene		110		1/3	0 - 110	37		
	1,2-DCB				0/3	0	0		
	DPS	1,300			1/3	0 - 1,300	433		
	Methoxyclor				0/3	0	0		
	Mirex	1	1	5	3/3	1 - 5	3		
	SUM OF MEAN CONCENTRATIONS						**6,744**	**154**	**340**
10-13	Benzene		3		1/3	0 - 3	1		
	Chlorobenzene				0/3	0	0		
	1,2-DCA		3		1/3	0 - 3	1		
	DCE		10		1/3	0 - 10	3		
	1,1,2,2-PCA				0/3	0	0		
	PCE		15		1/3	0 - 15	5		
	TCE		16		1/3	0 - 16	5		
	Toluene		2		1/3	0 - 2	1		
	1,2-DCB				0/3	0	0		
	DPS				0/3	0	0		
	Methoxyclor			36	1/3	0 - 36	12		
	Mirex		1	4	2/3	0 - 4	2		
	SUM OF MEAN CONCENTRATIONS						**30**	**1**	**2**
	TOTAL							**409**	**902**

Note: Samples taken during 1990 Remedial Investigation (RI) activities

POND 4 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-29 [ug/kg]	SB-30 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
0-3	Benzene		2	1/2	0 -2	1		
	Chlorobenzene			0/2	0	0		
	1,2-Dichloroethane			0/2	0	0		
	DCE			0/2	0	0		
	1,1,2,2-PCA			0/2	0	0		
	PCE			0/2	0	0		
	TCE		2	1/2	0 - 2	1		
	Toluene			0/2	0	0		
	1,2-DCB			0/2	0	0		
	DPS	98	49	2/2	49 - 98	74		
	Methoxyclor			0/2	0	0		
	Mirex	417		1/2	0 - 417	209		
	SUM OF MEAN CONCENTRATIONS					284	2	5
3-6	Benzene	88	200	2/2	88 - 200	144		
	Chlorobenzene			0/2	0	0		
	1,2-DCA			0/2	0	0		
	DCE			0/2	0	0		
	1,1,2,2-PCA	21		1/2	0 - 21	11		
	PCE			0/2	0	0		
	TCE	53		1/2	0 - 53	27		
	Toluene	35		1/2	0 - 35	18		
	1,2-DCB		170	1/2	0 - 170	85		
	DPS	1700	3100	2/2	1,700 - 3,100	2,400		
	Methoxyclor			0/2	0	0		
	Mirex	348		1/2	0 - 348	174		
	SUM OF MEAN CONCENTRATIONS					2,858	24	53

POND 4 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-29 [ug/kg]	SB-30 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
6-9	Benzene	270	1800	2/2	270 - 1,800	1,035		
	Chlorobenzene		130	1/2	0 - 130	65		
	1,2-DCA			0/2	0	0		
	DCE			0/2	0	0		
	1,1,2,2-PCA			0/2	0	0		
	PCE			0/2	0	0		
	TCE			0/2	0	0		
	Toluene		72	1/2	0 - 72	36		
	1,2-DCB	1700		1/2	0 - 1,700	850		
	DPS	27000	18000	2/2	18,0000 - 27,000	22,500		
	Methoxyclor			0/2	0	0		
	Mirex			0/2	0	0		
	SUM OF MEAN CONCENTRATIONS					**24,486**	**206**	**454**
9-12	Benzene	73		1/2	0 - 73	37		
	Chlorobenzene			0/2	0	0		
	1,2-DCA			0/2	0	0		
	DCE			0/2	0	0		
	1,1,2,2-PCA			0/2	0	0		
	PCE			0/2	0	0		
	TCE			0/2	0	0		
	Toluene			0/2	0	0		
	1,2-DCB		7400	1/2	0 - 7,400	3,700		
	DPS		12000	1/2	0 - 12,000	6,000		
	Methoxyclor			0/2	0	0		
	Mirex		33.6	1/2	0 - 33.6	17		
	SUM OF MEAN CONCENTRATIONS					**9,753**	**82**	**181**

TABLE 4c
POND 4 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-29 [ug/kg]	Soil Boring Numbers SB-30 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Concentration Mean [ug/kg]	Total Mass [kg]	Total Mass [lb]
12-15	Benzene		260	1/2	0 - 260	130		
	Chlorobenzene			0/2	0	0		
	1,2-DCA			0/2	0	0		
	DCE			0/2	0	0		
	1,1,2,2-PCA		140	1/2	0 - 140	70		
	PCE		1900	1/2	0 - 1,900	950		
	TCE		260	1/2	0 - 260	130		
	Toluene		37	1/2	0 - 37	19		
	1,2-DCB		200	1/2	0 - 200	100		
	DPS			0/2	0	0		
	Methoxyclor			0/2	0	0		
	Mirex		5.09	1/2	0 - 5.09	3		
	SUM OF MEAN CONCENTRATIONS					1,401	12	26
15-20	Benzene			0/2	0	0		
	Chlorobenzene			0/2	0	0		
	1,2-DCA			0/2	0	0		
	DCE			0/2	0	0		
	1,1,2,2-PCA			0/2	0	0		
	PCE			0/2	0	0		
	TCE			0/2	0	0		
	Toluene			0/2	0	0		
	1,2-DCB		210	1/2	0 - 210	105		
	DPS	190		1/2	0 - 190	95		
	Methoxyclor			0/2	0	0		
	Mirex			0/2	0	0		
	SUM OF MEAN CONCENTRATIONS					200	3	6
	TOTAL						329	725

Note: Samples taken during 1990 Remedial Investigation (RI) activities

TABLE 4d
POND 7 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-22 [ug/kg]	SB-23 [ug/kg]	SB-24 [ug/kg]	SB-25 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
0-3	Benzene					0/4	0 - 0	0		
	Chlorobenzene					0/4	0 - 0	0		
	1,2-Dichloroethane					0/4	0 - 0	0		
	DCE					0/4	0 - 0	0		
	1,1,2,2-PCA					0/4	0 - 0	0		
	PCE			15	6	4/4	0 - 15	5		
	TCE	2		12	30	4/4	0 - 30	11		
	Toluene					0/4	0 - 0	0		
	1 2-DCB					0/4	0 - 0	0		
	DPS			1800	130	2/4	0 - 1,800	483		
	Methoxyclor			22000	4900	2/4	0 - 22,000	6,725		
	Mirex	389	8850	5380	759	4/4	389 - 5380	3,845		
	SUM OF MEAN CONCENTRATIONS							**11,068**	**77**	**169**
3-6	Benzene			24	74000	2/4	0 - 830,000	18,506		
	Chlorobenzene			15	7700	2/4	0 - 300,000	1,929		
	1,2-DCA			6	6100	2/4	0 - 47,000	1,527		
	DCE					0/4	0 - 0	0		
	1,1,2,2-PCA	12				1/4	8 - 120,000	3		
	PCE	10	8	180	11000	4/4	30 - 1,600,000	2,800		
	TCE	2	5	160	39000	4/4	3 - 47,000	9,792		
	Toluene			31	1700	2/4	1 - 210,000	433		
	1,2-DCB					0/4	0 - 0	0		
	DPS			870000	1200000	2/4	0 - 2,600,000	517,500		
	Methoxyclor					0/4	0 - 0	0		
	Mirex	3	269	1,190	526	4/4	269 - 938,000	497		
	SUM OF MEAN CONCENTRATIONS							**552,985**	**3,837**	**8,461**

TABLE 4d
POND 7 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-22 [ug/kg]	SB-23 [ug/kg]	SB-24 [ug/kg]	SB-25 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
6-9	Benzene			620	76	2/4	0 - 230,000	174		
	Chlorobenzene			170	10	2/4	0 - 95,000	45		
	1,2-DCA				81	1/4	0 - 14,000	20		
	DCE					0/4	0	0		
	1,1,2,2-PCA	12				1/4	0 - 400,000	3		
	PCE			590	130	2/4	0 - 1,300,000	180		
	TCE	3		450	58	3/4	0 - 96,000	128		
	Toluene			710		1/4	0 - 89,000	178		
	1,2-DCB			690		1/4	0 - 3,000,000	173		
	DPS			250000	73000	2/4	0 - 7,200,000	80,750		
	Methoxyclor					0/4	0 - 41,000	0		
	Mirex	11		9.97	11.6	3/4	0 - 776,000	8		
	SUM OF MEAN CONCENTRATIONS							**81,658**	**567**	**1,249**
9-12	Benzene			45	28	2/4	1,700 - 300,000	18		
	Chlorobenzene			12		1/4	0 - 150,000	3		
	1,2-DCA			4	3	2/4	0 - 38,000	2		
	DCE					0/4	0	0		
	1,1,2,2-PCA	2				1/4	960 - 660,000	1		
	PCE	10		61		2/4	6,100 - 1,600,000	18		
	TCE	18		56		2/4	0 - 120,000	19		
	Toluene			35		1/4	250 - 150,000	9		
	1,2-DCB					0/4	16,000 - 2,700,000	0		
	DPS		97	310	7600	3/4	28,000 - 1,300,000	2,002		
	Methoxyclor					0/4	0 - 280,000	0		
	Mirex	39.8	4.76	5.51	59	4/4	3,550 - 290,000	27		
	SUM OF MEAN CONCENTRATIONS							**2,098**	**15**	**32**

TABLE 4d
POND 7 AREA RI SOIL BORING CHEMISTRY
NEASE SITE, SALEM, OHIO

Feet Below Surface	Compound	Soil Boring Numbers SB-22 [ug/kg]	SB-23 [ug/kg]	SB-24 [ug/kg]	SB-25 [ug/kg]	Frequency of Detection	Concentration Range [ug/kg]	Mean [ug/kg]	Total Mass [kg]	[lb]
12-15	Benzene			1	13	2/4	0 - 13	4		
	Chlorobenzene					0/4	0	0		
	1,2-DCA					0/4	0	0		
	DCE					0/4	0	0		
	1,1,2,2-PCA					0/4	0	0		
	PCE					0/4	0	0		
	TCE				8	1/4	0 - 8	2		
	Toluene					0/4	0	0		
	1,2-DCB			41		1/4	0 - 41	10		
	DPS			1,000	670	2/4	0 - 1000	418		
	Methoxyclor				41	1/4	0 - 41	10		
	Mirex	6		2	2	3/4	0 - 6	2		
	SUM OF MEAN CONCENTRATIONS							**446**	**3**	**7**
	TOTAL								**4,498**	**9,919**

Note: Samples taken during 1990 Remedial Investigation (RI) activities

BEECHWOOD ROAD

GAS PIPELINE

SOIL/SLUDGE AREA

POND 7

POND 4

POND 3

POND 2

(POND 1)

EXCLUSION AREA "B"

EXCLUSION AREA "A"

FEEDER CREEK

CRANE-DEMING COMPANY

INACTIVE (APPROX. LOCATION) LANDFILL

MIDDLE FORK OF LITTLE BEAVER CREEK

ALLEN ROAD

GARFIELD RD.

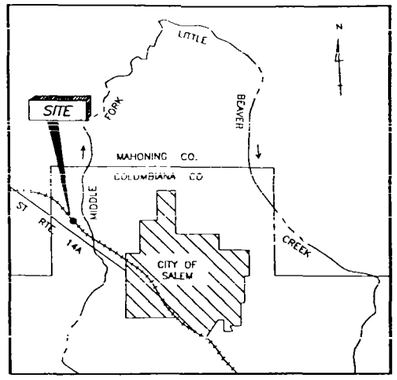
STATE ROUTE 14

CONRAIL

PENNSYLVANIA AVENUE

SALEM WASTE WATER TREATMENT PLANT

N



LOCAL SETTING

REGIONAL SETTING

LEGEND

- SITE BOUNDARY
- FENCE
- RAILROAD TRACKS
- SURFACE WATER DRAINAGE
- WOODS

AUG 04 1999

400 0 400
scale feet

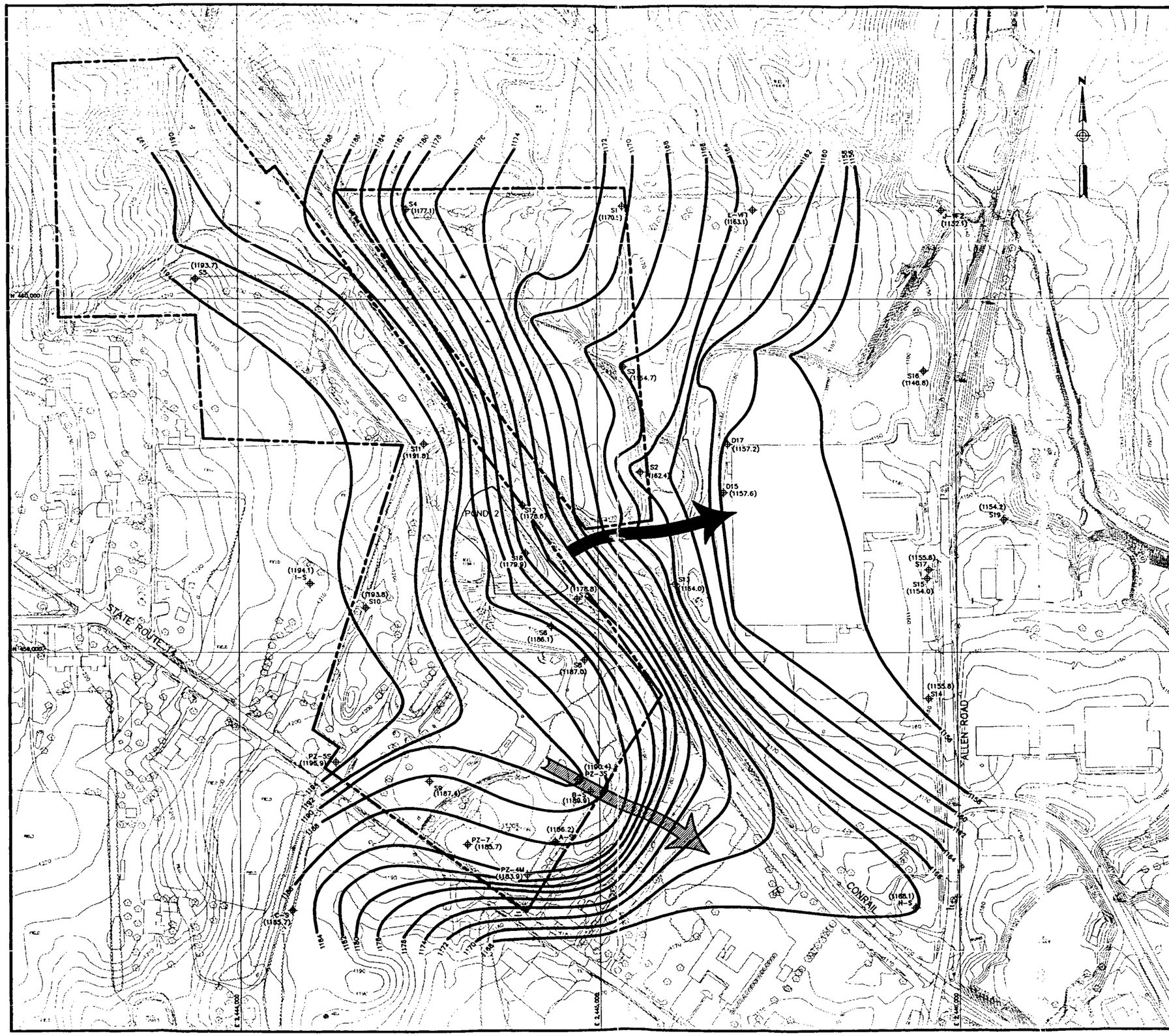
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	07/25/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-553
REV BY:	RV AUG 8, 1997	DR SUBTITLE:	15

Golder Associates

SITE LOCATION MAP

RUETGERS – NEASE CORPORATION

FIGURE 1



LEGEND

- PROPERTY LINE
- S16 — MONITORING WELL LOCATION
- (1132.2) — GROUNDWATER ELEVATION
- 1160 — GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
- POND 2 PLUME GROUNDWATER FLOW DIRECTION
- "EASTERN PLUME" GROUNDWATER FLOW DIRECTION

NOTES

1.) GROUNDWATER MEASUREMENTS OBTAINED BY HOWELLS AND BAIRD, INC. PERSONNEL ON APRIL 24, 1997.

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 0 7 1998

100 0 100 200
scale feet

REV	DATE	DESCRIPTION	DR BY	CHK BY	RVW

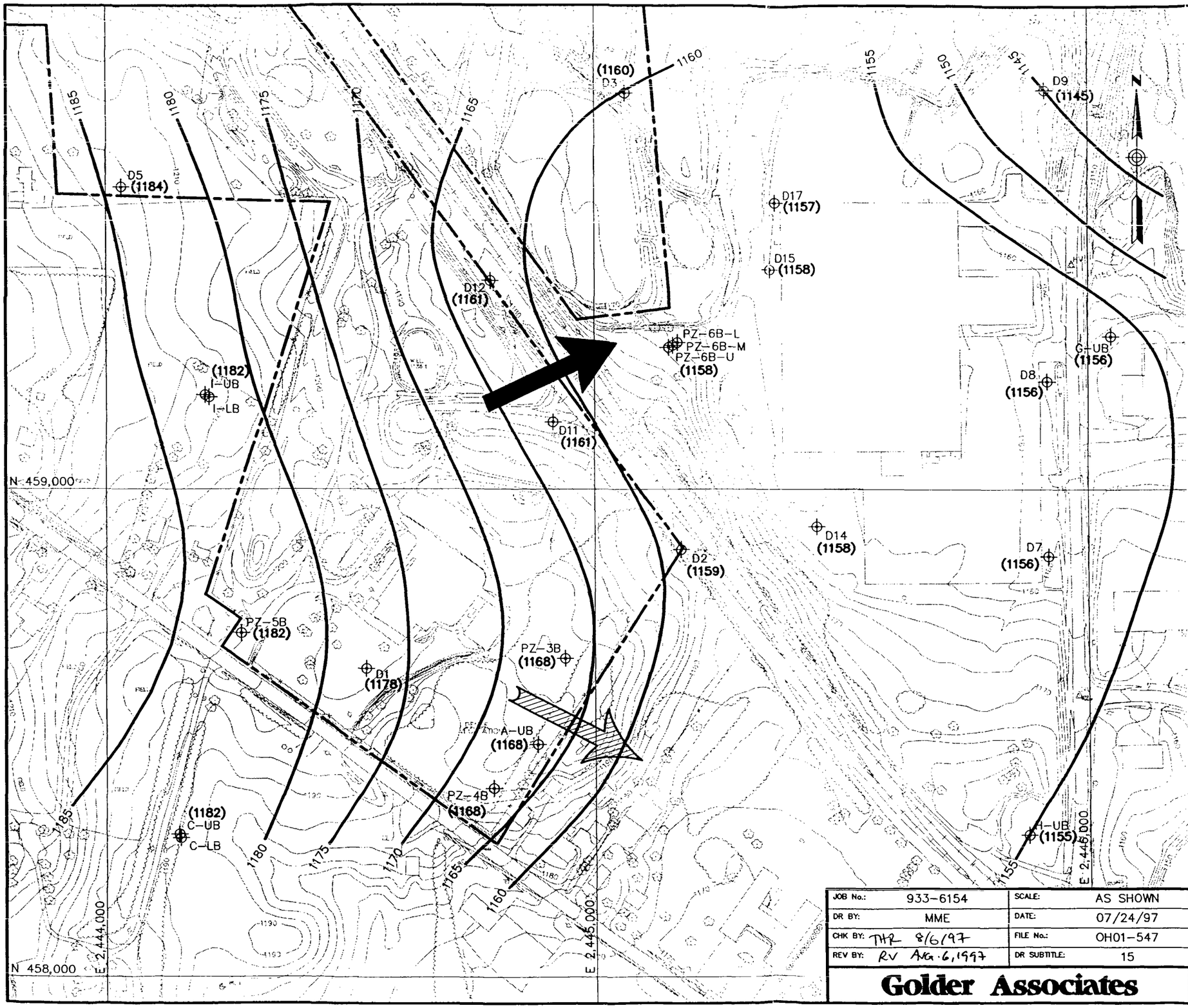
PROJECT: RUETGERS-NEASE CORPORATION
EASTERN PLUME / DNAPL INVESTIGATION
NEASE SITE, SALEM, OHIO

SHEET TITLE: COMPOSITE GROUNDWATER CONTOURS OVERBURDEN

Golder Associates
Mt. Laurel, New Jersey

PROJECT No.	933-6154		FILE No.	10H01-55
CLIENT PROJ. No.			DRAFTING SUBMITTED	1
DES BY	MME	06/03/97	SCALE:	AS SHOWN
DR BY	MME	07/24/97		
CHK BY	THR	08/28/98		
RVW BY	RV	08/28/98		

FIGURE 2



LEGEND

- PROPERTY LINE
- D8 — MONITORING WELL LOCATION
- (1156) — MEASURED GROUNDWATER ELEVATION (FT. MSL)
- GROUNDWATER ELEVATION CONTOUR
- POND 2 PLUME GROUNDWATER FLOW DIRECTION
- "EASTERN PLUME" GROUNDWATER FLOW DIRECTION

NOTES

1.) GROUNDWATER MEASUREMENTS TAKEN ON APRIL 24, 1997 BY HOWELLS AND BAIRD, INC. PERSONNEL.

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

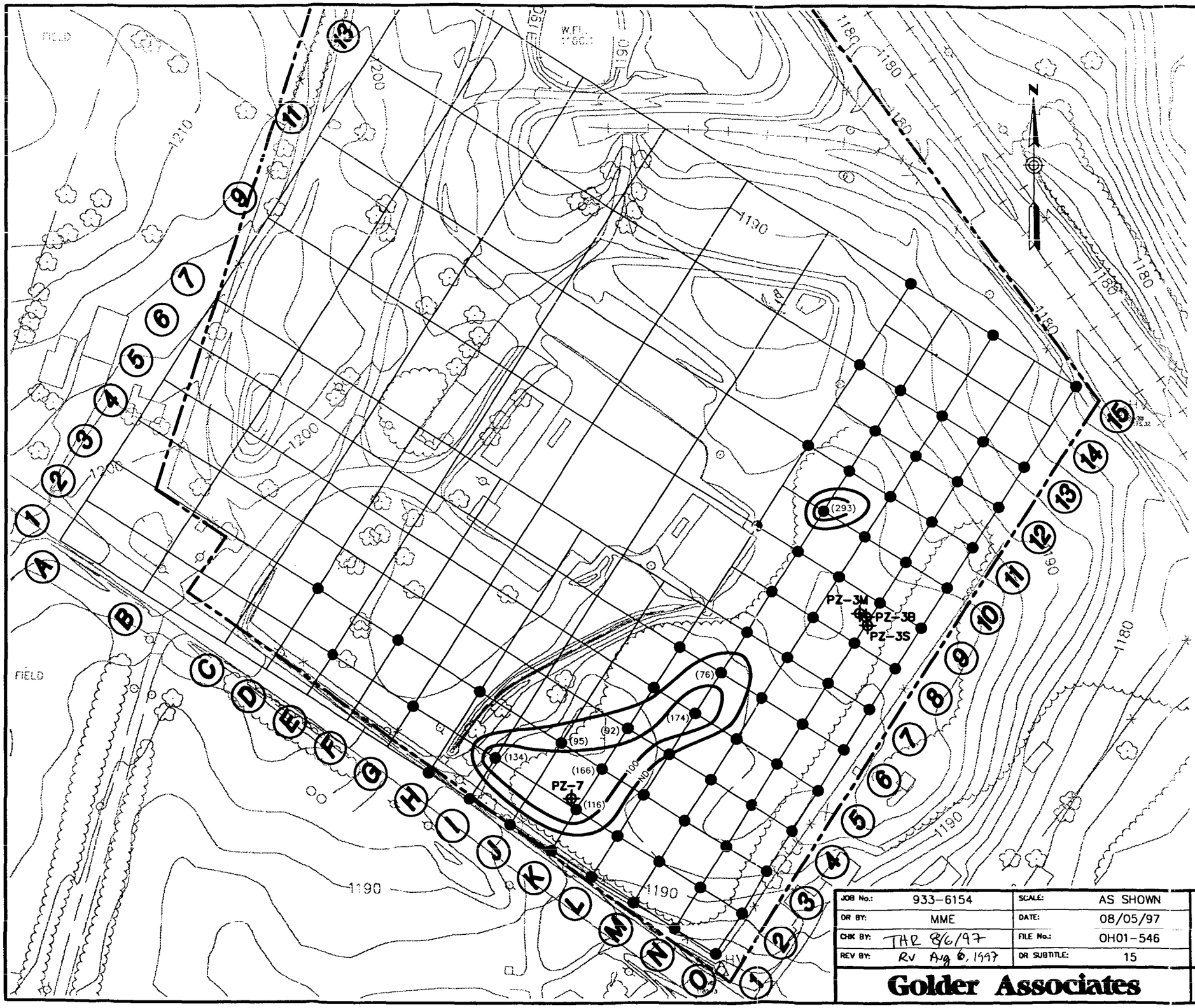
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	07/24/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-547
REV BY:	RV AUG. 6, 1997	DR SUBTITLE:	15

Golder Associates

INTERPRETED GROUNDWATER CONTOURS MIDDLE KITTANING SANDSTONE

RUETGERS-NEASE CORPORATION

FIGURE 3



LEGEND

— — —	PROPERTY LINE
✱	SOIL GAS SURVEY POINT
(334)	DETECTED TCE CONCENTRATION (ng)
(9)	SOIL GAS SURVEY ROW/COLUMN DESIGNATION
———	ISOCONCENTRATION CONTOUR
PZ-7 ⊕	MONITORING WELL WHOSE LOCATION DETERMINED AS A RESULT OF THE SOIL GAS SURVEY.

NOTES

1) SOIL GAS SURVEY POINTS WITHOUT A TCE CONCENTRATION LISTED ARE NON-DETECT (ND).

REFERENCE

1) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1999

100 0 100
scale feet

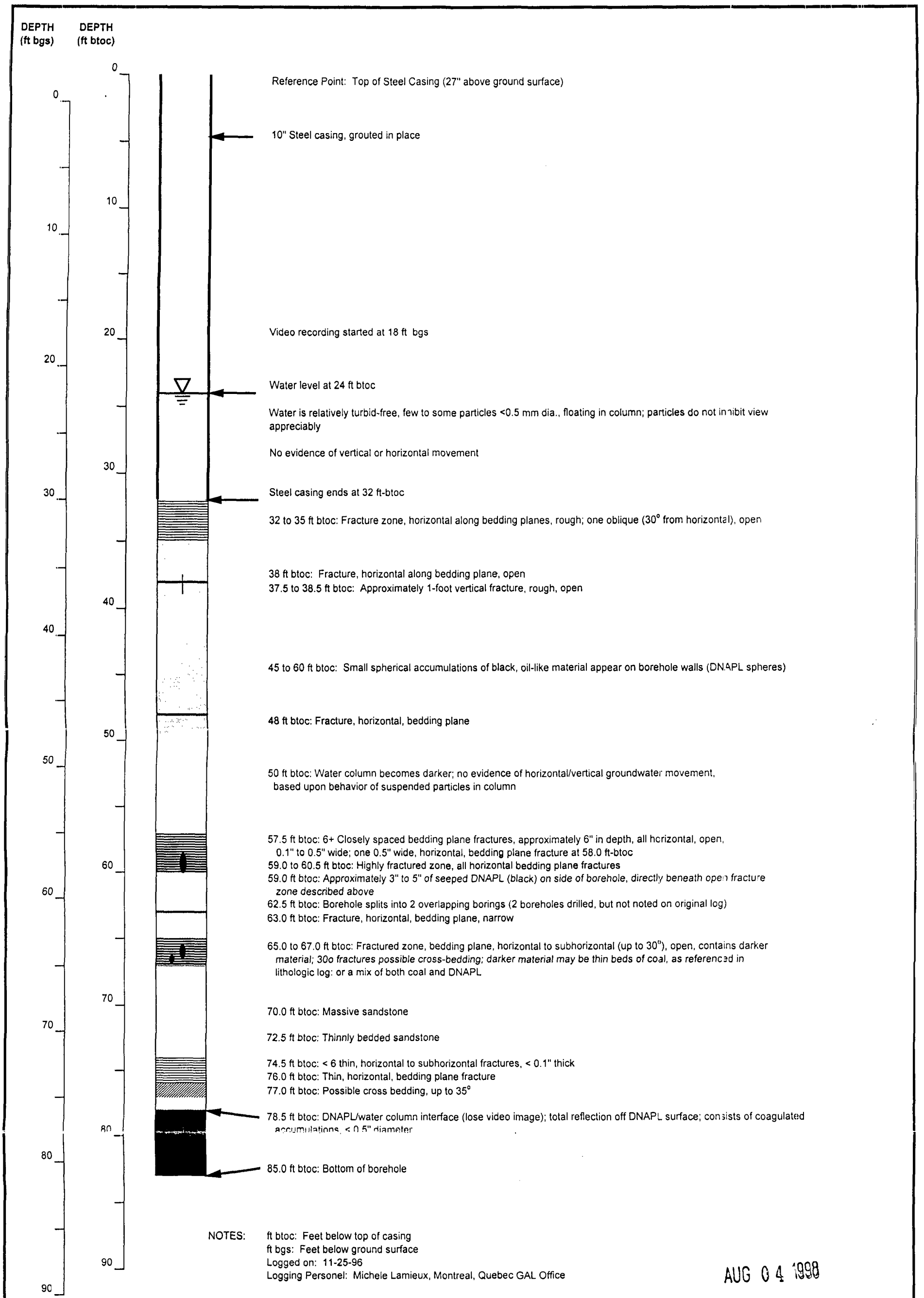
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	08/05/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-546
REV BY:	RV Aug 6, 1997	DR SUBTITLE:	15

Golder Associates

ISOCONCENTRATION CONTOURS VAPOR PHASE TCE IN THE SHALLOW OVERBURDEN

RUETGERS-NEASE CORPORATION

FIGURE 4

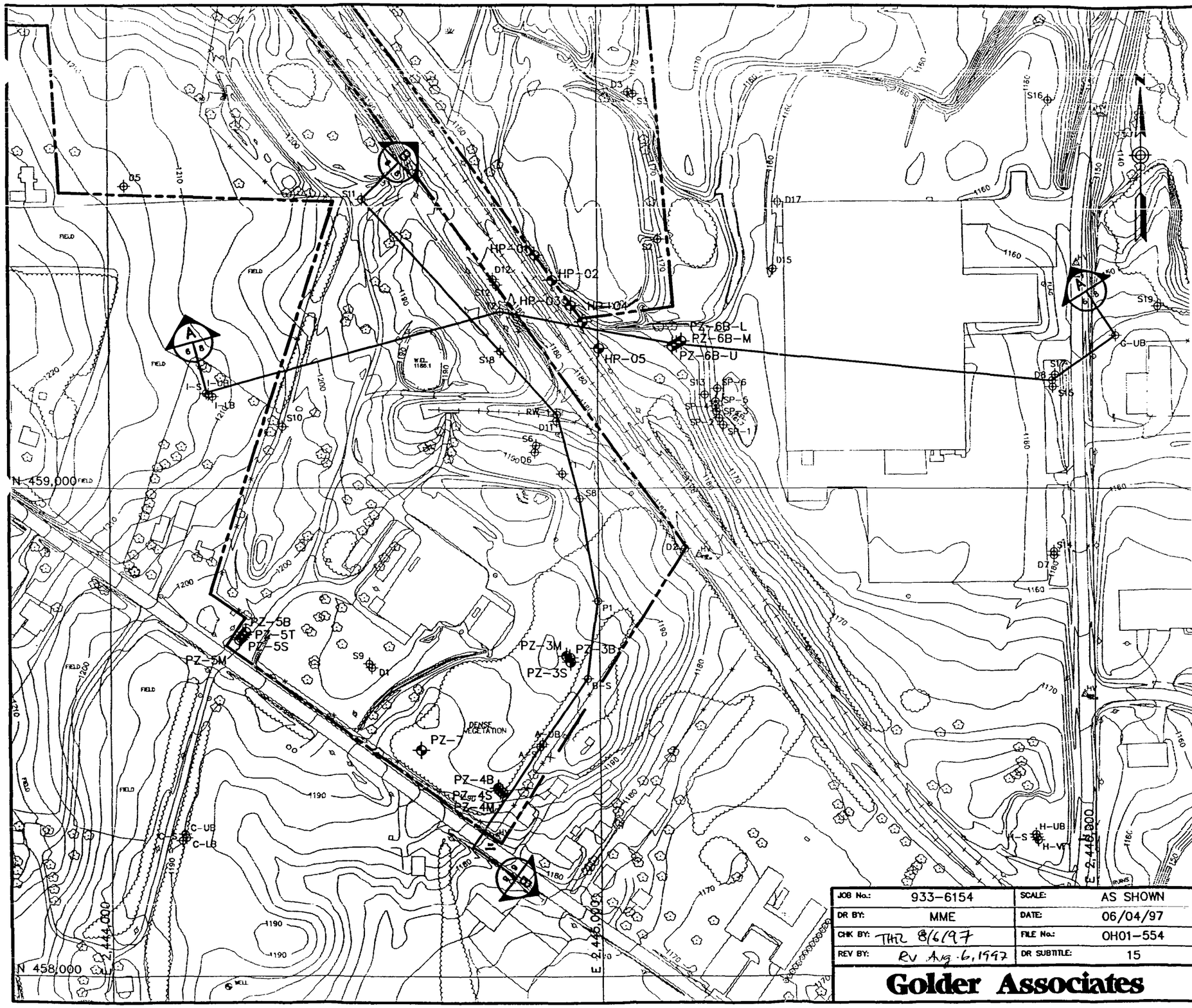


NOTES:
ft btoc: Feet below top of casing
ft bgs: Feet below ground surface
Logged on: 11-25-96
Logging Personel: Michele Lamieux, Montreal, Quebec GAL Office

AUG 0 4 1998

JOB No.: 933-6154	SCALE: NONE	**DOWNHOLE VIDEO LOG WELL RW-1**
DR BY: MME	DATE: 7/25/97	
CHK BY: THR 8/6/97	FILE No.: RW1VIDLG.XLS	
REV BY: RV Aug 6, 1997	DR SUBTITLE: NA	

Golder Associates | RUETGERS-NEASE CORPORATION | Figure 5



LEGEND

PROPERTY LINE

PZ-7 NEW MONITORING WELL LOCATION AND DESIGNATION

S19 PREVIOUSLY INSTALLED MONITORING WELL LOCATION AND DESIGNATION

ISOCONCENTRATION CONTOUR

A — CROSS SECTION DESIGNATION

6 — DRAWING No. WHERE CROSS SECTION IS PRESENTED

8 — DRAWING No. WHERE CROSS SECTION IS FIRST SHOWN

NOTES

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1999

200 0 200
scale feet

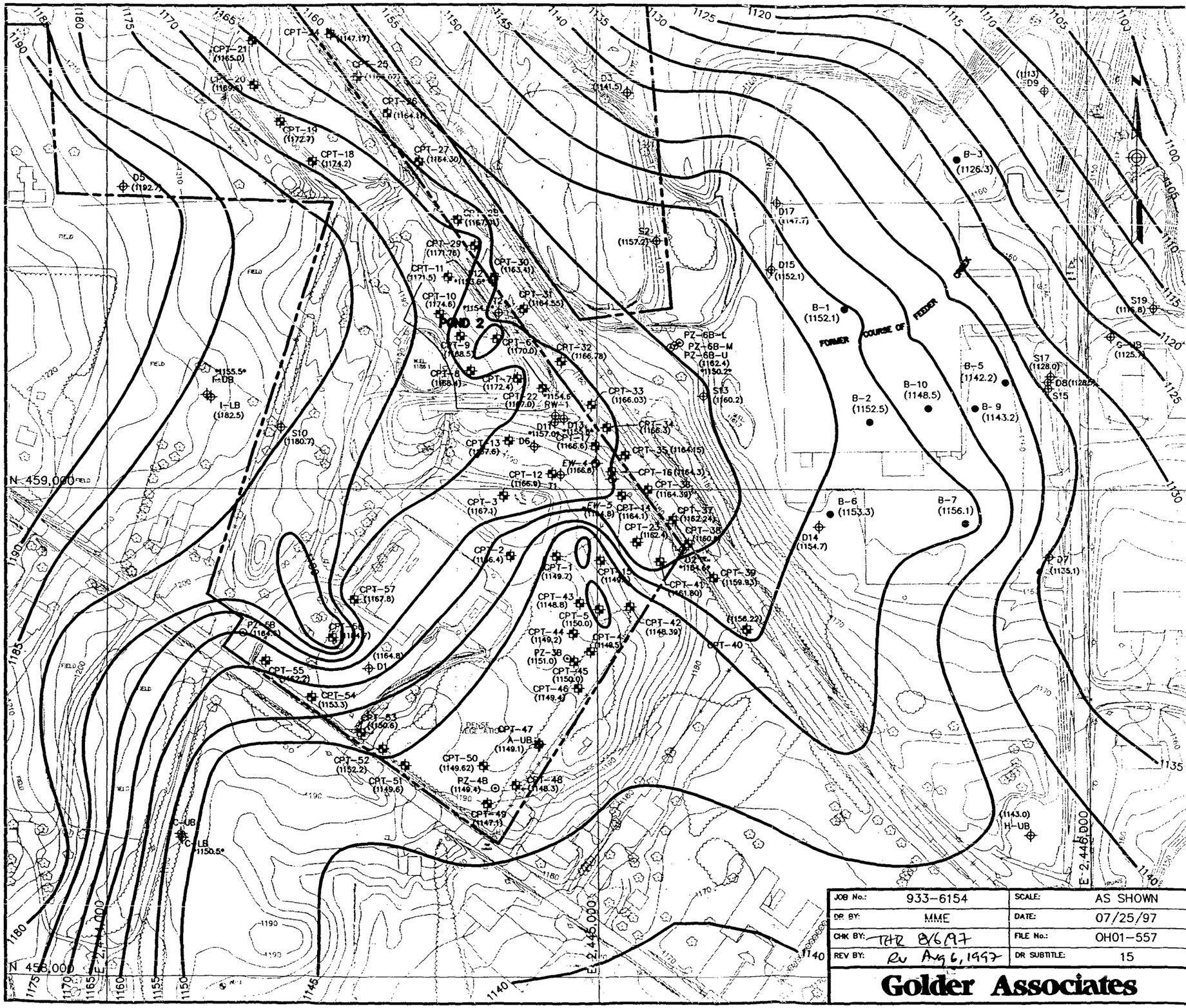
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	06/04/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-554
REV BY:	RV Aug. 6, 1997	DR SUBTITLE:	15

Golder Associates

MONITORING WELL AND CROSS SECTION LOCATIONS

RUETGERS-NEASE CORPORATION

FIGURE 6



LEGEND

- PROPERTY LINE
- 1135 — TOP OF BEDROCK CONTOUR (CONTOUR INTERVAL 5 FEET)
- PZ-5 — NEW PIEZOMETER LOCATION
- S19 — MONITORING WELL LOCATION
- EW-4 — EXTRACTION WELL LOCATION
- CPT-1 — CONE PENETROMETER LOCATION
- B-1 — TEST BORINGS (CRANE-DEMING PROPERTY, CIRCA 1970, ALL LOCATIONS ARE APPROXIMATE)
- (1091.3) — ELEVATION OF TOP OF BEDROCK (FEET MSL)
- *1091.3* — ELEVATION OF TOP OF MIDDLE KITTANING COAL (FEET MSL)

NOTES

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

2.) EXISTING CONE PENETROMETER TEST COORDINATE LOCATIONS SUPPLIED BY HOWELLS AND BAIRD, INC. ON 06/21/95.

AUG 04 1998

200 0 200
scale feet

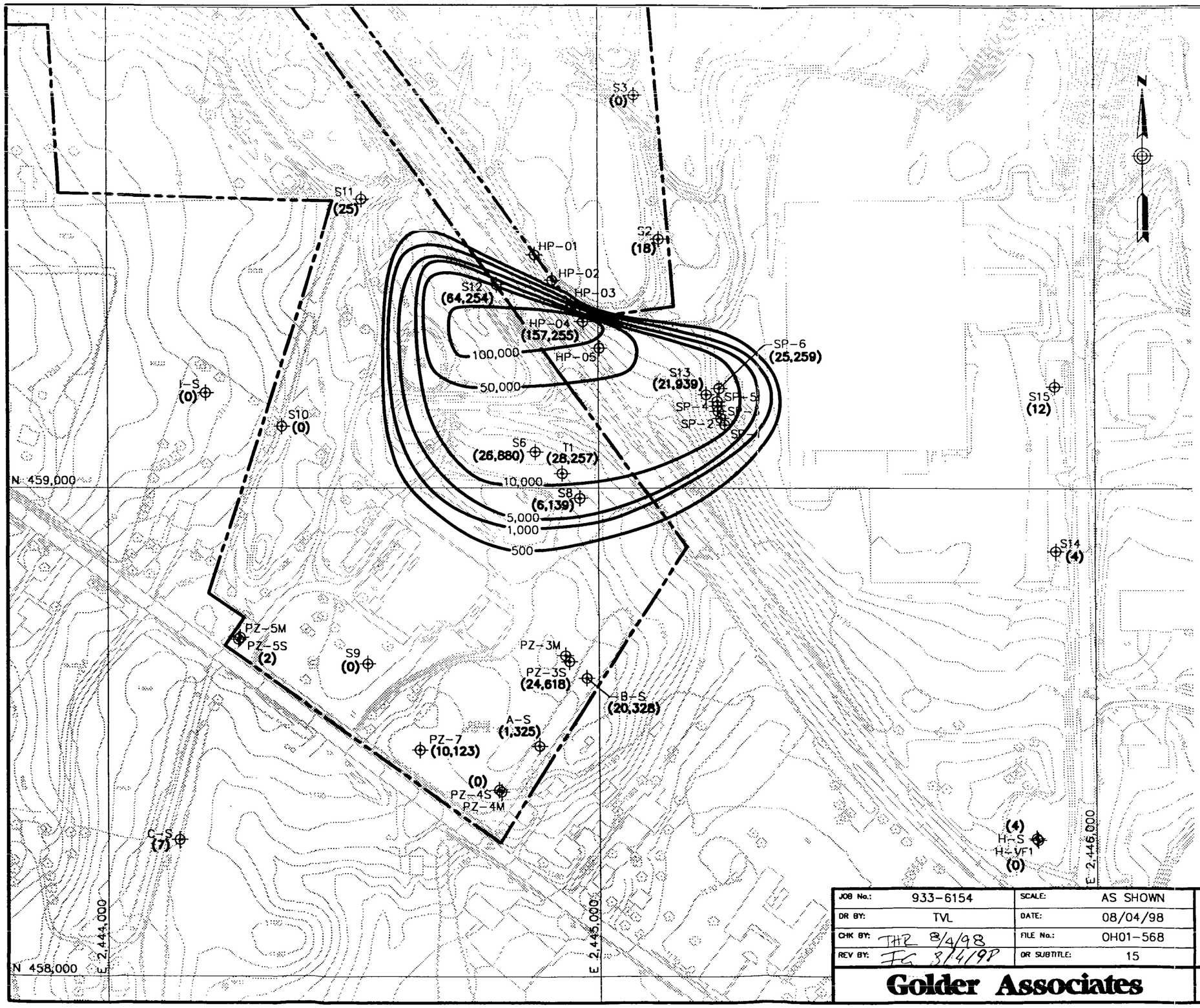
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	07/25/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-557
REV BY:	RV Aug 6, 1997	DR SUBTITLE:	15

Golder Associates

TOP OF BEDROCK CONTOUR MAP

RUETGERS-NEASE CORPORATION

FIGURE 7



LEGEND

PROPERTY LINE

S15 MONITORING WELL LOCATION

(12) DETECTED TOTAL VOC CONCENTRATION (ug/l)

ISOCONCENTRATION CONTOUR

NOTES

1.) DUE TO VARIABILITY IN DETECTED CONCENTRATIONS, ONLY THE HIGHEST DETECTED CONCENTRATION IN THE "SEEP AREA" PIEZOMETERS WAS USED FOR CONTOURING PURPOSES. THE RESULTS FOR ALL OF THE "SEEP AREA" PIEZOMETERS ARE AS FOLLOWS:

WELL	CONCENTRATION (ug/l)
SP-1	2,250
SP-2	3,888
SP-3	17,230
SP-4	5,022
SP-5	9,684
SP-6	25,259

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

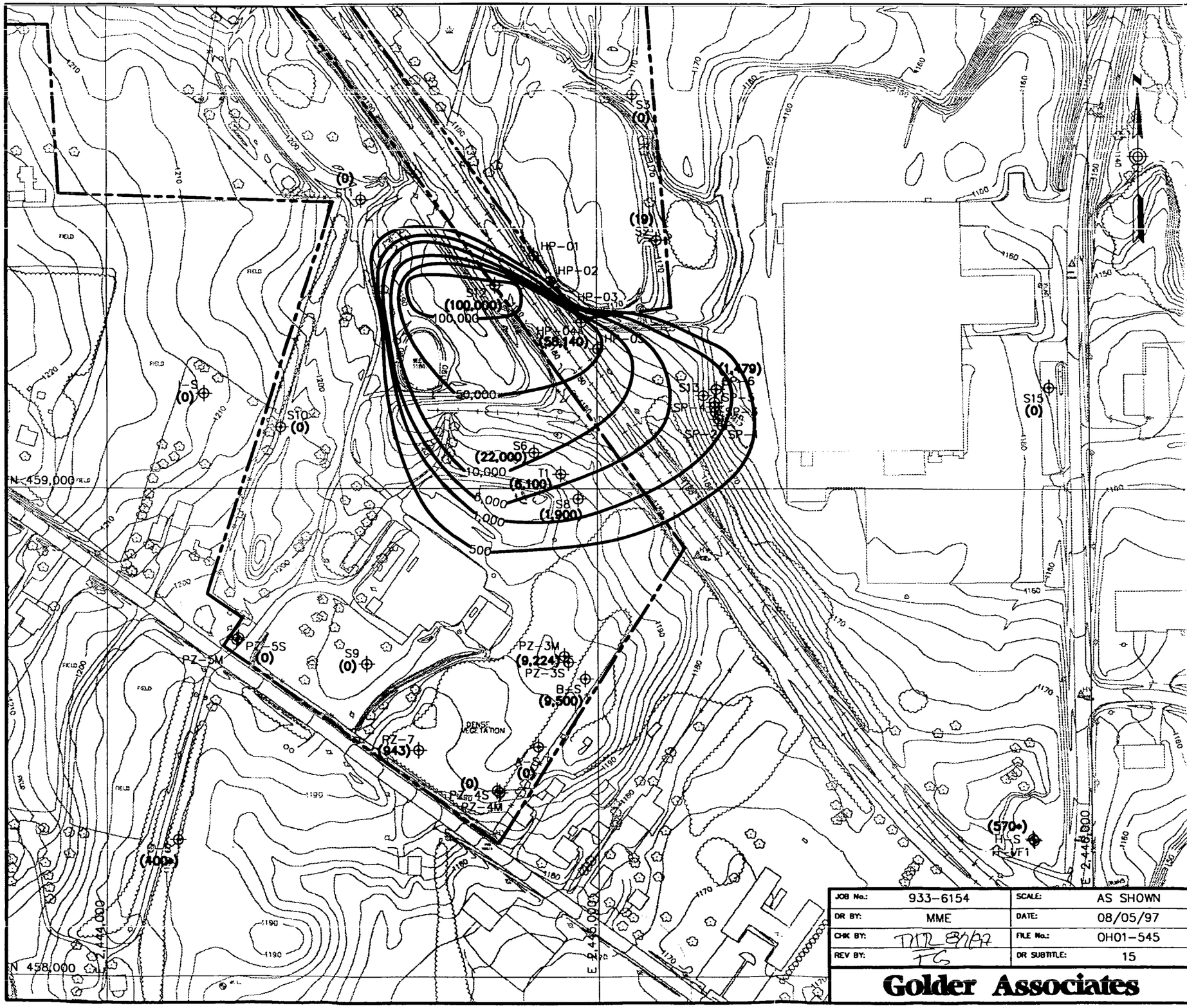
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	TVL	DATE:	08/04/98
CHK BY:	THR 8/4/98	FILE No.:	OH01-568
REV BY:	FG 8/4/98	OR SUBTITLE:	15

Golder Associates

INTERPRETED ISOCONCENTRATION CONTOURS- TOTAL VOCs OVERBURDEN- POND 2 PLUME

RUETGERS-NEASE CORPORATION

FIGURE 9



LEGEND

PROPERTY LINE

S2 MONITORING WELL LOCATION

(19) DETECTED TOTAL SVOC CONCENTRATION (ug/l)

ISOCONCENTRATION CONTOUR

NOTES

1.) DUE TO VARIABILITY IN DETECTED CONCENTRATIONS, ONLY THE HIGHEST DETECTED CONCENTRATION IN THE "SEEP AREA" PIEZOMETERS WAS USED FOR CONTOURING PURPOSES. THE RESULTS FOR ALL OF THE "SEEP AREA" PIEZOMETERS ARE AS FOLLOWS:

WELL	CONCENTRATION (ug/l)
SP-1	100
SP-2	210
SP-3	1,050
SP-4	530
SP-5	1,508
SP-6	1,479

2.) (*) INDICATES BIS (2-ETHYL HEXYL) PHTHALATE

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

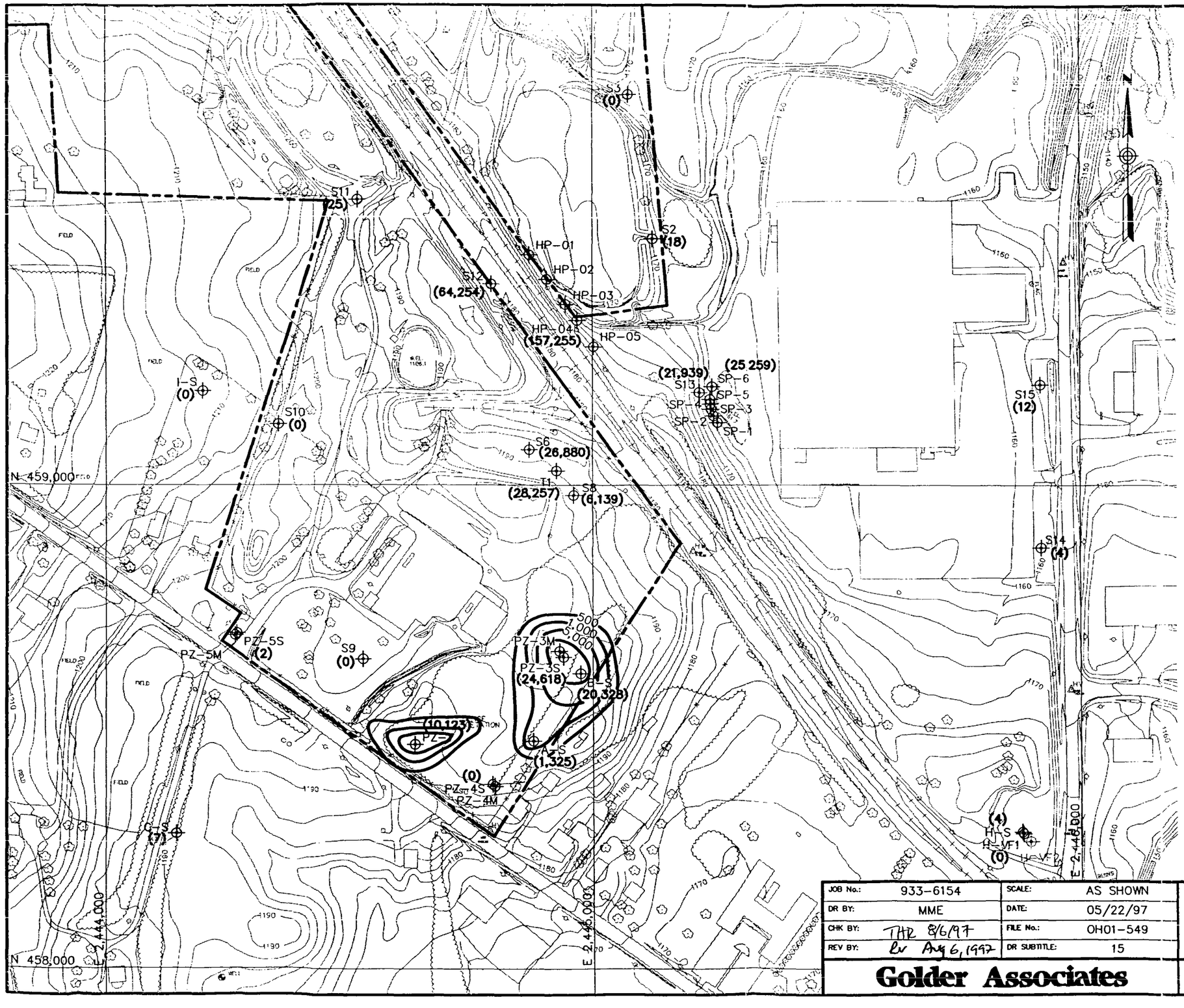
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	08/05/97
CHK BY:	DTR 8/6/97	FILE No.:	OH01-545
REV BY:	TG	DR SUBTITLE:	15

Golder Associates

INTERPRETED ISOCONCENTRATION CONTOURS- TOTAL SVOCs OVERBURDEN- POND 2 PLUME

REUTGERS-NEASE CORPORATION

FIGURE 10



LEGEND

PROPERTY LINE

S-15 MONITORING WELL LOCATION

(12) DETECTED TOTAL VOC CONCENTRATION (ug/l)

ISOCONCENTRATION CONTOUR

NOTES

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

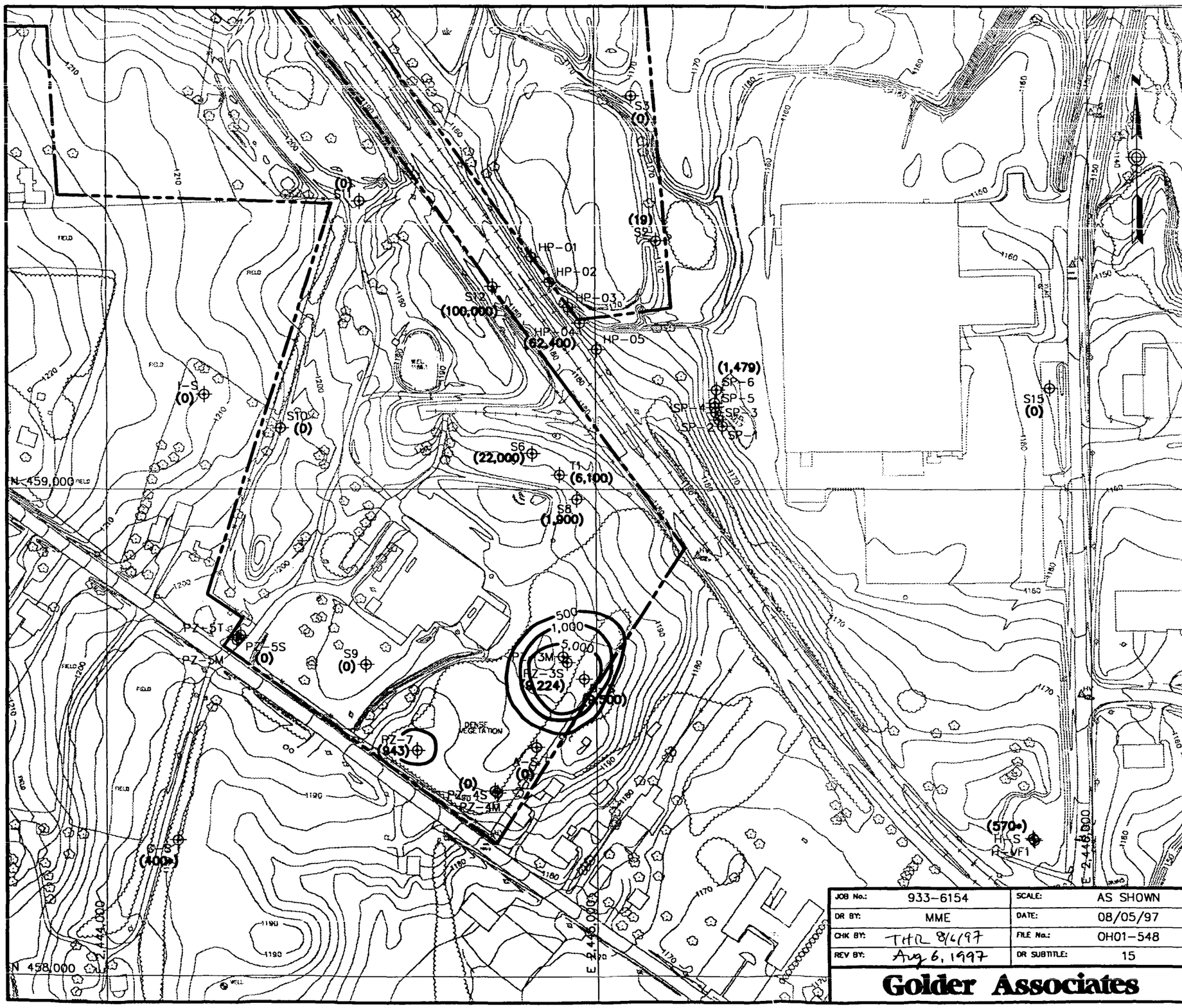
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	05/22/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-549
REV BY:	lv Aug 6, 1997	DR SUBTITLE:	15

Golder Associates

INTERPRETED ISOCONCENTRATION CONTOURS- TOTAL VOCs SOUTHEASTERN OVERBURDEN

RUETGERS-NEASE CORPORATION

FIGURE 11



LEGEND

PROPERTY LINE

PZ-7 MONITORING WELL LOCATION

(943) DETECTED TOTAL SVOC CONCENTRATION (ug/l)

ISOCONCENTRATION CONTOUR

NOTES

(•) BIS (2-ETHYL HEXYL) PHTHALATE

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

200 0 200
scale feet

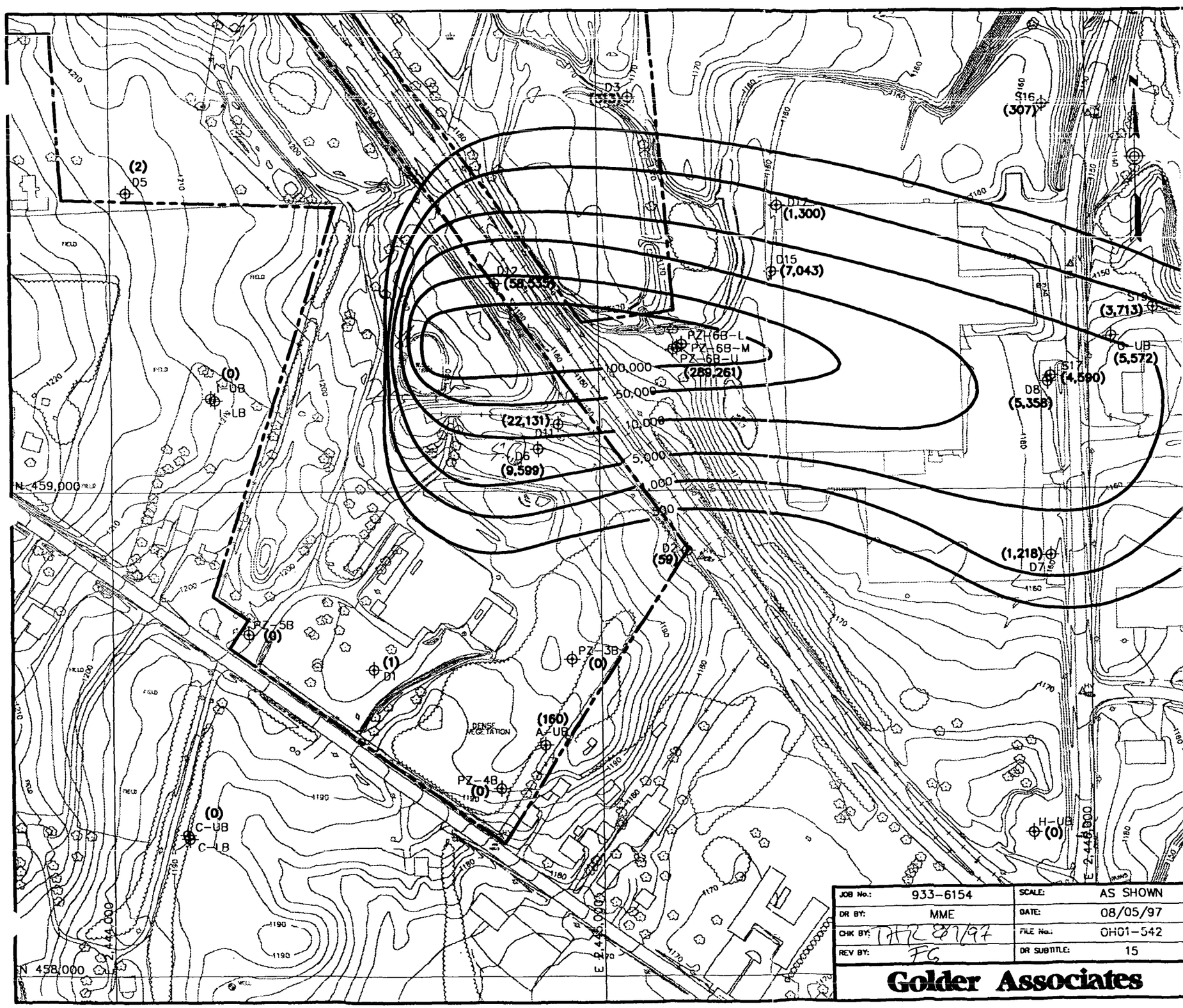
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	08/05/97
CHK BY:	THR 8/4/97	FILE No.:	OH01-548
REV BY:	Aug 6, 1997	DR SUBTITLE:	15

Golder Associates

INTERPRETED ISOCONCENTRATION CONTOURS- TOTAL SVOCs SOUTHEASTERN OVERBURDEN

RUETGERS-NEASE CORPORATION

FIGURE 12



LEGEND

PROPERTY LINE

S16 MONITORING WELL LOCATION

(307) DETECTED TOTAL VOC CONCENTRATION (ug/l)

ISOCONCENTRATION CONTOUR

NOTES

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200

scale feet

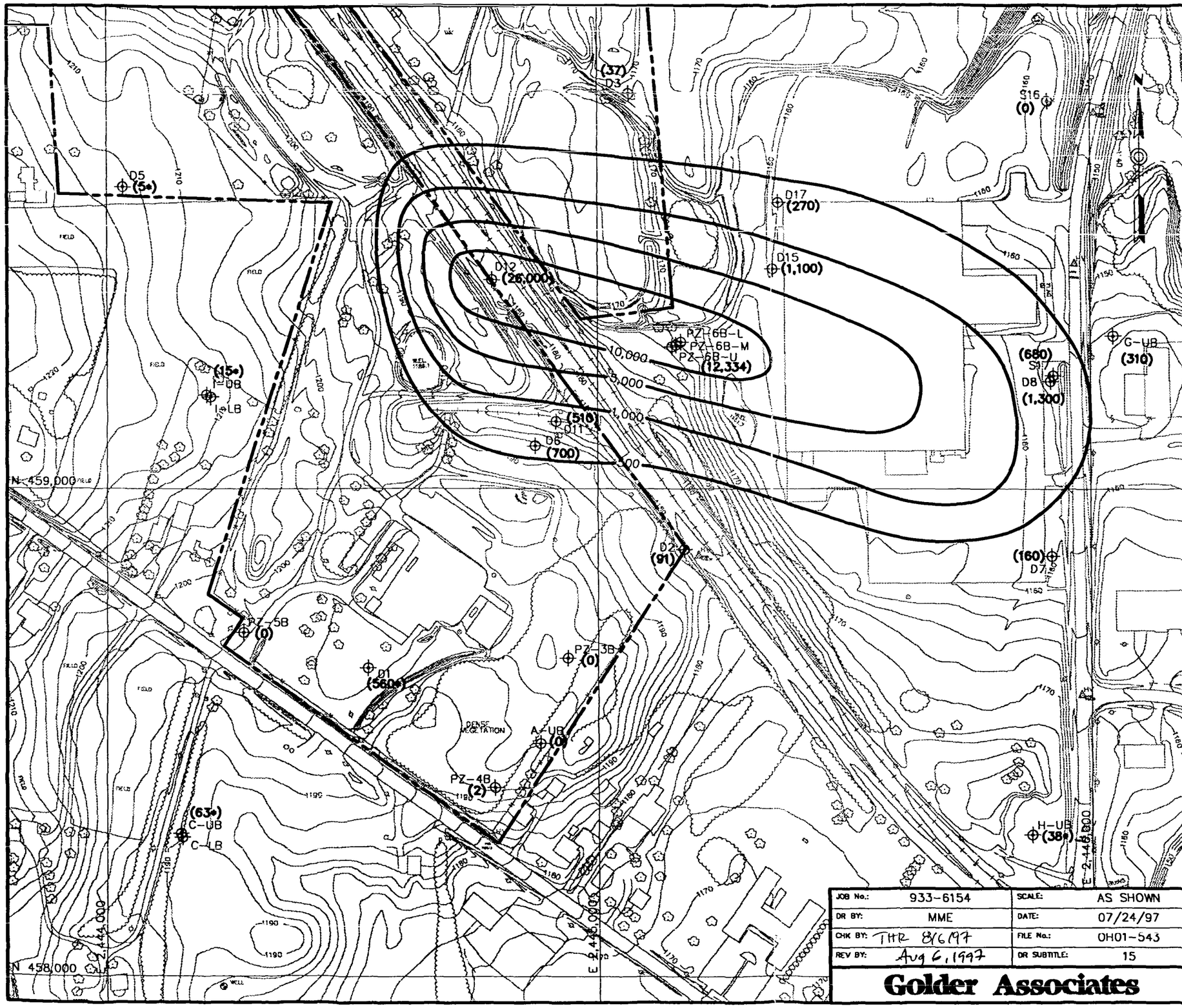
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	08/05/97
CHK BY:	TMR 8/7/97	FILE No.:	OH01-542
REV BY:	FG	DR SUBTITLE:	15

Golder Associates

INTERPRETED ISOCONCENTRATION CONTOURS- TOTAL VOCs MIDDLE KITTANING SANDSTONE

RUETGERS-NEASE CORPORATION

FIGURE 13



LEGEND

PROPERTY LINE

G-UB — MONITORING WELL LOCATION

(310) — DETECTED TOTAL SVOC CONCENTRATION (ug/l)

ISOCONCENTRATION CONTOUR

NOTES

(•) BIS (2-ETHYL HEXYL) PHTHALATE

REFERENCE

1.) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

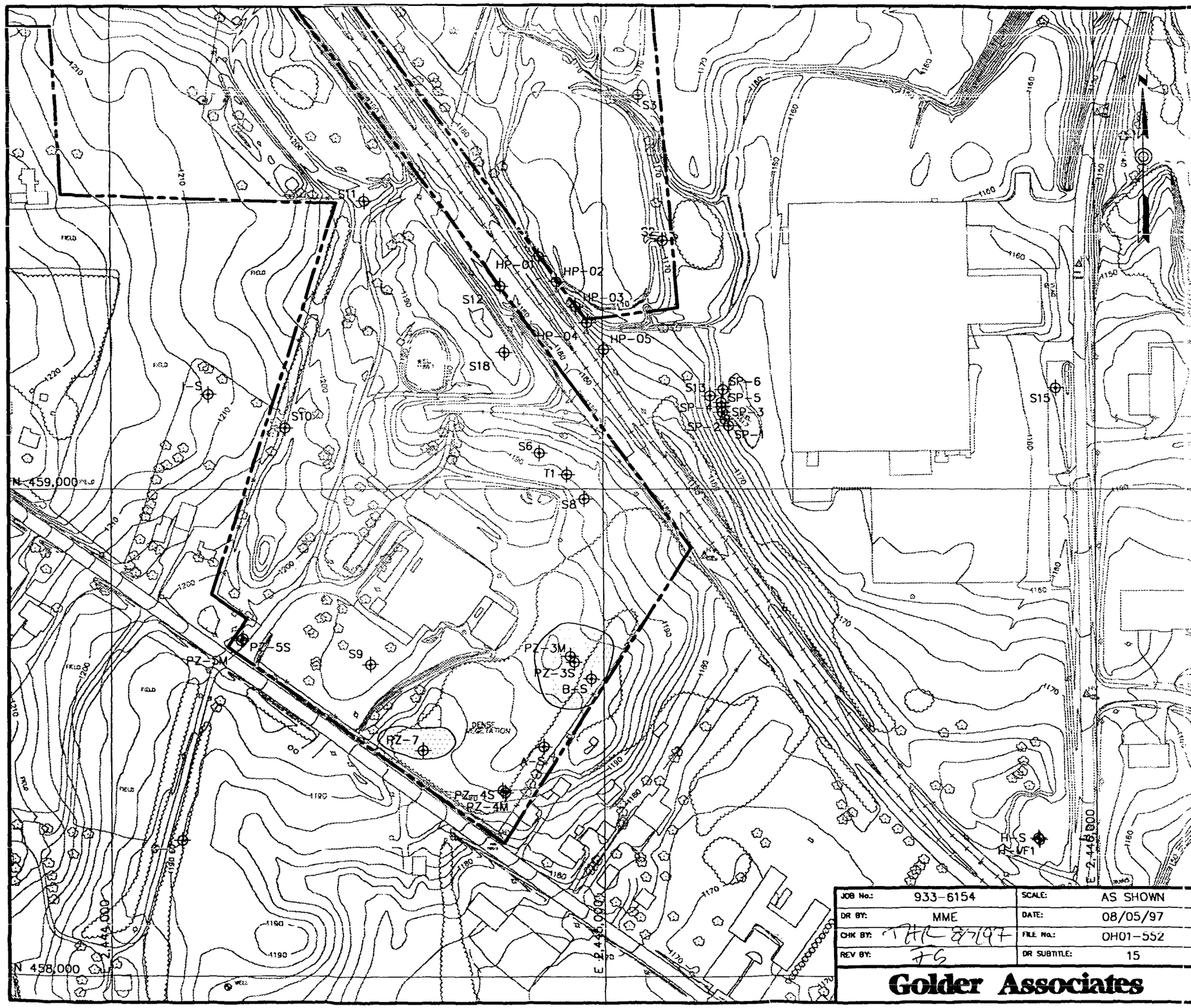
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	07/24/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-543
REV BY:	Aug 6, 1997	DR SUBTITLE:	15

Golder Associates

INTERPRETED ISOCONCENTRATION CONTOURS- TOTAL SVOCs MIDDLE KITTANING SANDSTONE

RUETGERS-NEASE CORPORATION

FIGURE 14



LEGEND

PROPERTY LINE

S15 MONITORING WELL LOCATION

POTENTIAL AREAL EXTENT OF NAPL COMPOUNDS IN GROUNDWATER DETECTED AT > 1% OF THEIR SOLUBILITY

NOTES

COMPOUNDS DETECTED AT > 1% OF THEIR SOLUBILITY

WELL	PCE	1,1,2,2-PCA	1,2-DCB	TCE	TOTAL 1,2-DCE	BENZENE	TOLUENE	VISUAL
PZ-3S	N	N	Y	N	N	N	N	N
PZ-7	Y	N	N	N	N	N	N	N
B-S	N	N	Y	N	N	N	N	N

1) CONCENTRATIONS BASED ON ROUND 2 AND ROUND 3 SAMPLING, JULY 1996 SEEP INVESTIGATION, AND DECEMBER 1996 EASTERN PLUME/DNAPL INVESTIGATION.

2) DELINEATED AREA AROUND PZ-7 BASED ON HIGH PCE CONCENTRATION AND DELINEATED AREA AROUND PZ-3/B-S BASED ON HIGH 1,2-DCE CONCENTRATIONS.

REFERENCE

1) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

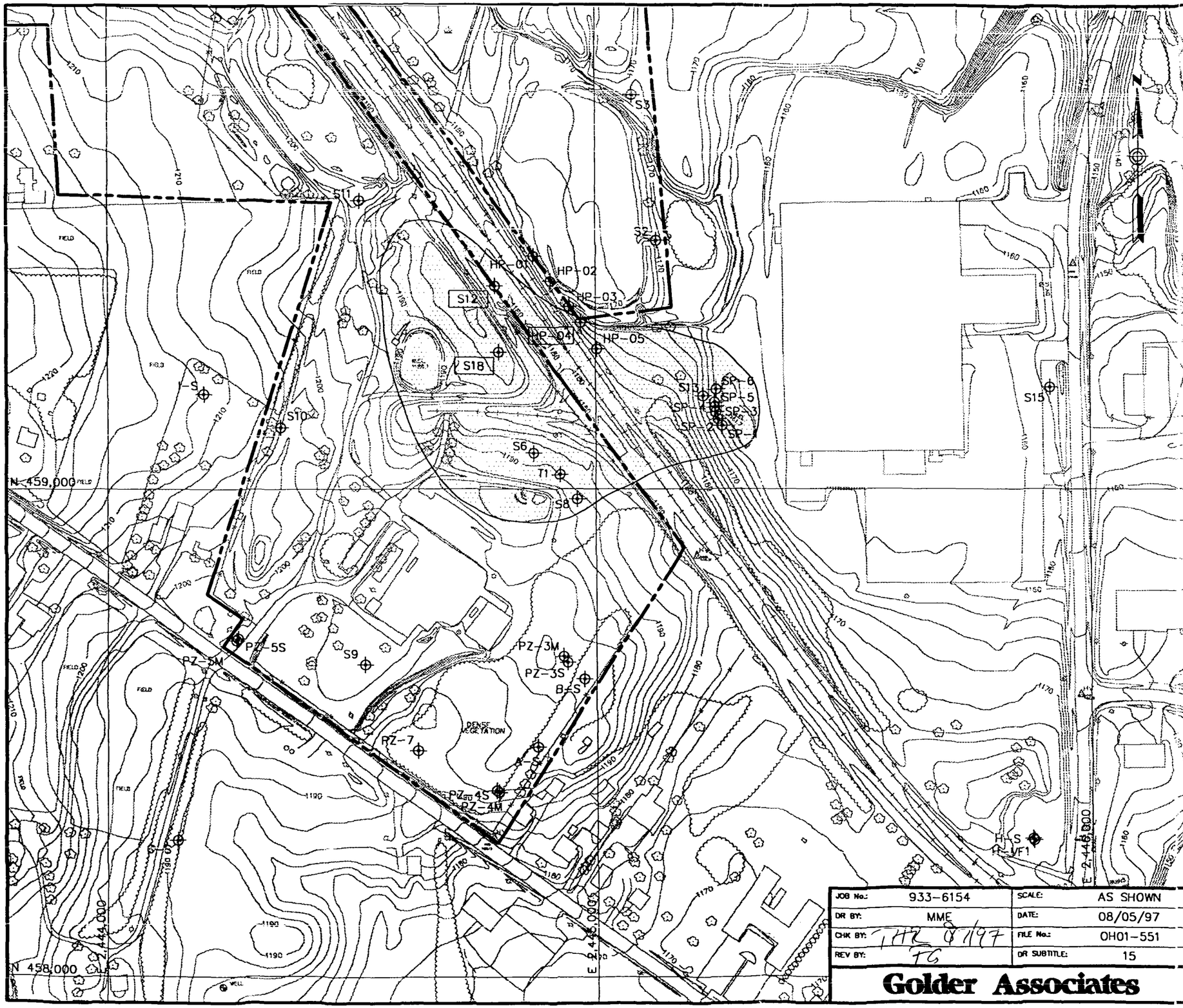
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	08/05/97
CHK BY:	THL 8/7/97	FILE No.:	OH01-552
REV BY:	FG	DR SUBTITLE:	15

Golder Associates

POTENTIAL AREAL EXTENT OF NAPL COMPUNDS (>1% OF SOLUBILITY) IN SOUTHEASTERN OVERBURDEN

RUETGERS-NEASE CORPORATION

FIGURE 15



LEGEND

PROPERTY LINE

S15 — MONITORING WELL LOCATION

POTENTIAL AREAL EXTENT OF NAPL COMPOUNDS IN GROUNDWATER DETECTED AT > 1% OF THEIR SOLUBILITY

S-12 — MONITORING WELL AT WHICH NAPL COMPOUNDS VISUALLY OBSERVED

NOTES

COMPOUNDS DETECTED AT > 1% OF THEIR SOLUBILITY

WELL	PCE	1,1,2,2-PCA	1,2-DCB	TCE	TOTAL 1,2-DCE	BENZENE	TOLUENE	VISUAL
HP-04	Y	N	Y	Y	Y	Y	N	Y
SP-02	N	N	N	N	Y	N	N	N
SP-04	N	N	Y	N	N	N	N	N
SP-05	N	N	Y	N	Y	N	N	N
S-6	Y	N	Y	N	N	N	N	N
S-8	N	N	N	N	Y	N	N	N
S-12	N	N	N	N	N	Y	N	Y
S-13	Y	N	N	N	Y	N	N	N
S-18	Y	Y	Y	Y	N	Y	Y	Y
T-1	N	N	Y	N	Y	N	N	N

1) CONCENTRATIONS BASED ON ROUND 2 AND ROUND 3 SAMPLING, JULY 1996 SEEP INVESTIGATION, AND DECEMBER 1996 EASTERN PLUME/DNAPL INVESTIGATION.

REFERENCE

1) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 04 1998

200 0 200
scale feet

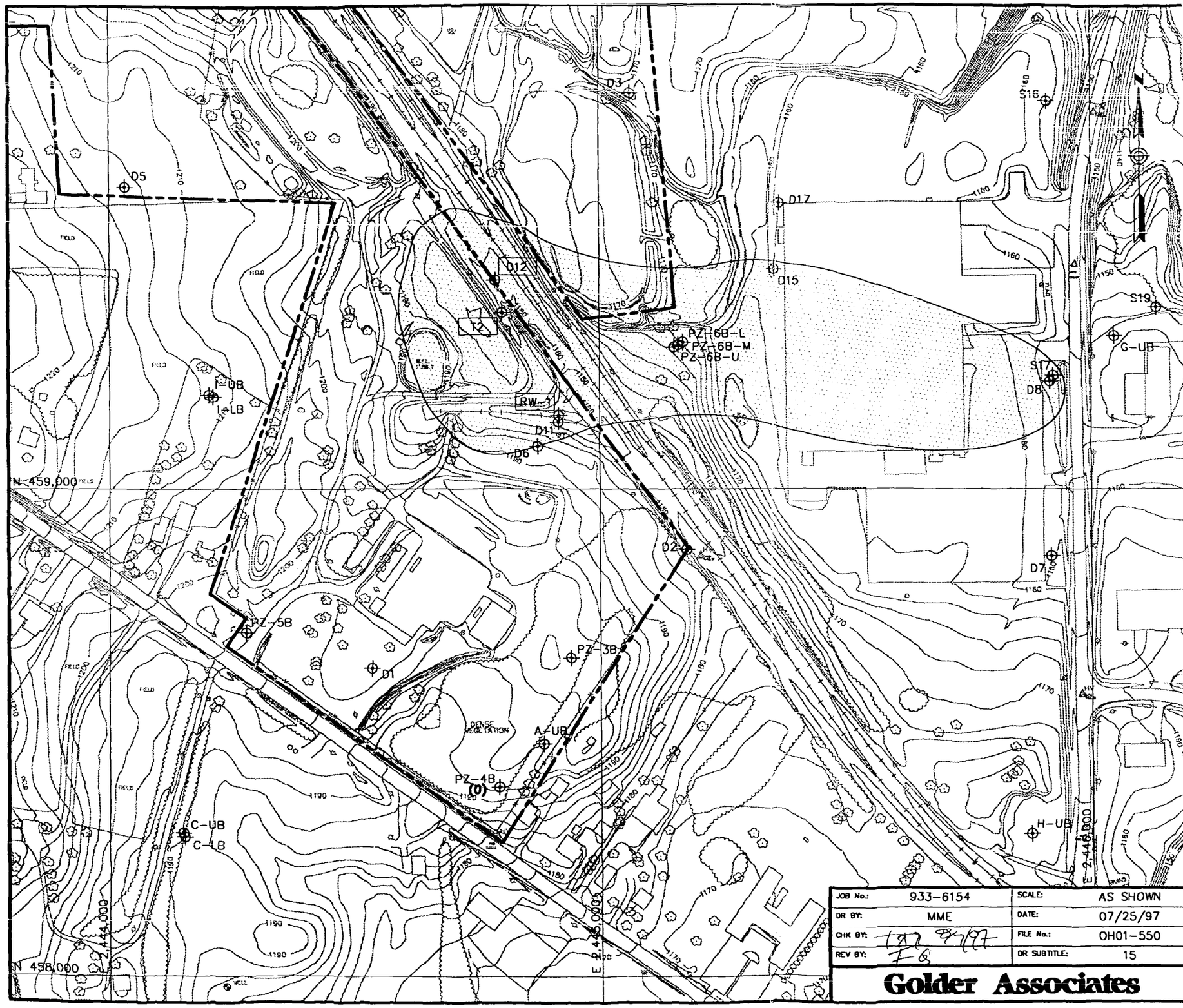
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	08/05/97
CHK BY:	THR 8/1/97	FILE No.:	OH01-551
REV BY:	TG	DR SUBTITLE:	15

Golder Associates

POTENTIAL AREAL EXTENT OF NAPL COMPUNDS (>1% OF SOLUBILITY) IN OVERBURDEN POND-2 PLUME

RUETGERS-NEASE CORPORATION

FIGURE 16



LEGEND

PROPERTY LINE

G-UB — MONITORING WELL LOCATION

POTENTIAL AREAL EXTENT OF NAPL COMPOUNDS IN GROUNDWATER DETECTED AT > 1% OF THEIR SOLUBILITY

T2 — MONITORING WELL AT WHICH NAPL COMPOUNDS VISUALLY OBSERVED

NOTES

COMPOUNDS DETECTED AT > 1% OF THEIR SOLUBILITY

WELL	PCE	1,1,2,2-PCA	1,2-DCB	TCE	TOTAL 1,2-DCE	BENZENE	TOLUENE	VISUAL
D-8	N	N	Y	N	N	N	N	N
D-11	Y	N	N	N	N	N	N	N
D-12	Y	N	Y	N	N	N	N	Y
D-15	N	N	Y	N	N	N	N	N
PZ-6BU	Y	N	Y	N	N	N	N	N
T-2	Y	N	Y	Y	N	N	N	Y
RW-1	Y	N	Y	N	N	N	N	Y

1) CONCENTRATIONS BASED ON ROUND 2 AND ROUND 3 SAMPLING, JULY 1996 SEEP INVESTIGATION, AND DECEMBER 1996 EASTERN PLUME/DNAPL INVESTIGATION.

REFERENCE

1) TOPOGRAPHIC BASE MAP TAKEN FROM AUTOCAD FILE CREATED BY HOWELLS AND BAIRD, INC., DATED 06/14/95, DATE OF AERIAL PHOTOGRAPHY 04/06/95.

AUG 0 4 1998

200 0 200
scale feet

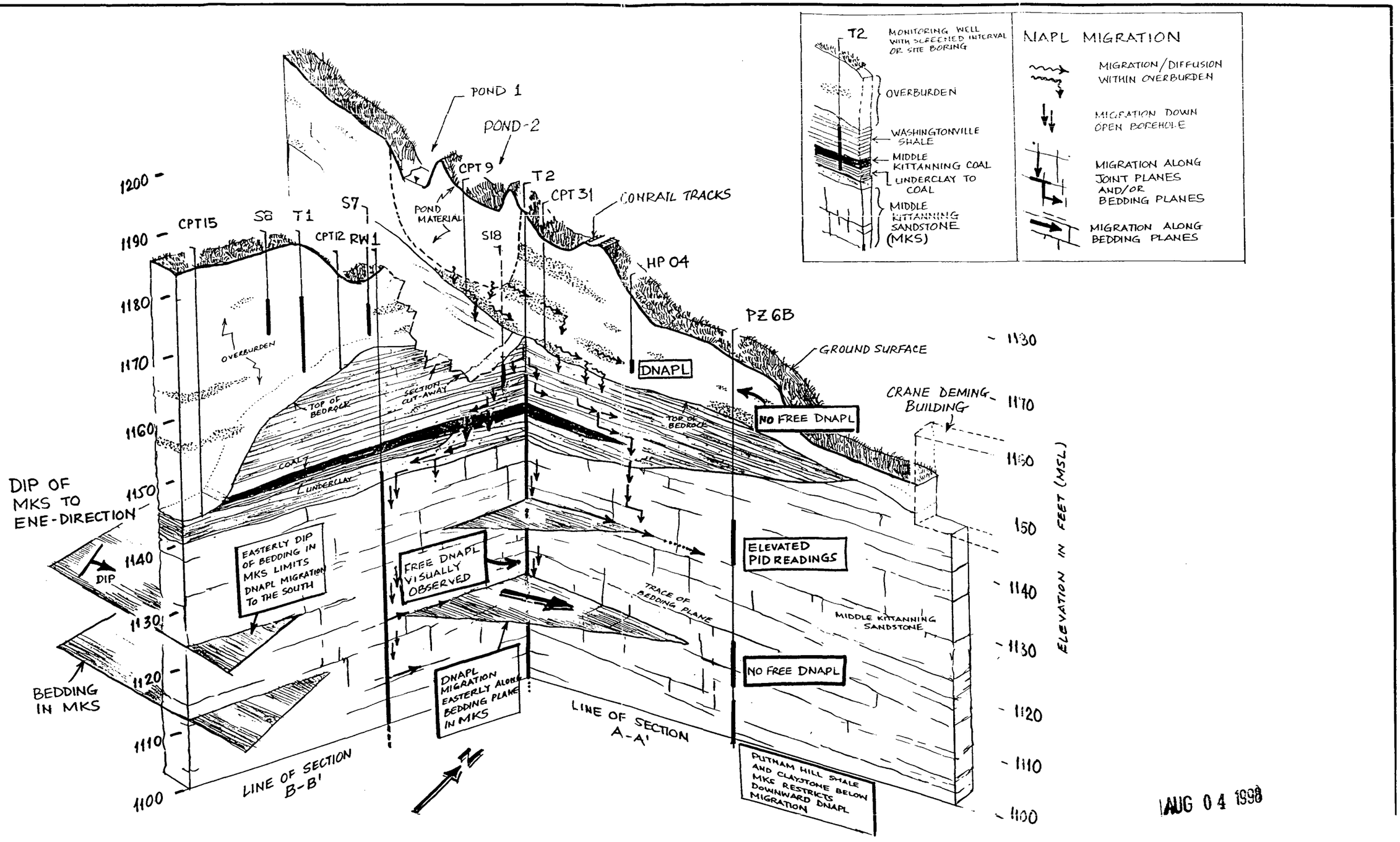
JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	MME	DATE:	07/25/97
CHK BY:	7/27/97	FILE No.:	OH01-550
REV BY:		DR SUBTITLE:	15

Golder Associates

POTENTIAL AREAL EXTENT OF NAPL COMPUNDS (>1% OF SOLUBILITY) IN MIDDLE KITTANING SANDSTONE

RUETGERS-NEASE CORPORATION

FIGURE 17



AUG 04 1998

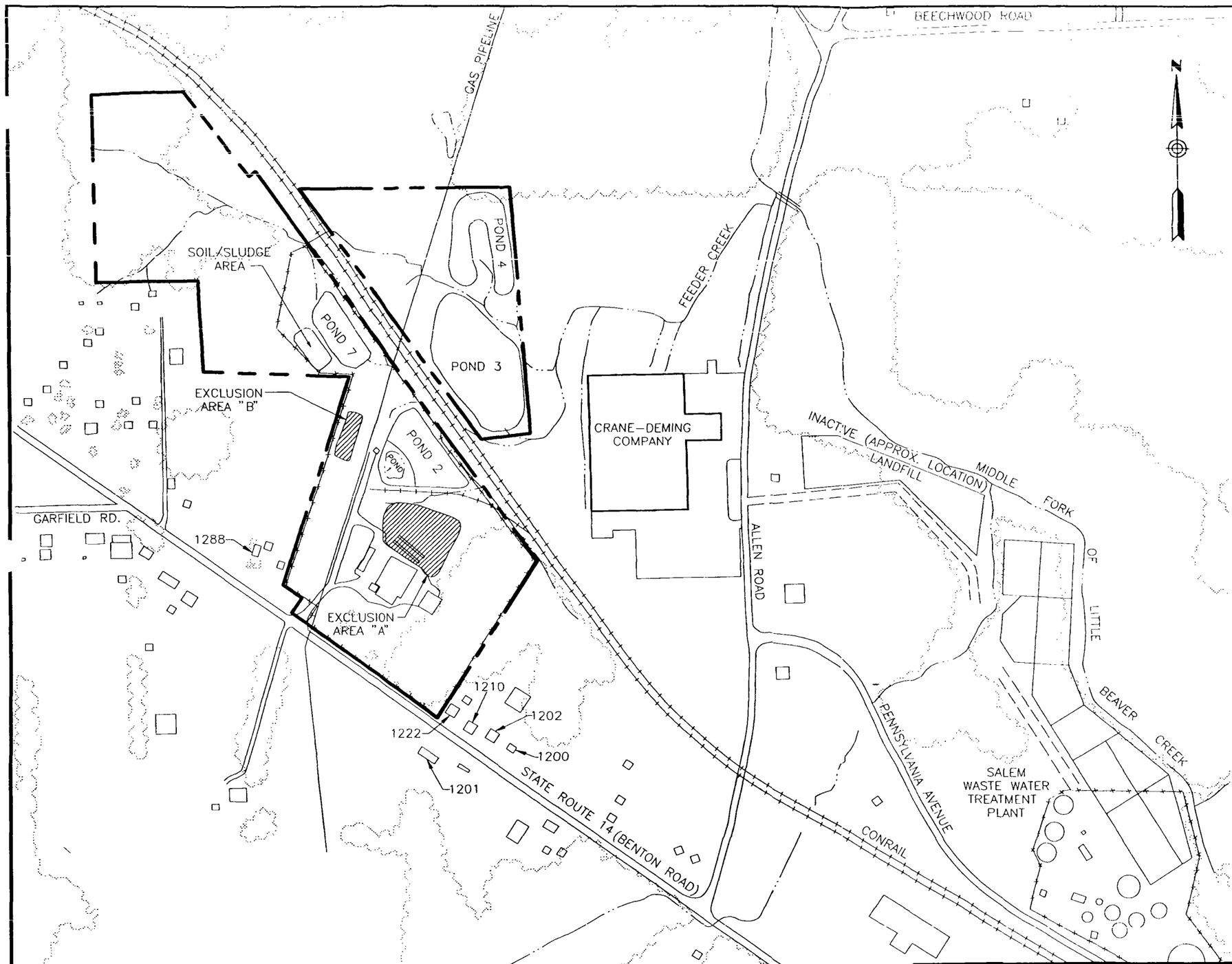
JOB No.:	933-6154	SCALE:	NOT TO SCALE
DR BY:	RV	DATE:	07/25/97
CHK BY:	THR 8/6/97	FILE No.:	OH01-561
REV BY:	Aug 6, 1997	DR SUBTITLE:	15

SITE CONCEPTUAL MODEL

Golder Associates

RUETGERS-NEASE CORPORATION

FIGURE 18



PROPOSED RESIDENTIAL WELL SAMPLING

1222 BENTON ROAD

1210 BENTON ROAD

1202 BENTON ROAD

1201 BENTON ROAD

1200 BENTON ROAD

1288 BENTON ROAD

LEGEND

- SITE BOUNDARY
- FENCE
- RAILROAD TRACKS
- SURFACE WATER DRAINAGE
- WOODS

AUG

400 0 400

scale feet

JOB No.:	933-6154	SCALE:	AS SHOWN
DR BY:	RAD	DATE:	07/30/98
CHK BY:	TRR 8/4/98	FILE No.:	OH01-566
REV BY:	RV 8/4/98	DR SUBTITLE:	15

Golder Associates

RESIDENTIAL WELL SAMPLING LOCATION PLAN

RÜTGERS ORGANIC CORP.

FIGURE 19

APPENDIX A

Comments on Eastern Plume/DNAPL Investigation Work Plan

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

SR-6J

March 24, 1997

RECEIVED
APR 8 1997
GOLDER - NJ

Ralph E. Peace, P.E.
Environmental Engineer
Ruetgers-Nease Corporation
201 Struble Road
State College, Pennsylvania 16801

VIA FACSIMILE AND FIRST CLASS U.S. MAIL

RE: Comments on Eastern Plume/DNAPL Investigation Work Plan for the Nease Chemical Site, Salem, Ohio

Dear Ralph,

Ruetgers-Nease Corporation (RNC) submitted a draft of the Eastern Plume/Dense Non-Aqueous Phase Liquids (DNAPL) Work Plan ("the Plan") to the U.S. EPA and Ohio EPA (Agencies) on September 3, 1996. The purpose of the Plan is to evaluate both the shallow groundwater in the overburden sediments and the deeper groundwater in the Middle Kittanning Sandstone directly east of the site. The Plan also describes the assessment of DNAPLs at the site and their potential impact on the migration of contaminants of concern. This Plan is the result of the remedial investigation activities at the site pursuant to the January 22, 1988 Administrative Order by Consent between the Agencies and RNC.

On November 13, 1996, the Agencies conditionally approved the portion of the Plan pertaining to the installation and construction of piezometers/monitoring wells. At that time, RNC and Golder Associates agreed to the five modifications involving monitoring well installation, construction and sampling that were specified by the Agencies in their November 13, 1996 letter (see attached) to RNC, with the understanding that additional specific comments would follow at a later date so as not to delay the initiation of this investigation. The Agencies request that the five previously noted modifications, as well as the following comments, which were verbally discussed with RNC prior to fieldwork, be formally incorporated into the Plan.

General Comments

1.) A clear definition of the eastern plume and a brief history of groundwater flow at the site must be included in the Introduction.

Recycled/Recyclable·Printed with Vegetable Oil Based Inks on 100% Recycled Paper (40% Postconsumer)

2.) The delineation of DNAPL source areas at the site is mentioned as an objective throughout the work plan. However, the document states several times that there are some DNAPL source areas already defined. Identify the defined DNAPL source areas and state clearly the undefined DNAPL source areas.

Specific Comments

1.) Preface, Second Paragraph, Objective 1. The objective states that the work plan proposes to evaluate the deeper groundwater in the Middle Kittanning Sandstone (MKS) directly east of the site. As indicated in Figure 6, DNAPL compounds have been identified in Wells D8 and G-UB in the MKS. The work plan does not include any plans to further evaluate the presence of DNAPL in this area (east of Crane-Deming building). Discuss why there are no plans to include this area.

2.) Page 1, Section 1.0, First Paragraph, Second Sentence. Revise this sentence to read: "This Work Plan addresses outstanding issues that need to be addressed at the Site that were identified as RI follow-up activities."

3.) Page 1, Section 1.0, Second Paragraph, First Sentence. Please state the location in Section 2 where it is "explained further that observations made during the RI indicated that DNAPLs are present at the site."

4.) Page 1, Section 1.0, Second Paragraph, Second Sentence. As stated in the RI, the United States Environmental Protection Agency (USEPA) suggests that if a compound whose specific gravity is greater than 1.0 is detected at concentrations greater than one percent of that compound's solubility, then there is a likelihood of DNAPL occurrence. Discuss the USEPA's guidance in this paragraph so the reader can understand the significance of "the detection of compounds in groundwater whose concentrations exceed one percent of that compounds' solubility."

5.) Page 3, Last Paragraph, First Sentence. Revise this sentence to more accurately state the following: "This investigation will focus on characterizing the Eastern Plume and DNAPL problems at the Site in order to conclude the RI follow-up activities."

6.) Page 4, Section 2.1, Second Paragraph, Last Sentence. Revise this sentence to correctly state: " . . . drains toward the Middle Fork of Little Beaver Creek (MFLBC)."

7.) Page 6, Section 2.2, Last Paragraph, Last Sentence. Change "Ruetgers-Nease Chemical Company, Inc." to "Ruetgers-Nease Corporation".

8.) Page 6, Section 2.3, First Paragraph First and Second Sentences. Revise these sentences to more accurately state the following:

"RNC has implemented numerous voluntary removal measures or "early actions" including removal measures under the Removal AOC, effective November 14, 1993. Because of the complexity of . . . a summary of the existing removal and remedial measures implemented at the Site is provided below."

9.) Page 14, Section 3.2.2, Third Paragraph. First Sentence. If the term "transition zone" is not previously defined, either more explanation needs to be provided, or at the very least, refer the reader to Figure 9 which depicts this zone in the cross-section.

10.) Page 14, Section 3.2.2, Fourth Paragraph. The first sentence states that there are downward hydraulic gradients in the west of the site, to generally upward hydraulic gradients in the west of the site. Please revise the text to indicate that the upward hydraulic gradients are in the east of the site (if this is correct) and refer the reader to the appropriate figure (4 or 5?). In addition, revise the spelling of Crane-Demming to Crane-Deming in the two references within this paragraph.

11.) Page 15, Section 3.3, second and third paragraphs; Figure seven is stated as displaying the monitoring wells in which the likelihood of DNAPL occurrence exists. However, monitoring wells D-8 and G-UB contained significant levels of DNAPLs, and were not included in the above-mentioned figure. The third paragraph states that the wells which indicate the potential for DNAPL occurrence are primarily concentrated within the site. Again, this statement does not take into account monitoring wells D-8 and G-UB which are located east of Allen road. Please explain why these two wells have been disregarded in this section.

12.) Page 16, Section 3.3, Second Paragraph. Discuss why the VOC results from the Feeder Creek/State Route 14 sampling event are the only VOC soil results included in this report. Determine if the VOC soil results from the RI should be included.

13.) Page 17, First Paragraph, Third Sentence. Please clarify if this section implies that the DNAPL compounds in the Feeder Creek sediments are the source of DNAPL in the eastern wells (S-13, D-15, D-8, and Well Cluster 6).

14.) Pages 18-20, Section 3.4. Include a discussion on the factors controlling DNAPL distribution in the MKS.

15.) Page 21, Section 4.2, Second Paragraph, Second Sentence. Revise this sentence to read: "Given the complex nature of DNAPL transport and fate, some of the above objectives may not be able to be defined on a quantitative basis and will be indicated as such in the text."

16.) Page 22, Section 4.2.1, First Paragraph, First Sentence. The phrase "...there is a likelihood of DNAPL at the site" implies that DNAPLs may not exist at the site, however

the RI indicated that there were DNAPLs. Section 1.0, second paragraph, first sentence of this work plan indicates that there are DNAPLS at the site. Please revise this first sentence to read: "As indicated by previous site investigation work and discussed in earlier sections of this work plan, DNAPLs are present at the site."

17.) Page 22, Section 4.2.1, Second Paragraph, First Sentence. Explain how estimates of DNAPL quantities will be made. Also indicate what steps would be followed if a sample from PZ-6 shows no contamination.

18.) Page 22, Section 4.2.2, Second Paragraph, First Sentence. Discuss why the work plan does not include the use of soil gas surveys to identify offsite subsurface contamination.

19.) Page 23, Section 4.2.3, Second Paragraph, Last Sentence, and Page 30, Section 5.3.1, Third Paragraph. To confirm the lack of a pathway for the offsite migration of DNAPLs within the overburden, it is suggested that the soil sampling methodology be changed from split spoon samples collected at 2 foot centers, which misses 1 foot intervals, to continuous sampling which does not lose any subsurface stratigraphy information. The samplers could be continuous split spoons or a 5 foot continuous CME sampler (preferred). This suggestion is made based on the fact that DNAPLs introduced into relatively impermeable formations (clay till) will follow any preferential pathways (cracks, fractures, root vesicles, and layers with a slightly different particle size, ie: silt or clayey silt layer in a clay till). Without continuous sampling, the above preferential pathways may be over looked. This is comparable to Task 1c (Re-Evaluation of Existing Rock Core). The rock core is being re-evaluated because specific features with importance to DNAPL migration may have been overlooked or not mentioned in previous descriptions.

20.) Page 26, Section 5.1. Discuss why the collection of groundwater information near the site entrance is a site-specific objective, when no evidence of DNAPL has been found there.

21.) Page 28, Section 5.2.2, Last Sentence. Describe in more detail how direct video camera observation will provide an indication of the current migration depth of DNAPL.

22.) Page 29, Section 5.3. DNAPL was detected in the overburden at Well B-S. Explain why there is not an MKS or Washington shale monitoring well at this location. Describe if the MKS well cluster PZ-4 will be representative of DNAPL conditions in the MKS below Well B-S.

23.) Page 29, Section 5.3, Paragraph 2, Last Sentence. Delete the phrase "on site representative".

24.) Page 31, Section 5.3.1, First and Second Paragraphs. The term piezometer is being used for shallow wells. The previous page uses the term wells. Indicate whether the new PZ clusters are wells or piezometers.

25.) Page 31, Section 5.3.2, Last Paragraph. Same comments as above.

26.) Page 32, Section 5.3.3, First Paragraph, Third Sentence. The text designates the PZ-6 cluster as PZ-6B-U, PZ-6B-M, and PZ-6B-D. Figure 10 designates the PZ-6 cluster as PZ-6B-U, PZ-6B-I, and PZ-6B-L. Please clarify.

27.) Page 32, Section 5.3.3, First Paragraph, Last Sentence. The text states that the PZ-6 cluster will be located along a **potential** migration pathway in the MKS. Please clarify, since this is a **known** pathway of DNAPL migration, based on Figure 6 which indicates the presence of DNAPLs in Well D15 northeast of PZ-6 and DNAPL in Wells D8 and G-UB directly east of PZ-6.

28.) Page 34, Section 5.5, First Paragraph, First Sentence. Clarify if PZ-5D should be PZ-5T. Describe the location of I-shale, since this is the first time this well is mentioned in the report.

29.) Page 35, Section 5.6.3. Explain the purpose of installing five HydroPunch temporary piezometers at the eastern edge of the railroad between Pond 2 and Pond 3. Describe how the information will be used for the Feasibility Study.

30.) Table 1. The shading indicating a sample result exceeds 1% of solubility needs to be better defined or darker, since the shading appears to be almost white.

31.) Figures 6 and 7. These figures refer to the DNAPL compounds as NAPL compounds. Throughout the rest of the workplan, the same compounds are called DNAPL compounds. Please clarify.

32.) Figures 6 and 7. Figure 6 shows NAPL compounds at greater than 1% of their solubility and Figure 7 presents potential areal extent of NAPL compounds in Sand 1, Sand 2, and MKS groundwater. In Figure 6, Wells G-UB and D-8 (both located in the MKS) contain NAPL compounds detected at greater than 1% of their solubility. Include these wells in Figure 7 as the tentative areal extent of NAPL compounds in the MKS groundwater greater than 1% solubility.

33.) Figure 10. Explain why the work plan includes the installation of well clusters PZ-4 and PZ-5 and a soil vapor investigation in the southern portion of the site, when no evidence of DNAPL has been found there. Discuss if the purpose of these measures is to determine if DNAPL is migrating south.

34.) Appendix A, Fifth Paragraph. State what materials or class of compounds were sampled in the 101 drums.

Although the Plan was conditionally approved by the Agencies, and those conditions were met by RNC and its consultants, we look forward to receiving a final work plan which incorporates the above-mentioned comments. In the mean time, if you have any questions regarding this letter, please do not hesitate to contact us at the below-listed numbers.

Sincerely,

Sheila Sullivan

Sheila Sullivan
Remedial Project Manager
U.S. EPA, Region V
312/886-5251

Sheila Sullivan
for Joseph Trocchio
Site Coordinator
Ohio EPA, NEDO
216/963-1193

Attachment

cc: R. Domalski, RNC (w/att.)
P. Finn, Golder (w/att.)
T. Rees, Golder (w/att.)
D. McAvoy, BVSPC (w/att.)
J. Gonzalez, BVSPC (w/att.)
J. Trocchio, OEPA, NEDO (w/att.)
F. Kovac, OEPA, CO. Legal Section
C. Kawakami, USEPA, ORC
Files

APPENDIX B

Results of Soil Gas Survey

Quadrel Report No. QS1592

EMFLUX® Passive, Non-Invasive Soil-Gas Survey

NEASE SITE
SALEM, OHIO

Prepared for

Golder Associates Inc.
305 Fellowship Road, Suite 200
Mt. Laurel, NJ 08054

by

Quadrel Services, Inc.
1896 Urbana Pike
Suite 20
Clarksburg, MD 20871-8517

November 22, 1996

Applying Results from Soil-Gas Surveys

The usefulness of a soil-gas survey is directly proportional to the accuracy with which it reflects or represents changes in subsurface concentrations of targeted source compounds. A soil-gas survey, however, measures vapor-phase concentrations, and vapor-phase concentrations are never equivalent to the concentrations of their source compounds, essentially being dilute "extracts" of those compounds. The units used in reporting volatile detections, therefore, as a matter of convenience are usually smaller than those employed for source-compound concentrations. For example, where the concentration of a source may readily be expressed in mg/kg (or parts per million), the concentration of the gas deriving from it may be best measured in nanograms per liter (parts per trillion).

The critical fact is that, whatever the relative concentrations of source and derivative soil gas, the latter must track the former proportionally; that is, the ratio of soil gas measurements to the actual subsurface concentrations must remain constant, or as close to constant as the real world permits. It is the reliability and consistency of this ratio, not the particular units of mass (*e.g.*, nanograms) or units of concentration (*e.g.*, ng/L) that determine the usefulness of any soil-gas system. Thus, Quadrel emphasizes the necessity of conducting follow-on intrusive sampling at one or two sample points which show high EMFLUX® Survey values to obtain corresponding concentrations of actual soil and groundwater contaminants. These corresponding concentrations furnish the basis for the requisite ratio. Once the ratio is established, it can be used in conjunction with the EMFLUX® measurements (regardless of units adopted) to extrapolate subsurface contaminant concentrations across the survey field.

When EMFLUX® Survey results are handled in this way, the data provides excellent information which can yield substantial savings in both drilling costs and time. They furnish, among other things, a checklist for compounds that will be encountered at each survey location and help determine how and where drilling budgets can most cost-effectively be spent.

EMFLUX® Survey Number: QS1592

NEASE SITE
SALEM, OHIO

This EMFLUX® Laboratory Data Report has been prepared for Golder Associates Inc. (Golder), by Quadrel Services, Inc. (Quadrel) in accordance with the terms of Golder Project No. 933-6154-080. Quadrel's principal technical contact at Golder for this project has been Mr. Todd Reese.

1. Objectives

To survey the Nease Site in Salem, Ohio, for soil-gas emissions of Benzene, Ethylbenzene, Tetrachloroethene (PCE), Trichloroethene (TCE), and Total Halogenated Hydrocarbons (THH). Survey results will be used to guide further site investigation.

2. Investigation Plan

•	No. of Field Sample Points:	75
•	No. of Trip Blanks:	1
•	No. of Ambient-Air Control Samples:	7
•	Total No. of EMFLUX® Cartridges:	83

3. Field Work

Quadrel provided Golder an EMFLUX® Field Kit with the equipment needed to conduct a 75-point EMFLUX® Soil-Gas Survey. Collectors were deployed on November 11, 1996 and retrieved November 15, 1996. A description of field procedures is provided in **Attachment 1**. Individual deployment and retrieval times will be found in the Field Deployment Report (**Attachment 2**).

4. Analysis and Reporting Dates

- Quadrel received 83 sample cartridges for analysis on November 18, 1996.

- The laboratory analyzed the samples for the compounds specified, using thermal desorption and a capillary-column gas chromatograph (GC) with photo ionization detector (PID) and a dry electrolytic conductivity detector (DELCD) in accordance with EPA Method 8021 (**Attachment 3**).

  Note: Quadrel's laboratory uses a 60-m, 0.53-mm-i.d., 5-μm-film-thickness MXT-5 capillary column for separation of compounds during analysis. When using this

column TCE and 1,2-Dichloropropane coelute; that is, when both compounds are present they appear at the same time on the DELCD chromatogram. The PID chromatogram, however, can confirm the presence of TCE, but cannot determine wether a detection represents TCE alone or the combined presence of TCE and 1,2-Dichloropropane. Therefore, when reviewing the data, it should be kept in mind that detections of TCE could in part represent 1,2-Dichloropropane contamination.

- Analysis was completed on November 20, 1996. Laboratory data (in nanograms) is presented in **Table 1**.

5. Quality Assurance/Quality Control Factors

- Laboratory QA/QC procedures consist of control blanks and verifications and system calibration as specified by EPA Method 8021. Laboratory personnel conducted internal control blanks and control-verification analyses daily to ensure that the system was contaminant free and properly calibrated. The system was calibrated using external-standard procedures to at least five different concentrations for each compound (**Attachment 3**).

- The trip blank is a cartridge prepared, transported, and analyzed with other samples but intentionally not exposed. In this survey, the trip blank (see **Table 1**) reported 133 ng of PCE which was also recorded as 133 ng of THH. *Because compounds adsorbed by a trip blank normally indicate sources of contamination other than the site of interest, Quadrel recommends as standard practice that the nanogram values of those detections be subtracted from measurements of the same compounds on both field and control samples.*

- Control samples serve to identify compounds present in ambient air during deployment and retrieval of collection devices. *An average of the contamination found on the control samples should be subtracted from measurements on field samples when interpreting the data. In this survey, after correction for contamination on the trip blank, control samples A through G recorded an average measurement of 66 ng of PCE and 106 ng of THH.*

- No information is available for sample 73, because of a laboratory equipment malfunction.

- Data Integrity. Quadrel's laboratory noted upon receipt of the samples that the EMFLUX® collectors and vial holders in all of the Field Kits were only sealed inside single plastic component bags and not double sealed in inner and outer plastic component bags, as specified in the Kit Instructions. Therefore, the samples may have been exposed ambient air contamination during transport. This may account for some of the detections of PCE, which was detected on almost every sample analyzed, including the trip blank.

- The following Attachments are included:

  -1- EMFLUX® Field Procedures
  -2- Field Deployment Report
  -3- Laboratory Procedures
  -4- Chain-of-Custody Form

6. Discussion

- **Table 1** provides survey results in nanograms of specific compound or compound group per sample. The reported quantitation level represents the value above which quantitative laboratory results can be achieved within specified limits of precision and with a high degree of confidence. The quantitation level, therefore, provides a reliable basis for comparison of the relative strength of individual detections.

- Survey findings are relative exclusively to this project and should not routinely be compared with results of other EMFLUX® Surveys. When reviewing the data, remember that a positive EMFLUX® finding indicates subsurface contamination in soil and/or ground water below the sampling device; a negative finding indicates the absence of contamination. *To identify those soil-gas detections which represent significant subsurface contamination, it is necessary to establish a relationship between reported soil-gas detections and actual subsurface contaminant concentrations. For this purpose, Quadrel recommends the guidelines on the inside front cover of this report.*

mtc\labrept\QS1592

TABLE 1

Laboratory Report
Results in Nanograms (ng)
Analysis Completed: November 20, 1996

Quadrel Project No. QS1592

In this analysis 83 EMFLUX® samples were analyzed under the requirements of EPA Method 8021 using an **SRI 8610B Gas Chromatograph** equipped with a **thermal desorber**, a **photo ionization detector**, and a **dry electrolytic conductivity detector**.

SAMPLE NO.	1	2	3	4	5	6	7
COMPOUNDS							
Benzene	U	U	U	U	U	U	U
Ethylbenzene	U	U	U	U	U	U	U
Tetrachloroethene	155	178	132	124	912	212	525
Trichloroethene	U	U	U	U	U	U	U
THH Volatiles	**155**	**178**	**132**	**124**	**912**	**212**	**525**

SAMPLE NO.	8	9	10	11	12	13	14
COMPOUNDS							
Benzene	U	U	U	U	U	U	U
Ethylbenzene	U	U	U	U	U	U	U
Tetrachloroethene	222	308	1,603	967	472	127	865
Trichloroethene	U	U	U	U	U	U	U
THH Volatiles	**222**	**336**	**1,603**	**1,122**	**472**	**127**	**865**

SAMPLE NO.	15	16	17	18	19	20	21
COMPOUNDS							
Benzene	U	U	U	U	U	U	U
Ethylbenzene	U	U	U	U	U	U	U
Tetrachloroethene	609	1,214	778	4,636	1,092	232	275
Trichloroethene	U	U	U	293	U	U	U
THH Volatiles	**609**	**1,214**	**778**	**9,793**	**1,092**	**232**	**275**

Reported Quantitation Level = 30 nanograms; U = Below Reported Quantitation Level

TABLE 1 (cont.)

Laboratory Report
Results in Nanograms (ng)
Analysis Completed: November 20, 1996

Quadrel Project No. QS1592

SAMPLE NO.	22	23	24	25	26	27	28
COMPOUNDS							
Benzene	U	U	U	U	U	U	U
Ethylbenzene	U	U	U	U	U	U	U
Tetrachloroethene	295	658	784	633	819	589	231
Trichloroethene	U	U	U	U	U	U	U
THH Volatiles	**295**	**658**	**784**	**633**	**819**	**589**	**231**

SAMPLE NO.	29	30	31	32	33	34	35
COMPOUNDS							
Benzene	U	U	U	U	U	U	32
Ethylbenzene	U	U	U	U	U	U	U
Tetrachloroethene	330	352	213	257	142	613	418
Trichloroethene	U	U	U	U	U	U	U
THH Volatiles	**330**	**352**	**213**	**257**	**142**	**613**	**418**

SAMPLE NO.	36	37	38	39	40	41	42
COMPOUNDS							
Benzene	U	U	U	U	U	U	U
Ethylbenzene	677	2,633	U	U	U	U	U
Tetrachloroethene	798	419	169	U	290	292	148
Trichloroethene	76	U	U	U	U	U	U
THH Volatiles	**882**	**419**	**169**	**U**	**301**	**292**	**148**

Reported Quantitation Level = 30 nanograms; U = Below Reported Quantitation Level

TABLE 1 (cont.)

Laboratory Report
Results in Nanograms (ng)
Analysis Completed: November 20, 1996

Quadrel Project No. QS1592

SAMPLE NO.	43	44	45	46	47	48	49
COMPOUNDS							
Benzene	38	U	U	48	U	30	U
Ethylbenzene	U	173	U	55	U	43	U
Tetrachloroethene	655	624	367	455	230	396	892
Trichloroethene	174	U	U	U	U	U	92
THH Volatiles	**856**	**645**	**367**	**476**	**230**	**396**	**984**

SAMPLE NO.	50	51	52	53	54	55	56
COMPOUNDS							
Benzene	U	71	294	U	U	U	U
Ethylbenzene	U	389	U	U	U	U	U
Tetrachloroethene	571	180	194	469	640	441	447
Trichloroethene	95	166	U	U	U	U	U
THH Volatiles	**666**	**805**	**194**	**469**	**640**	**441**	**447**

SAMPLE NO.	57	58	59	60	61	62	63
COMPOUNDS							
Benzene	39	U	U	U	U	U	U
Ethylbenzene	129	53	U	U	65	U	U
Tetrachloroethene	79	U	663	1,618	549	468	172
Trichloroethene	U	U	U	116	134	U	U
THH Volatiles	**171**	**56**	**663**	**1,734**	**683**	**468**	**172**

Reported Quantitation Level = 30 nanograms; U = Below Reported Quantitation Level

TABLE 1 (cont.)

Laboratory Report
Results in Nanograms (ng)
Analysis Completed: November 20, 1996

Quadrel Project No. QS1592

SAMPLE NO.	64	65	66	67	68	69	70
COMPOUNDS							
Benzene	U	U	U	U	U	U	48
Ethylbenzene	U	U	U	U	U	U	U
Tetrachloroethene	334	211	304	289	411	643	489
Trichloroethene	U	U	U	U	U	U	U
THH Volatiles	**334**	**211**	**304**	**289**	**411**	**643**	**489**

SAMPLE NO.	71	72	73	74	75	A	B
COMPOUNDS							
Benzene	U	U	—	U	U	U	U
Ethylbenzene	U	U	—	U	U	U	U
Tetrachloroethene	1,353	246	—	485	206	154	279
Trichloroethene	U	U	—	U	U	U	U
THH Volatiles	**1,357**	**246**	—	**485**	**308**	**426**	**279**

SAMPLE NO.	C	D	E	F	G	Trip Blank
COMPOUNDS						
Benzene	U	U	U	U	U	U
Ethylbenzene	U	U	U	U	U	U
Tetrachloroethene	220	170	165	230	173	133
Trichloroethene	U	U	U	U	U	U
THH Volatiles	**220**	**170**	**177**	**230**	**173**	**133**

Reported Quantitation Level = 30 nanograms; U = Below Reported Quantitation Level

NOTE: No information is available for sample 73 because of a laboratory equipment failure (see Section 5).

Attachment 1

FIELD PROCEDURES FOR EMFLUX® SOIL-GAS SURVEYS

The following field procedures are routinely used during EMFLUX® Soil-Gas Surveys. Modifications can be and are incorporated from time to time in response to individual project requirements. In all instances, Quadrel adheres to EPA-approved Quality Assurance and Quality Control practices.

A. Field personnel carry EMFLUX® system components and support equipment to the site and deploy the EMFLUX® Collectors in a prearranged survey pattern. Although EMFLUX® Collectors require only one person for emplacement and retrieval, the specific number of field personnel required depends upon the scope and schedule of the project. Each Collector emplacement generally takes less than two minutes.

B. For those sample locations covered with soils or vegetation, a field technician clears vegetation and debris exposing the ground surface. Using a hammer and a ¾-inch-diameter pointed metal stake, the technician creates a hole approximately three inches deep. For those locations covered with an asphalt or concrete cap, the field technician drills a one-inch-diameter hole through the cap to the soils beneath. [If necessary, the Collector can be sleeved with a ¾-inch i.d. copper pipe for either capped or uncapped locations).

C. The technician then removes the solid plastic cap from an EMFLUX® Collector (a glass vial containing an adsorbent cartridge with a length of wire attached to the vial for retrieval) and replaces it with a Sampling Cap (a plastic cap with a hole covered by screen meshing). The technician inserts the Collector, with the Sampling Cap end facing down, into the hole (**see attached figure**). The Collector is then covered with either local soils for uncapped locations or, for capped locations, aluminum foil and a concrete patch. The Collector's location, time and date of emplacement, and other relevant information are recorded on the Field Deployment Form.

D. As a quality-control check during emplacement and retrieval, the technician takes periodic ambient-air control samples and records the date, time, and location of each. (One or more trip blanks are also included as part of the quality-control procedures).

E. Once all EMFLUX® Collectors have been deployed, field personnel schedule Collector recovery (approximately 72 hours after emplacement) and depart, taking all no-longer-needed equipment and materials with them.

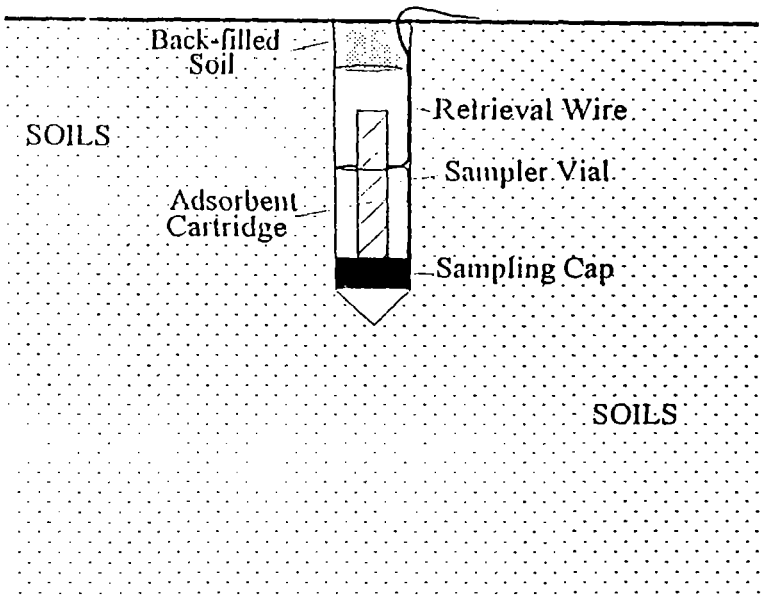
F. Field personnel retrieve the Collectors at the end of the 72-hour exposure period. At each location, a field technician withdraws the Collector from its hole and wipes the outside of the vial clean using gauze cloth; following removal of the Sampling Cap, the wire is removed with the wire cutters, and the threads of the vial are cleaned. A solid plastic cap is screwed onto the vial and the sample location number is written on the label. The technician then records sample-point location, date, time, etc. on the Field Deployment Form.

G. Sampling holes are refilled with soil, sand, or other suitable material. If Collectors have been installed through asphalt or concrete, the hole if filled to grade with a plug of cold patch or cement.

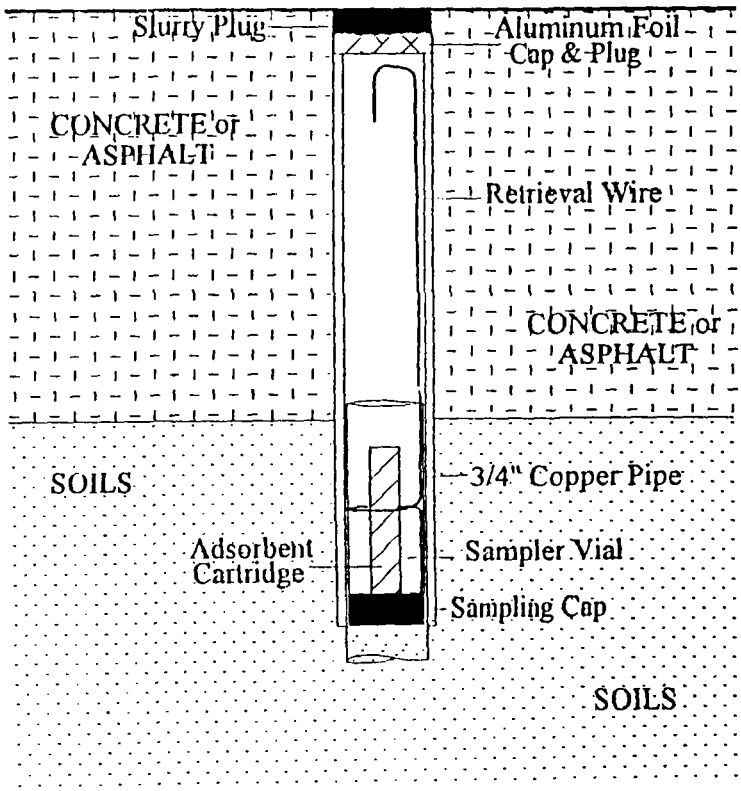
H. Following retrieval, field personnel ship or carry the EMFLUX® Collectors to analytical laboratories under contract to Quadrel Services. The remaining equipment is returned to Quadrel's preparation facility.

EMFLUX® COLLECTOR

DEPLOYMENT THROUGH SOILS



DEPLOYMENT THROUGH AN ASPHALT/CONCRETE CAP



Attachment 2

Field Deployment Report

QUADREL SERVICES, INC.
FIELD DEPLOYMENT REPORT

CLIENT: GOLDER ASSOCIATES | SITE: SALEM, OH.

EMPLACEMENT DATE: 11/11/96 | RETRIEVAL DATE: 11/15/96

FIELD TECH. INIT.	SAMPLE NUMBER	TIME		FIELD NOTES (e.g., asphalt or concrete surfacing, description of sample location, condition of cartridge or vial)
		Emplaced	Retrieved	
DSL/SEW	1	1346	1104	0-~~13~~ 15 D.L.
	2	1349	1106	M-15
	3	1353	1108	K-15
	4	1400	1132	O-13
	5	1402	1130	N-13
	6	1403	1128	M-13
	7	1405	1123	L-13
	8	1407	1122	K-13
	9	1410	1140	L-12
	10	1413	1138	M-12
	11	1415	1136	N-12
	12	1417	1134	O-12
	13	1419	1153	O-11
	14	1421	1151	N-11
	15	1423	1148	M-11
	16	1424	1144	L-11
	17	1445	1142	K-11 QARC Sample (D) taken at K-11 @ 1445 1146
	18	1447	1159	L-10

FIELD TECH. INIT.	SAMPLE NUMBER	TIME		FIELD NOTES (e.g., asphalt or concrete surfacing, description of sample location, condition of cartridge or vial)
		Emplaced	Retrieved	
DSL/SEW	19	1448	1157	M-10
	20	1449	1155	N-10
	21	1451	1154	O-10
	22	1452	1304	O-9
	23	1453	1302	N-9
	24	1454	1258	M-9
	25	1456	1254	L-9 QAQC sample E taken @ L-9 at 1456 1256
	26	1500	1252	K-9
	27	1502	1311	L-8
	28	1503	1309	M-8
	29	1504	1308	N-8
	30	1506	1306	O-8
	31	1507	1319	O-7
	32	1508	1317	N-7
	33	1510	1315	M-7
	34	1511	1312	L-7 QAQC Sample C @ L-7 @ 1512 1313
	35	1514	1327	K-6
	36	1516	1325	L-6
	37	1517	1323	M-6
	38	1518	1322	N-6
	39	1520	1321	O-6
	40	1521	1337	O-5

FIELD TECH. INIT.	SAMPLE NUMBER	TIME		FIELD NOTES (e.g., asphalt or concrete surfacing, description of sample location, condition of cartridge or vial)
		Emplaced	Retrieved	
DSL/SEW	41	1523	1335	N-5
	42	1524	1333	M-5
	43	1526	1332	L-5
	44	1527	1330	K-5
	45	1531	1341	O-4
	46	1532	1342	N-4 QAQC Sample B @ ~~4~~ N-4 @ 1532 1343
	47	1534	1344	M-4
	48	1536	1347	L-4
	49	1539	1349	K-4
	50	1541	1352	J-3
	51	1542	1353	K-3 QAQC Sample A @ K-3 @ 1543 1354
	52	1543	1356	L-3
	53	1607	1357	M-3
	54	1608	1359	N-3
	55	1609	1400	O-3 QAQC Sample F @ O-3 @ 1609 1401
	56	1610	1402	O-2
	57	1611	1403	N-2
	58	1613	1406	M-2
	59	1615	1408	L-2
	60	1616	1418	K-2
	61	1618	1420	I-2
	62	1619	1423	H-3

FIELD TECH. INIT.	SAMPLE NUMBER	TIME		FIELD NOTES (e.g., asphalt or concrete surfacing, description of sample location, condition of cartridge or vial)
		Emplaced	Retrieved	
	63	1621	1432	G-2
	64	1622	1437	F-3 (QAQC Sample G @ D-3 @ 1626) 1436
	65	1623	1433	E-2
	66	1625	1435	D-3
	67	1628	1430	H-1
	68	1629	1425	I-1
	69	1630	1427	J-1
	70	1631	1416	K-1
	71	1632	1408	L-1
	72	1634	1410	M-1
	73	1635	1413	N-1
	74	1636	1414	O-1
	75	1738	1126	L-14
	A			COLLECTED NEAR SAMPLE POINT # K-3
	B			COLLECTED NEAR SAMPLE POINT # N-4
	C			COLLECTED NEAR SAMPLE POINT # L-7
	D			COLLECTED NEAR SAMPLE POINT # K-11
	E			COLLECTED NEAR SAMPLE POINT # L-9
	F			COLLECTED NEAR SAMPLE POINT # O-3
	G			COLLECTED NEAR SAMPLE POINT # D-3
	TRIP BLANK	—	—	—

Attachment 3

LABORATORY PROCEDURES FOR EMFLUX® ADSORBENT CARTRIDGES

After exposure, EMFLUX® cartridges are analyzed using U.S. EPA Method 8021 as described in the Solid Waste Manual (SW-846). This method, which is modified to accommodate thermal desorption of the adsorbent cartridges, uses a capillary gas chromatograph with a photo ionization detector (PID) in series with a dry electrolytic conductivity detector (DELCD). This procedure is summarized below:

A. EMFLUX® cartridges are placed in the thermal desorbtion chamber, where they are desorbed at 300°C and immediately injected into the GC. At injection, helium flushes the desorption chamber and continues to flow through the desorption chamber during the entire sample run. The analytes are cryofocused at the front of the column using liquid CO_2. Analytes in the helium flow are detected with a PID then a DELCD.

B. The laboratory uses a 60-m, 0.53-mm-i.d., 5 μm-film-thickness MXT-5 capillary column for separation during analysis.

C. The PID and DELCD are set at high gain; the air pressure for the DELCD is set between two and three psi air.

D. Lab personnel conduct internal control blank and internal control verification analyses every 12 hours to ensure that the system is contaminant free and properly calibrated. The system is calibrated using the external standard calibration procedure to at least five different concentration levels for each compound targeted, with the lowest concentration level at or near the method detection limit.

E. The instrumentation used for these analyses is an SRI 8610 Gas Chromatograph, connected to a PID in series with a DELCD and equipped with a manually actuated thermal desorber.

Attachment 4

Chain-of-Custody Form

QUADREL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: QS1592	PROJECT NAME: CLIENT PROPERTY
LOCATION: SALEM, OH	CLIENT: GOLDER ASSOCIATES

TARGET COMPOUNDS: THH, BENZENE, ETHYLBENZENE, PCE, & TCE

SAMPLE NUMBER	LAB ID No. (for lab use only)	REMARKS			
		Condition of sample or vial	Date	Time	Init.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					

RELINQUISHED BY		DATE	TIME	RECEIVED BY	
Signature	Printed Name			Signature	Printed Name
Dan Smith	DAN SMITH	11-8-96	1500	FEDEX	
FEDEX					
		11.18.96	1115	[illegible]	Steve Thornley

QUADREL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: QS1592

PROJECT NAME: CLIENT PROPERTY

LOCATION: SALEM, OH

CLIENT: GOLDER ASSOCIATES

TARGET COMPOUNDS: THH, BENZENE, ETHYLBENZENE, PCE, & TCE

SAMPLE NUMBER	LAB ID No. (for lab use only)	REMARKS			
		Condition of sample or vial	Date	Time	Init.
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					
63					
64					

RELINQUISHED BY		DATE	TIME	RECEIVED BY	
Signature	Printed Name			Signature	Printed Name
Dan Smith	DAN SMITH	11-8-96	1500	FEDEX	
FEDEX					
		11-15-96	1115	[illegible]	Steve Thornley

QUADREL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: QS1592

PROJECT NAME: CLIENT PROPERTY

LOCATION: SALEM, OH

CLIENT: GOLDER ASSOCIATES

TARGET COMPOUNDS: THH, BENZENE, ETHYLBENZENE, PCE, & TCE

SAMPLE NUMBER	LAB ID No. (for lab use only)	REMARKS			
		Condition of sample or vial	Date	Time	Init.
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					
A					
B					
C					
D					
E					
F					
G					
Trip Blank					

RELINQUISHED BY		DATE	TIME	RECEIVED BY	
Signature	Printed Name			Signature	Printed Name
Dan Smith	DAN SMITH	11-8-96	1500	FEDEX	
FEDEX					
		11·18·96	1115	[illegible]	Steve Thornley

APPENDIX C

Downhole Video Survey of Well RW-1

VIDEO ATTACHED SEPARATELY

APPENDIX D

Soil Boring Logs

FIELD BORING LOG

DEPTH HOLE	46.2'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-3-S
DEPTH SOIL DRILL	46.0'	GA INSP.	M. LEMIEUX	DRILLING METHOD	4-1/4" I.D. HOLLOW STEM AUGER	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	SNOW	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL.	1197.0
NO. DIST. SA. 0 US. SA. 24		TEMP.	32° F	DRILL RIG	CME-75	DRILLER D. WRIGHT	DATUM MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP 30-inch	STARTED 0900 11/27/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP NA	COMPLETED 1400 11/27/96

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T	SLOTTED TUBE
T.O	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OC	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
L	LITTLE	RX	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMMER BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-16.0' SAND AND SILT LAYERED TILL.		1	DO	0,1, 1,1	1.3/2.0	0	0-2 ft. bgs. Moist, brown SILT with some clay, trace roots.
2			2	DO	4,10, 10,8	1.9/2.0	1	2-4 ft. bgs. Dry, beige SILT with some sand
4			3	DO	6,8, 10,4	1.8/2.0	2	4-6 ft. bgs. Moist, brown SAND with some silt to 5.4 ft. bgs. then dry, beige SILT with some sand.
6			4	DO	5,6, 7,9	1.9/2.0	2	6-8 ft. bgs. Moist, beige and brown SILT with some sand to 7.3 ft. bgs. then brown SAND with some silt
8			5	DO	4,4, 1,4	1.7/2.0	2	8-10 ft. bgs. Moist, med. brown SAND with some silt, trace gravel to 9.2 ft. bgs. then brown SILT with some sand.
10			6	DO	3,3, 4,5	1.8/2.0	7	10-12 ft. bgs. Saturated, gray SILT with some sand to 10.2 ft. bgs. then brown with trace gravel to 11.2 ft. bgs. then moist, med.-fine brown sand with some silt, trace gravel.
12			7	DO	1,2, 3,3,	1.4/2.0	50	12-14 ft. bgs. Dark brown SILT with some clay to 12.5 ft.bgs. then gray-brown SILT to 13.0 ft. bgs. then coarse black SAND with trace gravel
14			8	DO	3,4, 4,7	1.5/2.0	70	14-16 ft. bgs. Gray SILT with some clay to 14.7 ft. bgs. then saturated, gray coarse SAND with trace silt.
16	16.0-32.0' SILT		9	DO	4,5, 5,6	1.0/2.0	5	16-18 ft. bgs. Gray CLAYEY SILT with trace sand and gravel.
18			10	DO	3,5, 7,9	1.8/2.0	0	18-20 ft. bgs. As above
20			11	DO	4,6, 8,10	1.6/2.0	0	20-22 ft. bgs. Gray SILT with trace clay to 20.3 ft.bgs. then some clay and trace sand and gravel.
22			12	DO	3,6, 7,8	2.0/2.0	0	22-24 ft. bgs. Gray, SILT with some clay, trace sand and gravel.
24			13	DO	3,4, 5,13	1.4/2.0	0	24-26 ft. bgs. As above.
26			14	DO	2,3, 7,5	2.0/2.0	0	26-28 ft. bgs. As above with sand layer from 26.4 to 26.7 ft. bgs.
28			15	DO	3,4, 5,7	1.7/2.0	0	28-30 ft. bgs. Gray SILT with some sand, trace clay, gravel.
30			16	DO	4,7, 9,13	0.5/2.0	0	30-32 ft. bgs. As above.
32	32.0-46.0' SILTY SAND		17	DO	6,5, 7,5	0.6/2.0	0	32-34 ft. bgs. Gray SILTY SAND with some gravel.
34			18	DO	3,4, 7,9	1.8/2.0	0	34-36 ft. bgs. As above.
36			19	DO	3,4, 8,9	1.6/2.0	0	36-38 ft. bgs. As above
38			20	DO	3,5, 7,7	1.3/2.0	0	38-40 ft. bgs. As above.
40			21	DO	3,4, 6,9	1.4/2.0	0	40-42 ft. bgs. Gray SILTY SAND with some gravel.
42			22	DO	3,4, 7,7	1.6/2.0	0	42-44 ft. bgs. As above.
44			23	DO	4,7, 8,15	1.8/2.0	0	44-46 ft. bgs. As above
46	46.0-46.2' WASHINGTONVILLE SHALE							46-46.2 ft. bgs. Dry, gray SHALE.
	46.2' - End of Borehole		24	DO	50/0.2	0.2/0.2	0	

FIELD BORING LOG

DEPTH HOLE	38.0'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-3-M
DEPTH SOIL DRILL	0'	GA INSP.	M. LEMIEUX	DRILLING METHOD	8-1/4" I.D. HOLLOW STEM AUGER	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	SUN	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL	1197.0
NO. DIST SA. 0	US. SA 0	TEMP.	34° F	DRILL RIG	CME-75	DRILLER D. WRIGHT	DATUM MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP 30-inch	STARTED 1600 12/2/96
TIME WL	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP NA	COMPLETED 1100 12/4/96

SAMPLE TYPES

A.S	AUGER SAMPLE	B.S	BULK SAMPLE
C.S	CHUNK SAMPLE	D.O	DRIVE OPEN
D.S.	DENISON SAMPLE	P.S	PITCHER SAMPLE
R.C	ROCK CORE	S.T	SLOTTED TUBE
T.O	THIN-WALLED, OPEN	T.P.	THIN-WALLED, PISTON
W.S	WASH SAMPLE		

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-15.0' SAND AND SILT LAYERED TILL.							Soil descriptions based on samples collected for PZ-3-S.
2								
								8 1/4-inch augers advanced to 20 ft bgs. PID, LEL, O_2 meter readings non-detect in B2.
4								
								6-inch dia. Sch 40 steel casing set to 18.8 ft. bgs. and grouted in place
6								
								6-inch solid auger advanced inside casing to 38 ft. bgs. Non-detect meter readings in breathing zone.
8								
10								
12								
14								
16	16.0-32.0' SILT							
18								
20								
22								
24								
26								
28								
30								
32	32.0-38.0' SILTY SAND							
34								
36								
38	38.0' - End of Borehole.							
40								
42								
44								
46								

FIELD BORING LOG

DEPTH HOLE 63.5'	JOB NO. 933-6154	PROJECT RNC/SALEM/OH	BORING NO. PZ-3-B
DEPTH SOIL DRILL 46.0'	GA INSP. M. LEMIEUX	DRILLING METHOD 12-1/4, 4-1/4" I.D. HSA, 5-7/8" ROTARY	SHEET 1 of 1
DEPTH ROCK CORE 0	WEATHER CLOUDY	DRILLING CO. SPROWLS DRILLING CO.	SURFACE EL. 1197.0
NO. DIST. SA. 0 US. SA. 0	TEMP. 40° F	DRILL RIG CME-75 DRILLER D. WRIGHT	DATUM MSL
DEPTH WL. NA	HRS. PROD. NA	WT. SAMPLER HAMMER 140 LBS. DROP 30-inch	STARTED 0930 12/3/96
TIME WL. NA	HRS. DELAYED NA	WT. CASING HAMMER NA DROP NA	COMPLETED 1530 12/18/96

SAMPLE TYPES

A.S.	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S.	WASH SAMPLE

ABBREVIATIONS

BK	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.		SAMPLES NO.	TYPE	HAMM BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-15.0' SAND AND SILT LAYERED TILL.								Soil descriptions based on samples collected for PZ-3-S.
5									
									12 1/4-inch augers advanced to 19 ft. bgs. PID readings on cuttings from 14-16 ft. bgs were from 3 to 6 ppm.
10									
15									10-inch dia. Sch 40 steel casing set to 19 ft. bgs. and grouted in place.
	16.0-32.0' SILT								
20									4 1/4-inch augers advanced to 50 ft bgs.
25									6-inch dia Sch 40 steel casing set to 50 ft. bgs. and grouted in place.
30									5 7/8-inch air rotary bit advanced ito 63.5 ft. bgs. PID, LEL and O_2 reading non-detect over this interval in breathing zone
	32.0-46.0' SILTY SAND								
35									
40									
45									
	46.0-63.5' WASHINGTONVILLE SHALE								
50									
55									
60									
65	63.5' - End of Borehole.								
70									
75									
80									
85									
90									
95									
100									
105									
110									
115									

FIELD BORING LOG

DEPTH HOLE 12.5'	JOB NO. 933-6154	PROJECT RNC/SALEM/OH				BORING NO. PZ-4-S	
DEPTH SOIL DRILL 12.5'	GA INSP. D. WEHN	DRILLING METHOD 4-1/4" I.D. HOLLOW STEM AUGER				SHEET 1 of 1	
DEPTH ROCK CORE 0	WEATHER SNOW	DRILLING CO. SPROWLS DRILLING CO.				SURFACE EL. 1191.5	
NO. DIST. SA. 0 US. SA. 0	TEMP. 34° F	DRILL RIG CME-75		DRILLER D. WRIGHT		DATUM MSL	
DEPTH WL. NA	HRS. PROD. NA	WT. SAMPLER HAMMER 140#		DROP 30"		STARTED 1230 12/9/96	
TIME WL. NA	HRS. DELAYED NA	WT. CASING HAMMER NA		DROP NA		COMPLETED 1315 12/9/96	

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C	ROCK CORE
S.T.	SLOTTED TUBE
T.O	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BK	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SLY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.		SAMPLES NO	TYPE	HAMM. BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-11.3' - CLAYEY SILT TILL								Soil descriptions based on samples collected for PZ-4-M.
2									4 1/4-inch augers advanced to 12.5 ft. bgs. No detections at auger top on PID, LEL or O_2 meters.
4									
6									
8									
10									
	11.3-12.5' - SOFT CLAY								
12									
	12.5' - END OF BOREHOLE								
14									
16									
18									
20									
22									
24									

FIELD BORING LOG

DEPTH HOLE	43.2'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-4-M
DEPTH SOIL DRILL	43.2'	GA INSP.	D. WEHN	DRILLING METHOD	4-1/4" I.D. HOLLOW STEM AUGER	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL	1191.2
NO DIST SA. 0	US SA. 22	TEMP.	30° F	DRILL RIG	CME-75	DRILLER DALE	DATUM MSL
DEPTH WL	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP 30-inch	STARTED 0800 12/6/96
TIME WL	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP NA	COMPLETED 1130 12/6/96

SAMPLE TYPES

A.S.	AUGER SAMPLE	BL	BLACK
C.S.	CHUNK SAMPLE	BR	BROWN
D.O.	DRIVE OPEN	C	COARSE
D.S.	DENISON SAMPLE	CA	CASING
P.S.	PITCHER SAMPLE	CL	CLAY
R.C.	ROCK CORE	CLY	CLAYEY
S.T.	SLOTTED TUBE	F	FINE
T.O.	THIN-WALLED, OPEN	FRAG	FRAGMENTS
T.P.	THIN-WALLED, PISTON	GL	GRAVEL
W.S.	WASH SAMPLE	LYD	LAYERED
		LI	LITTLE

ABBREVIATIONS

M	MEDIUM	SA	SAMPLE
MIC	MICACEOUS	SAT	SATURATED
MOT	MOTTLED	SD	SAND
NP	NON-PLASTIC	SI	SILT
OG	ORANGE	SIY	SILTY
ORG	ORGANIC	SM	SOME
PH	PRESSURE-HYDRAULIC	TR	TRACE
PM	PRESSURE-MANUAL	WL	WATER LEVEL
R	RED	WH	WEIGHT OF HAMMER
RES	RESIDUAL	Y	YELLOW
RX	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMM BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-11.3' CLAYEY SILT TILL		1	DO	1,2, 3,3	1.2/2.0	0	0-2 ft. bgs. Soft, moist, yellow-brown CLAYEY SILT with trace gravel, fine sand.
2			2	DO	4,8, 8,9	1.6/2.0	0	2-4 ft. bgs As above.
4			3	DO	10,8, 7,3	1.5/2.0	0	4-6 ft. bgs. As above.
6			4	DO	4,5, 6,7	1.9/2.0	0	6-8 ft. bgs. As above with 3-inch thick coarse sand lens.
8			5	DO	5,5, 5,5	1.8/2.0	0	8-10 ft. bgs. As from 4-6 ft. bgs. above to 9.2 ft. bgs., then loose, moist, gray SILT with some clay, little fine gravel.
10			6	DO	2,9, 8,7	1.9/2.0	0	
12	11.3-21.0' SOFT CLAY		7	DO	2,3, 2,3	2.0/2.0	0	10-12 ft. bgs. As above to 10.8 ft. bgs., then compact, red-brown SILT AND FINE SAND with little clay (and 3-inch thick sand layer) to 11.3 ft. bgs., then firm, moist, brown CLAY.
14			8	DO	WH,2, 3,1	2.0/2.0	0	
16			9	DO	4,4, 5,6	2.0/2.0	0	12-14 ft. bgs. Firm to soft, moist, gray CLAY with a few 2 mm thick silt partings.
18			10	DO	WH,WH, 3,4	2.0/2.0	0	14-16 ft bgs. As above.
20			11	DO	1,2, 2,3	2.0/2.0	0	16-18 ft. bgs. As above with no silt partings.
22	21.0-28.0' SILT AND SAND		12	DO	1,2, 4,6	1.4/2.0	0	18-20 ft. bgs. As above.
24			13	DO	3,4, 5,10	1.0/2.0	0	20-22 ft. bgs. As above with several silt partings and a 2-inch thick sand layer.
26			14	DO	4,7, 11,11	1.8/2.0	0	22-24 ft. bgs. As from 12-14 ft. bgs above grading to loose, saturated, gray SILT with some clay.
28	28.0-42.4' SILT		15	DO	2,3, 5,7	1.8/2.0	0	24-26 ft. bgs. Alternating zones of the above and a loose, gray, coarse SAND with little clay.
30			16	DO	2,3, 5,6	0.5/2.0	0	26-28 ft. bgs Alternating zones of loose gray coarse SAND with little clay and compact, gray CLAYEY SILT.
32			17	DO	2,3, 6,7	1.7/2.0	0	
34			18	DO	3,5, 8,10	1.6/2.0	0	28-30 ft. bgs. Loose, saturated, gray SILT with some rounded fine gravel and little clay and fine sand.
36			19	DO	3,6, 8,9	1.8/2.0	0	30-32 ft. bgs. As above.
38			20	DO	3,3, 5,9	1.7/2.0	0	32-34 ft bgs. As above. 34-36 ft. bgs. As above. 36-38 ft. bgs. As above.
40			21	DO	5,6, 9,16	1.7/2.0	0	38-40 ft. bgs. As above. 40-42 ft. bgs. As above.
42	42.4-43.2' WASHINGTONVILLE SHALE		22	DO	3,15, 50/0.2	1.0/1.2	0	42-44 ft. bgs. Weathered, gray SHALE at 42.4 ft. bgs.
44	43.2' - End of Borehole.							
46								No breathing zone detections on PID, LEL or O_2 meters

FIELD BORING LOG

DEPTH HOLE 65.5'	JOB NO. 933-6154	PROJECT RNC/SALEM/OH				BORING NO. PZ-4-B	
DEPTH SOIL DRILL 42.4'	GA INSP. D. WEHN	DRILLING METHOD 4-1/4" I.D. HOLLOW STEM AUGER				SHEET 1 of 1	
DEPTH ROCK CORE 0	WEATHER SNOW	DRILLING CO. SPROWLS DRILLING CO.				SURFACE EL. 1191.8	
NO. DIST SA. 0	US. SA. 0	TEMP. 34° F	DRILL RIG CME-75		DRILLER D. WRIGHT	DATUM MSL	
DEPTH WL. NA	HRS. PROD. NA	WT. SAMPLER HAMMER 140#			DROP 30"	STARTED 1400 12/9/96	
TIME WL. NA	HRS. DELAYED NA	WT. CASING HAMMER NA			DROP NA	COMPLETED 1000 12/17/96	

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S	CHUNK SAMPLE
D.O	DRIVE OPEN
D.S.	DENSON SAMPLE
P.S	PITCHER SAMPLE
R.C	ROCK CORE
S.T	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SLY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" – 0–5%
"LITTLE" – 5–12%
"SOME" – 12–30%
"AND" – 30–50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.		SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN. (FORCE)	REC/ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
	0.0–11.3' CLAYEY SILT TILL								Soil descriptions based on samples collected for PZ-4-M.
5									
									8 1/4-inch augers bored to 45 ft. bgs.
10									PID, LEL and O_2 meter readings over this interval
	11.3–21.0' SOFT CLAY								measured at the top of augers are normal
15									(non-detect).
									6-inch auger bit run inside 8 1/4-inch augers
20									from 45 to 48 ft. bgs. to cut casing socket.
	21.0–28.0' SILT AND SAND								As before, instruments non-detect.
25									
									6-inch dia. Sch. 40 steel casing set to 48 ft. bgs.
30	28.0–42.4' SILT								and grouted in place.
									5 7/8-inch roller bit used (with air) to ream
35									from 48 to 60.5 ft. bgs. on 12/17/96. PID, LEL,
									and O_2 meters non-detect measured at return
40									air collection tank.
	42.4–45.0' WASHINGTONVILLE SHALE								
45	45.0–60.5' MIDDLE KITTANNING SANDSTONE								
50									
55									
60									
	60.5' -- END OF BOREHOLE								
65									
70									

FIELD BORING LOG

DEPTH HOLE	18.5'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-5-S
DEPTH SOIL DRILL	18.5'	GA INSP.	M. LEMIEUX	DRILLING METHOD	4-1/4" I.D HOLLOW STEM AUGER	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL.	1197.3
NO DIST SA. 0 US. SA 0		TEMP.	40° F	DRILL RIG	CME-75	DRILLER	D. WRIGHT
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP	30-inch
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP	NA

DATUM MSL
STARTED 1135 11/21/96
COMPLETED 1200 11/21/96

SAMPLE TYPES

A.S.	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S.	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" – 0–5%
"LITTLE" – 5–12%
"SOME" – 12–30%
"AND" – 30–50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV DEPTH	DESCRIPTION	BLOWS/FT.		SAMPLES NO.	TYPE	HAMM BLOWS PER 6 IN (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0–7.0' SAND AND SILT LAYERED TILL.								Soil descriptions based on samples collected for PZ-5-M.
2									4 1/4-inch augers advanced to 18.5 ft. bgs.
4									PID averaged 1 ppm over this interval.
	7.0–18.5' SILT								
6									
8									
10									
12									
14									
16									
18									
	18.5' – End of Borehole.								
20									
22									
24									
26									
28									
30									
32									
34									
36									
38									
40									
42									
44									
46									

FIELD BORING LOG

DEPTH HOLE	34.0'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH			BORING NO	P2-5-M
DEPTH SOIL DRILL	34.0'	GA INSP.	M. LEMIEUX	DRILLING METHOD	4-1/4" I.D. HOLLOW STEM AUGER			SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.			SURFACE EL.	1197.2
NO. DIST SA. 0	US. SA. 18	TEMP.	36° F	DRILL RIG	CME-75	DRILLER	D. WRIGHT	DATUM	MSL
DEPTH WL	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP	30-inch	STARTED	1315 11/20/96
TIME WL	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP	NA	COMPLETED	1430 11/20/96

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
U	LITTLE	RK	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" – 0-5%
"LITTLE" – 5-12%
"SOME" – 12-30%
"AND" – 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO	TYPE	HAMM. BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-7.0' SAND AND SILT LAYERED TILL.		1	DO	1,2, 1,1	1.1/2.0	0	0-2 ft. bgs. Firm, moist brown CLAYEY SILT with some roots.
2			2	DO	2,2, 3,3	1.7/2.0	0	2-4 ft. bgs. As Above.
4	7.0-32.6' SILT		3	DO	7,9, 7,8	1.3/2.0	0	4-6 ft. bgs. Compact, moist, brown, fine to med SAND with some silt.
6			4	DO	2,5, 5,5	1.7/2.0	0	6-8 ft. bgs. Fine SAND with some silt to 7 ft bgs, then SILT with some sand
8			5	DO	2,5, 6,6	1.9/2.0	0	8-10 ft. bgs. Compact, moist, brown, SILT with some sand, trace gravel.
10			6	DO	4,4, 6,9	2.0/2.0	0	10-12 ft. bgs As above.
12			7	DO	6,7, 7,10	1.8/2.0	0	12-14 ft. bgs. Compact, saturated gray-brown SILT with some sand, trace gravel.
14			8	DO	4,6, 8,11	1.7/2.0	6	14-16 ft. bgs. As above.
16			9	DO	SEE NOTE 1	1.0/1.0	2	16-17 ft. bgs. Saturated, gray SILT with some SAND, trace gravel.
18			10	DO	SEE NOTE 1	1.0/1.2	4	17-18.1 ft. bgs. As above. No sample from 18.1 to 20.0 ft. bgs.
20			11	DO	4,8, 10,10	1.3/2.0	7	20-22 ft. bgs. Compact, saturated green-brown SANDY SILT with trace gravel.
22			12	DO	4,5, 6,4	1.7/2.0	6	22-24 ft. bgs. Gray, CLAYEY SILT with some sand to 22.8 ft. bgs. then gray coarse SAND with some silt.
24			13	DO	3,10, 13,13	0.7/2.0	10	24-26 ft. bgs. SILT with some sand and clay, trace gravel to 24.6 ft. bgs. then med SAND.
26			14	DO	4,6, 2,6	0.3/2.0	18	26-28 ft. bgs. Loose SILT with some sand, trace gravel.
28			15	DO	6,10, 9,11	1.8/2.0	4	28-30 ft. bgs Compact, saturated, dark gray, SANDY SILT with trace gravel.
30			16	DO	6,10, 12,15	2.0/2.0	6	30-32 ft. bgs As above, but moist
32	32.6-34.9' WASHINGTONVILLE SHALE		17	DO	22,32, 35,50/.4	1.9/1.9	40	32-34 ft. bgs. As above, to 32.6 ft. bgs. then dark gray friable SHALE.
34	34.9' -- End of Borehole.		18	DO	30,35	0.8/1.0	12	34-34.9 ft. bgs Dark gray, friable SHALE
36								
38								
40								
42								NOTE 1: Split spoon shoe lost while removing DO-8. Shoe recovered in DO-10 using 3 3/4-inch diameter sampler.
44								
46								

FIELD BORING LOG

DEPTH HOLE	65.5'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH			BORING NO.	PZ-5-B
DEPTH SOIL DRILL	32.0'	GA INSP.	M LEMIEUX	DRILLING METHOD	8-1/4" I.D. HSA, 7" SSA, 5 7/8" ROTARY			SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.			SURFACE EL.	1197.2
NO. DIST. SA. 0	US. SA. 0	TEMP.	35° F	DRILL RIG	CME-75	DRILLER	D. WRIGHT	DATUM	MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP	30-inch	STARTED	1300 11/25/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP	NA	COMPLETED	1230 12/13/96

SAMPLE TYPES

A.S.	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S.	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE		
BR	BROWN	MC	MICACEOUS	SAT	SATURATED		
C	COARSE	MOT	MOTTLED	SD	SAND		
CA	CASING	NP	NON-PLASTIC	SI	SILT		
CL	CLAY	OC	ORANGE	SIY	SILTY		
CLY	CLAYEY	ORG	ORGANIC	SM	SOME		
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE		
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL		
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER		
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW		
LI	LITTLE	RX	ROCK				

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.		SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-7.0' SAND AND SILT LAYERED TILL.								Soil descriptions based on samples collected for PZ-5-M.
5									
	7.0-32.6' SILT								8 1/4-inch augers advanced to 36.0 ft. bgs. switched to 7-inch SSA and continued to 53.0 ft. bgs. (inside HSA's)
10									
15									6-inch dia. Sch 40 steeel casing set at 53.0 ft. bgs. and grouted in place.
20									5 7/8-inch roller bit used (with air) to ream from 53.0 to 65.5 ft. bgs.
25									
30									No detections on PID, LEL and O_2 meters during augering or air drilling
	32.6-50.0' WASHINGTONVILLE SHALE								
35									
40									
45									
50	50.0-65.5' MIDDLE KITTANNING SANDSTONE								
55									
60									
65	65.5' - End of Borehole.								
70									
75									
80									
85									
90									
95									
100									
105									
110									
115									

FIELD BORING LOG

DEPTH HOLE	50.5'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH			BORING NO.	PZ-5-1
DEPTH SOIL DRILL	32.6'	GA INSP.	M LEMIEUX	DRILLING METHOD	8-1/4" I.D. HSA, 5-7/8" ROTARY			SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.			SURFACE EL.	1197.3
NO. DIST. SA. 0	US SA. 0	TEMP.	40° F	DRILL RIG	CME-75	DRILLER	D. WRIGHT	DATUM	MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP	30-inch	STARTED	0845 12/6/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP	NA	COMPLETED	1645 12/13/96

SAMPLE TYPES

A.S.	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S.	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SLT	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" – 0–5%
"LITTLE" – 5–12%
"SOME" – 12–30%
"AND" – 30–50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0–7.0' SAND AND SILT LAYERED TILL.							Soil descriptions based on samples collected for PZ-5-M.
5								
	7.0–32.6' SILT							8 1/4-inch augers advanced to 36.0 ft. bgs. PID averaged from 0 to 2 ppm over this interval.
10								
								6-inch dia. Sch 40 steeel casing set at 35.0 ft. bgs. and grouted in place.
15								
								5 7/8-inch roller bit used (with air) to ream from 36.0 to 50.5 ft bgs. No detections on PID, LEL and O_2 meters at air return tank.
20								
25								
30								
	32.6–50.0' WASHINGTONVILLE SHALE							
35								
40								
45								
50								
	50.0–50.5' MIDDLE KITTANNING SANDSTONE							
55	50.5' – End of Borehole.							
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								

FIELD BORING LOG

DEPTH HOLE	37.2'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-6B-U
DEPTH SOIL DRILL	8.7'	GA INSP.	D WEHN	DRILLING METHOD	8-1/4" I.D. HSA, 5 7/8" ROTARY	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL.	1172.0
NO. DIST. SA. 0	US. SA. 5	TEMP.	35° F	DRILL RIG	IR TH-60	DRILLER D. GLOBE	DATUM MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP 30-inch	STARTED 0815 11/21/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP NA	COMPLETED 1430 11/25/96

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C	ROCK CORE
S.T	SLOTTED TUBE
T.O	THIN-WALLED, OPEN
T.P	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BK	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-7.4' SILTY CLAY TO CLAYEY SILT TILL		1	DO	N/A	1.0/2.0	0	0-2 ft. bgs. Moist, dark brown, SILTY CLAY with trace gravel.
2			2	DO	N/A	1.6/2.0	0	2-4 ft. bgs. As above to 2.4 ft. bgs. then moist, stiff, yellow brown CLAYEY SILT with trace fine sand. Trace flecks of gray clay.
4			3	DO	N/A	1.8/2.0	0	
6			4	DO	N/A	1.7/2.0	0	4-6 ft. bgs. As from 2.4 ft. bgs. above.
8	7.4-8.7' FINE TO COARSE SAND		5	DO	N/A	0.7/0.7	0	6-8 ft. bgs. As above to 7.4 ft. bgs. then moist, loose, grayish brown FINE TO COARSE SAND.
10	8.7-22.0' WASHINGTONVILLE SHALE							8-8.7 ft. bgs. Saturated, loose, brown FINE TO V. COARSE SAND with trace gravel. Weathered gray SHALE in tip of spoon.
12								
14								No detections on PID, LEL or O_2 meters in overburden measured at top of augers.
16								Auger through Washingtonville Shale 3 ft. into (MKS). No detections on PID in breathing zone.
18								50 ppm at base of augers while in sandstone. No detections on LEL or O_2 meters.
20								
22	22.0-37.2' MIDDLE KITTANNING SANDSTONE							At 25 ft. bgs. switched to 7 1/8-inch rotary bit to complete casing socket in MKS. PID reading at collection drum ave. 200 ppm over this interval. Breathing Zone = 5 ppm at rig. (Air rotary)
24								Bit changed to 5 7/8-inch dia. and borehole drilled from 27 ft. bgs. to 37.2 ft. bgs. PID
26								readings at cutting collection drum ave. 2 ppm during drilling. No detections on LEL or O_2 meter
28								
30								
32								
34								
36								
38	37.2' - END OF BOREHOLE							
40								
42								
44								
46								

FIELD BORING LOG

DEPTH HOLE	56.0'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH			BORING NO.	PZ-6B-M
DEPTH SOIL DRILL	8.7'	GA INSP.	D. WEHN	DRILLING METHOD	12-1/4" I.D. HOLLOW STEM AUGER			SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	CLOUDY	DRILLING CO.	SPROWLS DRILLING CO.			SURFACE EL.	1171.1
NO. DIST. SA. 0	US. SA. 0	TEMP.	32° F	DRILL RIG	IR TH-60	DRILLER	D. GLOBE	DATUM	MSL
DEPTH WL	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	NA	DROP	NA	STARTED	0900 11/26/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP	NA	COMPLETED	1815 12/2/96

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C	ROCK CORE
S.T	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SLT	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" – 0–5%
"LITTLE" – 5–12%
"SOME" – 12–30%
"AND" – 30–50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV DEPTH	DESCRIPTION	BLOWS/FT.		SAMPLES NO.	TYPE	HAMM BLOWS PER 6 IN (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0–7.4' SILTY CLAY TO CLAYEY SILT TILL								Augered with 12 1/4-inch HSAs to 10 ft. bgs.
5									No detections on PID, LEL or O_2 meters.
	7.4–8.7' FINE TO COARSE SAND								Soil descriptions based on samples collected
									for PZ-6B-U.
10	8.7–21.0' WASHINGTONVILLE SHALE								
									Hole out of plumb – so it was backfilled with
15									cuttings, moved approx. 6 ft. south and restarted.
									11/27/96 Augered to 11 ft. bgs. with 12 1/4
20	21.0–22.0' COAL								inch HSAs No detections on PID, LEL or O_2
	22.0–56.0' MIDDLE KITTANNING								meters. Switched to 12 1/4-inch roller bit and
25	SANDSTONE								drilled from 11 ft. bgs. to 24 ft. bgs. lost air
									seal around augers, so advanced augers to 20 ft
									bgs. Continued to drill with 12 1/4-inch rotary
30									bit to 30 ft. bgs. PID readings at cuttings
									collection drum = 1.2 ppm from 11–30 ft. bgs
									No detections on LEL or O_2 meter.
35									
									Installed 10-inch casing to 30 ft. bgs. and
40									grouted in place.
									Air reamed from 30 ft. bgs. to 56 ft. bgs. with
45									5 7/8-inch rotary bit. PID readings of return air
									over this interval were 1 to 2 ppm No detections
50									on LEL or O_2 meters
55									
	56.0' – END OF BOREHOLE								
60									
65									
70									
75									
80									
85									
90									
95									
100									
105									
110									
115									

FIELD BORING LOG

DEPTH HOLE	68.8'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-6B-L
DEPTH SOIL DRILL	8.7'	GA INSP.	D. WEHN	DRILLING METHOD	12-1/4" I.D. HOLLOW STEM AUGER	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	SUN	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL.	1170.1
NO. DIST. SA. 0 US. SA. 0		TEMP.	40° F	DRILL RIG	IR TH-60 / DRILLER D. GLOBE	DATUM	MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	NA / DROP NA	STARTED	1330 12/3/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA / DROP NA	COMPLETED	830 12/5/96

SAMPLE TYPES

A.S.	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S.	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION – RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN. (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-7.4' SILTY CLAY TO CLAYEY SILT TILL							Advanced 12 1/4-inch ID augers to 15 ft. bgs.
5								Soil descriptions based on samples collected for PZ-6B-U. No detections on PID, LEL or O_2 meters
	7.4-8.7' FINE TO COARSE SAND							
10	8.7-21.0' WASHINGTONVILLE SHALE							11-inch roller bit used to air-ream from 15 to 56 ft. bgs. Max PID reading of return air over this interval 0.5 ppm. No detections on LEL or O_2
15								meters
20	21.0-22.0' COAL							6-inch dia. SCH-40 steel casing set to 56 ft. from 45 to 48 ft. bgs. to cut casing socket.
	22.0-67.2' MIDDLE KITTANNING SANDSTONE							As before, instruments non-detect.
25								
30								6-inch dia. Sch. 40 steel casing set to 48 ft. bgs and grouted in place
35								5 7/8-inch roller bit used (with air) to ream from 48 to 60.5 ft. bgs. on 12/17/96. PID, LEL, and O_2 meters non-detect measured at return air collection tank.
40								
45								
50								
55								
60								
65	67.2-68.8' COLUMBIANA SHALE							
70	68.8' -- END OF BOREHOLE							
75								
80								
85								
90								
95								
100								
105								
110								
115								

FIELD BORING LOG

DEPTH HOLE	36'	JOB NO.	933-6154	PROJECT	RNC/SALEM/OH	BORING NO.	PZ-7
DEPTH SOIL DRILL	36'	GA INSP.	D. WEHN	DRILLING METHOD	4-1/4" I.D. HOLLOW STEM AUGER	SHEET	1 of 1
DEPTH ROCK CORE	0	WEATHER	SNOW	DRILLING CO.	SPROWLS DRILLING CO.	SURFACE EL.	1190.9
NO. DIST. SA. 0	US. SA. 0	TEMP.	30° F	DRILL RIG	CME-75	DRILLER D. WRIGHT	DATUM MSL
DEPTH WL.	NA	HRS. PROD.	NA	WT. SAMPLER HAMMER	140 LBS.	DROP 30-inch	STARTED 0800 12/18/96
TIME WL.	NA	HRS. DELAYED	NA	WT. CASING HAMMER	NA	DROP NA	COMPLETED 1130 12/18/96

SAMPLE TYPES

A.S.	AUGER SAMPLE
C.S.	CHUNK SAMPLE
D.O.	DRIVE OPEN
D.S.	DENISON SAMPLE
P.S.	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S.	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OG	ORANGE	SIY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RX	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" - 0-5%
"LITTLE" - 5-12%
"SOME" - 12-30%
"AND" - 30-50%

CONSISTENCY

LS	LOOSE	S	SOFT
CP	COMPACT	FM	FIRM
DN	DENSE	ST	STIFF
V	VERY	H	HARD

ELEV. DEPTH	DESCRIPTION	BLOWS/FT.	SAMPLES NO.	TYPE	HAMM. BLOWS PER 6 IN (FORCE)	REC/ATT	PID READING (ppm)	SAMPLE DESCRIPTION AND BORING NOTES
	0.0-9.2' CLAYEY SILT TILL		1	DO	2,3, 3,7	0.8/2.0	0	0-2 ft. bgs. Loose, yellow-brown, moist CLAYEY SILT with some fine sand.
2			2	DO	2,2, 3,7	1.8/2.0	0	2-4 ft. bgs. As above with trace gray mottling and gravel.
4			3	DO	3,4, 6,4	0.7/2.0	0	4-6 ft. bgs. Loose, brown, moist SILT with some clay trace gravel and coal.
6			4	DO	4,5, 6,8	2.0/2.0	0	6-8 ft. bgs. As above with no coal.
8			5	DO	3,2, 2,4	0.9/2.0	0	8-10 ft bgs. As above to 9.6 ft. bgs then loose, brown, saturated, coarse SAND with trace clay and bright orange colored zone.
10	9.6-11.6' SAND		6	DO	4,5, 5,7	1.2/2.0	0	
12	11.6-12.0' CLAY 12.0-14.8' SAND		7	DO	4,5, 4,4	1.3/2.0	0	10-12 ft bgs. As above (without orange zone) to 11.6 ft bgs. then soft, gray, moist, CLAY with some silt.
14	14.8-20.0' CLAY		8	DO	2,3, 5,6	1.5/2.0	0	12-14 ft. bgs. Loose, dark brown, saturated coarse SAND.
16			9	DO	1,3, 5,6	1.9/2.0	0	
18			10	DO	2,3, 4,4	1.9/2.0	0	14-16 ft. bgs. As above to 14.8 ft bgs. then soft gray, moist CLAY with trace silt partings
20	20.0-23.4' SAND		11	DO	3,4, 5,5	1.0/2.0	0	16-18 ft. bgs. As from 14.8 ft. bgs. above.
22			12	DO	1,3, 5,3	1.2/2.0	0	18-20 ft. bgs. As above.
24	23.4-36.0' CLAYEY SILT		13	DO	3,6, 8,10	1.2/2.0	0	20-22 ft. bgs. Loose, gray, saturated coarse SAND.
26			14	DO	3,6, 10,10	1.7/2.0	0	22-24 ft. bgs. As above to 23.4 ft bgs. then loose, gray, moist CLAYEY SILT with trace gravel
28			15	DO	4,5, 5,8	1.0/2.0	0	24-26 ft. bgs. As above. 26-28 ft. bgs. As above.
30			16	DO	2,4, 6,9	1.6/2.0	0	28-30 ft bgs. As above. 30-32 ft. bgs. As above. 32-34 ft. bgs. As above.
32			17	DO	3,4, 5,8	1.8/2.0	0	34-36 ft. bgs. As above.
34			18	DO	4,6, 8,9	1.9/2.0	0	36-38 ft. bgs. As above to 37.8 ft. bgs then weathered gray SHALE.
36	36.0' - END OF AUGERING 37.8-38.0' WASHINGTONVILLE SHALE		19	DO	4,7, 12,22	1.7/2.0	0	
38	38.0' - END OF SAMPLING.							
40								
42								
44								
46								

APPENDIX E

Well Installation Logs

MONITORING WELL INSTALLATION LOG

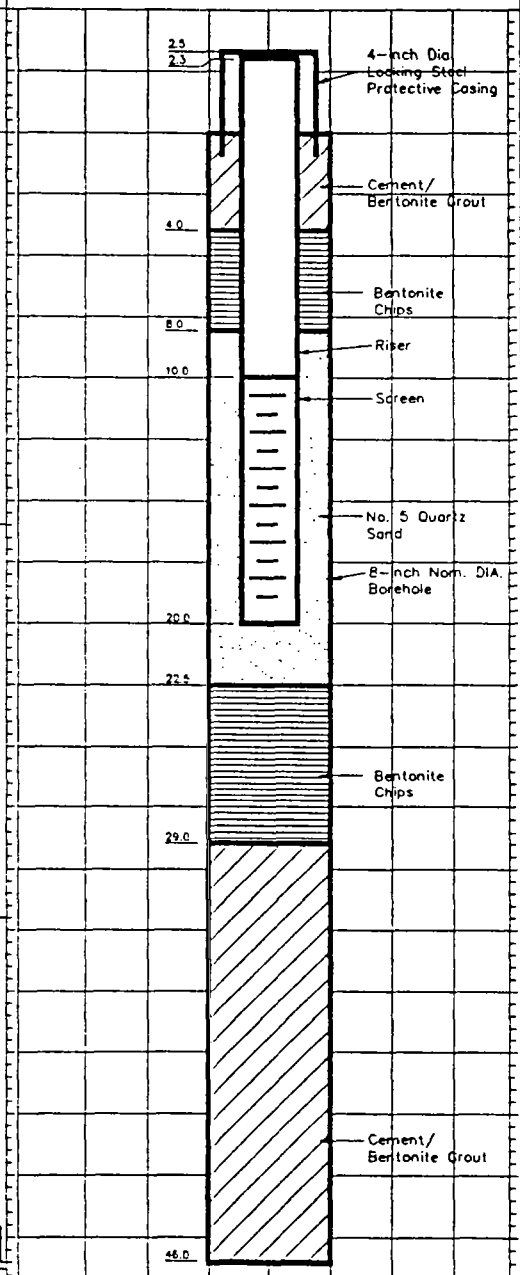
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-3-S SHEET 1 of 1
GA INSP M.LEMIEUX DRILLING METHOD 4 1/4-INCH ID HSA GROUND ELEV. 1197.0 WATER DEPTH 11 FEET
WEATHER SUNNY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.48 DATE/TIME 12/3/96
TEMP. 34F DRILL RIG CME-75 DRILLER D WRIGHT STARTED 1100 12/2/96 (TIME / DATE) COMPLETED 1500 12/2/96 (TIME / DATE)
LOCATION / COORDINATES N: 458642.28 E: 2444933.75

MATERIALS INVENTORY

WELL CASING 2 in. dia. 12 l.f. WELL SCREEN 2 in. dia. 10 l.f BENTONITE SEAL 3/8-INCH HOLEPLUG
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 550 LBS
GROUT QUANTITY ~50 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0–16.0' SAND AND SILT LAYERED TILL
5.0	
10.0	
15.0	
	16.0–32.0' SILT
20.0	
25.0	
30.0	
	32.0–46.0' SILTY SAND
35.0	
40.0	
45.0	46.0–46.2' WASHINGTONVILLE SHALE
	46.2' – End of Borehole.
50.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 55 gal. developed with dedicated HDPE bailer week of 12/8/96. Strong chemical odor. Persistent turbidity.

MONITORING WELL INSTALLATION LOG

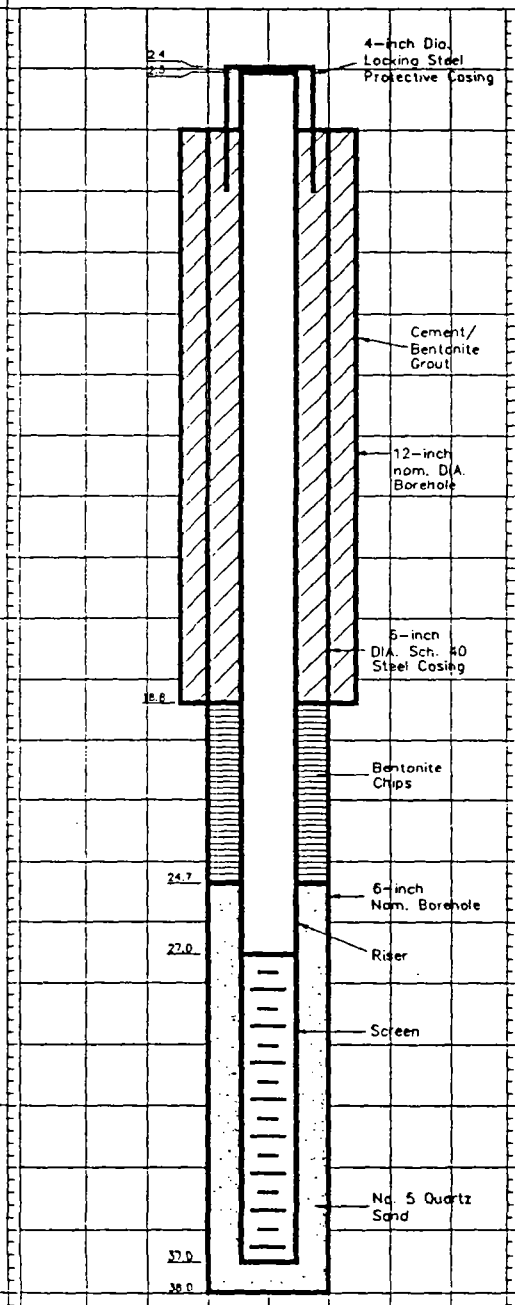
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-3-M SHEET 1 of 1
GA INSP V LEMIEUX DRILLING METHOD 8 1/4-INCH ID HSA, 6-INCH SSA GROUND ELEV. 1197.0 WATER DEPTH 11 FEET
WEATHER SUNNY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.47 DATE/TIME 12/3/96
TEMP 34°F DRILL RIG CME-75 DRILLER D. WRIGHT STARTED 1600 12/2/96 (TIME / DATE) COMPLETED 1005 12/4/96 (TIME / DATE)
LOCATION / COORDINATES N: 458654.68 E 2444931.68

MATERIALS INVENTORY

WELL CASING 2 in. dia. 29 l.f. WELL SCREEN 2 in. dia. 10 l.f. BENTONITE SEAL 3/8-INCH HOLEPLUG
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.
GROUT QUANTITY ~100 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-16.0' SAND AND SILT LAYERED TILL.
16.0	16.0-32.0' SILT
32.0	32.0-38.0' SILTY SAND
38.0	End of Borehole.

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 25 gal. developed with dedicated HDPE bailer week of 12/8/96. Slight chemical odor.

MONITORING WELL INSTALLATION LOG

JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-3-B SHEET 1 of 1

GA INSP M.LEMIEUX DRILLING METHOD 12 1/4,4 1/4-INCH ID HSA, 5 7/8-INCH ROTARY GROUND ELEV. 1197.0 WATER DEPTH 11 FEET

WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.04 DATE/TIME 12/3/96

TEMP. 40F DRILL RIG CME-75 DRILLER D. WRIGHT STARTED 930 12/3/96 (TIME / DATE) COMPLETED 1530 12/18/96 (TIME / DATE)

LOCATION / COORDINATES

MATERIALS INVENTORY

WELL CASING 2 in. dia. 60 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH HOLEPLUG

CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY

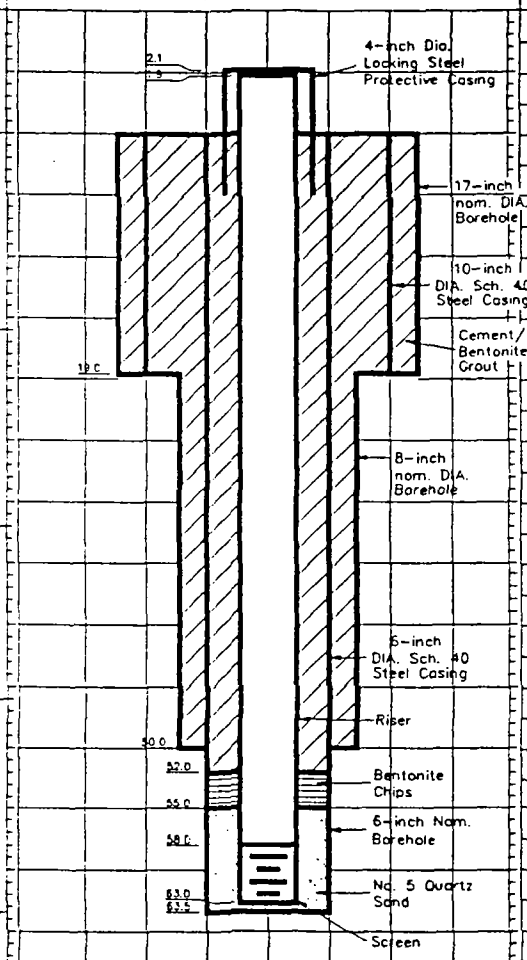
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.

GROUT QUANTITY 240 GAL CENTRALIZERS NONE FILTER PACK TYPE NO 5 QUARTZ SAND

GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-16.0' SAND AND SILT LAYERED TILL
10.0	
	16.0-32.0' SILT
20.0	
30.0	
	32.0-46.0' SILTY SAND
40.0	
	46.0-63.5' WASHINGTONVILLE SHALE
50.0	
60.0	
	63.5' End Of Borehole.
70.0	
80.0	
90.0	
100.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 30 gal. developed with dedicated HDPE bailer on 12/19/96.

MONITORING WELL INSTALLATION LOG

JOB NO 933-5154 PROJECT RNC/SALEM/OH WELL NO. PZ-4-S SHEET 1 of 1

GA INSP D. VEHN DRILLING METHOD 4 1/4-INCH ID HSA GROUND ELEV. 1191.5 WATER DEPTH

WEATHER SNOW DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1193.78 DATE/TIME

TEMP. 34F DRILL RIG CME-75 DRILLER D.WRIGHT STARTED 1315 12/9/96 (TIME / DATE) COMPLETED 1400 12/9/96 (TIME / DATE)

LOCATION / COORDINATES N: 458379.72 E: 2444793.33

MATERIALS INVENTORY

WELL CASING 2 in. dia. 9.5 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH CHIPS

CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY

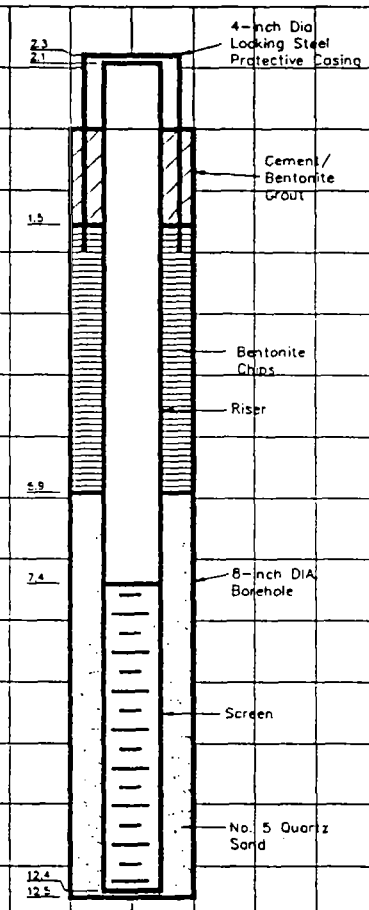
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.

GROUT QUANTITY 10 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND

GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	
	GROUND SURFACE
0.0	0.0--11.3' CLAYEY SILT TILL
2.0	
4.0	
6.0	
8.0	
10.0	
	11.3--12.5' SOFT CLAY
12.0	
	12.5' End of Borehole.
14.0	
16.0	
18.0	
20.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 15 gallons developed with dedicated HDPE bailer week of 12/8/96. Well bails dry-slow recovery (overnight).

MONITORING WELL INSTALLATION LOG

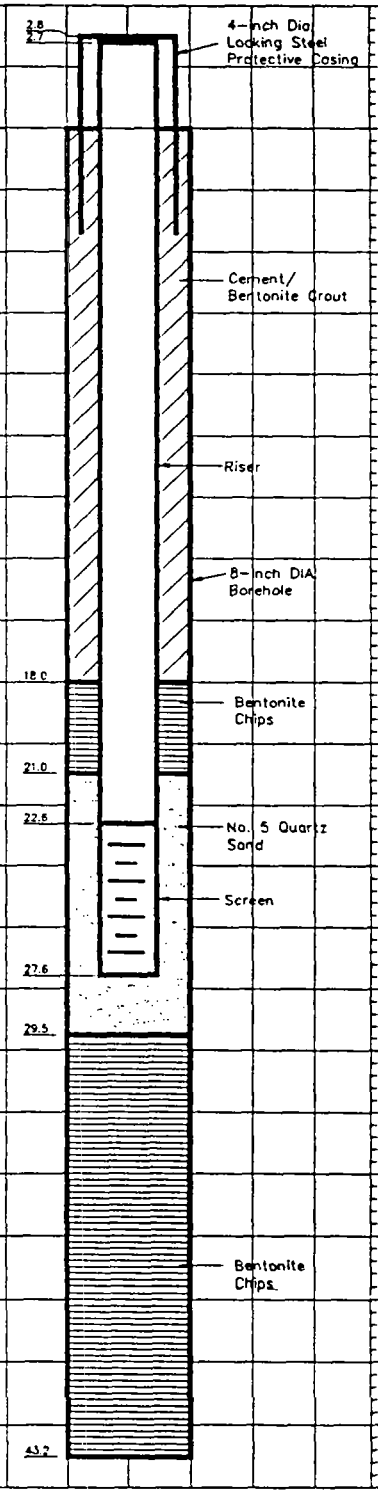
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-4-M SHEET 1 of 1
GA INSP. D WEHN DRILLING METHOD 4 1/4-INCH ID HSA GROUND ELEV. 1191.2 WATER DEPTH
WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1193.71 DATE/TIME
TEMP. 35°F DRILL RIG CME-75 DRILLER D.WRIGHT STARTED 1130 12/6/96 (TIME / DATE) COMPLETED 1430 12/6/96 (TIME / DATE)
LOCATION / COORDINATES N 458375.75 E: 2444798.10

MATERIALS INVENTORY

WELL CASING 2 in. dia. 25 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 300 LBS.
GROUT QUANTITY 30 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-11.3' CLAYEY SILT TILL
4.0	
8.0	
12.0	11.3-21.0' SOFT CLAY
16.0	
20.0	
24.0	21.0-28.0' SILT AND SAND
28.0	28.0-42.4' SILT
32.0	
36.0	
40.0	
	42.4-43.2' WASHINGTONVILLE SHALE
	43.2' End of Borehole.

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 30 gallons developed with dedicated HDPE bailer week of 12/8/96. Well still quite turbid.

MONITORING WELL INSTALLATION LOG

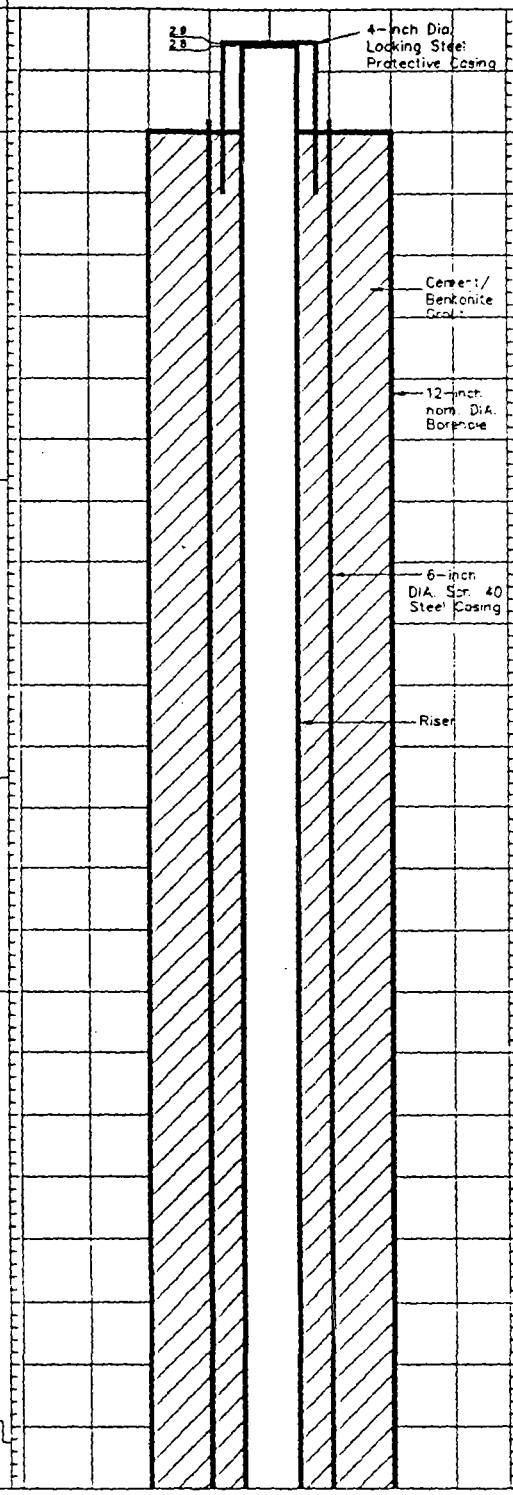
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-4-B SHEET 1 of 2
GA INSP D. WEHN DRILLING METHOD 8 1/4-INCH ID HSA GROUND ELEV. 1191.8 WATER DEPTH
WEATHER RAIN DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV 1194.56 DATE/TIME
TEMP. 35°F DRILL RIG CME-75 DRILLER D.WRIGHT STARTED 1000 12/17/96 (TIME / DATE) COMPLETED 1200 12/17/96 (TIME / DATE)
LOCATION / COORDINATES N: 458385.42 E: 2444789.74

MATERIALS INVENTORY

WELL CASING 2 in. dia. 58 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 300 LBS.
GROUT QUANTITY ~250 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-11.3' CLAYEY SILT TILL
4.0	
8.0	
12.0	11.3-21.0' SOFT CLAY
16.0	
20.0	
	21.0-28.0' SILT AND SAND
24.0	
28.0	28.0-42.4' SILT
32.0	
36.0	
40.0	
	42.4-45.0' WASHINGTONVILLE SHALE

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 25 gallons developed with dedicated HDPE bailer week of 12/15/96. Well clear.

MONITORING WELL INSTALLATION LOG

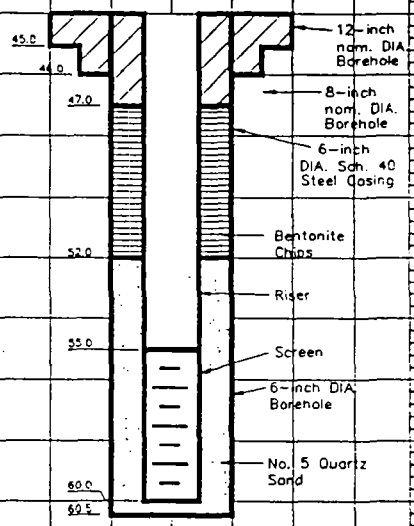
JOB NO. 933-6154 PROJECT RNC/SALAM/OH WELL NO. PZ-4-B SHEET 2 of 2
GA INSP. D WEHN DRILLING METHOD 8 1/4-INCH ID HSA GROUND ELEV. 1191.8 WATER DEPTH
WEATHER RAIN DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1194.56 DATE/TIME
TEMP. 35F DRILL RIG CME-75 DRILLER D.WRIGHT STARTED 1000 12/17/96 (TIME / DATE) COMPLETED 1200 12/17/96 (TIME / DATE)
LOCATION / COORDINATES N: 458385.42 E: 2444789.74

MATERIALS INVENTORY

WELL CASING 2 in. dia 58 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 300 LBS.
GROUT QUANTITY ~250 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
44.0	42.4-45.0' WASHINGTONVILLE SHALE
	45.0-60.5' MIDDLE KITTANNING SANDSTONE
48.0	
52.0	
56.0	
60.0	60.5' End of Borehole.
64.0	
68.0	
72.0	
76.0	
80.0	
84.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 25 gallons developed with dedicated HDPE bailer week of 12/15/96. Well clear.

MONITORING WELL INSTALLATION LOG

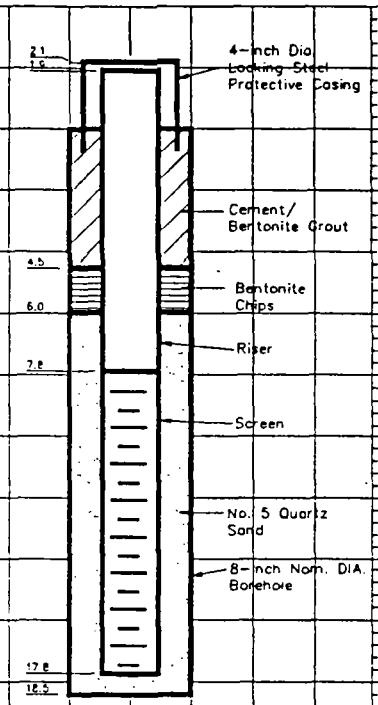
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-5-S SHEET 1 of 1
GA INSP M.LEMIEUX DRILLING METHOD 4 1/4-INCH ID HSA GROUND ELEV. 1197.3 WATER DEPTH
WEATHER SNOW DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.22 DATE/TIME
TEMP. 25°F DRILL RIG CME-75 DRILLER D.WRIGHT STARTED 1130 12/18/96 (TIME / DATE) COMPLETED 1320 12/18/96 (TIME / DATE)
LOCATION / COORDINATES N 458692.24 E: 2444266.90

MATERIALS INVENTORY

WELL CASING 2 in. dia. 10 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.
GROUT QUANTITY 20 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-7.0' SAND AND SILT LAYERED TILL
4.0	
8.0	7.0-18.5' SILT
12.0	
16.0	
20.0	18.5' - End of Borehole.
24.0	
28.0	
32.0	
36.0	
40.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 50 gal. developed with dedicated HDPE bailer week of 12/18/96.

MONITORING WELL INSTALLATION LOG

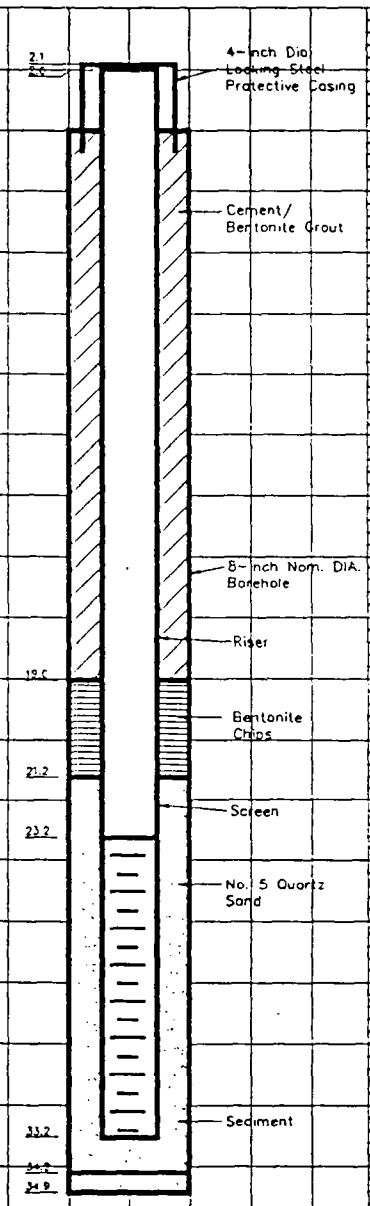
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO PZ-5-M SHEET 1 of 1
GA INSP M LEMIEUX DRILLING METHOD 8 1/4-INCH ID HSA GROUND ELEV. 1197.2 WATER DEPTH 11 FEET
WEATHER SUNNY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.27 DATE/TIME 12/3/96
TEMP. 34F DRILL RIG CME-75 DRILLER D WRIGHT STARTED 0815 11/21/96 (TIME / DATE) COMPLETED 1115 11/21/96 (TIME / DATE)
LOCATION / COORDINATES N 458683.40 E 2444263.33

MATERIALS INVENTORY

WELL CASING 2 in. dia. 25 l.f WELL SCREEN 2 in. dia. 10 l.f BENTONITE SEAL 3/8-INCH HOLEPLUG
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 450 LBS.
GROUT QUANTITY ~80 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0–7.0' SAND AND SILT LAYERED TILL
4.0	
8.0	7.0–32.6' SILT
12.0	
16.0	
20.0	
24.0	
28.0	
32.0	32.6–34.9' WASHINGTONVILLE SHALE
36.0	34.9' – End of Borehole.
40.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 100 gal. developed with dedicated HDPE bailer and suction pump week of 12/8/96. Well quite turbid.

MONITORING WELL INSTALLATION LOG

JOB NO. 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-5-B SHEET 1 of 1

GA INSP M LEMIEUX DRILLING METHOD 8 1/4-INCH ID HSA, 5 7/8-INCH ROTARY GROUND ELEV. 1197.2 WATER DEPTH 11 FEET

WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.25 DATE/TIME 12/3/96

TEMP. 40°F DRILL RIG CME-75 DRILLER D. WRIGHT STARTED 1350 12/16/96 (TIME / DATE) COMPLETED 1500 12/16/96 (TIME / DATE)

LOCATION / COORDINATES N: 458703.99 E: 2444276.16

MATERIALS INVENTORY

WELL CASING 2 in. dia. 62 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH HOLEPLUG

CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY

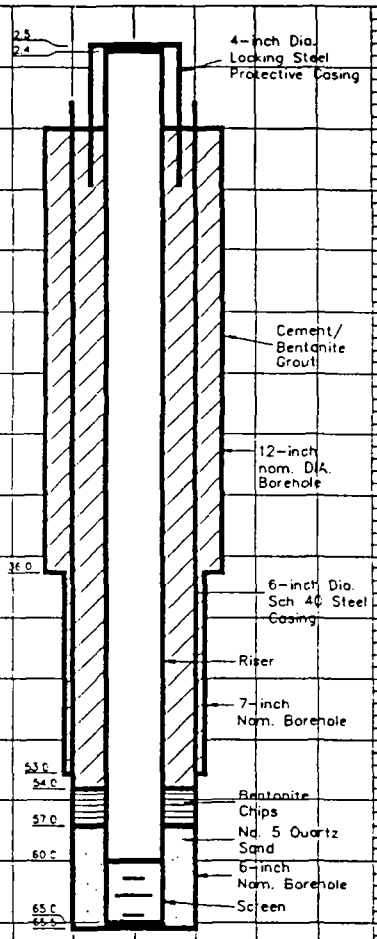
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.

GROUT QUANTITY ~300 GAL CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND

GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-7.0' SAND AND SILT LAYERED TILL
	7.0-32.6' SILT
10.0	
20.0	
30.0	
	32.6-50.0' WASHINGTONVILLE SHALE
40.0	
50.0	
	50.0-65.5' MIDDLE KITTANNING SANDSTONE
60.0	
	65.5' - End of Borehole.
70.0	
80.0	
90.0	
100.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 25 gal. developed with dedicated HDPE bailer week of 12/18/96.

MONITORING WELL INSTALLATION LOG

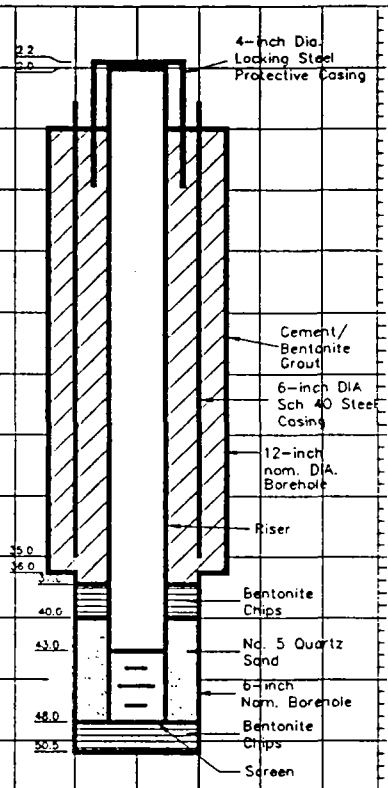
JOB NO. 933-5154 PROJECT RNC/SALEM/OH WELL NO. PZ-5-T SHEET 1 of 1
GA INSP. M LEMIEUX DRILLING METHOD 8 1/4-INCH ID HSA, 5 7/8-INCH ROTARY GROUND ELEV. 1197.3 WATER DEPTH 11 FEET
WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1199.14 DATE/TIME 12/3/96
TEMP 40F DRILL RIG CME-75 DRILLER D. WRIGHT STARTED 1350 12/16/96 (TIME / DATE) COMPLETED 1500 12/16/96 (TIME / DATE)
LOCATION / COORDINATES N: 458698.43 E: 2444270.84

MATERIALS INVENTORY

WELL CASING 2 in. dia. 45 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL 3/8-INCH HOLEPLUG
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.
GROUT QUANTITY ~200 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-7.0' SAND AND SILT LAYERED TILL
	7.0-32.6' SILT
10.0	
20.0	
30.0	
	32.6-50.0' WASHINGTONVILLE SHALE
40.0	
	50.0-50.5' MIDDLE KITTANNING SANDSTONE
50.0	50.5' - End of Borehole.
60.0	
70.0	
80.0	
90.0	
100.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 50 gal developed with dedicated HDPE bailer week of 12/18/96.

MONITORING WELL INSTALLATION LOG

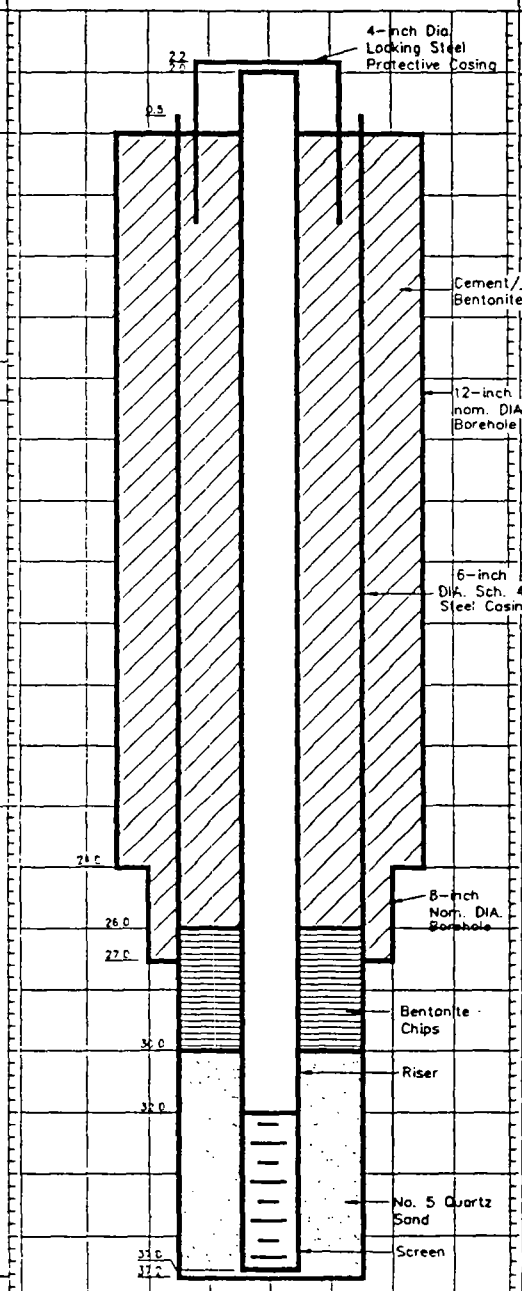
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-6B-U SHEET 1 of 1
GA INSP D WEHN DRILLING METHOD 8 1/4-INCH ID HSA, 5 7/8 ROTARY GROUND ELEV. 1172.0 WATER DEPTH
WEATHER SNOW DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1174.08 DATE/TIME
TEMP. 30°F DRILL RIG IR TH-60 DRILLER D.GLOBE STARTED 1330 11/26/96 (TIME / DATE) COMPLETED 1500 11/26/96 (TIME / DATE)
LOCATION / COORDINATES N: 459292.47 E: 2445150.94

MATERIALS INVENTORY

WELL CASING 2 in. dia. 34.3 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL MEDIUM CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 120 LBS.
GROUT QUANTITY ~150 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-7.4' SILTY CLAY TO CLAYEY SILT TILL
4.0	
8.0	7.4-8.7' FINE TO COARSE SAND
	8.7-22.0' WASHINGTONVILLE SHALE
12.0	
16.0	
20.0	
	22.0-37.2' MIDDLE KITTANNING SANDSTONE
24.0	
28.0	
32.0	
36.0	
	37.2' End of Borehole.
40.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 30 gal. developed with dedicated HDPE bailer week of 12/8/96.

MONITORING WELL INSTALLATION LOG

JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-6B-M SHEET 1 of 2

GA INSP. D. WEHN DRILLING METHOD 12 1/4-INCH ID HSA, 12 1/4 + 5 7/8 ROTARY GROUND ELEV. 1171.1 WATER DEPTH

WEATHER SUN DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1173.25 DATE/TIME

TEMP. 25F DRILL RIG IR TH-60 DRILLER D.GLOBE STARTED 800 12/3/96 (TIME / DATE) COMPLETED 1100 12/4/96 (TIME / DATE)

LOCATION / COORDINATES N 459296.41 E: 2445159.11

MATERIALS INVENTORY

WELL CASING 2 in. dia. 53.3 l.f. WELL SCREEN 2 in. dia 5 l.f. BENTONITE SEAL MEDIUM CHIPS

CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY

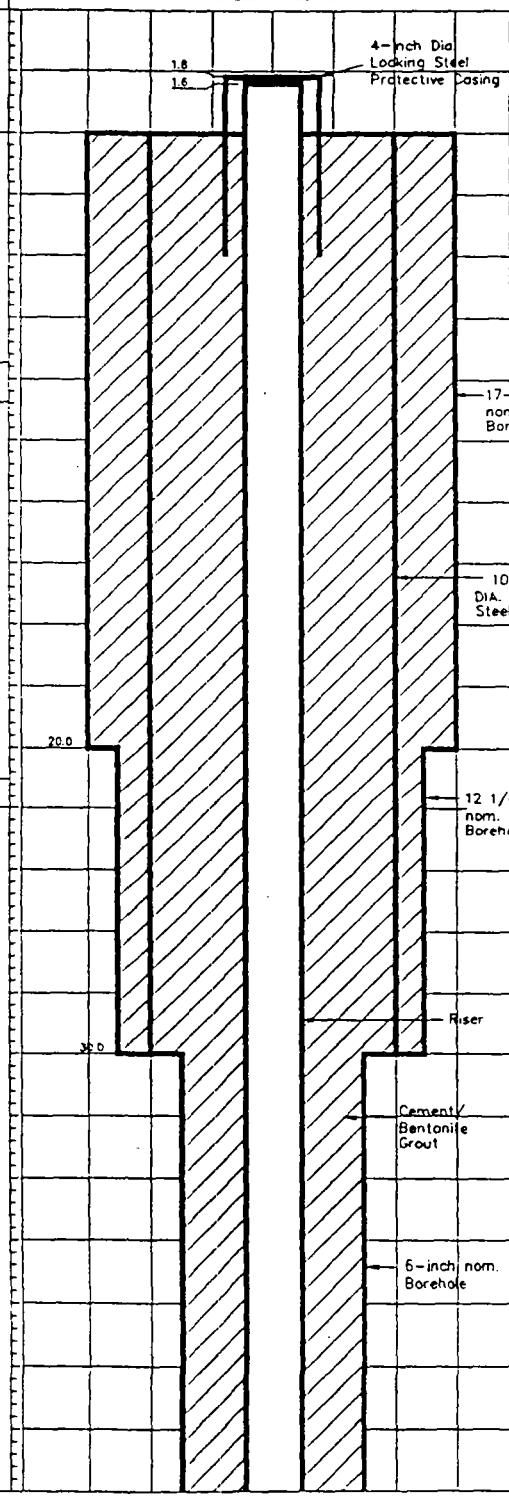
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 150 LBS.

GROUT QUANTITY ~350 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND

GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-7.4' SILTY CLAY TO CLAYEY SILT TILL
4.0	
8.0	7.4-8.7' FINE TO COARSE SAND
	8.7-21.0' WASHINGTONVILLE SHALE
12.0	
16.0	
20.0	
	21.0-22.0' COAL
	22.0-56.0' MIDDLE KITTANNING SANDSTONE
24.0	
28.0	
32.0	
36.0	
40.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 30 gal. developed with dedicated HDPE bailer week of 12/8/96.

MONITORING WELL INSTALLATION LOG

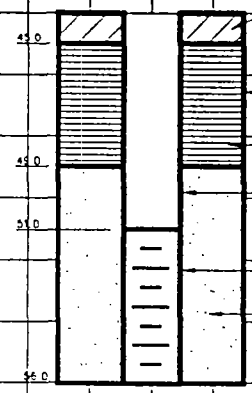
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-6B-M SHEET 2 of 2
GA INSP D WEHN DRILLING METHOD 12 1/4-INCH ID HSA, 12 1/4 + 5 7/8 ROTARY GROUND ELEV. 1171.1 WATER DEPTH
WEATHER SUN DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1173.25 DATE/TIME
TEMP. 25F DRILL RIG IR TH-60 DRILLER D.GLOBE STARTED 800 12/3/96 (TIME / DATE) COMPLETED 1100 12/4/96 (TIME / DATE)
LOCATION / COORDINATES N: 459296.41 E: 2445159.11

MATERIALS INVENTORY

WELL CASING 2 in. dia. 53.3 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL MEDIUM CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY 150 LBS.
GROUT QUANTITY ~350 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
44.0	22.0-56.0' MIDDLE KITTANNING SANDSTONE
48.0	
52.0	
56.0	56.0' - End of Borehole.
60.0	
64.0	
68.0	
72.0	
76.0	
80.0	
84.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 30 gal. developed with dedicated HDPE bailer week of 12/8/96.

MONITORING WELL INSTALLATION LOG

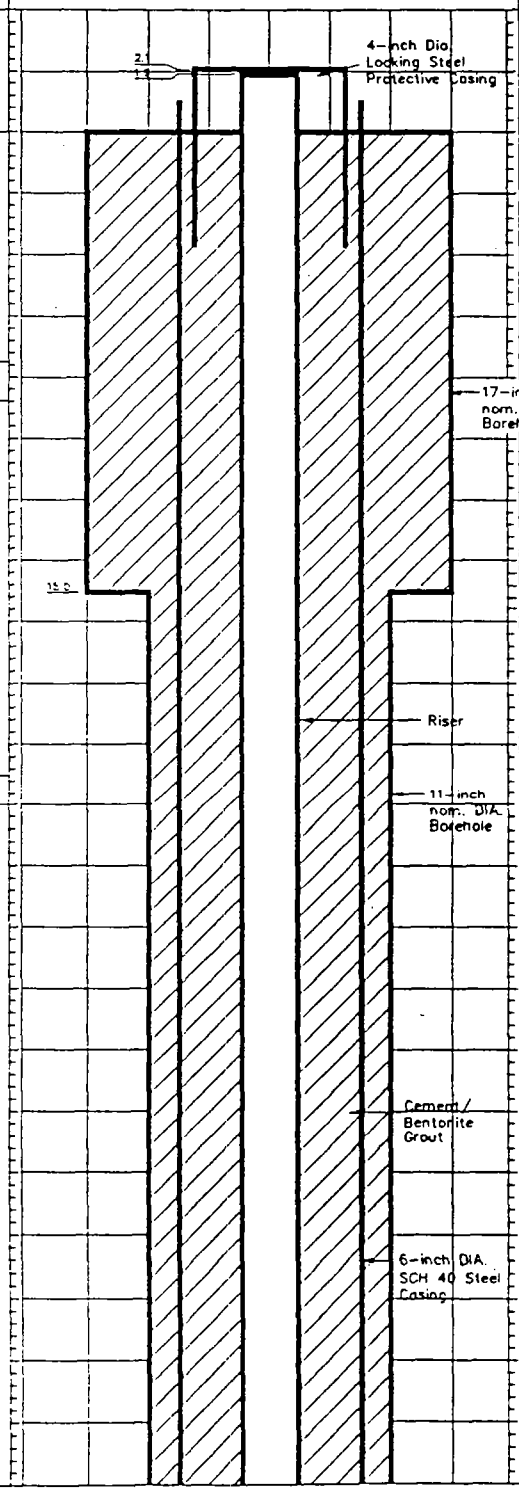
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-6B-L SHEET 1 of 2
GA INSP D. WEHN DRILLING METHOD 12 1/4-INCH ID HSA, 11 + 5 7/8-INCH ROTARY GROUND ELEV. 1170.1 WATER DEPTH
WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1172.34 DATE/TIME
TEMP. 40F DRILL RIG. IR TH-60 DRILLER D.GLOBE STARTED 1330 12/5/96 (TIME / DATE) COMPLETED 1530 12/5/96 (TIME / DATE)
LOCATION / COORDINATES N 459302.18 E: 2445169.16

MATERIALS INVENTORY

WELL CASING 2 in dia. 59 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL MEDIUM CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 150 LBS.
GROUT QUANTITY ~400 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT / 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-7.4' SILTY CLAY TO CLAYEY SILT TILL
4.0	
8.0	7.4-8.7' FINE TO COARSE SAND
	8.7-21.0' WASHINGTONVILLE SHALE
12.0	
16.0	
20.0	
	21.0-22.0' COAL
	22.0-67.2' MIDDLE KITTANNING SANDSTONE
24.0	
28.0	
32.0	
36.0	
40.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 25 gal. developed with dedicated HDPE bailer week of 12/8/96.

MONITORING WELL INSTALLATION LOG

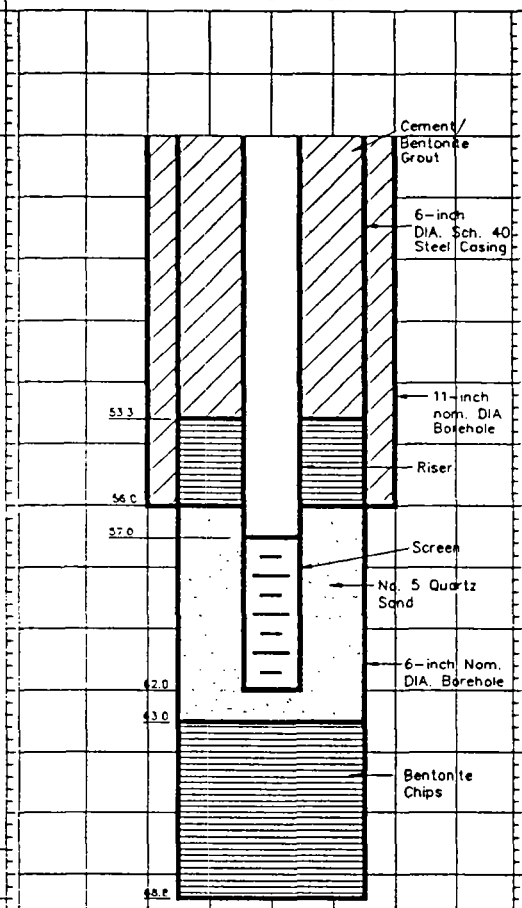
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-6B-L SHEET 2 of 2
GA INSP. D. WEHN DRILLING METHOD 12 1/4-INCH ID HSA, 11 + 5 7/8-INCH ROTARY GROUND ELEV. 1170.1 WATER DEPTH
WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1172.34 DATE/TIME
TEMP. 40F DRILL RIG IR TH-60 DRILLER D.GLOBE STARTED 1330 12/5/96 (TIME / DATE) COMPLETED 1530 12/5/96 (TIME / DATE)
LOCATION / COORDINATES N: 459302.18 E: 2445169.16

MATERIALS INVENTORY

WELL CASING 2 in. dia. 59 l.f. WELL SCREEN 2 in. dia. 5 l.f. BENTONITE SEAL MEDIUM CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 150 LBS.
GROUT QUANTITY ~400 GAL. CENTRALIZERS NONE FILTER PACK TYPE NO. 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
44.0	22.0-67.2' MIDDLE KITTANNING SANDSTONE
48.0	
52.0	
56.0	
60.0	
64.0	
68.0	67.2'-68.8' COLUMBIANA SHALE
	68.8' – End of Borehole.
72.0	
76.0	
80.0	
84.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 25 gal. developed with dedicated HDPE bailer week of 12/8/96.

MONITORING WELL INSTALLATION LOG

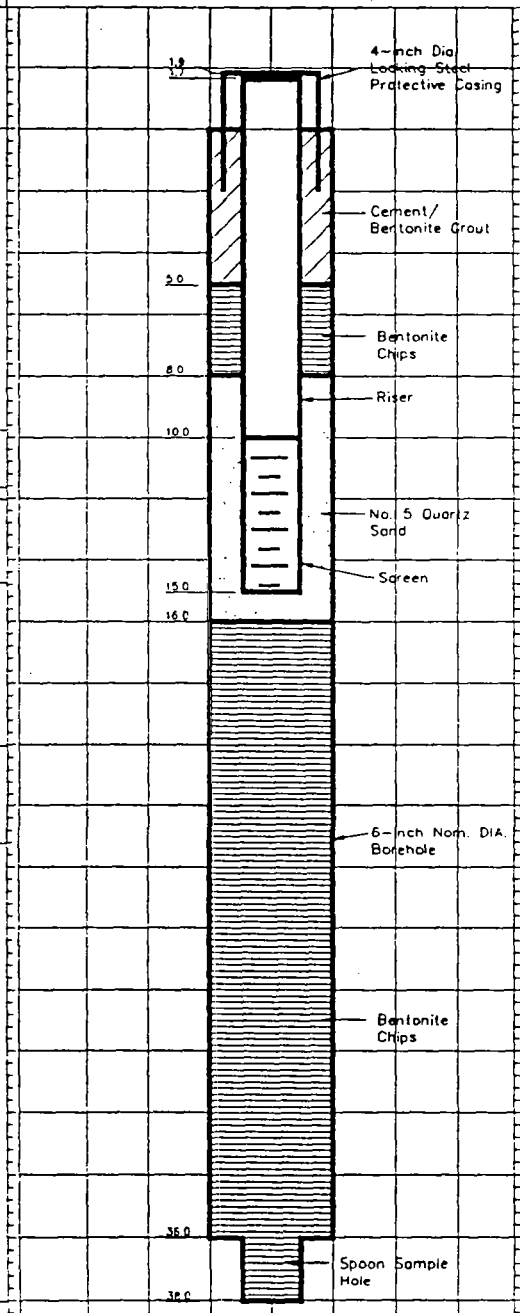
JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. PZ-7 SHEET 1 of 1
GA INSP. D. WEHN DRILLING METHOD 4 1/4-INCH ID HSA GROUND ELEV. 1190.9 WATER DEPTH
WEATHER SNOW DRILLING COMPANY SPROWLS DRILLING CO. COLLAR ELEV. 1192.54 DATE/TIME
TEMP. 25°F DRILL RIG CME-75 DRILLER D.WRIGHT STARTED 1130 12/18/96 (TIME / DATE) COMPLETED 1300 12/18/96 (TIME / DATE)
LOCATION / COORDINATES N: 458461.68 E: 2444633.62

MATERIALS INVENTORY

WELL CASING 2 in. dia. 12 l.f. WELL SCREEN 2 in. dia. 5 l.f BENTONITE SEAL 3/8-INCH CHIPS
CASING TYPE TYPE 304 STAINLESS SCREEN TYPE CONTINUOUS WRAP INSTALLATION METHOD GRAVITY
JOINT TYPE FLUSH THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. 175 LBS.
GROUT QUANTITY ~30 GAL CENTRALIZERS NONE FILTER PACK TYPE NO 5 QUARTZ SAND
GROUT TYPE 90% CEMENT/ 10% BENTONITE DRILLING MUD TYPE NA INSTALLATION METHOD GRAVITY

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	0.0-9.6' CLAYEY SILT
4.0	
8.0	
	9.6-11.6' SAND
	11.6-12.0' CLAY
12.0	12.0-14.8' SAND
	14.8-20.0' CLAY
16.0	
20.0	20.0-23.4' SAND
24.0	23.4-38.0' CLAYEY SILT
28.0	
32.0	
36.0	
	38.0' WASHINGTONVILLE SHALE End of Borehole.
40.0	

WELL SKETCH



INSTALLATION NOTES

SEE FIELD BORING LOG FOR DRILLING NOTES.

WELL DEVELOPMENT NOTES

Approx. 30 gal. developed by dedicated HDPE bailer on 12/19/96.

APPENDIX F

Groundwater Analytical Results

ANALYTICAL CHEMISTRY RESULTS

TCL Volatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-3-B		Sample Point PZ-3-M		Sample Point PZ-3-S		Sample Point PZ-4-B		Sample Point PZ-4-M	
	Lab ID: L13491-14		Lab ID: L13491-13		Lab ID: L13491-12		Lab ID: L13491-11		Lab ID: L13491-10	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Chloromethane	10	U	10	U	10	U	10	U	10	U
Bromomethane	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	10	U	10	U	2600		10	U	10	U
Chloroethane	10	U	10	U	10	U	10	U	10	U
Methylene Chloride	5	U	5	U	2	J	5	U	5	U
Acetone	10	U	10	U	850	J	10	U	10	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	300	J	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U
Total 1,2-Dichloroethene	5	U	5	U	3600		5	U	5	U
Chloroform	5	U	5	U	34		5	U	5	U
1,2-Dichloroethane	5	U	5	U	4900		5	U	5	U
2-Butanone	10	U	10	U	10	U	10	U	10	U
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U
Vinyl Acetate	10	U	10	U	10	U	10	U	10	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U
Trichloroethene	5	U	2	J	6400		5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	19		5	U	5	U
Benzene	5	U	5	U	4200		5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	U	5	U	320	J	5	U	5	U
Toluene	5	U	5	U	580		5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	130		5	U	5	U
Chlorobenzene	5	U	5	U	680		5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U
Total Xylenes	5	U	5	U	3	J	5	U	5	U

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Volatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-4-S		Sample Point PZ-5-B		Sample Point PZ-5-M		Sample Point PZ-5-S		Sample Point PZ-5-T	
	Lab ID: L13491-9		Lab ID: L13491-8		Lab ID: L13491-6		Lab ID: L13491-5		Lab ID: L13491-7	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Chloromethane	10	U	10	U	10	U	10	U	10	U
Bromomethane	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U
Chloroethane	10	U	10	U	10	U	10	U	10	U
Methylene Chloride	5	U	5	U	5	U	5	U	5	U
Acetone	10	U	10	U	10	U	10	U	10	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U
Total 1,2-Dichloroethene	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U
2-Butanone	10	U	10	U	10	U	10	U	10	U
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U
Vinyl Acetate	10	U	10	U	10	U	10	U	10	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U
Trichloroethene	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U
Benzene	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U
Total Xylenes	5	U	5	U	5	U	2	J	5	U

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Volatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-6-BL		Sample Point PZ-6-BM		Sample Point PZ-6-BU		Sample Point PZ-7		Sample Point	
	Lab ID: L13491-3		Lab ID: L13491-2		Lab ID: L13491-1		Lab ID: L13491-15		Lab ID:	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled:	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor:	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Chloromethane	10	U	10	U	10	U	10	U		
Bromomethane	10	U	10	U	10	U	10	U		
Vinyl Chloride	4	J	10	U	100		14			
Chloroethane	10	U	10	U	10	U	10	U		
Methylene Chloride	4	J	5	U	53		2	J		
Acetone	22		15		110		10	U		
Carbon Disulfide	5	U	5	U	2	J	5	U		
1,1-Dichloroethene	7		5	U	85		6			
1,1-Dichloroethane	5	U	5	U	5	U	5	U		
Total 1,2-Dichloroethene	400		69		25000		190			
Chloroform	5	U	5	U	23		120			
1,2-Dichloroethane	490		29		5900		1300			
2-Butanone	10	U	10	U	10	U	10	U		
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U		
Carbon Tetrachloride	5	U	5	U	5	U	11			
Vinyl Acetate	10	U	10	U	10	U	10	U		
Bromodichloromethane	5	U	5	U	5	U	5	U		
1,2-Dichloropropane	5	U	5	U	3	J	5	U		
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U		
Trichloroethene	1800		210		52000		2700			
Dibromochloromethane	5	U	5	U	5	U	5	U		
1,1,2-Trichloroethane	5	U	5	U	31		37			
Benzene	1800		150		21000		33			
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U		
Bromoform	5	U	5	U	5	U	5	U		
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U		
2-Hexanone	10	U	10	U	10	U	10	U		
Tetrachloroethene	3700		380		170000		3200			
Toluene	34		2	J	2900		10			
1,1,2,2-Tetrachloroethane	28		4	J	12000		1900			
Chlorobenzene	12		1	J	420	J	590			
Ethylbenzene	5	U	5	U	18	N	4	JN		
Styrene	3	J	5	U	39		5	U		
Total Xylenes	5	U	5	U	20		6			
	6593				289,261		~~10117~~			
	8304						10123			

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

(value) - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Semivolatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-3-B		Sample Point PZ-3-M		Sample Point PZ-3-S		Sample Point PZ-4-B		Sample Point PZ-4-M	
	Lab ID: L13491-14		Lab ID: L13491-13		Lab ID: L13491-12		Lab ID: L13491-11		Lab ID: L13491-10	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Phenol	10	U	10	U	13		2	J	10	U
bis(2-Chloroethyl)ether	10	U	10	U	10	U	10	U	10	U
2-Chlorophenol	10	U	10	U	2	J	10	U	10	U
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	100		10	U	10	U
Benzyl alcohol	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	9100		10	U	10	U
2-Methylphenol	10	U	10	U	10	U	10	U	10	U
2,2'-Oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U
N-Nitroso-di-n-propylamine	10	U	10	U	10	U	10	U	10	U
Hexachloroethane	10	U	10	U	10	U	10	U	10	U
Nitrobenzene	10	U	10	U	10	U	10	U	10	U
Isophorone	10	U	10	U	10	U	10	U	10	U
2-Nitrophenol	10	U	10	U	10	U	10	U	10	U
2,4-Dimethylphenol	10	U	10	U	10	U	10	U	10	U
Benzoic acid	50	U	50	U	50	U	50	U	50	U
bis(2-Chloroethoxy)Methane	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	7	J	10	U	10	U
1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	2	J	10	U	10	U
4-Chloroaniline	50	U	50	U	50	U	50	U	50	U
Hexachlorobutadiene	10	U	10	U	10	U	10	U	10	U
4-Chloro-3-Methylphenol	10	U	10	U	10	U	10	U	10	U
2-Methylnaphthalene	10	U	10	U	10	U	10	U	10	U
Hexachlorocyclopentadiene	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U
2,4,5-Trichlorophenol	50	U	50	U	50	U	50	U	50	U
2-Chloronaphthalene	10	U	10	U	10	U	10	U	10	U
2-Nitroaniline	50	U	50	U	50	U	50	U	50	U
Dimethyl Phthalate	10	U	10	U	10	U	10	U	10	U
Acenaphthylene	10	U	10	U	10	U	10	U	10	U
2,6-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U
3-Nitroaniline	50	U	50	U	50	U	50	U	50	U
Acenaphthene	10	U	10	U	10	U	10	U	10	U
2,4-Dinitrophenol	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ
4-Nitrophenol	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ
Dibenzofuran	10	U	10	U	10	U	10	U	10	U

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Semivolatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-3-B		Sample Point PZ-3-M		Sample Point PZ-3-S		Sample Point PZ-4-B		Sample Point PZ-4-M	
	Lab ID: L13491-14		Lab ID: L13491-13		Lab ID: L13491-12		Lab ID: L13491-11		Lab ID: L13491-10	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
2,4-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U
Diethylphthalate	10	U	10	U	10	U	10	U	10	U
4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U	10	U
Fluorene	10	U	10	U	10	U	10	U	10	U
4-Nitroaniline	50	U	50	U	50	U	50	U	50	U
4,6-Dinitro-2-methylphenol	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ
N-Nitrosodiphenylamine	10	U	10	U	10	U	10	U	10	U
4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U	10	U
Hexachlorobenzene	10	U	10	U	10	U	10	U	10	U
Pentachlorophenol	50	R	50	R	50	R	50	R	50	R
Phenanthrene	10	U	10	U	10	U	10	U	10	U
Anthracene	10	U	10	U	10	U	10	U	10	U
Di-n-butylphthalate	10	U	10	U	10	U	10	U	10	U
Fluoranthene	10	U	10	U	10	U	10	U	10	U
Pyrene	10	U	10	U	10	U	10	U	10	U
Butylbenzylphthalate	10	U	10	U	10	U	10	U	10	U
3,3'-Dichlorobenzidine	20	U	20	U	20	U	20	U	20	U
Benzo(a)Anthracene	10	U	10	U	10	U	10	U	10	U
Chrysene	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)Phthalate	10	U	16	U	11	U	10	U	10	U
Di-n-Octyl Phthalate	10	U	10	U	10	U	10	U	10	U
Benzo(b)Fluoranthene	10	U	10	U	10	U	10	U	10	U
Benzo(k)Fluoranthene	10	U	10	U	10	U	10	U	10	U
Benzo(a)Pyrene	10	U	10	U	10	U	10	U	10	U
Indeno(1,2,3-cd)Pyrene	10	U	10	U	10	U	10	U	10	U
Dibenz(a,h)Anthracene	10	U	10	U	10	U	10	U	10	U
Benzo(g,h,i)Perylene	10	U	10	U	10	U	10	U	10	U

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

(value) - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Semivolatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-4-S		Sample Point PZ-5-B		Sample Point PZ-5-M		Sample Point PZ-5-S		Sample Point PZ-5-T	
	Lab ID: L13491-9		Lab ID: L13491-8		Lab ID: L13491-6		Lab ID: L13491-5		Lab ID: L13491-7	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Phenol	10	U	10	U	10	U	10	U	10	U
bis(2-Chloroethyl)ether	10	U	10	U	10	U	10	U	10	U
2-Chlorophenol	10	U	10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
Benzyl alcohol	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U
2-Methylphenol	10	U	10	U	10	U	10	U	10	U
2,2'-Oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U
N-Nitroso-di-n-propylamine	10	U	10	U	10	U	10	U	10	U
Hexachloroethane	10	U	10	U	10	U	10	U	10	U
Nitrobenzene	10	U	10	U	10	U	10	U	10	U
Isophorone	10	U	10	U	10	U	10	U	10	U
2-Nitrophenol	10	U	10	U	10	U	10	U	10	U
2,4-Dimethylphenol	10	U	10	U	10	U	10	U	10	U
Benzoic acid	50	U	50	U	50	U	50	U	50	U
bis(2-Chloroethoxy)Methane	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	10	U	10	U	10	U
4-Chloroaniline	50	U	50	U	50	U	50	U	50	U
Hexachlorobutadiene	10	U	10	U	10	U	10	U	10	U
4-Chloro-3-Methylphenol	10	U	10	U	10	U	10	U	10	U
2-Methylnaphthalene	10	U	10	U	10	U	10	U	10	U
Hexachlorocyclopentadiene	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U
2,4,5-Trichlorophenol	50	U	50	U	50	U	50	U	50	U
2-Chloronaphthalene	10	U	10	U	10	U	10	U	10	U
2-Nitroaniline	50	U	50	U	50	U	50	U	50	U
Dimethyl Phthalate	10	U	10	U	10	U	10	U	10	U
Acenaphthylene	10	U	10	U	10	U	10	U	10	U
2,6-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U
3-Nitroaniline	50	U	50	U	50	U	50	U	50	U
Acenaphthene	10	U	10	U	10	U	10	U	10	U
2,4-Dinitrophenol	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ
4-Nitrophenol	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ
Dibenzofuran	10	U	10	U	10	U	10	U	10	U

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Semivolatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-4-S		Sample Point PZ-5-B		Sample Point PZ-5-M		Sample Point PZ-5-S		Sample Point PZ-5-T	
	Lab ID: L13491-9		Lab ID: L13491-8		Lab ID: L13491-6		Lab ID: L13491-5		Lab ID: L13491-7	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
2,4-Dinitrotoluene	10	U	10	U	10	U	10	U	10	U
Diethylphthalate	10	U	10	U	2	J	10	U	10	U
4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U	10	U
Fluorene	10	U	10	U	10	U	10	U	10	U
4-Nitroaniline	50	U	50	U	50	U	50	U	50	U
4,6-Dinitro-2-methylphenol	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ
N-Nitrosodiphenylamine	10	U	10	U	10	U	10	U	10	U
4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U	10	U
Hexachlorobenzene	10	U	10	U	10	U	10	U	10	U
Pentachlorophenol	50	R	50	R	50	R	50	R	50	R
Phenanthrene	10	U	10	U	10	U	10	U	10	U
Anthracene	10	U	10	U	10	U	10	U	10	U
Di-n-butylphthalate	10	U	10	U	4	J	10	U	10	U
Fluoranthene	10	U	10	U	10	U	10	U	10	U
Pyrene	10	U	10	U	10	U	10	U	10	U
Butylbenzylphthalate	10	U	10	U	10	U	10	U	10	U
3,3'-Dichlorobenzidine	20	U	20	U	20	U	20	U	20	U
Benzo(a)Anthracene	10	U	10	U	10	U	10	U	10	U
Chrysene	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)Phthalate	15	U	10	U	68		10	U	10	U
Di-n-Octyl Phthalate	10	U	10	U	10	U	10	U	10	U
Benzo(b)Fluoranthene	10	U	10	U	10	U	10	U	10	U
Benzo(k)Fluoranthene	10	U	10	U	10	U	10	U	10	U
Benzo(a)Pyrene	10	U	10	U	10	U	10	U	10	U
Indeno(1,2,3-cd)Pyrene	10	U	10	U	10	U	10	U	10	U
Dibenz(a,h)Anthracene	10	U	10	U	10	U	10	U	10	U
Benzo(g,h,i)Perylene	10	U	10	U	10	U	10	U	10	U

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

TCL Semivolatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-6-BL		Sample Point PZ-6-BM		Sample Point PZ-6-BU		Sample Point PZ-7		Sample Point	
	Lab ID: L13491-3		Lab ID: L13491-2		Lab ID: L13491-1		Lab ID: L13491-15		Lab ID:	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled:	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor:	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Phenol	10	U	10	U	10	U	10	U		
bis(2-Chloroethyl)ether	10	U	10	U	10	U	10	U		
2-Chlorophenol	10	U	10	U	10	U	10	U		
1,3-Dichlorobenzene	10	U	10	U	10	U	10	U		
1,4-Dichlorobenzene	10	U	10	U	81		10	U		
Benzyl alcohol	10	U	10	U	25		10	U		
1,2-Dichlorobenzene	160	N	24	U	12000		940			
2-Methylphenol	10	U	10	U	10	U	10	U		
2,2'-Oxybis(1-Chloropropane)	10	U	10	U	10	U	10	U		
4-Methylphenol	10	U	10	U	10	U	10	U		
N-Nitroso-di-n-propylamine	10	U	10	U	10	U	10	U		
Hexachloroethane	10	U	10	U	10	J	3	J		
Nitrobenzene	10	U	10	U	10	U	10	U		
Isophorone	10	U	10	U	10	U	10	U		
2-Nitrophenol	10	U	10	U	10	U	10	U		
2,4-Dimethylphenol	10	U	10	U	10	U	10	U		
Benzoic acid	50	U	50	U	140		50	U		
bis(2-Chloroethoxy)Methane	10	U	10	U	10	U	10	U		
2,4-Dichlorophenol	2	J	10	U	57		10	U		
1,2,4-Trichlorobenzene	10	U	10	U	2	J	10	U		
Naphthalene	10	U	10	U	4	J	10	U		
4-Chloroaniline	50	U	50	U	50	U	50	U		
Hexachlorobutadiene	10	U	10	U	8	J	10	U		
4-Chloro-3-Methylphenol	10	U	10	U	10	U	10	U		
2-Methylnaphthalene	10	U	10	U	10	U	10	U		
Hexachlorocyclopentadiene	10	UJ	10	UJ	10	UJ	10	UJ		
2,4,6-Trichlorophenol	10	U	10	U	17		10	U		
2,4,5-Trichlorophenol	50	U	50	U	50	U	50	U		
2-Chloronaphthalene	10	U	10	U	10	U	10	U		
2-Nitroaniline	50	U	50	U	50	U	50	U		
Dimethyl Phthalate	10	U	10	U	10	U	10	U		
Acenaphthylene	10	U	10	U	10	U	10	U		
2,6-Dinitrotoluene	10	U	10	U	10	U	10	U		
3-Nitroaniline	50	U	50	U	50	U	50	U		
Acenaphthene	10	U	10	U	10	U	10	U		
2,4-Dinitrophenol	50	UJ	50	UJ	50	UJ	50	UJ		
4-Nitrophenol	50	UJ	50	UJ	50	UJ	50	UJ		
Dibenzofuran	10	U	10	U	10	U	10	U		

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL C STRY RESULTS

TCL Semivolatile Organics

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-6-BL		Sample Point PZ-6-BM		Sample Point PZ-6-BU		Sample Point PZ-7		Sample Point	
	Lab ID: L13491-3		Lab ID: L13491-2		Lab ID: L13491-1		Lab ID: L13491-15		Lab ID:	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled:	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor:	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
2,4-Dinitrotoluene	10	U	10	U	10	U	10	U		
Diethylphthalate	1	J	10	U	10	U	10	U		
4-Chlorophenyl-phenylether	10	U	10	U	10	U	10	U		
Fluorene	10	U	10	U	10	U	10	U		
4-Nitroaniline	50	U	50	U	50	U	50	U		
4,6-Dinitro-2-methylphenol	50	UJ	50	UJ	50	UJ	50	UJ		
N-Nitrosodiphenylamine	10	U	10	U	10	U	10	U		
4-Bromophenyl-phenylether	10	U	10	U	10	U	10	U		
Hexachlorobenzene	10	U	10	U	10	U	10	U		
Pentachlorophenol	50	R	50	R	50	R	50	R		
Phenanthrene	10	U	10	U	10	U	10	U		
Anthracene	10	U	10	U	10	U	10	U		
Di-n-butylphthalate	10	U	10	U	10	U	10	U		
Fluoranthene	10	U	10	U	10	U	10	U		
Pyrene	10	U	10	U	10	U	10	U		
Butylbenzylphthalate	10	U	10	U	10	U	10	U		
3,3'-Dichlorobenzidine	20	U	20	U	20	U	20	U		
Benzo(a)Anthracene	10	U	10	U	10	U	10	U		
Chrysene	10	U	10	U	10	U	10	U		
bis(2-Ethylhexyl)Phthalate	10	U	10	U	10	U	10	U		
Di-n-Octyl Phthalate	10	U	10	U	10	U	10	U		
Benzo(b)Fluoranthene	10	U	10	U	10	U	10	U		
Benzo(k)Fluoranthene	10	U	10	U	10	U	10	U		
Benzo(a)Pyrene	10	U	10	U	10	U	10	U		
Indeno(1,2,3-cd)Pyrene	10	U	10	U	10	U	10	U		
Dibenz(a,h)Anthracene	10	U	10	U	10	U	10	U		
Benzo(g,h,i)Perylene	10	U	10	U	10	U	10	U		

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CH[illegible]STRY RESULTS

MPK

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-3-B		Sample Point PZ-3-M		Sample Point PZ-3-S		Sample Point PZ-4-B		Sample Point PZ-4-M	
	Lab ID: L13491-14		Lab ID: L13491-13		Lab ID: L13491-12		Lab ID: L13491-11		Lab ID: L13491-10	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Mirex	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Photomirex	0.004	U	0.004	U	0.004	U	0.004	U	0.004	U
Kepone	0.04	R	0.04	R	0.04	R	0.04	R	0.04	R

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

(value) - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

MPK

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-4-S		Sample Point PZ-5-B		Sample Point PZ-5-M		Sample Point PZ-5-S		Sample Point PZ-5-T	
	Lab ID: L13491-9		Lab ID: L13491-8		Lab ID: L13491-6		Lab ID: L13491-5		Lab ID: L13491-7	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Mirex	0.142		0.036		0.015		0.002	U	0.031	
Photomirex	0.03		0.004	U	0.004	U	0.004	U	0.004	U
Kepone	0.04	R	0.04	R	0.04	R	0.04	R	0.04	R

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL C[redacted]ISTRY RESULTS

MPK

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-6-BL		Sample Point PZ-6-BM		Sample Point PZ-6-BU		Sample Point PZ-7		Sample Point	
	Lab ID: L13491-3		Lab ID: L13491-2		Lab ID: L13491-1		Lab ID: L13491-15		Lab ID:	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled:	
	Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor: 1.0		Dilution Factor:	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Mirex	0.002	U	0.141		0.459		0.002	U		
Photomirex	0.004	U	0.123		0.106		0.004	U		
Kepone	0.04	R	0.04	R	0.04	R	0.04	R		

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CH[illegible]STRY RESULTS

Dissolved Metals

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-3-B		Sample Point PZ-3-M		Sample Point PZ-3-S		Sample Point PZ-4-B		Sample Point PZ-4-M	
	Lab ID: L13491-14D		Lab ID: L13491-13D		Lab ID: L13491-12D		Lab ID: L13491-11D		Lab ID: L13491-10D	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Aluminum	62.4		97.4		76.9		85.3		59.7	U
Antimony	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U
Arsenic	0.29		13.59		30.96		4.7		9.02	
Barium	78.73		102.93		120.91		79.35		104.56	
Beryllium	0.47	U	0.47	U	0.47	U	0.47	U	0.47	U
Cadmium	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U
Calcium	117500		55620		138000		16760		77630	
Chromium	121.63		2.96		6.44		53.53		1.31	
Cobalt	0.43		0.36	U	2.76		0.94		0.6	
Copper	6.7	U	6.7	U	6.7	U	17.8		6.7	U
Iron	63		205.4		129.9		109.6		40	
Lead	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U
Magnesium	90.5		12730		43750		232.6		20370	
Manganese	0.51		49.31		1879.79		0.58		132.78	
Mercury	0.38		0.03	U	0.03	U	0.03	U	0.03	U
Nickel	2.4		2.54		14.3		4.82		11.27	
Potassium	256700		3241		1543		217100		2703	
Selenium	0.62		0.33	U	0.33	U	0.33	U	0.33	U
Silver	0.72	UJ	0.72	UJ	0.72	UJ	0.72	UJ	0.72	UJ
Sodium	50630		16670		53450		51660		13040	
Thallium	0.15	U	0.15	U	0.15	U	0.23		0.15	U
Vanadium	0.36	U	1		1.79		0.36	U	0.36	U
Zinc	1.18		1.09		2.34		1.55		2.93	
Cyanide										

Notes:

All units are µg/l.

The Qual column indicates the qualifier appliec to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

Dissolved Metals

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-4-S		Sample Point PZ-5-B		Sample Point PZ-5-M		Sample Point PZ-5-S		Sample Point PZ-5-T	
	Lab ID: L13491-9D		Lab ID: L13491-8D		Lab ID: L13491-6D		Lab ID: L13491-5D		Lab ID: L13491-7D	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Aluminum	225		59.7	U	59.7	U	128.1		59.7	U
Antimony	0.95	U	0.95	U	0.95	U	0.95	U	0.95	U
Arsenic	7.96		3.44		8.66		1.13		2.57	
Barium	84.12		55.5		53.19		48.35		67.11	
Beryllium	0.47	U	0.47	U	0.47	U	0.47	U	0.47	U
Cadmium	0.64	U	0.64	U	0.64	U	0.64	U	0.64	U
Calcium	196000		59800		99230		142900		64310	
Chromium	7.87		3.46		3.51		5.22		3.38	
Cobalt	2.1		1.49		0.54		2.46		0.36	U
Copper	6.7	U	6.7	U	6.7	U	6.7	U	6.7	U
Iron	574.1		64.1		64.8		281.2		130.4	
Lead	0.19	U	0.19	U	0.19	U	0.19	U	0.19	U
Magnesium	55990		11540		27350		34110		15800	
Manganese	487.41		270.91		120.06		999.84		195.46	
Mercury	0.03	U	0.03	U	0.11		0.18		0.54	
Nickel	25.26		10		4.55		8.99		5.44	
Potassium	4903		4274		2887		2453		4825	
Selenium	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Silver	0.72	UJ	0.72	UJ	0.72	UJ	0.72	UJ	0.72	UJ
Sodium	23610		7230		10060		49150		7901	
Thallium	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U
Vanadium	2.08		0.79		0.88		1.33		0.81	
Zinc	4.84		10.25		0.86		3.3		5.37	
Cyanide										

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

Dissolved Metals

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-6-BL		Sample Point PZ-6-BM		Sample Point PZ-6-BU		Sample Point PZ-7		Sample Point	
	Lab ID: L13491-3D		Lab ID: L13491-2D		Lab ID: L13491-1D		Lab ID: L13491-15D		Lab ID:	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled:	
	Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor:	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Aluminum	59.7	U	59.7	U	59.7	U	104.4			
Antimony	1.86		0.95	U	0.95	U	0.95	U		
Arsenic	3.79		3.5		12	J	6.54			
Barium	105.78		169.29		174.37		53.46			
Beryllium	0.47	U	0.47	U	0.47	U	0.47	U		
Cadmium	0.64	U	0.64	U	0.64	U	0.64	U		
Calcium	124300		209200		232400		98370			
Chromium	3.2		4.1		6.84		5.46			
Cobalt	0.36	U	0.47		1.24		3.55			
Copper	6.7	U	6.7	U	6.7	U	6.7	U		
Iron	67		23.2		21.4		242			
Lead	0.19	U	0.19	U	0.19	U	0.19	U		
Magnesium	24270		47400		64030		24510			
Manganese	124		151.44		339.24		2688.33			
Mercury	0.03	U	0.03	U	0.03	U	0.03	U		
Nickel	6.27		14.25		34.76		40.5			
Potassium	38840		7257		15760		2218			
Selenium	0.33	U	0.33	U	0.33	U	0.33	U		
Silver	0.72	UJ	0.72	UJ	0.72	UJ	0.72	UJ		
Sodium	39120		24860		51430		62650			
Thallium	0.15	U	0.15	U	0.15	U	0.15	U		
Vanadium	0.89		1.12		1.43		1.52			
Zinc	2.83		0.61		2.3		3.69			
Cyanide										

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
. - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

Total Metals

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-3-B		Sample Point PZ-3-M		Sample Point PZ-3-S		Sample Point PZ-4-B		Sample Point PZ-4-M	
	Lab ID: L13491-14		Lab ID: L13491-13		Lab ID: L13491-12		Lab ID: L13491-11		Lab ID: L13491-10	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Aluminum	494.9		52400		26270		7548		1891	
Antimony	0.95	U	4.75	U	4.75	U	0.95	U	0.95	U
Arsenic	0.52		45.96		64.57		8.26		6.96	
Barium	83.74		586.35		241.9		328.98		91.01	
Beryllium	0.47	U	3.97		2.35	U	1.63		0.47	U
Cadmium	0.64	U	3.2	U	3.2	U	0.68		0.64	U
Calcium	151100		110950		181300		440000		78370	
Chromium	180.7		123.71		50.93		122.85		2.74	
Cobalt	1.8		74.03		35.39		14.76		2.18	
Copper	61.4		132		61		78.2		6.7	U
Iron	1052		158450		89000		10700		3767	
Lead	2.08		89.44		42.95		14.84		3.99	
Magnesium	3358		41285		60400		34660		21170	
Manganese	38.66		2654.32		3017.38		776.09		159.92	
Mercury	1.04		1.87		3.79		0.71		0.2	
Nickel	44.65		164.47		88.77		198.42		17.41	
Potassium	261100		13470		17590		271900		3297	
Selenium	0.47		1.65	U	1.65	U	0.33	U	0.33	U
Silver	0.72	UJ	3.6	UJ	3.6	UJ	0.72	UJ	0.72	UJ
Sodium	52640		26575		63900		59720		16330	
Thallium	0.15	U	1.27		1.39		0.86		0.15	U
Vanadium	0.36	U	72.72		37.66		3.15		1.82	
Zinc	34.21		404.87		213.55		65.59		17.64	
Cyanide										

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

(value) - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CH[illegible]MISTRY RESULTS

Total Metals

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-4-S		Sample Point PZ-5-B		Sample Point PZ-5-M		Sample Point PZ-5-S		Sample Point PZ-5-T	
	Lab ID: L13491-9		Lab ID: L13491-8		Lab ID: L13491-6		Lab ID: L13491-5		Lab ID: L13491-7	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96	
	Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Aluminum	165050		184.7		3111		15000		5595	
Antimony	4.75	U	0.95	U	0.95	U	0.95	U	0.95	U
Arsenic	63.39		2.61		12.34		11.67		5.87	
Barium	1104.94		61.51		47.55		91.26		195.47	
Beryllium	8.77		0.47	U	0.47	U	0.9		1.06	
Cadmium	4.7		0.64	U	0.64	U	0.64	U	0.64	U
Calcium	386550		60290		108900		151900		70170	
Chromium	249.26		4.73		6.83		25.53		27.46	
Cobalt	195.52		2.06		3.49		17.3		9.86	
Copper	379.5		25.2		6.7	U	32.9		75.3	
Iron	464600		1154		8116		42170		15750	
Lead	297.89		2.32		3.94		20.9		15.45	
Magnesium	155550		11570		28890		40790		17970	
Manganese	10877.33		292.74		227.6		1271.92		434.9	
Mercury	2.29		0.39		0.53		37.88		0.53	
Nickel	424.08		16.46		11.48		47.43		89.57	
Potassium	21950		4297		3242		4662		12530	
Selenium	2.34		0.33	U	0.33	U	0.6		0.36	
Silver	3.6	UJ	0.72	UJ	0.72	UJ	0.72	UJ	0.72	UJ
Sodium	28575		7314		11170		53980		9613	
Thallium	3.19		0.15	U	0.15	U	0.26		0.36	
Vanadium	195.05		0.36		4.1		21.26		5.8	
Zinc	941.18		22.87		25.46		92.5		63.64	
Cyanide										

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

{value} - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

ANALYTICAL CHEMISTRY RESULTS

Total Metals

Matrix: Groundwater

Nease Site, Salem, Ohio

	Sample Point PZ-6-BL		Sample Point PZ-6-BM		Sample Point PZ-6-BU		Sample Point PZ-7		Sample Point	
	Lab ID: L13491-3		Lab ID: L13491-2		Lab ID: L13491-1		Lab ID: L13491-15		Lab ID:	
	Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled: 12/20/96		Date Sampled:	
	Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor: NA		Dilution Factor:	
	Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: NA %		Percent Solids: %	
Parameter	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Aluminum	2062		192.3		260.5		54250			
Antimony	1.34		0.95	U	0.95	U	4.75	U		
Arsenic	4.96		2.3		10.04	J	67.28			
Barium	214.71		229.38		192.88		342.1			
Beryllium	0.47	U	0.47	U	0.47	U	3.59			
Cadmium	0.64	U	0.64	U	0.64	U	3.2	U		
Calcium	145900		221100		232200		176250			
Chromium	10.05		5.07		9.81		90.53			
Cobalt	3.39		0.99		2.21		73.63			
Copper	8.4		6.7	U	6.7	U	149			
Iron	8575		980		1900		179450			
Lead	5.51		0.4		1.48		126.04			
Magnesium	29210		51090		72430		60800			
Manganese	412.19		288.85		476.35		4767.15			
Mercury	1.15		2.75		0.35		2.5			
Nickel	19.68		24.84		49.34		194.94			
Potassium	46730		9234		26620		20225			
Selenium	0.33	U	0.33	U	0.33	U	1.65	U		
Silver	1.56	J	0.72	UJ	0.72	UJ	3.6	UJ		
Sodium	46390		28560		60490		65100			
Thallium	0.15	U	0.15	U	0.15	U	1.2			
Vanadium	1.56		0.36		0.36	U	83.8			
Zinc	35.63		11.32		19.72		497.82			
Cyanide										

Notes:

All units are µg/l.

The Qual column indicates the qualifier applied to the result following data validation:

(value) - Acceptable (Quantitative) Data
J - Estimated (Subquantitative) Data
UJ - Not Detected / Estimated Data
U - Not Detected / Quantitative Data
R - Unusable Data
N -

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

January 9, 1997

RECEIVED
JAN 10 1997
GOLDER-NJ

Mr. Todd Rees
GOLDER ASSOCIATES, INC.
305 Fellowship Road
Mt. Laurel, NJ 08054

Episode: 28073.01

Dear Mr. Rees:

Please find the enclosed analytical results for your sample received in our laboratory on December 24, 1996.

If, in your review, you should have any questions or require additional information, do not hesitate to call.

Sincerely,

Jayant Shringarpure, Ph.D.
Technical Director

JS/llr

Enclosures

1700 WEST ALBANY • BROKEN ARROW, OK 74012-1421 • (918) 251-2858 • FAX (918) 251-2599

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office: 918-251-2858 • Fax 918-251-2599

TM

SAMPLING FIRM	CLIENT CONTACT	PHONE NUMBER
GOLDER ASSOC.	TODD REES	609-273-1110

P.O. or PROPOSAL NUMBER	PROJECT NAME
933-6154	RNC / SALEM / OH

SAMPLER: (Signature) [signature]

ANALYTICAL TESTS REQUESTED

SAMPLE ID	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	DIVIN/FORAN								REMARKS
MONY	12/20/96	16:40		X	DECON PAD FAUCET	WATER	4	X								

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[signature]	12/23/96	13:30	

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 FOR LABORATORY BY: (Signature)
	12/24/96	10:10	[signature]

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)

REMARKS: 5°C

[SR012-1192-03]

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 West Albany • Broken Arrow, Oklahoma 74012 • Office (918) 251-2858 • Fax (918) 251-2599

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

METHODOLOGY

SM = Standard Methods, 17th Edition, 1989
EPA = #EPA600/4-79-020, March 1983
SW = EPA Methodology, "#SW846", 3rd Edition, July, 1992

GENERAL QUALIFIER FLAGS

B - Analyte is detected in blank as well as sample.
J - Estimated value: concentration is below limit of quantitation
T - Trace Amount
U - Not detected above quantitation limit
> - Concentration greater than value reported
E - Compound exceeds calibration range
D - Sample dilution run or surrogates diluted out sample run at secondary dilution
I - Not quantifiable due to matrix interference
* - Surrogate outside of QC limits on both original and re-analysis

TEST SPECIFIC FOOTNOTES

TPH 8015

1 - Analysis shows miscellaneous peaks which cannot be identified as any specific pattern. Response factor for nearest eluting hydrocarbon standard was used to calculate concentration. Numbers indicate the approximate carbon chain length.
2 - Pattern is similar to, but not identical to standard.
3 - May be a weathered gasoline.

APPENDIX IX SEMIVOLATILES

1 - Detected as Diphenylamine
2 - Coelute on GC Column

TCLP SEMIVOLATILES

1 - 2-Methyl Phenol
2 - Compounds Co-elute (3&4-Methylphenol)
3 - Combination of O,M, & P Cresols

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.
MUNY(DECON PAD

Lab Name: Southwest Lab. of Oklahoma Episode No.: 28073

Lab Code: SWL Case No.: SDG No.: Lab Sample ID: 28073.01

Client Name: Golder Sample Wt/Vol: 1000 g or mL: mL

Matrix (aqueous/solid/leachate): aqueous Initial Calibration Date: 07/10/96

Sample Receipt Date: 12/24/96 Instrument ID: AutoSpec

Ext. Date: 01/02/97 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):2.00 Sample Data Filename: A102685#3

Analysis Date: 4-JAN-97 Time: 13:50:30 Blank Data Filename: A102685#4

Dilution Factor: 1 Cal. Ver. Data Filename: A102682#12

Concentration Units (pg/L or ng/Kg dry weight): pg/L % Moisture:

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	-	2.393	U	*	*	1.07
1,2,3,7,8-PeCDD	-	8.326	U	*	*	1.09
1,2,3,4,7,8-HxCDD	-	3.207	U	*	*	0.66
1,2,3,6,7,8-HxCDD	-	2.065	U	*	*	1.03
1,2,3,7,8,9-HxCDD	-	2.249	U	*	*	0.95
1,2,3,4,6,7,8-HpCDD	-	2.734	U	*	*	1.00
OCDD	-	1.306	U	*	*	1.17
2,3,7,8-TCDF	-	2.183	U	*	*	0.90
1,2,3,7,8-PeCDF	-	2.757	U	*	*	0.94
2,3,4,7,8-PeCDF	-	2.764	U	*	*	0.93
1,2,3,4,7,8-HxCDF	-	1.885	U	*	*	1.02
1,2,3,6,7,8-HxCDF	-	1.477	U	*	*	1.31
1,2,3,7,8,9-HxCDF	-	2.136	U	*	*	0.90
2,3,4,6,7,8-HxCDF	-	1.931	U	*	*	1.00
1,2,3,4,6,7,8-HpCDF	2.642	1.459	XB	0.76	1.001	1.39
1,2,3,4,7,8,9-HpCDF	-	1.743	U	*	*	1.16
OCDF	-	2.015	U	*	*	1.34
Total Tetra-Dioxins	-	2.393	U			
Total Penta-Dioxins	-	8.326	U			
Total Hexa-Dioxins	-	2.065	U			
Total Hepta-Dioxins	-	2.734	U			
Total Tetra-Furans	-	2.183	U			
Total Penta-Furans	-	2.764	U			
Total Hexa-Furans	-	1.477	U			
Total Hepta-Furans	-	1.459	U			

(1) Qualifier U indicates not detected; The X & I indicates EMPC. The C needs value from second column analysis. The B indicates possible blank contamination.
(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND
CLEANUP STANDARD RECOVERIES

CLIENT ID.

MUNY(DECON PAD

Lab Name: Southwest Lab. of Oklahoma Episode No.: 28073

Lab Code: SWL Case No.: SDG No.: Lab Sample ID: 28073.01

Client Name: Golder Sample Wt/Vol: 1000 g or mL: mL

Matrix (aqueous/solid/leachate): aqueous Initial Calibration Date: 07/10/96

Sample Receipt Date: 12/24/96 Instrument ID: AutoSpec

Ext. Date: 01/02/97 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 2.00 Sample Data Filename: A102685#3

Analysis Date: 4-JAN-97 Time: 13:50:30 Blank Data Filename: A102685#4

Dilution Factor: 1 Cal. Ver. Data Filename: A102682#12

Concentration Units (pg/L or ng/Kg dry weight): pg/L % Moisture:

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS						
13C-2,3,7,8-TCDD	1000	743.58	74.36	0.79	1.012	1.29
13C-1,2,3,7,8-PeCDD	1000	641.37	64.14	1.67	1.286	1.19
13C-1,2,3,6,7,8-HxCDD	2500	2221.20	88.85	1.29	0.991	0.96
13C-1,2,3,4,6,7,8-HpCDD	2500	2468.50	98.74	1.05	1.079	0.99
13C-OCDD	5000	4988.30	99.77	0.91	1.161	0.75
13C-2,3,7,8-TCDF	1000	795.37	79.54	0.79	0.969	2.35
13C-1,2,3,7,8-PeCDF	1000	642.78	64.28	1.55	1.224	2.35
13C-1,2,3,4,7,8-HxCDF	2500	2239.22	89.57	0.52	0.964	1.12
13C-1,2,3,4,6,7,8-HpCDF	2500	2459.37	98.37	0.44	1.052	0.93
CLEANUP STANDARD						
37Cl-2,3,7,8-TCDD	800				1.013	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.

DFBLK

Lab Name: Southwest Lab. of Oklahoma Episode No.: 28073

Lab Code: SWL Case No.: SDG No.: Lab Sample ID: BL0102WA

Client Name: Golder Sample Wt/Vol: 1000 g or mL: mL

Matrix (aqueous/solid/leachate): aqueous Initial Calibration Date: 07/10/96

Sample Receipt Date: Instrument ID: AutoSpec

Ext. Date: 01/02/97 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):2.00 Sample Data Filename: A102685#4

Analysis Date: 4-JAN-97 Time: 14:39:27 Blank Data Filename: A102685#4

Dilution Factor: 1 Cal. Ver. Data Filename: A102682#13

Concentration Units (pg/L or ng/Kg dry weight): pg/L % Moisture:

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	-	2.457	U	*	*	1.07
1,2,3,7,8-PeCDD	-	5.775	U	*	*	1.09
1,2,3,4,7,8-HxCDD	-	2.271	U	*	*	0.66
1,2,3,6,7,8-HxCDD	-	1.462	U	*	*	1.03
1,2,3,7,8,9-HxCDD	-	1.592	U	*	*	0.95
1,2,3,4,6,7,8-HpCDD	-	2.044	U	*	*	1.00
OCDD	2.286	2.685		0.87	1.000	1.17
2,3,7,8-TCDF	-	2.133	U	*	*	0.90
1,2,3,7,8-PeCDF	-	1.667	U	*	*	0.94
2,3,4,7,8-PeCDF	-	1.672	U	*	*	0.93
1,2,3,4,7,8-HxCDF	-	1.345	U	*	*	1.02
1,2,3,6,7,8-HxCDF	-	1.055	U	*	*	1.31
1,2,3,7,8,9-HxCDF	-	1.524	U	*	*	0.90
2,3,4,6,7,8-HxCDF	-	1.379	U	*	*	1.00
1,2,3,4,6,7,8-HpCDF	2.355	1.167	X	0.78	1.000	1.39
1,2,3,4,7,8,9-HpCDF	-	1.394	U	*	*	1.16
OCDF	-	2.819	U	*	*	1.34
Total Tetra-Dioxins	-	2.457	U			
Total Penta-Dioxins	-	5.775	U			
Total Hexa-Dioxins	-	1.462	U			
Total Hepta-Dioxins	-	2.044	U			
Total Tetra-Furans	-	2.133	U			
Total Penta-Furans	-	1.672	U			
Total Hexa-Furans	-	1.055	U			
Total Hepta-Furans	-	1.167	U			

(1) Qualifier U indicates not detected; The X & I indicates EMPC. The C needs value from second column analysis. The B indicates possible blank contamination.
(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND
CLEANUP STANDARD RECOVERIES

CLIENT ID.

DFBLK

Lab Name: Southwest Lab. of Oklahoma Episode No.: 28073

Lab Code: SWL Case No.: SDG No.: Lab Sample ID: BL0102WA

Client Name: Golder Sample Wt/Vol: 1000 g or mL: mL

Matrix (aqueous/solid/leachate): aqueous Initial Calibration Date: 07/10/96

Sample Receipt Date: Instrument ID: AutoSpec

Ext. Date: 01/02/97 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 2.00 Sample Data Filename: A102685#4

Analysis Date: 4-JAN-97 Time: 14:39:27 Blank Data Filename: A102685#4

Dilution Factor: 1 Cal. Ver. Data Filename: A102682#13

Concentration Units (pg/L or ng/Kg dry weight): pg/L % Moisture:

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS						
13C-2,3,7,8-TCDD	1000	776.16	77.62	0.76	1.012	1.29
13C-1,2,3,7,8-PeCDD	1000	633.54	63.35	1.59	1.286	1.19
13C-1,2,3,6,7,8-HxCDD	2500	2288.81	91.55	1.26	0.991	0.96
13C-1,2,3,4,6,7,8-HpCDD	2500	2472.40	98.90	1.02	1.079	0.99
13C-OCDD	5000	4992.93	99.86	0.91	1.161	0.75
13C-2,3,7,8-TCDF	1000	785.36	78.54	0.78	0.970	2.35
13C-1,2,3,7,8-PeCDF	1000	649.11	64.91	1.54	1.224	2.35
13C-1,2,3,4,7,8-HxCDF	2500	2282.15	91.29	0.53	0.964	1.12
13C-1,2,3,4,6,7,8-HpCDF	2500	2494.82	99.79	0.45	1.052	0.93
CLEANUP STANDARD						
37Cl-2,3,7,8-TCDD	800				1.014	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

AATS/SWOK
PCDD/PCDF SPIKED SAMPLE SUMMARY

EPA SAMPLE NO.

Lab Name: SOUTHWEST LAB. OF OKLAHOMA Contract: LCS
Client: GOLDER Case No: SAS No.: SDG No.: 28073
Matrix: AQUEOUS (aqueous/solid/leachate)

CONCENTRATION UNITS: (pg/L or ng/Kg) pg/L

ANALYTE	SPIKE ADDED (PG)	SPIKED SAMPLE CONCENT.	SAMPLE CONCENTRAT.	% REC #	QC LIMITS
2378-TCDD	200	180.475	0.000	90.2	50-150
12378-PeCDD	500	477.574	0.000	95.5	50-150
123478-HxCDD	500	480.582	0.000	96.1	50-150
123678-HxCDD	500	468.034	0.000	93.6	50-150
123789-HxCDD	500	455.705	0.000	91.1	50-150
1234678-HpCDD	500	461.714	0.000	92.3	50-150
OCDD	1000	843.379	0.000	84.3	50-150
2378-TCDF	200	185.621	0.000	92.8	50-150
12378-PeCDF	500	475.808	0.000	95.2	50-150
23478-PeCDF	500	519.727	0.000	103.9	50-150
123478-HxCDF	500	468.077	0.000	93.6	50-150
123678-HxCDF	500	463.077	0.000	92.6	50-150
123789-HxCDF	500	495.653	0.000	99.1	50-150
234678-HxCDF	500	466.676	0.000	93.3	50-150
1234678-HpCDF	500	452.427	0.000	90.5	50-150
1234789-HpCDF	500	471.858	0.000	94.4	50-150
OCDF	1000	811.551	0.000	81.2	50-150

Form 1

PCDD/PCDF ANALYSIS DATA SHEET
Use for Sample and Blank Results

CLIENT ID.

LCS

Lab Name: Southwest Lab. of Oklahoma Episode No.: 28073

Lab Code: SWL Case No.: SDG No.: Lab Sample ID: LC0102WA

Client Name: Golder Sample Wt/Vol: 1000 g or mL: mL

Matrix (aqueous/solid/leachate): aqueous Initial Calibration Date: 07/10/96

Sample Receipt Date: Instrument ID: AutoSpec

Ext. Date: 01/02/97 GC Column:DB-5

Ext. Vol(ul):20.0 Inj. Vol(ul):2.00 Sample Data Filename: A102686#3

Analysis Date: 4-JAN-97 Time: 17:07:24 Blank Data Filename: A102685#4

Dilution Factor: 1 Cal. Ver. Data Filename: A102682#13

Concentration Units (pg/L or ng/Kg dry weight): pg/L % Moisture:

ANALYTE	CONCENTRATION FOUND	DETECTION LIMIT	Qual. (1)	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
2,3,7,8-TCDD	180.475	7.251		0.77	1.001	1.07
1,2,3,7,8-PeCDD	477.574	10.830		1.78	1.000	1.09
1,2,3,4,7,8-HxCDD	480.582	7.116		1.24	0.998	0.66
1,2,3,6,7,8-HxCDD	468.034	4.582		1.21	1.000	1.03
1,2,3,7,8,9-HxCDD	455.705	4.989		1.17	1.009	0.95
1,2,3,4,6,7,8-HpCDD	461.714	3.604		1.11	1.000	1.00
OCDD	843.379	7.310		0.88	1.000	1.17
2,3,7,8-TCDF	185.621	6.907		0.86	1.001	0.90
1,2,3,7,8-PeCDF	475.808	4.302		1.53	1.000	0.94
2,3,4,7,8-PeCDF	519.727	4.313		1.54	1.035	0.93
1,2,3,4,7,8-HxCDF	468.141	3.943		1.22	1.000	1.02
1,2,3,6,7,8-HxCDF	463.077	3.090		1.18	1.004	1.31
1,2,3,7,8,9-HxCDF	495.653	4.467		1.16	1.044	0.90
2,3,4,6,7,8-HxCDF	466.676	4.040		1.21	1.021	1.00
1,2,3,4,6,7,8-HpCDF	452.427	4.596		1.07	1.000	1.39
1,2,3,4,7,8,9-HpCDF	471.858	5.491		1.01	1.035	1.16
OCDF	811.551	6.928		0.89	1.003	1.34
Total Tetra-Dioxins	180.475	7.251				
Total Penta-Dioxins	477.574	10.830				
Total Hexa-Dioxins	1404.322	4.582				
Total Hepta-Dioxins	461.714	3.604				
Total Tetra-Furans	185.621	6.907				
Total Penta-Furans	1027.056	4.313				
Total Hexa-Furans	1893.547	3.090				
Total Hepta-Furans	924.285	4.596				

(1) Qualifier U indicates not detected; The X & I indicates EMPC. The C needs value from second column analysis. The B indicates possible blank contamination.
(2) RRTs and ion ratios are specified in Tables 11 and 8, Method 8290 8290F1

FORM 2

PCDD/PCDF LABELED COMPOUND AND
CLEANUP STANDARD RECOVERIES

CLIENT ID.

LCS

Lab Name: Southwest Lab. of Oklahoma Episode No.: 28073

Lab Code: SWL Case No.: SDG No.: Lab Sample ID: LC0102WA

Client Name: Golder Sample Wt/Vol: 1000 g or mL: mL

Matrix (aqueous/solid/leachate): aqueous Initial Calibration Date: 07/10/96

Sample Receipt Date: Instrument ID: AutoSpec

Ext. Date: 01/02/97 GC Column: DB-5

Ext. Vol(ul): 20.0 Inj. Vol(ul): 2.00 Sample Data Filename: A102686#3

Analysis Date: 4-JAN-97 Time: 17:07:24 Blank Data Filename: A102685#4

Dilution Factor: 1 Cal. Ver. Data Filename: A102682#13

Concentration Units (pg/L or ng/Kg dry weight): pg/L % Moisture:

	SPIKE CONC.(pg)	CONCENT. FOUND(pg)	RECOV. %	ION ABUND. RATIO (2)	RRT (2)	MEAN RRF
LABELED COMPOUNDS						
13C-2,3,7,8-TCDD	1000	755.38	75.54	0.83	1.012	1.29
13C-1,2,3,7,8-PeCDD	1000	632.21	63.22	1.62	1.287	1.19
13C-1,2,3,6,7,8-HxCDD	2500	2094.10	83.76	1.28	0.991	0.96
13C-1,2,3,4,6,7,8-HpCDD	2500	2806.47	112.26	1.03	1.079	0.99
13C-OCDD	5000	6186.88	123.74	0.91	1.161	0.75
13C-2,3,7,8-TCDF	1000	745.52	74.55	0.83	0.970	2.35
13C-1,2,3,7,8-PeCDF	1000	604.65	60.46	1.56	1.225	2.35
13C-1,2,3,4,7,8-HxCDF	2500	2099.42	83.98	0.51	0.964	1.12
13C-1,2,3,4,6,7,8-HpCDF	2500	2586.51	103.46	0.44	1.052	0.93
CLEANUP STANDARD						
37Cl-2,3,7,8-TCDD	800				1.013	

(1) Contract-required limits for percent recovery are 40%-135% (section 8.4, Method 8290).

(2) Contract-required Reference Attributions for RRTs and ion abundance ratios are specified in Tables 11 and 8, respectively, Method 8290.

NOTE: There is no ion abundance ratio for 37Cl4-2378-TCDD (cleanup standard).

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS- JULY 1996
NEASE SITE, SALEM, OHIO

	SW-1*	SP-1	SP-2	SP-3	SP-4	SP-5
VOCs (ug/l)						
Vinyl Chloride	110 J	260	170	57 J	190	46
Methyl Chloride		1 J	6	2 J	3 J	4 J
Acetone			32	11	41	76
Carbon Disulfide						1 J
1,1-Dichloroethene	16	14	50	28	57	53
1,2-Dichloroethene (Total)	1400	1400	8400	2300	1300	15000
Chloroform		1 JB	76 B	15 B	52 B	52 B
1,2- Dichloroethane	380	1300	4400	1000	3700	4300
Trichloroethene	71 J	780	490	560	960	890
Benzene	260	99 J	1900	540	2000	2300
1,1,2-Trichloroethane			64	10	44	60
Tetrachloroethene		8	76	76	35	75
1,1,2,2-Tetrachloroethane			1500	390	1200	2300
Toluene	3 J		24	10	28	31
Chlorobenzene	10	4 J	42	23	70	66
Styrene					2 J	3 J
Xylenes (Total)					2 J	2 J
Total VOCs	**2250**	**3867**	**17230**	**5022**	**9684**	**25259**
SVOCs						
1,4-Dichlorobenzene					8 J	8 J
1,2-Dichlorobenzene	100	210	770	400	1500	1400
2,4-Dichlorophenol						7 J
Benzoic Acid				130 J		64
bis(2-Ethylhexyl)phthalate			280 E			
Total SVOCs	**100**	**210**	**1050**	**530**	**1508**	**1479**
MPK						
Mirex						0.051

Notes: * This sample was a surface water sample taken from the Crane-Deming swamp.
Blank Result = Non detect

Qualifiers: B = Present in associated blanks (semi-quantitative) Data
E = Exceeded calibration limits
J = Estimated (semi-quantitative) Data

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS- JULY 1996
NEASE SITE, SALEM, OHIO

	SW-1*	SP-1	SP-2	SP-3	SP-4	SP-5
METALS						
Aluminum (T)	559.9	257100	19815	14080	6938	7527
Aluminum (D)		475.2	312.3	103.1 B	76.8 B	87.5 B
Antimony (T)						
Antimony (D)			6.11 B		6 B	7.2 B
Arsenic (T)	9.68 B	94.9 B	63.82 B	26.56	37.88	19.43 B
Arsenic (D)	6.97 B	16.05	15.53	4.94 B	9.68 B	8.43 B
Barium (T)	59.93 B	6733.48	964.47 B	150.96 B	90.44 B	53.47 B
Barium (D)	49.8 B	47.81 B	51.66 B	72.71 B	43.13 B	31.28 B
Beryllium (T)		29.19 B	18.17 B	1.1 B		
Beryllium (D)						
Cadmium (T)	52.95	257.7	245.21	50.94	52.09	51.21
Cadmium (D)						
Calcium (T)	210000	339700	328450	181700	218300	181100
Calcium (D)	200000	283400	274500	164300	204200	152100
Chromium (T)	1.64 B	436.06	329.84	21.23	12.53 B	12.6 B
Chromium (D)	0.69 B	1.61 B	24.86	1.03 B	1.38 B	1.22 B
Cobalt (T)	1.06 B	535.01	298.76 B	32.32 B	15.79 B	9.93 B
Cobalt (D)		6.38 B	3.39 B	0.85 B	2.4 B	0.73 B
Copper (T)		579	276.5	22.6 B	14.4 B	
Copper (D)						
Iron (T)	5441	721000	651500	61480	67580	53740
Iron (D)	265.6	10040	73700	502.9	23650	27540
Lead (T)	3.02 B	445.74	250.54	27.29	53.2	12.35
Lead (D)						
Magnesium (T)	51490	186950	188650	47140	53540	54930
Magnesium (D)	50610	75880	95780	39270	48180	47780
Manganese (T)	410.84	12408.3	20417.6	2501.7	4621.58	4744
Manganese (D)	353.69	3760.09	13768.5	1579.47	3791.67	4312.09
Mercury (T)	1.19	2.84	3.31	0.55	0.59	0.67
Mercury (D)			0.11 B			
Nickel (T)	6.99 B	1064.7	590.89	61.67 B	37.79 B	24.77 B
Nickel (D)	4.53 B	24.5 B	16.17 B	5.23 B	9.26 B	5.78 B
Potassium (T)	2410 B	23865 B	21905 B	5983	4230 B	4087 B
Potassium (D)	2337 B	4022 B	6701	4305 B	3415 B	3185 B
Selenium (T)	20.71	95.09	78.95	19.05	20.87	18.81
Selenium (D)	3.56 B	5.64	11.1	3.53 B	3.88 B	3.8 B
Sodium (T)	38980	118450	129050	54240	55640	57680
Sodium (D)	38150	113900	127600	53930	53070	57430
Thallium (T)		6.31 B	2.35 B		0.37 B	
Thallium (D)						
Vanadium (T)		392.52 B	295.04 B	23.74 B	15.35 B	12.73 B
Vanadium (D)			6.74 B			0.39 B
Zinc (T)	27.57 B	3696.1	1965.26	187.68	186.09	78.88
Zinc (D)		18.68 B	10.27 B		12.48 B	13.97 B

Notes: * This sample was a surface water sample taken from the Crane-Deming swamp.
Blank Result = Non detect
(D) = TAL Dissolved Metals
(T) = TAL Total Metals

Qualifiers: B = Present in associated blanks (semi-quantitative) Data

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS-MAY 1997
NEASE SITE, SALEM, OHIO

	SP-1	SP-2	SP-3	SP-4	SP-5	SP-6*
VOCs (ug/l)						
Vinyl Chloride	110	220	54	110	54	120
Methyl Chloride			14	8	6	
Acetone	6 JB	14 B	2200 B	88 JB	150 B	
Carbon Disulfide			9		1 J	
1,1-Dichloroethene	25	33	72	68	80	11
1,2-Dichloroethene (Total)	100	240	81	280	350	170
Chloroform		43 B	230 JB	61 B	47 B	
1,2- Dichloroethane	920	2000	5900	2500	2000	1900
1,2-Dichloropropene			2 J			
Trichloroethene	810	250	3800	480	540	210
Benzene	140	1400	5800	2100	1900	250
1,1,2-Trichloroethane		29	110	72	60	
Bromoform			4 J			
Tetrachloroethene	2 J	56	2200	43	59	
1,1,2,2-Tetrachloroethane	2 J	610	4900	1500	1200	12
Toluene	1 J	14	120	20	25	28
Chlorobenzene	6	31	160	68	62	70
Ethylbenzene			2 J			
Styrene					2 J	2 J
Xylenes (Total)			9	4 J	3 J	2 J
Total VOCs	**2122**	**4940**	**25667**	**7402**	**6539**	**2775**
SVOCs						
Phenol			16	8 J	10	
1,4-Dichlorobenzene			24		7 J	
Benzyl Alcohol			120			
1,2-Dichlorobenzene	70	270	3400	1200	1000	
Benzoic Acid			4000			
bis(2-Ethylhexyl)phthalate			54 B	30 B	760 B	16 B
Total SVOCs	**70**	**270**	**7614**	**1230**	**1767**	**16**
MPK						
Mirex						

Notes: * SP-6 did not contain enough water for MPK analysis.
Blank Result = Non detect

Qualifiers: B = Present in associated blanks (semi-quantitative) Data
J = Estimated (semi-quantitative) Data

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS-MAY 1997
NEASE SITE, SALEM, OHIO

	SP-1	SP-2	SP-3	SP-4	SP-5	SP-6*
METALS						
Aluminum (T)	80450	101800	42690	70700	16655	
Aluminum (D)	157.5	228.7	179.9	161.3 B		
Antimony (T)	3.93 B	2.44 B	2.5 B	8.8 B		
Antimony (D)						
Arsenic (T)	103.28	107.27	116.1	333.24	50.85	
Arsenic (D)	21.38	28.9	62.44	16.55	13.22	
Barium (T)	3071.52	934.14 B	369.28 B	510.13 B	165.23 B	
Barium (D)	38.45 B	26.61 B	61.52 B	20.52 B	22.92 B	
Beryllium (T)	7.93 B	9.69 B	4.05 B	8.51 B		
Beryllium (D)						
Cadmium (T)						
Cadmium (D)						
Calcium (T)	220000	258400	325350	259450	163700	
Calcium (D)	165700	237100	318000	202900	159700	
Chromium (T)	106.24	146.1	72.67	98.95	33.07 B	
Chromium (D)	12.45	17.87	18.09	11.03	10.22	
Cobalt (T)	121.24 B	131.57 B	137.47 B	166.56 B	21.96 B	
Cobalt (D)	4.08 B	6.33 B	46.75 B	5.21 B	1.08 B	
Copper (T)	185.5	162.5	66 B	288.5		
Copper (D)						
Iron (T)	316050	484350	285750	487950	94300	
Iron (D)	537.4	8462	103400	3700	1469	
Lead (T)	150.63	176.08	120.01	647.81	42.19	
Lead (D)						
Magnesium (T)	86100	121400	136200	89000	52050	
Magnesium (D)	39040	73410	127300	51560	48800	
Manganese (T)	3381.88	9367.38	21155.7	11466.5	4736.27	
Manganese (D)	1328.48	7446.82	20797.8	4237.89	4032.04	
Mercury (T)	1.25	1.47	2.37	2.31	2.41	
Mercury (D)						
Nickel (T)	257.3	271.44	251.86	348.06	51.48 B	
Nickel (D)	20.11 B	24.48 B	80.72	18.57 B	9.03 B	
Potassium (T)	11755 B	11515 B	8205 B	9520 B	5235 B	
Potassium (D)	1775 B	2967 B	4220 B	2382 B	2550 B	
Selenium (T)	9.93 B	6.83 B	3.54 B	13.05 B	4.11 B	
Selenium (D)	2.95 B	1.29 B	0.55 B	0.86 B	0.58 B	
Sodium (T)	75750	102400	143800	55750	51250	
Sodium (D)	50530	98800	139300	51670	45660	
Thallium (T)	1.87 B	1.71 B		2.13 B		
Thallium (D)						
Vanadium (T)	113.78 B	151.98 B	77.22 B	133.1 B	34.16 B	
Vanadium (D)	3.25 B	3.78 B	4.72 B	2.9 B	2.63 B	
Zinc (T)	895.43	946.56	687.07	1985.24	233.6	
Zinc (D)	3.29 B	3.46 B	19.22 B	3.64 B	2.76 B	

Notes: * SP-6 did not contain enough water for metals analysis.
Blank Result = Non detect
(D) = TAL Dissolved Metals
(T) = TAL Total Metals

Qualifiers: B = Present in associated blanks (semi-quantitative) Data

APPENDIX G

Data Validation Narrative

1.0 INTRODUCTION

Analytical data for the samples collected on December 20, 1996 and January 23, 1997 at the Nease Site in Salem, Ohio have been validated as part of the Easter Plume/DNAPL Investigation (Investigation). The samples were collected as specified by the Eastern Plume/DNAPL Investigation Work Plan (Work Plan), dated August 30, 1996. The Sample points chosen for analysis and the parameters which were analyzed are described in the Work Plan.

The samples were analyzed for the Inorganic Target Analyte List (TAL) excluding cyanide in accordance with the U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration (CLP SOW 7/88); the Organic Target Compound List (TCL) in accordance with the Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration (CLP SOW 2/88) for Volatile Organic Compounds (VOCs); and Mirex, Photomirex, and Kepone (MPK) in accordance with SOP 5.0: Analysis of Mirex, Photomirex and Kepone in Aqueous Samples, Ruetgers-Nease, Salem, Ohio Site. The sample collected on January 23, 1997 was analyzed for TCL VOCs and SVOCs only. All of the groundwater monitoring well samples for metals analysis were collected as filtered (dissolved) and unfiltered (total). The analyses were performed by Centre Analytical Laboratories, Inc. (CAL) of State College, Pennsylvania.

Samples were collected from 15 primary locations. In addition, one sample of the on-site potable water supply (MUNY) was taken and analyzed for full TCL/TAL, MPK and Dioxin/Furans. One sampling location was sampled in duplicate for Field Duplicate analysis. The Sample Identification Points, sampling dates and the corresponding Sample Delivery Groups (SDGs) are summarized in Table G-1.

Data validation of inorganic data collected using the CLP SOW 7/88 was performed in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, dated February 1994. Data validation for the organics was performed in accordance with the USEPA Contract Laboratory Program national Functional Guidelines for Organic Data Review, dated February 1994. These documents are referred to as "functional guidelines" hereafter. The MPK analytical data was validated using the criteria specified in the MPK SOP#5. The municipal water supply sample was not validated.

Data qualifiers are defined in Table G-2. Where quality control criteria were met, positive results were not qualified and non-detected results were qualified with a "U" flag signifying that the result is below the quantitation limit (organics). Where more than one qualifier for a sample result was warranted, the most predominant or general qualifier was applied to the results. For example, a positive result for a volatile organic compound may need to be qualified as undetected (U) due to its presence in the associated blanks; however, the initial or continuing calibration criteria for that compound may not have been met and would warrant qualification as an estimated result (J) or quantitation limit (UJ). In this particular case, the compound would be qualified as having an estimated quantitation limit (UJ). The (R) qualifier, which signifies that the result has been rejected, takes priority over all other qualifiers.

In some cases, there are multiple degrees to which the quality control criteria may not be met. For example, a matrix spike for an inorganic analyte may be slightly greater than the upper limit of the Contract Required Recovery range; the corresponding positive results may be qualified as estimated (J). However, if the matrix spike recovery is greater than 150%, the positive results would be qualified as unusable (R). It should be noted that the discussions contained within Sections 2.0 through 5.0 explain where quality control was deficient. As specified in the functional guidelines, if the non-adherence to quality control criteria are slight, qualification of data may not be warranted. However, if the non-adherence is significant, qualification and possible rejection of the data may be necessary. The narrative discussion specifies where rejection of the data is necessary.

In general, the discussions which follow in Sections 2.0 through 4.0 describe only instances where the quality control criteria specified in the documents named above were not met. Tables G-3 through G- 8 of this document summarize specific samples for which qualification occurred.

Following data validation and qualification, the analytical data and qualifiers for each sample point were summarized. Qualified results for the Investigation monitoring wells are provided in Appendix F of this report in a tabular format.

2.0 TARGET COMPOUND LIST VOLATILE ORGANIC PARAMETERS

Samples were collected from 15 groundwater monitoring wells. Additionally, one well was sampled in duplicate and one rinsate blanks was collected for VOCs. The samples were reported in two SDGs (P2-6-BU and HP04)by the laboratory, all of which were analyzed for VOCs using the CLP SOW 2/88. The VOCs were validated in accordance with the functional guidelines.

Data Quality Objectives

Precision: Goals for laboratory and field precision were generally met, except where noted below.

Accuracy: Goals for accuracy were generally met, except where noted below.

Sample Result Verification: All sample results were supported in raw data.

Detection Limits: The detection limit goals were achieved for all analyses, except where dilutions were required due to matrix problems.

Completeness: The data packages were complete for all requested analyses. Fifteen (16) samples were validated in this data set. A total of 544 results for these samples were reported in which 544 were deemed valid. This results in a completeness of 100% for these samples.

Major Deficiencies

There were no major deficiencies identified with VOCs.

Minor Deficiencies

Identified below are the minor deficiencies which required qualification of the data. Refer to Table 3 for the specific samples affected by each deficiency.

Laboratory preparation blanks, rinsate blanks and trip blanks are evaluated for target compound contamination. Chloroform and Bromodichloromethane were found as contaminants in various blanks for SDG P2-6-BU. For both Chloroform and Bromodichloromethane an action limit of 5 times the concentration found in the blank was calculated. For samples where any of these compounds were detected as a positive result between the Contract Required Quantitation Limit

(CRQL) and the action limit, the result was flagged as undetected (U). For samples where any of these compounds were detected below the CRQL, the result was changed to the CRQL and qualified as undetected (U). Samples with positive results above the action limit did not require clarification.

During the data validation process, the qualitative identification of compounds are evaluated. The evaluations are based on mass spectra, retention time, peak shape and intensity. For the compound Ethylbenzene in samples PZ-6-Bu, PZ-7 and HP04, the mass spectra indicates that there is presumptive evidence of the presence of the compound, however, all criteria are not met. Since the compound is only presumed to be present in the samples, the results for this compound in specified samples were qualified with the "N" flag.

The functional Guidelines as well as the CLP SOW require the laboratory to dilute compounds whose concentrations exceed the upper concentration limit of the initial calibration. The laboratory failed to properly dilute sample PZ-6-BU for Chlorobenzene, sample PZ-3-S for the compounds Acetone, 1,1,-Dichloroethene and Tetrachloroethene, and sample HP04 for the compounds Acetone and 1,2-Dichloroethane. The compounds in these samples were qualified as estimated values (J).

3.0 TARGET COMPOUND LIST SEMI-VOLATILE ORGANIC PARAMETERS

Samples were collected from 15 groundwater monitoring wells. Additionally, one well was sampled in duplicate and one rinsate blank was collected for SVOCs. The samples were reported in two SDGs (P2-6-BU and HP04) by the laboratory. All samples were analyzed for SVOCs using the SOW dated 2/88. The SDG was validated in accordance with the functional guidelines.

Data Quality Objectives

Precision: Goals for laboratory and field precision were generally met, except where noted below.

Accuracy: Goals for accuracy were generally met, except where noted below.

Sample Result Verification: All sample results were supported in raw data.

Detection Limits: The detection limit goals were achieved for all analyses.

Completeness: The data packages were complete for all requested analyses. Fifteen (16) samples were validated in this data set. A total of 1041 results for these samples were reported in which 1041 were deemed valid. This results in a completeness of 100% for these samples.

Major Deficiencies

Identified below are the major deficiencies which required rejection of the data. Refer to the tables in Attachment ____ for the specific samples affected by each deficiency.

The initial and continuing calibrations had response factors (RRF) which were less than the minimum of 0.05 for Pentachlorophenol. All sample results were non-detected for Pentachlorophenol, therefore, the results were qualified rejected (R).

Minor Deficiencies

Identified below are the minor deficiencies which required qualification of the data. Refer to Table 4 for the specific samples affected by each deficiency.

4.0 TAL METALS PARAMETERS

Unfiltered and filtered samples were collected from 14 groundwater monitoring wells at the Site. Additionally, one well was sampled in duplicate and one field rinsate blank was collected for both unfiltered and filtered metals. The samples were reported in one SDG by the laboratory and analyzed using the SOW 7/88. All samples were validated in accordance with the functional guidelines. The laboratory used an ICP-MS instrument for the analysis of Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc. The remaining elements were analyzed by a conventional ICP instrument.

Data Quality Objectives

Precision: Goals for laboratory and field precision were generally met, except where noted below.

Accuracy: Goals for accuracy were generally met, except where noted below.

Sample Result Verification: All sample results were supported in raw data.

Detection Limits: The detection limit goals were achieved for all analyses.

Completeness: The data packages were complete for all requested analyses. Sixteen unfiltered samples and 16 filtered samples were validated in this data set. A total of 368 results for unfiltered samples were reported in which 368 were deemed valid. A total of 368 results for filtered samples were reported in which 368 were deemed valid. This result in a completeness of 100% for unfiltered samples and 100% for filtered samples.

Major Deficiencies

There were no major deficiencies identified for the TAL Metals.

Minor Deficiencies

identified below are the minor deficiencies which required qualification of the data. Refer to the tables in Attachment ____ for the specific samples affected by each deficiency.

The matrix spike recovery for Silver was lower than the criteria (75% - 125%) specified by the functional guidelines but greater than 30%. For the filtered and unfiltered portions of the affected samples, positive results were qualified as estimated values (J), and non-detects were qualified as estimated detection limit (UJ).

The Laboratory Control Sample (LCS) recovery for Silver was lower than the criteria (80% - 120%) specified by the functional guidelines but greater than 50%. For the filtered and unfiltered portions of the affected samples, positive results were qualified as estimated values (J), and non-detects were qualified as estimated detection limit (UJ).

The result for Arsenic from the filtered portion of sample PZ-6-BU was greater than the CRDL and the percent differences compared to the results of the unfiltered portions of the samples were greater than +10%, but less than +50%. The positive result of Arsenic in the filtered and unfiltered portions of the samples were qualified as estimated values (J).

5.0 MIREX, PHOTOMIREX, AND KEPONE ANALYSIS

Samples were collected from 14 groundwater monitoring wells. Additionally, one well was sampled in duplicate and one rinsate blank was collected for MPK. The samples were reported in one SDG by the laboratory. All samples were analyzed for MPK using appropriate SOP. The SDG was validated in accordance with the functional guidelines.

Data Quality Objectives

Precision: Goals for laboratory and field precision were generally met, except where noted below.

Accuracy: Goals for accuracy were generally met, except where noted below.

Sample Result Verification: All sample results were supported in raw data.

Detection Limits: The detection limit goals were achieved for all analyses.

Completeness: The data packages were complete for all requested analyses. Sixteen (16) samples were validated in this data set. A total of 48 results for unfiltered samples were reported in which 32 were deemed valid. This results in a completeness of 67% for these samples.

Major Deficiencies

Identified below are the major deficiencies which required rejection of the data. Refer to the tables in Attachment ____ for the specific samples affected by each deficiency.

The matrix spike/matrix spike duplicate recovers for Kepone were 0% and 4%, respectively. In addition, the LCS recovery was 45%. Using professional judgment, the data validator qualified the results unusable (R).

6.0 SUMMARY

Validation of the data collected for the Eastern Plume/DNAPL Investigation from the Nease Site was performed in accordance with USEPA National data validation guidelines, and the criteria specified by the specific method for MPK.

Overall, the data required qualification due to some quality control criteria which were not achieved, but the majority of the data may be deemed usable in terms of objectives of the investigation. Although a positive result was qualified as estimated, the analyte should be considered present. Similarly, a non-detected result which was qualified as an estimated quantitation/detection limit should be considered not present for the purposes of this study, although the limit itself may not be precise. Rejected (unusable) data that are assigned the "R" qualifier should not be used. Rejected data have been included in the summary tables only for the purpose of completeness.

G:\PROJECTS\933-6154\NARRTXT.DOC

TABLE G-1
SAMPLE POINT IDENTIFICATIONS

		SDG NUMBERS		
SAMPLE POINT I. D.	DATE SAMPLED	ORGANICS	METALS, FILTERED/ UNFILTERED	MPK
GROUNDWATER SAMPLES				
PZ-6-BU	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-6-BM	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-6-BL	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-5-S	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-5-M	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-5-T	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-5-B	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-4-S	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-4-M	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-4-B	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-3-S\PZ-3-M	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-3-B	12/20/96	P2-6-BU	P2-6-BU	NA
PZ-7	12/20/96	P2-6-BU	P2-6-BU	NA
HP04	1/23/97	HP04	NA	NA
QUALITY CONTROL SAMPLES				
RINSATE BLANKS				
FB	12/20/96	P2-6-BU	P2-6-BU	NA
TRIP BLANK				
Trip Blank	1/23/97	HP04	NA	NA
FIELD DUPLICATE				
DUP	12/20/96	P2-6-BU	P2-6-BU	NA
MATRIX SPIKE/MATRIX SPIKE DUPLICATE				
PZ-6-BU	12/20/96	P2-6-BU	P2-6-BU	NA

Notes:

NA - Not Applicable

Sample ID "DUP" is a blind duplicate of PZ-6-BL

TABLE G-2

GROUNDWATER QUALIFIERS AND ABBREVIATION DEFINITIONS FOR ORGANICS

VALUE - Acceptable (Quantitative) data.

U - Not Detected/Quantitative data.

J - Estimated (Semiquantitative) data.

P - This flag is used for a Pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentrations between the two GC columns.

C - This flag applies to Pesticide/Aroclor results where the identification has been confirmed by GC/MS.

B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

X - This flag was chosen by the laboratory to identify when two isomers are not separable on the GC column (Semiquantitative data).

* - Rejected (unusable) data.

CRQL - Contract Required Quantitation Limit - The lowest concentration which can be reliably quantified in an undiluted sample, as required by the USEPA Contract Laboratory Program.

SQL - Sample Quantitation Limit - The lowest concentration which can be reliably quantified for a particular sample accounting for matrix and dilution effects.

N - This flag indicates presumptive evidence of the presence of the compound.

GROUNDWATER QUALIFIERS AND ABBREVIATION DEFINITIONS FOR INORGANICS

VALUE - Acceptable (Quantitative) data.

U - Not Detected/Quantitative data.

B - Acceptable (Quantitative) data between the Instrument Detection Limit (IDL) and Contract Required Detection Limit (CRDL).

CRDL - Contract Required Detection Limit - The IDL obtained in pure water as determined by the USEPA Contract Laboratory Program.

IDL - Instrument Detection Limit - The lowest concentration which can be reliably quantified on a particular instrument using methods specified in the Contract Laboratory Program Statement of Work.

TABLE G-3

DATE: July 1997 PROJECT NO.: 933-6154
PROJECT NAME: Nease-Site Salem, Ohio
ANALYSIS: TCL Volatiles; 2/88 SOW

SAMPLE DELIVERY GROUP NUMBER: P2-6-BU
REVIEWER: Jeffrey R. Hendel

DEFICIENCY	COMPOUND(S)	QUALIFIER	SAMPLES AFFECTED
Blank contamination	Chloroform	U (after changing value to CRQL)	PZ-6-BL, DUP, PZ-3-B
Presumptive evidence of the presence of the compound based on mass spectra.	Ethylbenzene	N	PZ-6-BU, PZ-7
Concentration of the compound exceeds the upper concentration limit of the initial calibration	Chlorobenzene	J	PZ-6-BU
	Acetone, 1,1-Dichloroethene, Tetrachloroethene		

TABLE G-4

DATE: July 1997 PROJECT NO.: 933-6154
PROJECT NAME: Nease-Site Salem, Ohio
ANALYSIS: TCL Volatiles; 2/88 SOW

SAMPLE DELIVERY GROUP NUMBER: HP04
REVIEWER: Jeffrey R. Hendel

DEFICIENCY	COMPOUND(S)	QUALIFIER	SAMPLES AFFECTED
Presumptive evidence of the presence of the compound based on mass spectra.	Ethylbenzene	N	HP04
Concentration of the compound exceeds the upper concentration limit of the initial calibration	Acetone, 1,2-Dichloroethane	J	HP04

TABLE G-5

DATE: July 1997 **PROJECT NO.: 933-6154**
PROJECT NAME: Nease-Site Salem, Ohio
ANALYSIS: TCL Semi-Volatiles; 2/88 SOW

SAMPLE DELIVERY GROUP NUMBER: P2-6-BU
REVIEWER: Jeffrey R. Hendel

DEFICIENCY	COMPOUND(S)	QUALIFIER	SAMPLES AFFECTED
Continuing calibration RFs less than 0.05	Pentachlorophenol	R	ALL
Blank contamination	bis(2-Ethylhexyl)phthalate	U	PZ-6-BU, PZ-4-S, PZ-3-S, PZ-3-M
	bis(2-Ethylhexyl)phthalate	U (after changing value to CRQL)	PZ-6-BM, PZ-6-BL, DUP, PZ-5-S, PZ-5-T, PZ-5-B, PZ-4-B, PZ-3-B, PZ-7
Presumptive evidence to the presence of the compound	1,2-Dichlorobenzene	N	PZ-6-BL, DUP
RRF unstable over the concentration range of the initial calibration (>30% RSD)	Hexachlorocyclopentadiene, 2,4-Dinitrophenol, 4-Nitrophenol, 4,6-Dinitro-2-methylphenol	J for positive results UJ for non-detected results	ALL

TABLE G-6

DATE: July 1997 PROJECT NO.: 933-6154
PROJECT NAME: Nease-Site Salem, Ohio
ANALYSIS: TCL Semi-Volatiles; 2/88 SOW

SAMPLE DELIVERY GROUP NUMBER: HP04
REVIEWER: Jeffrey R. Hendel

DEFICIENCY	COMPOUND(S)	QUALIFIER	SAMPLES AFFECTED
Initial and continuing calibration RFs less than 0.05	Pentachlorophenol	R	ALL
RRF unstable over the concentration range of the initial calibration (>30% RSD)	Hexachlorocyclopentadiene, 2,4-Dinitrophenol, 4-Nitrophenol, 4,6-Dinitro-2-methylphenol	J for positive results UJ for non-detected results	ALL

TABLE G-7

DATE: July 1997 PROJECT NO.: 933-6154
PROJECT NAME: Nease-Site Salem, Ohio
ANALYSIS: TAL Filtered and Unfiltered Metals - CLP 7/88 SOW

SAMPLE DELIVERY GROUP NUMBER: P2-6-BU
REVIEWER: Jeffrey R. Hendel

DEFICIENCY	COMPOUND(S)	QUALIFIER	SAMPLES AFFECTED
Matrix spike recovery less than 75% but greater than 30%	Silver	J for positive results UJ for non-detected results	ALL
LCS revovery less than 75% but greater than 50%	Silver	J for positive results UJ for non-detected results	ALL
Filtered value exceeds unfiltered value by more than 10% but less than 50%	Arsenic	J for positive results	PZ-6-BU

TABLE G-8

DATE: July 1997 PROJECT NO.: 933-6154
PROJECT NAME: Nease-Site Salem, Ohio
ANALYSIS: MPK

SAMPLE DELIVERY GROUP NUMBER: NA
REVIEWER: Jeffrey R. Hendel

DEFICIENCY	COMPOUND(S)	QUALIFIER	SAMPLES AFFECTED
Matrix spike / matrix spike duplicate recovery less than 10%	Kepone	R	ALL

APPENDIX H

Results of Hydrogeologic Testing

A rising head slug tests was performed in monitoring well PZ-5T. The slug of water for the test was removed using a dedicated hand bailer. Water removed from the well was contained in United States Department of Transportation (US DOT) approved 55-gallon drums and was transferred to the on-Site (former railroad tank car) tank pending disposal.

The water elevations in the well were measured using an In-Situ SP2000 TROLL transducer/datalogger. The datalogger was programmed to record the water levels every 3 seconds.

The general procedure for slug testing was as follows:

- Measure the static water level was using and electronic water level indicator prior to inserting the datalogger/transducer into the well;
- Place the datalogger/transducer in the well;
- Input the initial static water level into the datalogger/transduceras a reference elevation;
- Insert the bailer into the well and allow it to fill completely;
- Remove the bailer rapidly and start the datalogger;
- When the water level in the well reached the level at the beginning of the test, stop the datalogger; and,
- Download the data from the datalogger using a portable computer and insert the data into an Excel spreadsheet for analysis.

The data obtained from the slug test were analyzed using the Hvorslev (1951) method (U.S. Department of the Navy, 1982) and the Bouwer and Rice (1976) method. Hvorslev developed a method for the determination of horizontal hydraulic conductivity using measured values of head (h) versus time (t). The methodology of data analysis requires the plotting of head ratio (percentage of head yet to recover, h_t/h_o) on the vertical scale of semi-log paper versus time (t) on the linear horizontal scale. The steps required for the analysis are summarized below. A more detailed description of the analysis method is contained in Hvorslev, 1951.

<u>Step 1:</u>

Plot h_t/h_o (logarithmic) versus t in a semilogarithmic format.

Step 2:

Because h_t/h_o and t are the only variables in the equations, the plot must show a straight line (this is usually between 50 percent and 90 percent recovery). In other words, the straight line portion is the valid part of the readings, and the curved part of the plot may be due to wellbore storage, skin or boundary effects which are not accounted for.

Step 3:

Select two points on the straight line portion of the curve and record their coordinates (t_1, h_{t1}) and (t_2, h_{t2}). Record the other test specific parameters (i.e. well coring radius, test section length, etc.).

Step 4:

Use the equation below to calculate the horizontal hydraulic conductivity (K):

$$K = \frac{r_c^2}{2L} ln \frac{L_e}{R_e} \left[\frac{ln\left(\frac{h_1}{h_2}\right)}{(t_2 - t_1)} \right] 30.48$$

where:

r_c = casing radius [feet]
R_e = equivalent radius [feet]
L_e = length of screened interval [feet]
t = time [seconds]
h_t = hydraulic head at time t [feet]

Results of the Hvorslev analysis of the data for well PZ-5T are contained in Section 2.4 and Table H-1.

The Bouwer and Rice slug test analysis method was also used to analyse the slug test data from Well PZ-5T. Bouwer and Rice developed a method for the determination of horizontal hydraulic conductivity using measured values of head (h) versus time (t). The methodology of data analysis requires the plotting of the head (h) on a vertical log scale versus time on the horizontal linear scale. Information from this plot is then used to complete the analysis in the following stepwise manner:

Step 1:

Plot h versus t on semilogarithmic paper as described above.

Step 2:

The straight line portion is usually considered the most representative portion of the measurements, as the curved part of the plot may be due to wellbore storage, skin or boundary effects.

Step 3:

Select two points on the straight line portion of the curve and record their (t_1, h_1) and (t_2, h_2) coordinates.

Step 4:

Determine h_o, the initial drawdown, using the following equation:

$$h_0 = h_2 - \left(\frac{h_2 - h_1}{(t_2 - t_1)t_2} \right)$$

Use the following equation to calculate the horizontal hydraulic conductivity (K) in centimeters per second cm/sec):

$$K = \frac{r_c^{\,2} \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_o}{y_t}$$

where:

r_c = casing radius [feet]
R_e = effective radius [feet]
L_e = length of screened interval [feet]
r_w = radial distance to undisturbed aquifer [feet]
y_o = initial drawdown [feet]
y_t = drawdown at time t [feet]

Values of R_e, expressed as $ln(R_e/r_w)$, were experimentally derived for different values of r_w, L and D by Bouwer and Rice using an electrical analog model. For a partially penetrating well ($H < D$)

$$ln\left(\frac{R_e}{r_w}\right) = \left[\frac{1.1}{ln\left(\frac{H}{r_w}\right)} + \frac{A + B\,ln\left[\frac{(D-H)}{r_w}\right]^{-1}}{\frac{L}{r_w}}\right]$$

where: H = distance from the water table to the bottom of the well intake (feet);
A and B = dimensionless coefficients that are a function of L/r_w; and,
D = saturated aquifer thickness (feet).

Results of the Bouwer and Rice analysis of the data for well PZ-5T are contained in Section 2.4 and Table H-2.

REFERENCES

Bouwer , H. and R.C. Rice 1976. "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Paritally Penetrating Wells", *Water Resources Research*, Volume 12, pp. 423-428.

Hvorslev, M.J., 1951, "Time Lag and Soil Permeability in Groundwater Observations", Bulletin 36, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.

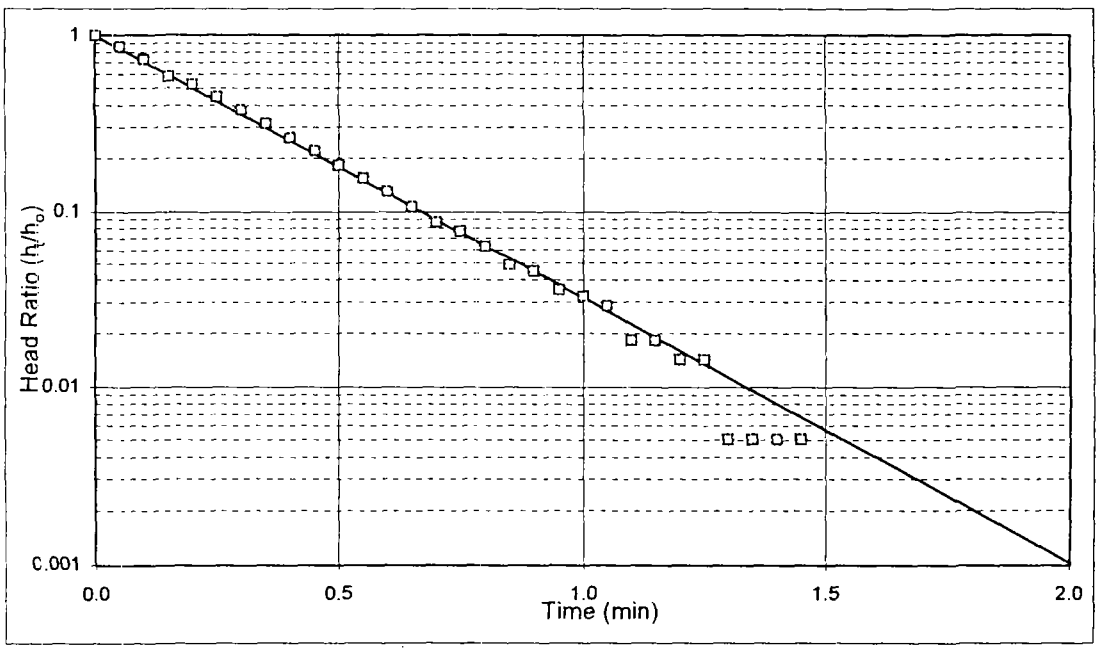
U.S. Department of the Navy, 1982, "Soil Mechanics, Design Manual 7.1," Department of the Navy, Naval Facilities and Engineering Command, Alexandria, Virginia.

TABLE H-1
HVORSLEV SLUG TEST ANALYSIS
RISING HEAD TEST PZ-5T

$$K = \frac{r_c^{\,2}}{2L_e} \ln \frac{L_e}{R_e} \left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t2 - t1)} \right] 30.48$$

where:
r_c = casing radius (feet)
R_e = equivalent radius (feet)
L_e = length of screened interval (feet)
t = time (minutes)
h_t = head at time t (feet)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
R_e =	0.25			
L_e =	8	K=	2.63E-03	cm/sec
t_1 =	0	K=	7.46E+00	ft/day
t_2 =	2			
h_1/h_0 =	1.00			
h_2/h_0 =	0.00			



Project Name: RNC / Salem / OH
Project No.: 933-6154
Test Date: 05/13/97

Analysis By: DSL
Checked By:
Analysis Date: 7/3/97

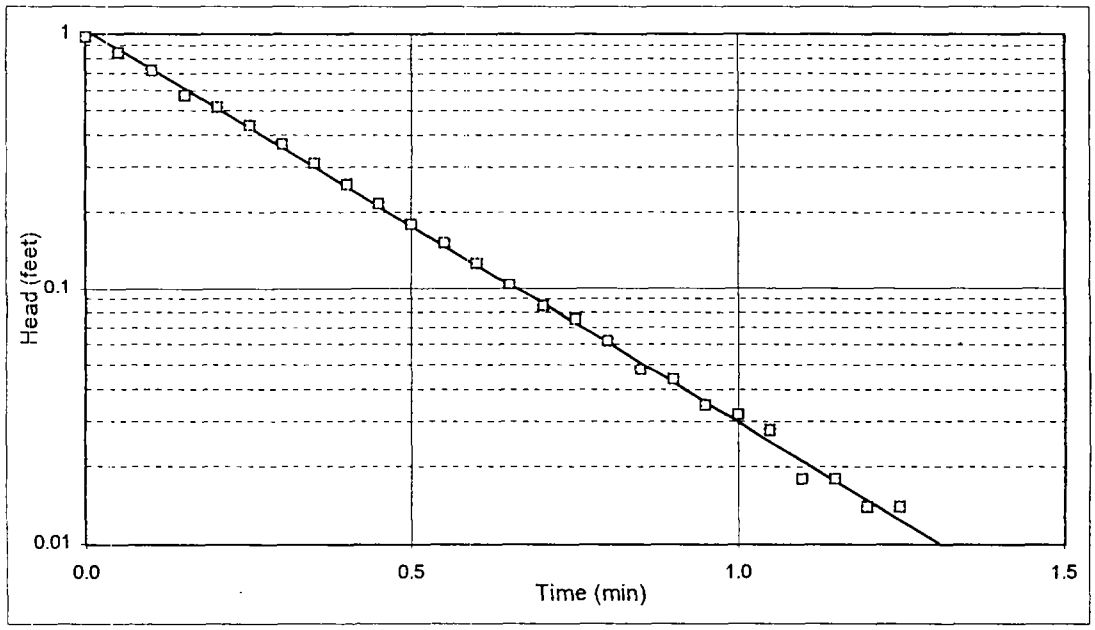
TABLE H-2
BOUWER AND RICE SLUG TEST ANALYSIS
RISING HEAD TEST PZ-5T

$$K = \frac{r_c^2 \ln\left(\frac{R_e}{r_w}\right)}{2L_e} \frac{1}{t} \ln \frac{y_0}{y_t}$$

where:

r_c = casing radius (feet);
R_e = effective radius (feet);
L_e = length of screened interval (feet);
r_w = radial distance to undisturbed aquifer (feet)
y_0 = initial drawdown (feet)
y_t = drawdown (feet) at time t (minutes)

INPUT PARAMETERS		RESULTS		
r_c =	0.08			
r_w =	0.25			
L_e =	8	K=	2.23E-03	cm/sec
$\ln(R_e/r_w)$=	2.87	K=	6.32E+00	ft/day
y_0 =	1.01			
y_t =	0.010			
t =	1.3			



Project Name: RNC / Salem / OH
Project No.: 933-6154
Test Date: 05/13/97

Analysis By: DSL
Checked By:
Analysis Date: 7/3/97

APPENDIX I

HydroPunch Installation Logs

MONITORING WELL INSTALLATION LOG

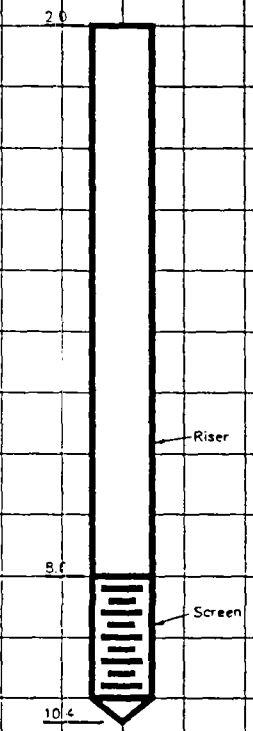
JOB NO 933-6154 PROJECT RNC/SALEM/CH WELL NO. HP-01 SHEET 1 of 1
GA INSP. D WEHN DRILLING METHOD HAND DRIVE GROUND ELEV. 1174.6 WATER DEPTH
WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING COLLAR ELEV. 1176.53 DATE/TIME
TEMP. 40T DRILL RIG N/A DRILLER R. WRIGHT STARTED 1020 12/13/96 (TIME / DATE) COMPLETED 1040 12/13/96 (TIME / DATE)
LOCATION / COORDINATES N: 459478.16 E 2444871.29

MATERIALS INVENTORY

WELL CASING 1.5 in. dia. 10 l.f. WELL SCREEN 1.5 in. dia. 2.4 l.f. BENTONITE SEAL N/A
CASING TYPE GALVANIZED STEEL SCREEN TYPE STAINLESS STEEL INSTALLATION METHOD N/A
JOINT TYPE PIPE THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. N/A
GROUT QUANTITY N/A CENTRALIZERS N/A FILTER PACK TYPE N/A
GROUT TYPE N/A DRILLING MUD TYPE N/A INSTALLATION METHOD N/A

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	
	GROUND SURFACE
0.0	OVERBURDEN
1.0	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	
9.0	
10.0	
	10.4' - HYDROPUNCH REFUSAL
11.0	
12.0	
13.0	
14.0	
15.0	
16.0	
17.0	
18.0	
19.0	
20.0	
21.0	

WELL SKETCH



INSTALLATION NOTES

WELL DEVELOPMENT NOTES

MONITORING WELL INSTALLATION LOG

JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. HP-02 SHEET 1 of 1

GA INSP E. WEHN DRILLING METHOD HAND DRIVE GROUND ELEV. 1174.1 WATER DEPTH

WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING COLLAR ELEV. 1176.42 DATE/TIME

TEMP. 40F DRILL RIG N/A DRILLER R. WRIGHT STARTED 1000 12/13/96 (TIME / DATE) COMPLETED 1020 12/13/96 (TIME / DATE)

LOCATION / COORDINATES N: 459427.12 E: 2444906.97

MATERIALS INVENTORY

WELL CASING 1.5 in dia. 10 l.f. WELL SCREEN 1.5 in. dia. 2.4 l.f. BENTONITE SEAL N/A

CASING TYPE GALVANIZED STEEL SCREEN TYPE STAINLESS STEEL INSTALLATION METHOD N/A

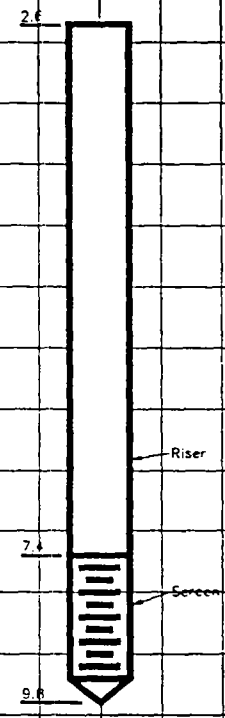
JOINT TYPE PIPE THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. N/A

GROUT QUANTITY N/A CENTRALIZERS N/A FILTER PACK TYPE N/A

GROUT TYPE N/A DRILLING MUD TYPE N/A INSTALLATION METHOD N/A

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	
	GROUND SURFACE
0.0	OVERBURDEN
1.0	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	
9.0	
10.0	9.8' – HYDROPUNCH REFUSAL
11.0	
12.0	
13.0	
14.0	
15.0	
16.0	
17.0	
18.0	
19.0	
20.0	
21.0	

WELL SKETCH



INSTALLATION NOTES

WELL DEVELOPMENT NOTES

MONITORING WELL INSTALLATION LOG

JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. HP-03 SHEET 1 of 1

GA INSP D. WEHN DRILLING METHOD HAND DRIVE GROUND ELEV. 1172.5 WATER DEPTH

WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING COLLAR ELEV. 1173.87 DATE/TIME

TEMP 40°F DRILL RIG N/A DRILLER R. WRIGHT STARTED 0938 12/13/96 (TIME / DATE) COMPLETED 1000 12/13/96 (TIME / DATE)

LOCATION / COORDINATES N 459375.70 E 2444945.08

MATERIALS INVENTORY

WELL CASING 1.5 in. dia 7 l.f. WELL SCREEN 1.5 in. dia. 2.4 l.f. BENTONITE SEAL N/A

CASING TYPE GALVANIZED STEEL SCREEN TYPE STAINLESS STEEL INSTALLATION METHOD N/A

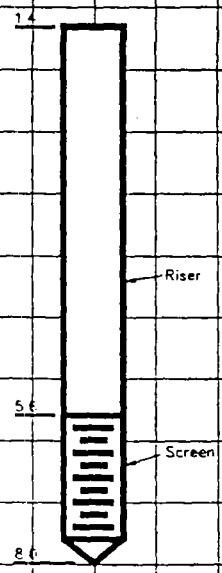
JOINT TYPE PIPE THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. N/A

GROUT QUANTITY N/A CENTRALIZERS N/A FILTER PACK TYPE N/A

GROUT TYPE N/A DRILLING MUD TYPE N/A INSTALLATION METHOD N/A

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	OVERBURDEN
1.0	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	8.0' – HYDROPUNCH REFUSAL
9.0	
10.0	
11.0	
12.0	
13.0	
14.0	
15.0	
16.0	
17.0	
18.0	
19.0	
20.0	
21.0	

WELL SKETCH



INSTALLATION NOTES

WELL DEVELOPMENT NOTES

Golder Associates

MONITORING WELL INSTALLATION LOG

JOB NO 933-6154 PROJECT RNC/SALEM/OH WELL NO. HP-04 SHEET 1 of 1

GA INSP D. WEHN DRILLING METHOD HAND DRIVE GROUND ELEV. 1173.6 WATER DEPTH

WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING COLLAR ELEV. 1174.74 DATE/TIME

TEMP 40°F DRILL RIG N/A DRILLER R. WRIGHT STARTED 0916 12/13/96 (TIME / DATE) COMPLETED 0938 12/13/96 (TIME / DATE)

LOCATION / COORDINATES N: 459342.40 E: 2444968.73

MATERIALS INVENTORY

WELL CASING 1.5 in. dia. 7 l.f. WELL SCREEN 1.5 in. dia. 2.4 l.f. BENTONITE SEAL N/A

CASING TYPE GALVANIZED STEEL SCREEN TYPE STAINLESS STEEL INSTALLATION METHOD N/A

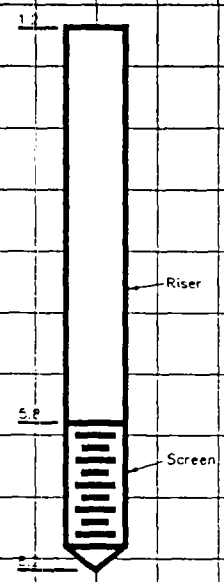
JOINT TYPE PIPE THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. N/A

GROUT QUANTITY N/A CENTRALIZERS N/A FILTER PACK TYPE N/A

GROUT TYPE N/A DRILLING MUD TYPE N/A INSTALLATION METHOD N/A

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	OVERBURDEN
1.0	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	8.2' - HYDROPUNCH REFUSAL
9.0	
10.0	
11.0	
12.0	
13.0	
14.0	
15.0	
16.0	
17.0	
18.0	
19.0	
20.0	
21.0	

WELL SKETCH



INSTALLATION NOTES

WELL DEVELOPMENT NOTES

Golder Associates

MONITORING WELL INSTALLATION LOG

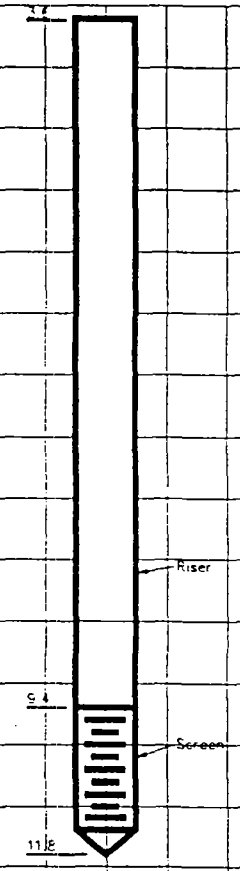
JOB NO. 933-6154 PROJECT RNC/SALEM/OH WELL NO. HP-05 SHEET 1 of 1
GA INSP D. WEHN DRILLING METHOD HAND DRIVE GROUND ELEV. 1177.4 WATER DEPTH
WEATHER CLOUDY DRILLING COMPANY SPROWLS DRILLING COLLAR ELEV. 1180.95 DATE/TIME
TEMP 40F DRILL RIG N/A DRILLER R. WRIGHT STARTED 0845 12/13/96 (TIME / DATE) COMPLETED 0915 12/13/96 (TIME / DATE)
LOCATION / COORDINATES N: 459288.04 E: 2445002.30

MATERIALS INVENTORY

WELL CASING 1.5 in. dia 13 l.f. WELL SCREEN 1.5 in. dia 2.4 l.f. BENTONITE SEAL N/A
CASING TYPE GALVANIZED STEEL SCREEN TYPE STAINLESS STEEL INSTALLATION METHOD N/A
JOINT TYPE PIPE THREAD SLOT SIZE 0.010 INCH FILTER PACK QTY. N/A
GROUT QUANTITY N/A CENTRALIZERS N/A FILTER PACK TYPE N/A
GROUT TYPE N/A DRILLING MUD TYPE N/A INSTALLATION METHOD N/A

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
2.0	GROUND SURFACE
0.0	OVERBURDEN
1.0	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	
9.0	
10.0	
11.0	
12.0	11.8 - HYDROPUNCH REFUSAL
13.0	
14.0	
15.0	
16.0	
17.0	
18.0	
19.0	
20.0	
21.0	

WELL SKETCH



INSTALLATION NOTES

WELL DEVELOPMENT NOTES

APPENDIX J

HydroPunch Analytical Results

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HP04

Lab Name: Centre Analytical Laboratories Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 5.0 (g/ml) ML Lab File ID: EJ319718.D

Level: (low/med) LOW Date Received: 01/23/97

% Moisture: not dec. _____ Date Analyzed: 01/31/97

GC Column: RTX-502 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	13	
74-83-9	Bromomethane	14	
75-01-4	Vinyl Chloride	120	
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	170	~~B~~
67-64-1	Acetone	330	~~E~~ J
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	61	
75-34-4	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	10000	~~E~~
67-66-3	Chloroform	18	
107-06-2	1,2-Dichloroethane	1000	~~E~~ J
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	4400	~~E~~
71-43-2	Benzene	4400	~~E~~
124-48-1	Dibromochloromethane	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
79-00-5	1,1,2-Trichloroethane	100	
75-25-2	Bromoform	5	J
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	3400	~~E~~
79-34-5	1,1,2,2-Tetrachloroethane	4000	~~E~~
108-88-3	Toluene	650	~~E~~
108-90-7	Chlorobenzene	730	~~E~~
100-41-4	Ethylbenzene	4	J N
100-42-5	Styrene	12	
1330-20-7	Xylene (total)	7	

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HP04

Lab Name: Centre Analytical Laboratories Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 5.0 (g/ml) ML Lab File ID: EJ319718.D

Level: (low/med) LOW Date Received: 01/23/97

% Moisture: not dec. _____ Date Analyzed: 01/31/97

GC Column: RTX-502 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/L

Number TICs found: 2

CAS NO.	COMPOUND	RT	EST. CONC.	Q
1. 000106-46-7	Benzene, 1,4-dichloro-	27.72	19	JN
2. 000541-73-1	Benzene, 1,2-dichloro-	28.39	310	JN

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HP04DL

Lab Name: Centre Analytical Laboratories Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1DL

Sample wt/vol: 5.0 (g/ml) ML Lab File ID: EF029706.D

Level: (low/med) LOW Date Received: 01/23/97

% Moisture: not dec. _____ Date Analyzed: 02/02/97

GC Column: RTX-502 ID: 0.53 (mm) Dilution Factor: 500.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	5000	U
74-83-9	Bromomethane	5000	U
75-01-4	Vinyl Chloride	5000	U
75-00-3	Chloroethane	5000	U
75-09-2	Methylene Chloride	820	~~JBD~~ J
67-64-1	Acetone	5000	U
75-15-0	Carbon Disulfide	2500	U
75-35-4	1,1-Dichloroethene	2500	U
75-34-4	1,1-Dichloroethane	2500	U
540-59-0	1,2-Dichloroethene (total)	38000	~~D~~
67-66-3	Chloroform	2500	U
107-06-2	1,2-Dichloroethane	2500	U
78-93-3	2-Butanone	5000	U
71-55-6	1,1,1-Trichloroethane	2500	U
56-23-5	Carbon Tetrachloride	2500	U
108-05-4	Vinyl Acetate	5000	U
75-27-4	Bromodichloromethane	2500	U
78-87-5	1,2-Dichloropropane	2500	U
10061-01-5	cis-1,3-Dichloropropene	2500	U
79-01-6	Trichloroethene	32000	~~D~~
71-43-2	Benzene	20000	~~D~~
124-48-1	Dibromochloromethane	2500	U
10061-02-6	trans-1,3-Dichloropropene	2500	U
79-00-5	1,1,2-Trichloroethane	2500	U
75-25-2	Bromoform	2500	U
108-10-1	4-Methyl-2-Pentanone	5000	U
591-78-6	2-Hexanone	5000	U
127-18-4	Tetrachloroethene	59000	~~D~~
79-34-5	1,1,2,2-Tetrachloroethane	4900	~~D~~
108-88-3	Toluene	830	J~~D~~
108-90-7	Chlorobenzene	860	J~~D~~
100-41-4	Ethylbenzene	2500	U
100-42-5	Styrene	2500	U
1330-20-7	Xylene (total)	2500	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HP04

Lab Name: Centre Analytical Labs, Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 776 (g/ml) ML Lab File ID: DF059706.D

Level: (low/med) LOW Date Received: 01/25/96

% Moisture: _____ decanted:(Y/N) N Date Extracted: 01/28/97

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 02/05/97

Injection Volume: 1.0 (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
111-44-4	bis(2-Chloroethyl)ether	1300	U
108-95-2	Phenol	1300	U
95-57-8	2-Chlorophenol	1300	U
541-73-1	1,3-Dichlorobenzene	1300	U
106-46-7	1,4-Dichlorobenzene	1300	U
100-51-6	Benzyl alcohol	1300	U
95-50-1	1,2-Dichlorobenzene	42000 ~~46000~~	~~ED~~
108-60-1	bis(2-chloroisopropyl)ether	1300	U
95-48-7	2-Methylphenol	1300	U
67-72-1	Hexachloroethane	870	~~JD~~
621-64-7	N-Nitroso-di-n-propylamine	1300	U
106-44-5	4-Methylphenol	1300	U
98-95-3	Nitrobenzene	1300	U
78-59-1	Isophorone	1300	U
88-75-5	2-Nitrophenol	1300	U
105-67-9	2,4-Dimethylphenol	1300	U
111-91-1	bis(2-Chloroethoxy)methane	1300	U
65-85-0	Benzoic acid	15000	D
120-83-2	2,4-Dichlorophenol	1300	U
120-82-1	1,2,4-Trichlorobenzene	1300	U
91-20-3	Naphthalene	1300	U
106-47-8	4-Chloroaniline	6400	U
87-68-3	Hexachlorobutadiene	270	~~JD~~ J
59-50-7	4-Chloro-3-methylphenol	1300	U
91-57-6	2-Methylnaphthalene	1300	U
77-47-4	Hexachlorocyclopentadiene	1300	U
88-06-2	2,4,6-Trichlorophenol	1300	U
95-95-4	2,4,5-Trichlorophenol	6400	U
91-58-7	2-Chloronaphthalene	1300	U
88-74-4	2-Nitroaniline	6400	U
208-96-8	Acenaphthylene	1300	U
131-11-3	Dimethylphthalate	1300	U
606-20-2	2,6-Dinitrotoluene	1300	U
83-32-9	Acenaphthene	1300	U
99-09-2	3-Nitroaniline	6400	U
51-28-5	2,4-Dinitrophenol	6400	~~U~~ J
132-64-9	Dibenzofuran	1300	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HP04

Lab Name: Centre Analytical Labs, Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 776 (g/ml) ML Lab File ID: DF059706.D

Level: (low/med) LOW Date Received: 01/25/96

% Moisture: _____ decanted:(Y/N) N Date Extracted: 01/28/97

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 02/05/97

Injection Volume: 1.0 (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
121-14-2	2,4-Dinitrotoluene	1300	U
100-02-7	4-Nitrophenol	6400	~~U~~ UJ
86-73-7	Fluorene	1300	U
7005-72-3	4-Chlorophenyl-phenylether	1300	U
84-66-2	Diethylphthalate	1300	U
100-01-6	4-Nitroaniline	6400	U
534-52-1	4,6-Dinitro-2-methylphenol	6400	~~U~~ UJ
86-30-6	n-Nitrosodiphenylamine	1300	U
101-55-3	4-Bromophenyl-phenylether	1300	U
118-74-1	Hexachlorobenzene	260	J~~B~~
87-86-5	Pentachlorophenol	6400	~~U~~ R
85-01-8	Phenanthrene	1300	U
120-12-7	Anthracene	1300	U
84-74-2	Di-n-butylphthalate	1300	U
206-44-0	Fluoranthene	1300	U
129-00-0	Pyrene	1300	U
85-68-7	Butylbenzylphthalate	1300	U
91-94-1	3,3'-Dichlorobenzidine	2600	U
56-55-3	Benzo[a]anthracene	1300	U
218-01-9	Chrysene	1300	U
117-81-7	bis(2-Ethylhexyl)phthalate	1300	U
117-84-0	Di-n-octylphthalate	1300	U
205-99-2	Benzo[b]fluoranthene	1300	U
207-08-9	Benzo[k]fluoranthene	1300	U
50-32-8	Benzo[a]pyrene	1300	U
193-39-5	Indeno[1,2,3-cd]pyrene	1300	U
53-70-3	Dibenz[a,h]anthracene	1300	U
191-24-2	Benzo[g,h,i]perylene	1300	U

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HP04

Lab Name: Centre Analytical Labs, Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 776 (g/ml) ML Lab File ID: DF059706.D

Level: (low/med) LOW Date Received: 01/25/96

% Moisture: _____ decanted: (Y/N) N Date Analyzed: 02/05/97

Concentrated Extract Volume: 1000 (uL) Dilution Factor: 100.0

Injection Volume: 1.0 (uL) Soil Aliquot Volume: 1 (uL)

GPC Cleanup: (Y/N) N pH: _____

Number TICs found: 12

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 000079-34-5	Ethane, 1,1,2,2-tetrachloro-	6.55	1100	JND
2. 000088-17-5	Benzenamine, 2-(trifluoromethyl)-	7.31	550	JND
3. 000095-64-7	Benzenamine, 3,4-dimethyl-	10.24	2500	JND
4. 000098-85-1	Benzenemethanol, .alpha.-methyl	10.68	560	JND
5. 000582-24-1	Ethanone, 2-hydroxy-1-phenyl-	15.40	770	JND
6. 000127-63-9	Diphenyl sulfone	16.23	14000	JND
7. 000090-43-7	o-Hydroxybiphenyl	16.77	830	JND
8. 000889-37-2	Benzenamine, N,N-dimethyl-4-[(p	17.91	820	JND
9.	unknown hydrocarbon	18.64	650	JD
10.	unknown hydrocarbon	18.78	550	JD
11.	unknown hydrocarbon	19.15	560	JD
12. 002385-85-5	Mirex	19.56	5800	JND

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HP04DL

Lab Name: Centre Analytical Labs, Inc. Contract: _____

Lab Code: CAL Case No.: _____ SAS No.: _____ SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 776 (g/ml) ML Lab File ID: DF059707.D

Level: (low/med) LOW Date Received: 01/25/96

% Moisture: _____ decanted:(Y/N) N Date Extracted: 01/28/97

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 02/05/97

Injection Volume: 1.0 (uL) Dilution Factor: 400.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
111-44-4	bis(2-Chloroethyl)ether	5200	U
108-95-2	Phenol	5200	U
95-57-8	2-Chlorophenol	5200	U
541-73-1	1,3-Dichlorobenzene	5200	U
106-46-7	1,4-Dichlorobenzene	5200	U
100-51-6	Benzyl alcohol	5200	U
95-50-1	1,2-Dichlorobenzene	42000	D
108-60-1	bis(2-chloroisopropyl)ether	5200	U
95-48-7	2-Methylphenol	5200	U
67-72-1	Hexachloroethane	5200	U
621-64-7	N-Nitroso-di-n-propylamine	5200	U
106-44-5	4-Methylphenol	5200	U
98-95-3	Nitrobenzene	5200	U
78-59-1	Isophorone	5200	U
88-75-5	2-Nitrophenol	5200	U
105-67-9	2,4-Dimethylphenol	5200	U
111-91-1	bis(2-Chloroethoxy)methane	5200	U
65-85-0	Benzoic acid	7300	JD
120-83-2	2,4-Dichlorophenol	5200	U
120-82-1	1,2,4-Trichlorobenzene	5200	U
91-20-3	Naphthalene	5200	U
106-47-8	4-Chloroaniline	26000	U
87-68-3	Hexachlorobutadiene	5200	U
59-50-7	4-Chloro-3-methylphenol	5200	U
91-57-6	2-Methylnaphthalene	5200	U
77-47-4	Hexachlorocyclopentadiene	5200	U
88-06-2	2,4,6-Trichlorophenol	5200	U
95-95-4	2,4,5-Trichlorophenol	26000	U
91-58-7	2-Chloronaphthalene	5200	U
88-74-4	2-Nitroaniline	26000	U
208-96-8	Acenaphthylene	5200	U
131-11-3	Dimethylphthalate	5200	U
606-20-2	2,6-Dinitrotoluene	5200	U
83-32-9	Acenaphthene	5200	U
99-09-2	3-Nitroaniline	26000	U
51-28-5	2,4-Dinitrophenol	26000	U
132-64-9	Dibenzofuran	5200	U

1C

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HP04DL

Lab Name: Centre Analytical Labs, Inc. Contract:

Lab Code: CAL Case No.: SAS No.: SDG No.: HP04

Matrix: (soil/water) WATER Lab Sample ID: L13743-1

Sample wt/vol: 776 (g/ml) ML Lab File ID: DF059707.D

Level: (low/med) LOW Date Received: 01/25/96

% Moisture: decanted:(Y/N) N Date Extracted: 01/28/97

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 02/05/97

Injection Volume: 1.0 (uL) Dilution Factor: 400.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
121-14-2	2,4-Dinitrotoluene	5600	D
100-02-7	4-Nitrophenol	26000	U
86-73-7	Fluorene	5200	U
7005-72-3	4-Chlorophenyl-phenylether	5200	U
84-66-2	Diethylphthalate	5200	U
100-01-6	4-Nitroaniline	26000	U
534-52-1	4,6-Dinitro-2-methylphenol	26000	U
86-30-6	n-Nitrosodiphenylamine	5200	U
101-55-3	4-Bromophenyl-phenylether	5200	U
118-74-1	Hexachlorobenzene	5200	U
87-86-5	Pentachlorophenol	26000	U
85-01-8	Phenanthrene	5200	U
120-12-7	Anthracene	5200	U
84-74-2	Di-n-butylphthalate	5200	U
206-44-0	Fluoranthene	5200	U
129-00-0	Pyrene	5200	U
85-68-7	Butylbenzylphthalate	5200	U
91-94-1	3,3'-Dichlorobenzidine	10000	U
56-55-3	Benzo[a]anthracene	5200	U
218-01-9	Chrysene	5200	U
117-81-7	bis(2-Ethylhexyl)phthalate	5200	U
117-84-0	Di-n-octylphthalate	5200	U
205-99-2	Benzo[b]fluoranthene	5200	U
207-08-9	Benzo[k]fluoranthene	5200	U
50-32-8	Benzo[a]pyrene	5200	U
193-39-5	Indeno[1,2,3-cd]pyrene	5200	U
53-70-3	Dibenz[a,h]anthracene	5200	U
191-24-2	Benzo[g,h,i]perylene	5200	U

APPENDIX K

Seep Piezometer Analytical Results

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS- JULY 1996
NEASE SITE, SALEM, OHIO

	SW-1*	SP-1	SP-2	SP-3	SP-4	SP-5
VOCs (ug/l)						
Vinyl Chloride	110 J	260	170	57 J	190	46
Methyl Chloride		1 J	6	2 J	3 J	4 J
Acetone			32	11	41	76
Carbon Disulfide						1 J
1,1-Dichloroethene	16	14	50	28	57	53
1,2-Dichloroethene (Total)	1400	1400	8400	2300	1300	15000
Chloroform		1 JB	76 B	15 B	52 B	52 B
1,2- Dichloroethane	380	1300	4400	1000	3700	4300
Trichloroethene	71 J	780	490	560	960	890
Benzene	260	99 J	1900	540	2000	2300
1,1,2-Trichloroethane			64	10	44	60
Tetrachloroethene		8	76	76	35	75
1,1,2,2-Tetrachloroethane			1500	390	1200	2300
Toluene	3 J		24	10	28	31
Chlorobenzene	10	4 J	42	23	70	66
Styrene					2 J	3 J
Xylenes (Total)					2 J	2 J
Total VOCs	**2250**	**3867**	**17230**	**5022**	**9684**	**25259**
SVOCs						
1,4-Dichlorobenzene					8 J	8 J
1,2-Dichlorobenzene	100	210	770	400	1500	1400
2,4-Dichlorophenol						7 J
Benzoic Acid				130 J		64
bis(2-Ethylhexyl)phthalate			280 E			
Total SVOCs	**100**	**210**	**1050**	**530**	**1508**	**1479**
MPK						
Mirex						0.051

Notes: * This sample was a surface water sample taken from the Crane-Deming swamp.
Blank Result = Non detect

Qualifiers: B = Present in associated blanks (semi-quantitative) Data
E = Exceeded calibration limits
J = Estimated (semi-quantitative) Data

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS- JULY 1996
NEASE SITE, SALEM, OHIO

	SW-1*	SP-1	SP-2	SP-3	SP-4	SP-5
METALS						
Aluminum (T)	559.9	257100	19815	14080	6938	7527
Aluminum (D)		475.2	312.3	103.1 B	76.8 B	87.5 B
Antimony (T)						
Antimony (D)			6.11 B		6 B	7.2 B
Arsenic (T)	9.68 B	94.9 B	63.82 B	26.56	37.88	19.43 B
Arsenic (D)	6.97 B	16.05	15.53	4.94 B	9.68 B	8.43 B
Barium (T)	59.93 B	6733.48	964.47 B	150.96 B	90.44 B	53.47 B
Barium (D)	49.8 B	47.81 B	51.66 B	72.71 B	43.13 B	31.28 B
Beryllium (T)		29.19 B	18.17 B	1.1 B		
Beryllium (D)						
Cadmium (T)	52.95	257.7	245.21	50.94	52.09	51.21
Cadmium (D)						
Calcium (T)	210000	339700	328450	181700	218300	181100
Calcium (D)	200000	283400	274500	164300	204200	152100
Chromium (T)	1.64 B	436.06	329.84	21.23	12.53 B	12.6 B
Chromium (D)	0.69 B	1.61 B	24.86	1.03 B	1.38 B	1.22 B
Cobalt (T)	1.06 B	535.01	298.76 B	32.32 B	15.79 B	9.93 B
Cobalt (D)		6.38 B	3.39 B	0.85 B	2.4 B	0.73 B
Copper (T)		579	276.5	22.6 B	14.4 B	
Copper (D)						
Iron (T)	5441	721000	651500	61480	67580	53740
Iron (D)	265.6	10040	73700	502.9	23650	27540
Lead (T)	3.02 B	445.74	250.54	27.29	53.2	12.35
Lead (D)						
Magnesium (T)	51490	186950	188650	47140	53540	54930
Magnesium (D)	50610	75880	95780	39270	48180	47780
Manganese (T)	410.84	12408.3	20417.6	2501.7	4621.58	4744
Manganese (D)	353.69	3760.09	13768.5	1579.47	3791.67	4312.09
Mercury (T)	1.19	2.84	3.31	0.55	0.59	0.67
Mercury (D)			0.11 B			
Nickel (T)	6.99 B	1064.7	590.89	61.67 B	37.79 B	24.77 B
Nickel (D)	4.53 B	24.5 B	16.17 B	5.23 B	9.26 B	5.78 B
Potassium (T)	2410 B	23865 B	21905 B	5983	4230 B	4087 B
Potassium (D)	2337 B	4022 B	6701	4305 B	3415 B	3185 B
Selenium (T)	20.71	95.09	78.95	19.05	20.87	18.81
Selenium (D)	3.56 B	5.64	11.1	3.53 B	3.88 B	3.8 B
Sodium (T)	38980	118450	129050	54240	55640	57680
Sodium (D)	38150	113900	127600	53930	53070	57430
Thallium (T)		6.31 B	2.35 B		0.37 B	
Thallium (D)						
Vanadium (T)		392.52 B	295.04 B	23.74 B	15.35 B	12.73 B
Vanadium (D)			6.74 B			0.39 B
Zinc (T)	27.57 B	3696.1	1965.26	187.68	186.09	78.88
Zinc (D)		18.68 B	10.27 B		12.48 B	13.97 B

Notes: * This sample was a surface water sample taken from the Crane-Deming swamp.
Blank Result = Non detect
(D) = TAL Dissolved Metals
(T) = TAL Total Metals

Qualifiers: B = Present in associated blanks (semi-quantitative) Data

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS-MAY 1997
NEASE SITE, SALEM, OHIO

	SP-1	SP-2	SP-3	SP-4	SP-5	SP-6*
VOCs (ug/l)						
Vinyl Chloride	110	220	54	110	54	120
Methyl Chloride			14	8	6	
Acetone	6 JB	14 B	2200 B	88 JB	150 B	
Carbon Disulfide			9		1 J	
1,1-Dichloroethene	25	33	72	68	80	11
1,2-Dichloroethene (Total)	100	240	81	280	350	170
Chloroform		43 B	230 JB	61 B	47 B	
1,2- Dichloroethane	920	2000	5900	2500	2000	1900
1,2-Dichloropropene			2 J			
Trichloroethene	810	250	3800	480	540	210
Benzene	140	1400	5800	2100	1900	250
1,1,2-Trichloroethane		29	110	72	60	
Bromoform			4 J			
Tetrachloroethene	2 J	56	2200	43	59	
1,1,2,2-Tetrachloroethane	2 J	610	4900	1500	1200	12
Toluene	1 J	14	120	20	25	28
Chlorobenzene	6	31	160	68	62	70
Ethylbenzene			2 J			
Styrene					2 J	2 J
Xylenes (Total)			9	4 J	3 J	2 J
Total VOCs	**2122**	**4940**	**25667**	**7402**	**6539**	**2775**
SVOCs						
Phenol			16	8 J	10	
1,4-Dichlorobenzene			24		7 J	
Benzyl Alcohol			120			
1,2-Dichlorobenzene	70	270	3400	1200	1000	
Benzoic Acid			4000			
bis(2-Ethylhexyl)phthalate			54 B	30 B	760 B	16 B
Total SVOCs	**70**	**270**	**7614**	**1230**	**1767**	**16**
MPK						
Mirex						

Notes: * SP-6 did not contain enough water for MPK analysis.
Blank Result = Non detect

Qualifiers: B = Present in associated blanks (semi-quantitative) Data
J = Estimated (semi-quantitative) Data

1996 SEEP INVESITGATION
SUMMARY OF DETECTIONS-MAY 1997
NEASE SITE, SALEM, OHIO

	SP-1	SP-2	SP-3	SP-4	SP-5	SP-6*
METALS						
Aluminum (T)	80450	101800	42690	70700	16655	
Aluminum (D)	157.5	228.7	179.9	161.3 B		
Antimony (T)	3.93 B	2.44 B	2.5 B	8.8 B		
Antimony (D)						
Arsenic (T)	103.28	107.27	116.1	333.24	50.85	
Arsenic (D)	21.38	28.9	62.44	16.55	13.22	
Barium (T)	3071.52	934.14 B	369.28 B	510.13 B	165.23 B	
Barium (D)	38.45 B	26.61 B	61.52 B	20.52 B	22.92 B	
Beryllium (T)	7.93 B	9.69 B	4.05 B	8.51 B		
Beryllium (D)						
Cadmium (T)						
Cadmium (D)						
Calcium (T)	220000	258400	325350	259450	163700	
Calcium (D)	165700	237100	318000	202900	159700	
Chromium (T)	106.24	146.1	72.67	98.95	33.07 B	
Chromium (D)	12.45	17.87	18.09	11.03	10.22	
Cobalt (T)	121.24 B	131.57 B	137.47 B	166.56 B	21.96 B	
Cobalt (D)	4.08 B	6.33 B	46.75 B	5.21 B	1.08 B	
Copper (T)	185.5	162.5	66 B	288.5		
Copper (D)						
Iron (T)	316050	484350	285750	487950	94300	
Iron (D)	537.4	8462	103400	3700	1469	
Lead (T)	150.63	176.08	120.01	647.81	42.19	
Lead (D)						
Magnesium (T)	86100	121400	136200	89000	52050	
Magnesium (D)	39040	73410	127300	51560	48800	
Manganese (T)	3381.88	9367.38	21155.7	11466.5	4736.27	
Manganese (D)	1328.48	7446.82	20797.8	4237.89	4032.04	
Mercury (T)	1.25	1.47	2.37	2.31	2.41	
Mercury (D)						
Nickel (T)	257.3	271.44	251.86	348.06	51.48 B	
Nickel (D)	20.11 B	24.48 B	80.72	18.57 B	9.03 B	
Potassium (T)	11755 B	11515 B	8205 B	9520 B	5235 B	
Potassium (D)	1775 B	2967 B	4220 B	2382 B	2550 B	
Selenium (T)	9.93 B	6.83 B	3.54 B	13.05 B	4.11 B	
Selenium (D)	2.95 B	1.29 B	0.55 B	0.86 B	0.58 B	
Sodium (T)	75750	102400	143800	55750	51250	
Sodium (D)	50530	98800	139300	51670	45660	
Thallium (T)	1.87 B	1.71 B		2.13 B		
Thallium (D)						
Vanadium (T)	113.78 B	151.98 B	77.22 B	133.1 B	34.16 B	
Vanadium (D)	3.25 B	3.78 B	4.72 B	2.9 B	2.63 B	
Zinc (T)	895.43	946.56	687.07	1985.24	233.6	
Zinc (D)	3.29 B	3.46 B	19.22 B	3.64 B	2.76 B	

Notes: * SP-6 did not contain enough water for metals analysis.
Blank Result = Non detect
(D) = TAL Dissolved Metals
(T) = TAL Total Metals

Qualifiers: B = Present in associated blanks (semi-quantitative) Data

EASTERN PLUME/DNAPLE INVESTIGATION
HYDROPUNCH SUMMARY OF DETECTIONS
NEASE SITE, SALEM, OHIO

	HP-4
VOCs (ug/l)	
Chloromethane	13
Bromomethane	14
Vinyl Chloride	120
Methylene Chloride	170
Acetone	820 J
1,1-Dichloroethene	61
1,2-Dichloroethene (Total)	38000
Chloroform	18
Trichloroethene	32000
Benzene	20000
1,1,2-Trichloroethane	100
Bromoform	5 J
Tetrachloroethene	59000
1,1,2,2-Tetrachloroethane	4900
Toluene	830 J
Chlorobenzene	860 J
Ethylbenzene	4 J
Styrene	12
Xylenes (Total)	7
Total VOCs	**156907**
SVOCs	
1,2-Dichlorobenzene	42000
Hexachloroethane	870 J
Benzoic Acid	15000
Hexachlorobutadiene	270 J
Hexachlorobenzene	260 J
Total SVOCs	**16400**

Qualifiers:

J = Estimated (semi-quantitative) Data