OPERATIONS AND MAINTENANCE MANUAL

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

PREPARED BY:

MCGILL ASSOCIATES, P.A.
870 Winfield Dunn Parkway, Suite 6
Sevierville, Tennessee 37876

PROJECT NUMBER 95315.01

September 6, 1996

10946585

MWPS007146

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June 9, 2006

VIA FACSIMILE AND USPS
Mr. Michael C. Mallen
Perimeter Properties, LLC
1810 Chestnut Street
Chattanooga, TN 37408

COPY

Re: U.S. Pipe & Foundry Company Site

Dear Mike:

In going through the last batch of documents that we forwarded over to Wayne, we noted references to a TVA permit that had been requested for an expansion of the landfill that was contemplated 20 years ago. TVA agreed to issue the permit, with typical conditions, for 0.24 acre-feet of fill in an area on the southern end of the landfill property, between 436 feet and 440 feet above msl. There are several copies of the permit information in the last batch of documents, including Bates Nos. USP-19417 - USP-19422.

In trying to locate the area covered by this permit, we consulted with Jim Smallwood and other U.S. Pipe officials. Jim believes that the area referenced in the permit was never in fact included in any expansion of the landfill to the South. Indeed, Mr. Smallwood does not believe that the permit was ever accepted by U.S. Pipe, and I do not recall seeing a copy of the document signed by U.S. Pipe, although I have not gone back through and undertaken an exhaustive search.

Rick Hudson indicates that we should have a topographic survey of the landfill completed by next week, and it seems to me that a simple way to approach this issue is to see if we can determine whether any portion of the landfill is below 440 feet above msl, at about Mile 461.7. In the meantime, U.S. Pipe officials are looking for other documentation that may shed light on the issue.

Please call me if you would like to discuss the issue further.

01463_00/0601/SJW-001011_1

With best regards, I am

Sincerely yours,

Frederick L. Hitchcock

FLH/sjw
cc: Mr. Wayne Peters
Mr. Danny Jennings
Mr. Miles Dearden
Mr. Walter Knollenberg
Ms. Myla Choy
Mr. Richard T. Hudson

01463_00/0601/SJW-001011_1

PRIDDY ENGINEERING
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May 18, 2005

Mr. Joe Hartman
Tennessee Department of Environment & Conservation
Chattanooga EAC
540 McCallie Avenue
Suite 550
Chattanooga, TN 37402-2013

RE: U.S. Pipe & Foundry Company
Chattanooga Valve & Fittings Plant Landfill
Chattanooga, Hamilton County, Tennessee
Registration No. 33-0102

Dear Mr. Hartman:

Per our telephone conversation last week, please find enclosed two (2) copies of "Revision to Operations and Maintenance Manual" for the referenced facility. This revision updates the manual to include actual permit conditions and the new groundwater monitoring well network.

Please add the enclosed revision section, remove Sheets 1 through 7, and replace the enclosed Sheets 1 through 6 in the Operation and Maintenance Manual.

Please contact me if you have questions or need additional information.

Yours truly,

Charles F. Priddy, Jr., P.E.

Enclosures

Pc: Danny Jennings (2 copies)
Ben Noble

REVISION TO OPERATIONS AND MAINTENANCE MANUAL
FOR
U. S. PIPE & FOUNDRY COMPANY
CLASS II FOUNDRY WASTE LANDFILL
CHATTANOOGA, TENNESSEE

MAY 2005

PREPARED BY:
PRIDDY ENGINEERING
221 Golf Club Drive
Sevierville, Tennessee 37876

This revision references the Operations and Maintenance Manual prepared for United States Pipe & Foundry Company (U. S. Pipe) by the engineer of record while employed by McGill Associates, Sevierville, TN and dated September 6, 1996. It updates the Manual to include Tennessee Department of Environment and Conservation, Division of Solid Waste Management (TDEC-DSWM) Permit Conditions issued on July 11, 2000 (Registration No. IDL 33-0102), and a minor permit modification in 2004 for a new groundwater monitoring well network. The revisions are referenced according to the section numbers of the manual.

3.0 OPERATION AND DESIGN CRITERIA

Valve and fittings production levels at U. S. Pipe have varied considerably over the past few years. This directly affects the amounts of waste generated. Future circumstances may further change the waste quantities.

3.2 VARIANCES AND WAIVERS

The TDEC-DSWM Permit Conditions lists the variances that were granted. A copy of the Permit is attached to this revision, which is includes the granted variances. Also attached is a letter from Siskin Steel and Supply Co. giving U. S. Pipe permission to place new waste to within fifty (50) feet of their common property line. Waste previously placed closer than 50 feet to the property line will remain.

Major variances include using a ten (10) foot lift of foundry sand as a buffer in previously unfilled areas in lieu of a liner/leachate collection system, and reducing the setback for placing new waste from normal stream boundaries (Tennessee River) from 200 feet to 100 feet. Waste previously placed closer than 100 feet will remain.

4.0 CONSTRUCTION AND OPERATION

4.1 FILL OPERATIONS

The landfill is now divided into two operational phases, instead of three. The originally proposed Phase 1 area located south of the existing landfill was not approved for use as a landfill since portions of the site are below the 100-year flood plain elevation. Therefore, the original Phase II storage yard to the north is now Phase 1, and the original Phase III that will place waste on top of the existing and proposed filled areas is renamed Phase 2. The fill operations remain the same, but the ten (10)-foot layer of compacted foundry sand will be placed in the Phase 1 area as a buffer, prior to disposing of other foundry wastes in that area. Some areas of the existing fill along the Siskin Steel property have been filled slightly outside the landfill boundary and will be regraded to comply with permit conditions.

U. S. Pipe has established a staging area for treated baghouse dust. It is a covered dumpster located across the road from the baghouse dust discharge bin. Cadmium and lead TCLP testing of composite samples of each dumpster volume is conducted, and results are obtained prior to transporting the baghouse dust to the landfill. The results must be less than the universal treatment land disposal standards (0.11 mg/l cadmium and 0.75 mg/l lead), or the entire dumpster load is retreated and resampled until the land disposal standards are met. (This statement updates Facility Specific Permit Condition 9; also, "Long Street Landfill" should read "Chattanooga Valve & Fittings Landfill"). Only then is the treated baghouse dust transported to the landfill for disposal. The TCLP test results will be submitted to TDEC-DSWM quarterly. Any TCLP value exceeding 1.0 mg/l for cadmium or 5.0 mg/l lead will be reported to TDEC-DSWM immediately.

4.2 COVER AND FINAL GRADING

As required by the Permit, a geosynthetic clay liner, or other approved material, will be used on all areas with a final grade of less than 4 to 1 slope. U. S. Pipe believes an alternate liner having a maximum permeability of $1x10^{-6}$ cm/sec could consist of a mixture of foundry sand and bentonite. This option may be proposed in the construction quality assurance document, which will be submitted to TDEC-DSWM for approval prior to construction of the final cap.

The final grade of the Phase 1 area below the 100-year flood elevation of 656 will be rip-rapped to protect the slope during floods.

5.0 PROJECTED REFUSE AND COVER VOLUMES

Due to the deletion of the original Phase I area of the landfill, Table 2 is revised according to 1996 quantities and conditions. Again, the projected capacities will vary with changes in production levels.

Table 2
Projected Landfill Capacities

PHASE	ACREAGE	VOLUME (Cubic Yards)	PROJECTED LIFE (Years)	ACREAGE USED EACH YEAR
Present	17.9	1,063,500	Filled	-
1	6.7	427,300	19.2	0.3
2	0	327,000	14.7	0
Subtotal	24.6	1,817,800	33.9	-
Other Areas (Non-Fill Access Roads, Rock Dams)	5.4	0	0	-
TOTAL	30.0	1,817,800	34	-

10.0 GROUNDWATER MONITORING

In June 2004, the entire groundwater monitoring well network was replaced. This was approved by TDEC as a minor permit modification. Monitoring wells MW-1 through MW-6 were abandoned and new monitoring wells USP-1 through USP-4 were installed. Well installation details are attached.

CONSTRUCTION DRAWINGS

Sheets 1 through 6 have been revised based on the Permit Conditions and the new monitoring well locations.

Gallet & ASSOCIATES

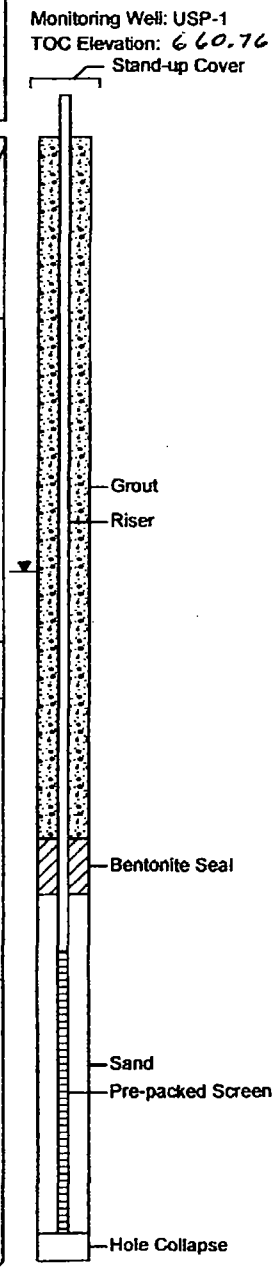
Log of Monitoring Well USP-1

Monitoring Well Installation
U.S. Pipe & Foundry Company
Chattanooga Valve and Fittings Plant Landfill
Chattanooga, Hamilton County, Tennessee

Gallet Project # 04BHUSP0701E

Date Started	: 6/9/04	Total Boring Depth	: 40'
Date Completed	: 6/10/04	Well Diameter/Material	: 2" Schedule 40 PVC
Drilling Method	: Hollow Stem Auger	Wet Soil Encountered	: ~30'
Drilling Company	: Tri-State	Boring Logged By	: Eric C. Reardon
Boring Diameter	: 10"	Weather	: Partly Cloudy 80's

Depth in Feet	Surface Elevation	Graphics	Lithologic Descriptions
0			Concrete
2			SANDY SILT, black with some landfill debris
4			
6			SILTY CLAY, olive, moist, low plasticity
8			
10			
12			
14			
16			
18			SILT, gray-black
20			Low to no drill cuttings for 10' of boring
22			
24			
26			
28			
30			SILTY CLAY, wet, olive-gray
32			
34			
36			
38			
40			Boring Terminated



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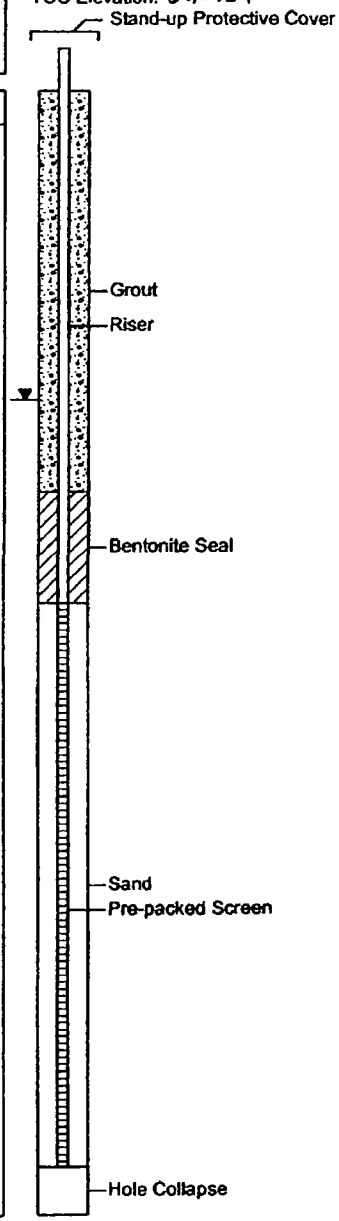
Gallet & ASSOCIATES

Log of Monitoring Well USP-2

Monitoring Well Installation U.S. Pipe & Foundry Company Chattanooga Valve and Fittings Plant Landfill Chattanooga, Hamilton County, Tennessee	Date Started	: 6/12/04	Total Boring Depth	: 20'
	Date Completed	: 6/12/04	Well Diameter/Material	: 2" Schedule 40 PVC
	Drilling Method	: Hollow Stem Auger	Wet Soil Encountered	: 7'
	Drilling Company	: Tri-State	Boring Logged By	: Eric C. Reardon
Gallet Project # 04BHUSP0701E	Boring Diameter	: 10"	Weather	: Partly Cloudy 80's

Depth in Feet	Surface Elevation	Graphics	Lithologic Descriptions
0			Topsoil
1			SILTY SAND, tan-olive, with limestone cobbles
4			Moist
7			Wet
20			Boring Terminated

Monitoring Well: USP-2
TOC Elevation: 640.51



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Gallet & ASSOCIATES

Log of Monitoring Well USP-3

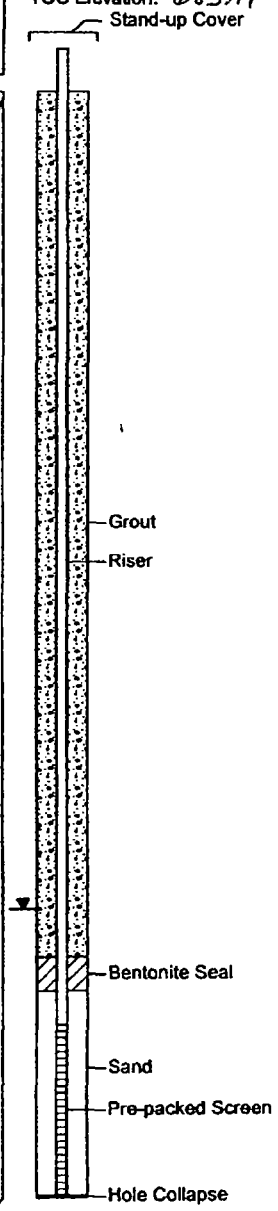
Monitoring Well Installation
U.S. Pipe & Foundry Company
Chattanooga Valve and Fittings Plant Landfill
Chattanooga, Hamilton County, Tennessee

Gallet Project # 04BHUSP0701E

Date Started	: 6/11/04	Total Boring Depth	: 65'
Date Completed	: 6/12/04	Well Diameter/Material	: 2" Schedule 40 PVC
Drilling Method	: Hollow Stem Auger	Wet Soil Encountered	: 50'
Drilling Company	: Tri-State	Boring Logged By	: Eric C. Reardon
Boring Diameter	: 10"	Weather	: Partly Cloudy 80's

Depth in Feet	Surface Elevation	Graphics	Lithologic Descriptions
0			Topsoil
2–4			SILTY SAND, black (Foundry fill), with 4" to 5" slag, copper, iron debris and intermittent yellow-orange sandstone cobbles
50			Wet
64–66			Boring Terminated

Monitoring Well: USP-3
TOC Elevation: 683.17



10-27-2004 .:\USP0701E\USP-3.bor

Gallet & ASSOCIATES

Log of Monitoring Well USP-4

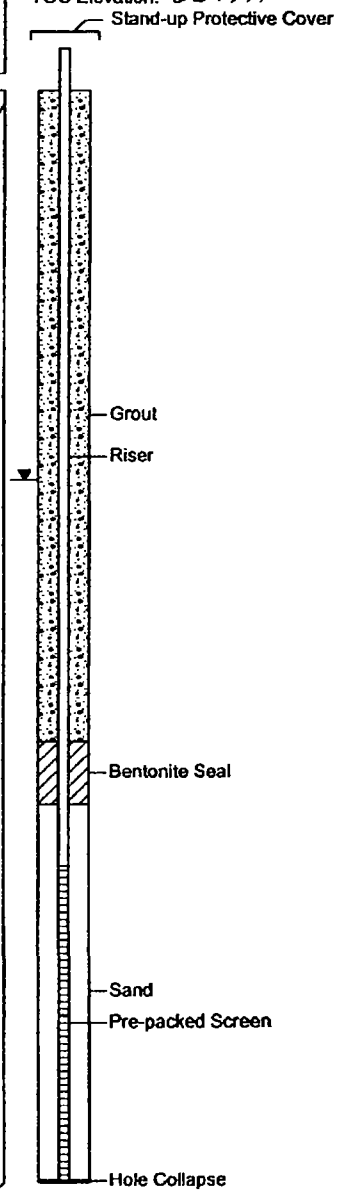
Monitoring Well Installation
U.S. Pipe & Foundry Company
Chattanooga Valve and Fittings Plant Landfill
Chattanooga, Hamilton County, Tennessee

Gallet Project # 04BHUSP0701E

Date Started	: 6/9/04	Total Boring Depth	: 35'
Date Completed	: 6/10/04	Well Diameter/Material	: 2" Schedule 40 PVC
Drilling Method	: Hollow Stem Auger	Wet Soil Encountered	: 10'
Drilling Company	: Tri-State	Boring Logged By	: Eric C. Reardon
Boring Diameter	: 10"	Weather	: Partly Cloudy 80's

Depth in Feet	Surface Elevation	Graphics	Lithologic Descriptions
0			Concrete
			SAND SILT, black with some landfill debris
2			
4			
6			Moist
8			
10			Wet
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			
34			Boring Terminated
36			

Monitoring Well: USP-4
TOC Elevation: 654.17



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NOTES

1. EXISTING TOPOGRAPHY TAKEN FROM MAP BY CONTINENTAL AERIAL SURVEYS, INC. (DATE OF PHOTOGRAPH 8/20/2000).
2. NO NEW WASTE TO BE PLACED WITHIN 100' OF THE NORMAL POOL ELEVATION (636 CONTOUR) ALONG THE RIVER OR WITHIN 50' OF THE PROPERTY BOUNDARY.
3. SEE SHEETS 4 & 5 AND APPENDIX IV OF REPORT FOR VIEWS AND SECTIONS.
4. SEE SHEET 6 FOR DETAILS.
5. FILL OUTSLOPES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STABILITY ANALYSIS REPORT PREPARED BY GEOLOGIC ASSOCIATES, INC. AND INCLUDED IN THE LANDFILL OPERATIONS AND MAINTENANCE MANUAL. SPECIFIC CONSTRUCTION RECOMMENDATIONS CONTAINED IN THE STABILITY ANALYSIS REPORT ARE AS FOLLOWS:
   A) PLACE WASTE IN MAXIMUM 18" LIFTS AND COMPACT WITH HAULING AND SPREADING EQUIPMENT.
   B) CONSTRUCT SLOPES SLIGHTLY STEEPER THAN DESIGNED WITH SPECIAL EFFORT TO COMPACT THE WASTE NEAR THE OUTSLOPE AND PERIODICALLY GRADE SLOPES TO DESIGN CONFIGURATION
   C) ROUTINELY INSPECT OUTSLOPES FOR SCOUR DUE TO HIGH WATER AND REPAIR AS REQUIRED.
6. CONSTRUCT TERRACES AS SHOWN ON THE SITE PLAN AND SECTIONS WITH APPROXIMATE CROSS SLOPE OF 3%.
7. TREES AND VEGETATION ADJACENT TO THE LANDFILL OPERATION WILL REMAIN UNDISTURBED WHERE PRACTICAL.
8. ALL RIPRAP CHANNELS SHALL BE CONSTRUCTED WITH A 1 1/2 FOOT THICK BLANKET OF CLASS B RIPRAP (SEE STANDARD DETAIL ON SHEET 6).
9. ALL UNSUITABLE TOPSOIL TO BE REMOVED PRIOR TO FILL CONSTRUCTION.
10. ALL NEW FILL SLOPES BELOW THE 100 YEAR FLOOD ELEVATION (656) MUST BE RIP-RAPPED A MINIMUM OF 18 INCHES THICK UNDERLAIN BY A FILTER FABRIC. RIP-RAP SHALL BE 5 INCHES TO 15 INCHES IN DIAMETER WITH A MEAN DIAMETER OF 10 INCHES.
11. UNFILLED PHASE 1 AREA SHALL FIRST BE COVERED WITH A 10 FOOT LIFT OF FOUNDRY SAND AS A BUFFER, COMPACTED TO 90% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR TEST, ASTM D 698.

PLAN
SCALE: 1"= 100'

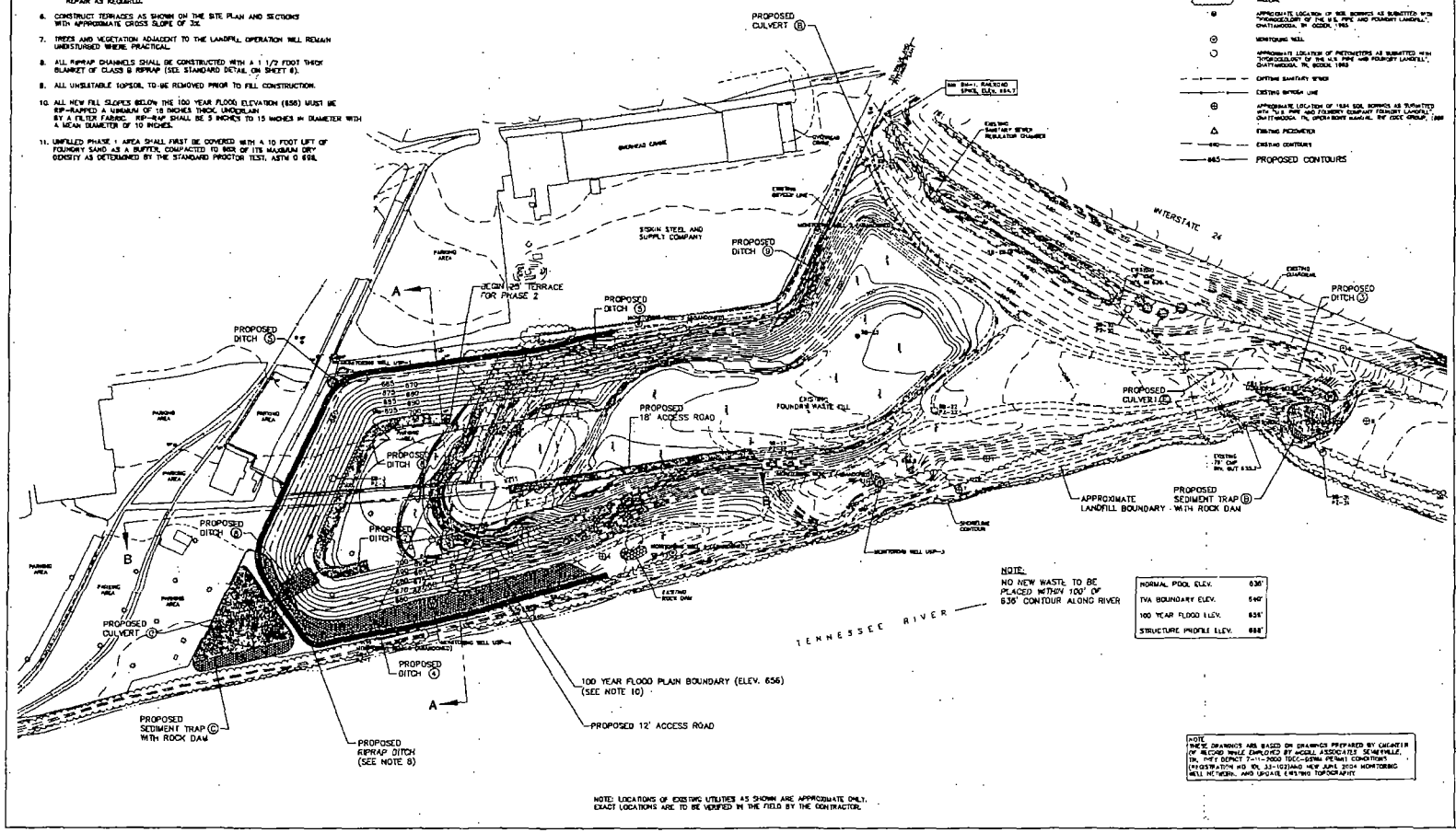
SCHEDULE OF DITCHES		
DITCH	DEPTH	% SLOPE
3	1.5'	7.8
4	1.5'	0.5
5	2'	0.8
6	1.5'	3.2
7	1.5'	2.2
8	1.5'	27.3
9	1.5'	0.5

SCHEDULE OF CULVERTS		
CULVERT	SIZE	SLOPE
B	30"x50'	0.5%
C	42"x40'	0.5%
E	24"x40'	0.5%

NOTE: CULVERT LENGTHS ARE APPROXIMATE. CONTRACTOR TO DETERMINE CORRECT LENGTH BY FIELD MEASUREMENT.

LEGEND- EXISTING CONDITIONS

- UTILITY POLE
- GUY WIRE ANCHOR
- MANHOLE
- WATER METER
- WATER VALVE
- FIRE HYDRANT
- CATCH BASIN
- CULVERT
- SIGN
- MAILBOX OR PAPER BOX
- POSTAL DROP BOX
- TELEPHONE PEDESTAL
- FENCE
- TREES/SHRUBS
- BASELINE
- APPROXIMATE LOCATION OF SOIL BORINGS AS SUBMITTED WITH "HYDROGEOLOGY OF THE U.S. PIPE AND FOUNDRY LANDFILL", CHATTANOOGA, TN OCTOBER, 1993
- MONITORING WELL
- APPROXIMATE LOCATION OF PIEZOMETERS AS SUBMITTED WITH "HYDROGEOLOGY OF THE U.S. PIPE AND FOUNDRY LANDFILL", CHATTANOOGA, TN, OCTOBER 1993
- EXISTING SANITARY SEWER
- EXISTING BATHER LINE
- APPROXIMATE LOCATION OF 1984 SOIL BORINGS AS SUBMITTED WITH "U.S. PIPE AND FOUNDRY COMPANY FERNBERT LANDFILL", CHATTANOOGA, TN, OPERATIONS MANUAL, RW COOK GROUP, 1988
- EXISTING PIEZOMETER
- 640 EXISTING CONTOURS
- 645 PROPOSED CONTOURS



NOTE:
NO NEW WASTE TO BE PLACED WITHIN 100' OF 636' CONTOUR ALONG RIVER

NORMAL POOL ELEV.	636'
TVA BOUNDARY ELEV.	640'
100 YEAR FLOOD ELEV.	656'
STRUCTURE PROFILE ELEV.	668'

NOTE
THESE DRAWINGS ARE BASED ON DRAWINGS PREPARED BY CHENTER OF RECORD WHILE EMPLOYED BY HOGELL ASSOCIATES, SENEVILLE, TN. THEY REFLECT T-11-2000 TDEC-SWM PERMIT CONDITIONS (REGISTRATION NO. TDL 33-1023440) NEW APRIL 2004 MONITORING WELL NETWORK, AND UPDATE EXISTING TOPOGRAPHY

NOTE: LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.

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CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

DATE: SEPTEMBER 2007
SCALE: 1" = 100'
REVISION: MAY 2008

PHASE 1 FILL AREA GRADING, DRAINAGE & EROSION CONTROL PLAN

SHEET 1 OF 6

MWPS007158

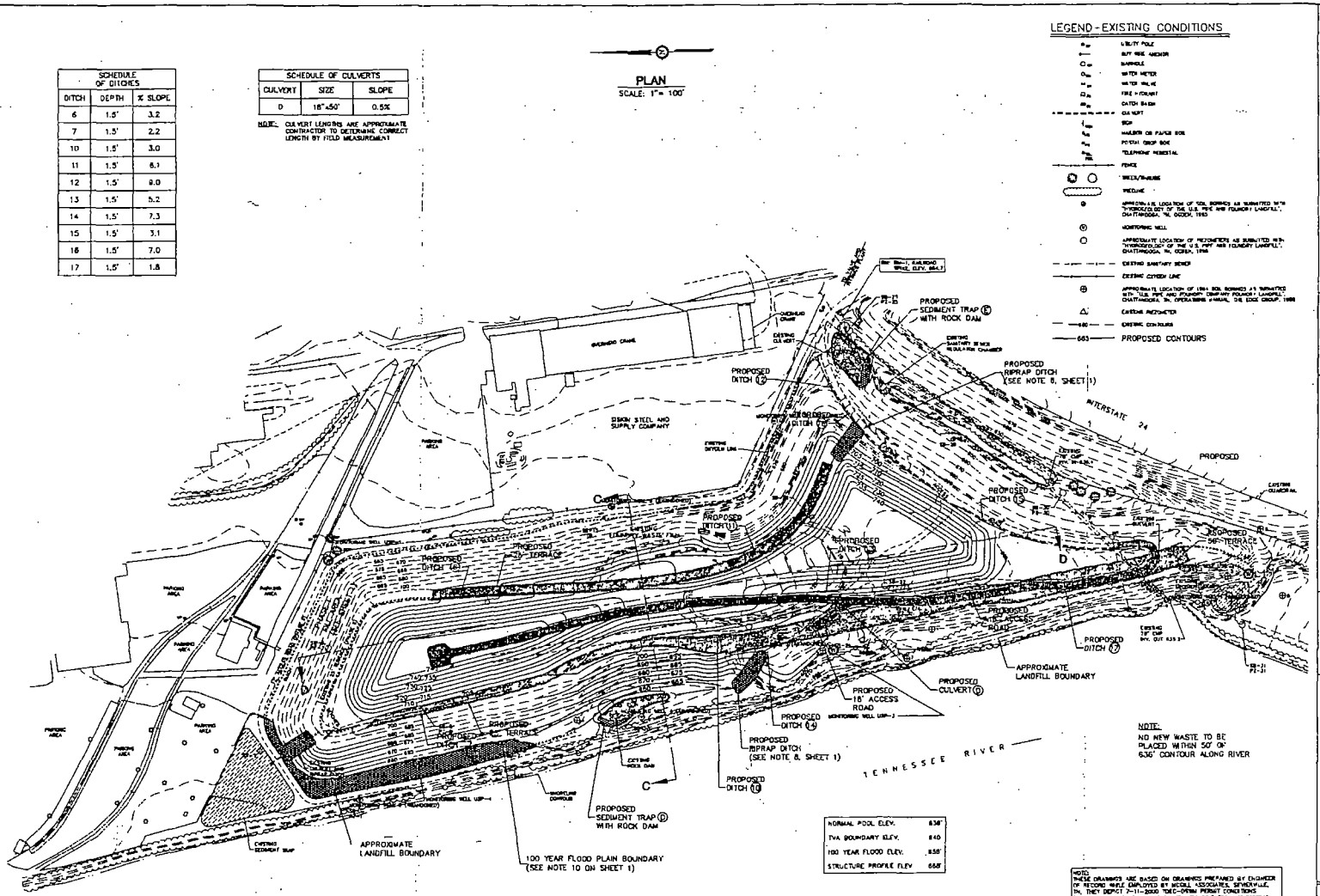
SCHEDULE OF DITCHES		
DITCH	DEPTH	% SLOPE
6	1.5'	3.2
7	1.5'	2.2
10	1.5'	3.0
11	1.5'	6.1
12	1.5'	9.0
13	1.5'	5.2
14	1.5'	7.3
15	1.5'	3.1
16	1.5'	7.0
17	1.5'	1.8

SCHEDULE OF CULVERTS		
CULVERT	SIZE	SLOPE
D	18"x50'	0.5%

NOTE: CULVERT LENGTHS ARE APPROXIMATE. CONTRACTOR TO DETERMINE CORRECT LENGTH BY FIELD MEASUREMENT

PLAN

SCALE: 1" = 100'



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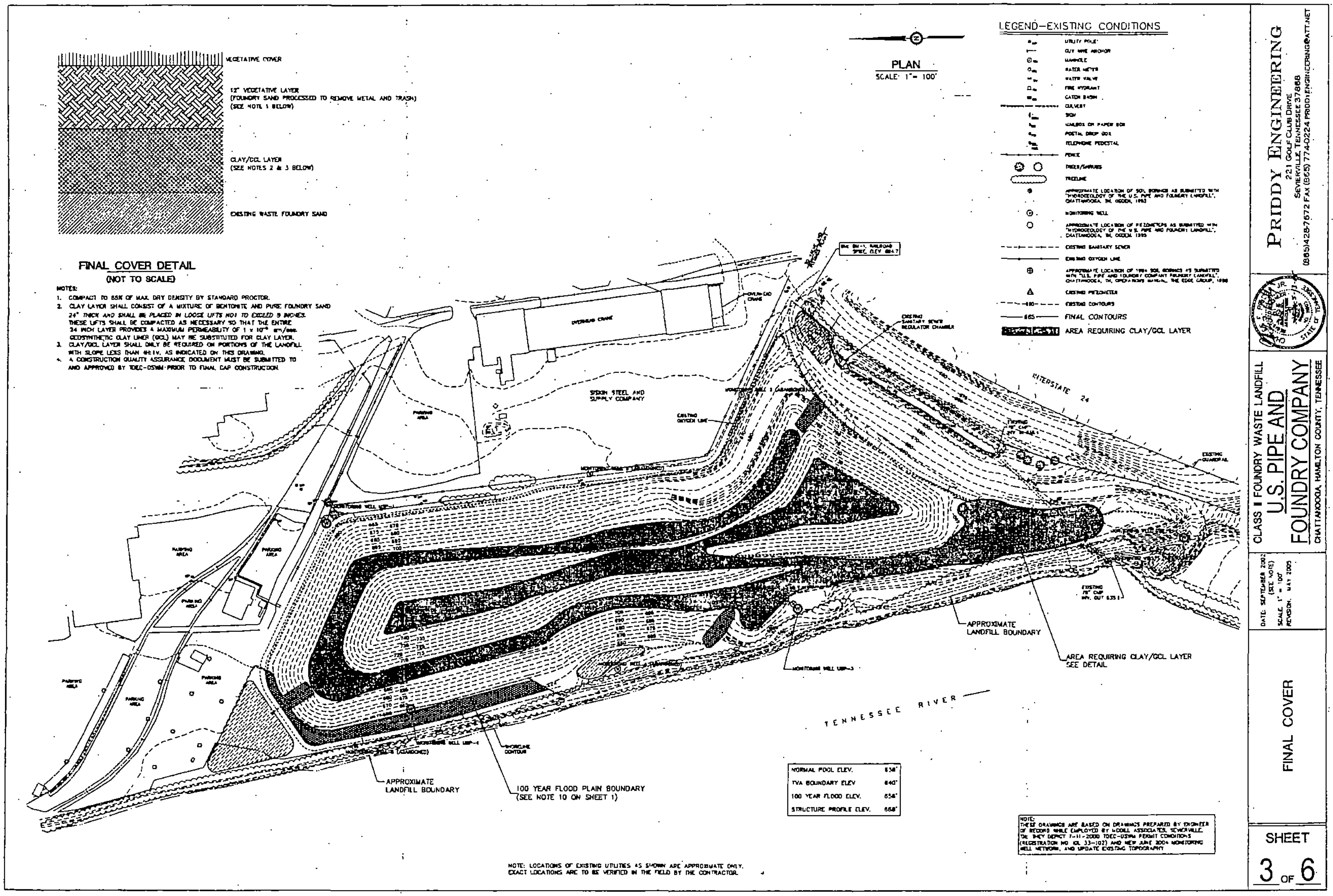
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

DATE: SEPTEMBER 2002
SCALE: 1" = 100'
REVISION: MAY 2005

PHASE 2 FILL AREA GRADING, DRAINAGE & EROSION CONTROL PLAN

SHEET 2 OF 6

MWPS007159


VEGETATIVE COVER
12" VEGETATIVE LAYER
(FOUNDRY SAND PROCESSED TO REMOVE METAL AND TRASH)
(SEE NOTE 1 BELOW)
CLAY/GCL LAYER
(SEE NOTES 2 & 3 BELOW)
EXISTING WASTE FOUNDRY SAND
FINAL COVER DETAIL
(NOT TO SCALE)
NOTES:
1. COMPACT TO 85% OF MAX. DRY DENSITY BY STANDARD PROCTOR.
2. CLAY LAYER SHALL CONSIST OF A MIXTURE OF BENTONITE AND PURE FOUNDRY SAND 24" THICK AND SHALL BE PLACED IN LOOSE LIFTS NOT TO EXCEED 9 INCHES. THESE LIFTS SHALL BE COMPACTED AS NECESSARY SO THAT THE ENTIRE 24 INCH LAYER PROVIDES A MAXIMUM PERMEABILITY OF 1 x 10⁻⁶ cm/sec. GEOSYNTHETIC CLAY LINER (GCL) MAY BE SUBSTITUTED FOR CLAY LAYER.
3. CLAY/GCL LAYER SHALL ONLY BE REQUIRED ON PORTIONS OF THE LANDFILL WITH SLOPE LESS THAN 4H:1V, AS INDICATED ON THIS DRAWING.
4. A CONSTRUCTION QUALITY ASSURANCE DOCUMENT MUST BE SUBMITTED TO AND APPROVED BY TDEC-DSWM PRIOR TO FINAL CAP CONSTRUCTION.
PLAN
SCALE: 1" = 100'
LEGEND-EXISTING CONDITIONS
UTILITY POLE
GUY WIRE ANCHOR
MANHOLE
WATER METER
WATER VALVE
FIRE HYDRANT
CATCH BASIN
CULVERT
SIGN
MAILBOX OR PAPER BOX
POSTAL DROP BOX
TELEPHONE PEDESTAL
FENCE
TREES/SHRUBS
TREELINE
APPROXIMATE LOCATION OF SOIL BORINGS AS SUBMITTED WITH "HYDROGEOLOGY OF THE U.S. PIPE AND FOUNDRY LANDFILL", CHATTANOOGA, TN, OGDEN, 1993
MONITORING WELL
APPROXIMATE LOCATION OF PIEZOMETERS AS SUBMITTED WITH "HYDROGEOLOGY OF THE U.S. PIPE AND FOUNDRY LANDFILL", CHATTANOOGA, TN, OGDEN, 1993
EXISTING SANITARY SEWER
EXISTING OXYGEN LINE
APPROXIMATE LOCATION OF 1984 SOIL BORINGS AS SUBMITTED WITH "U.S. PIPE AND FOUNDRY COMPANY FOUNDRY LANDFILL", CHATTANOOGA, TN, OPERATIONS MANUAL, THE EDGE GROUP, 1990
EXISTING PIEZOMETER
EXISTING CONTOURS
FINAL CONTOURS
AREA REQUIRING CLAY/GCL LAYER
OVERHEAD CRANE
SISKIN STEEL AND SUPPLY COMPANY
PARKING AREA
INTERSTATE 24
TENNESSEE RIVER
APPROXIMATE LANDFILL BOUNDARY
AREA REQUIRING CLAY/GCL LAYER SEE DETAIL
100 YEAR FLOOD PLAIN BOUNDARY (SEE NOTE 10 ON SHEET 1)
MONITORING WELL USP-3
NORMAL POOL ELEV. 634'
TVA BOUNDARY ELEV 640'
100 YEAR FLOOD ELEV. 654'
STRUCTURE PROFILE ELEV. 668'
NOTE: THESE DRAWINGS ARE BASED ON DRAWINGS PREPARED BY ENGINEER OF RECORD WHILE EMPLOYED BY MCGILL ASSOCIATES, SEVIERVILLE, TN. THEY DEPICT 7-11-2000 TDEC-DSWM PERMIT CONDITIONS (REGISTRATION NO. IDL 33-102) AND NEW JUNE 2004 MONITORING WELL NETWORK, AND UPDATE EXISTING TOPOGRAPHY
NOTE: LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
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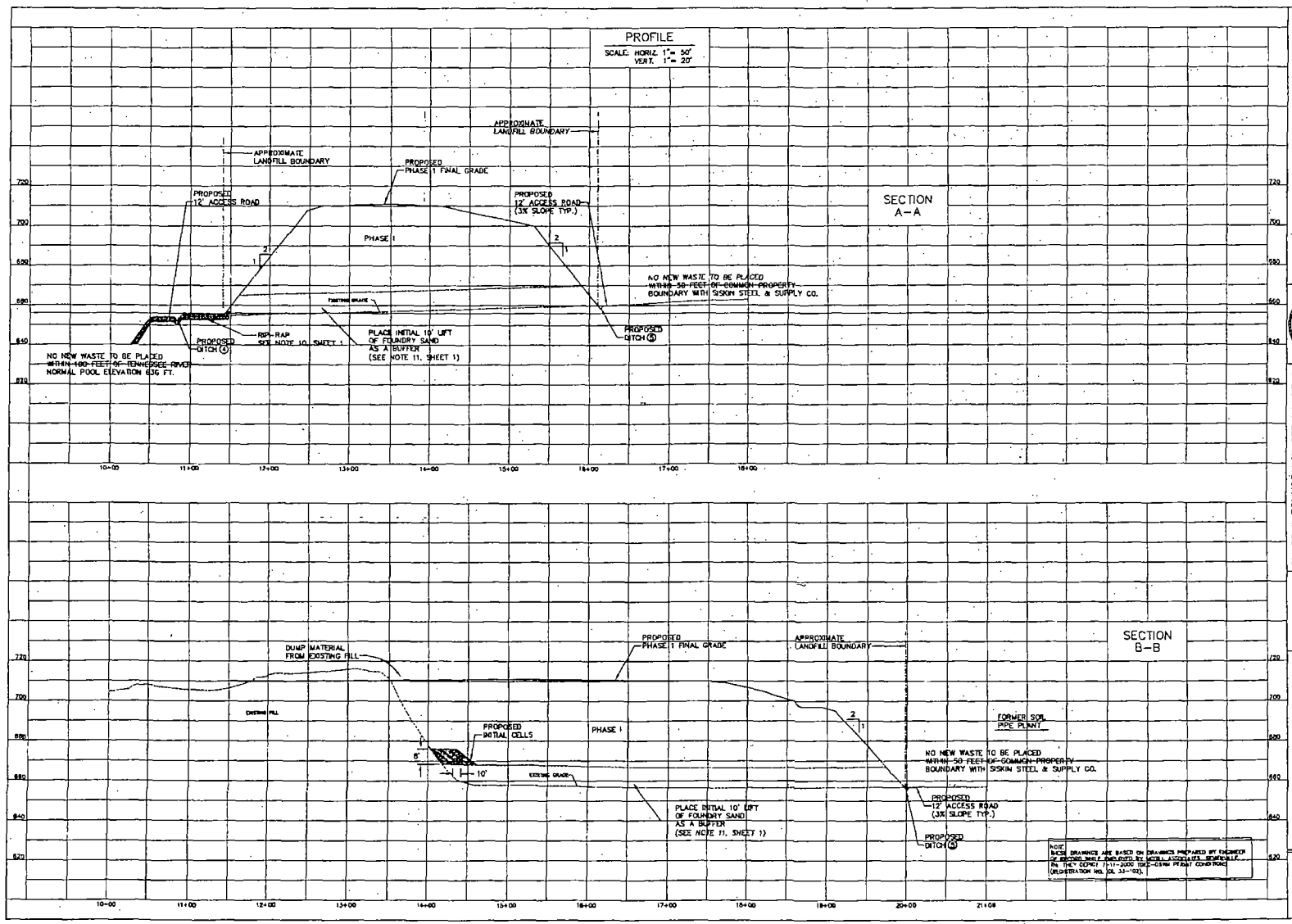
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE
DATE: SEPTEMBER 2002 (SEE NOTE)
SCALE: 1" = 100'
REVISION: MAY 2005
FINAL COVER
SHEET
3 OF 6

MWPS007160



NOTE:
THESE DRAWINGS ARE BASED ON DRAWINGS PREPARED BY ENGINEER OF RECORD, MARK F. EMELIOTO, P.E. MOTEL ASSOCIATES, SOMERVILLE, PA. THEY DEPICT 7-11-2000 TDEC-DSWM PERMIT CONDITIONS (REGISTRATION NO. DL 33-102).

PRIDDY ENGINEERING
221 GOLF CLUB DRIVE
SEVIERVILLE, TENNESSEE 37862
(865)428-7672 FAX (865) 774-0224 PRIDDYENGINEERING@AIT.NET

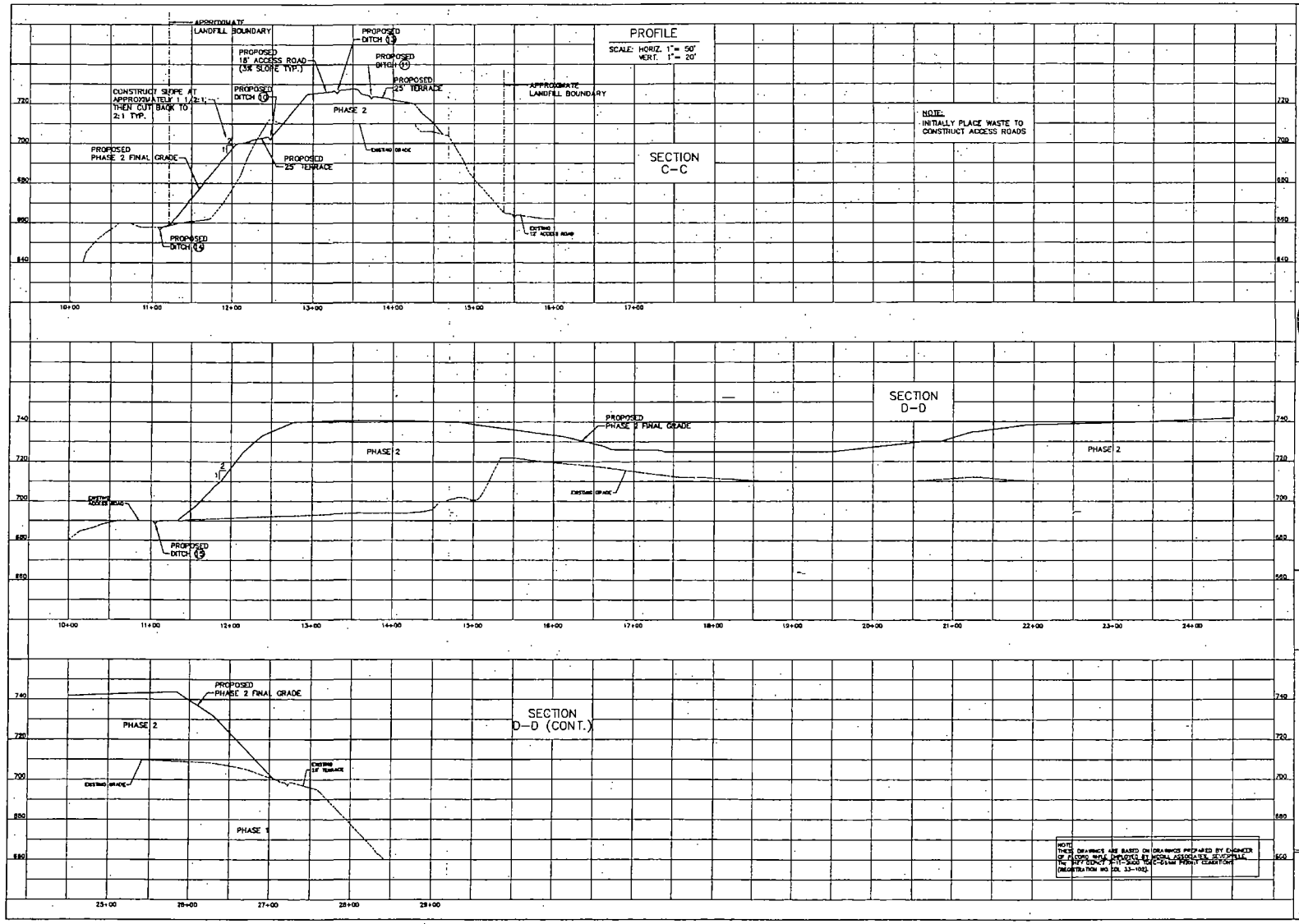
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

DATE: SEPTEMBER 2002 (SEE NOTE)
SCALE: AS NOTED
REVISION:

SECTIONS A-A & B-B

SHEET 4 OF 6

MWPS007161



NOTE:
THESE DRAWINGS ARE BASED ON DRAWINGS PREPARED BY ENGINEER OF RECORD, BOYLE ENGINEERING BY WEGMAN ASSOCIATES, SEVIERVILLE, TN. REFERENCE: A-11-2002 IDEA C-61 MM PERMIT CLARIFICATION (REGISTRATION NO. COL 33-102).

PRIDDY ENGINEERING
221 GOLF CLUB DRIVE
SEVIERVILLE, TENNESSEE 37868
(865)428-7672 FAX (865) 774-0224 PRIDDYENGINEERING@ATT.NET

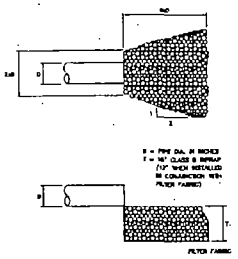
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

DATE: SEPTEMBER 2002 (SEE NOTE)
SCALE: AS NOTED
REVISION:

SECTIONS C-C & D-D

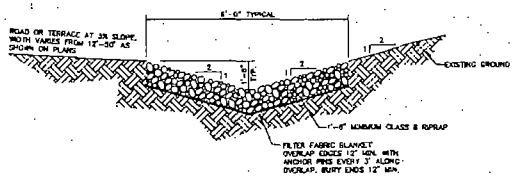
SHEET 5 OF 6

MWPS007162



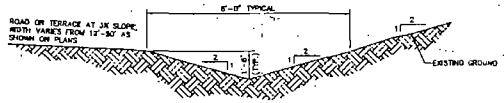
RIPRAP AT PIPE OUTLET

NOTE:
CLASS B (9"-15"), NO SPECIFIC GRADATION IS REQUIRED, HOWEVER, THE VARIOUS SIZES OF STONE SHALL BE EQUALLY DISTRIBUTED WITHIN THE REQUIRED SIZE RANGE.

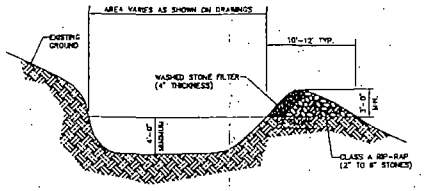


TYPICAL RIPRAP LINED DITCH

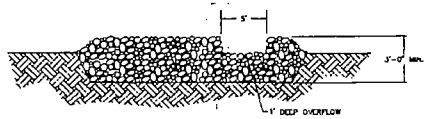
NOTE:
CLASS B (9"-15"), NO SPECIFIC GRADATION IS REQUIRED, HOWEVER, THE VARIOUS SIZES OF STONE SHALL BE EQUALLY DISTRIBUTED WITHIN THE REQUIRED SIZE RANGE.



TYPICAL PERMANENT DRAINAGE DITCH



SECTION



FRONT VIEW

TEMPORARY SEDIMENT TRAP WITH GRAVEL FILTER OUTLET

NOTES:

1. FILTER BARRIERS SHALL BE INSPECTED AFTER EACH RAINFALL AND DAILY DURING PROLONGED RAINFALL. REPAIR SHALL BE MADE AS NECESSARY.
2. SEDIMENT DEPOSITS SHALL BE REMOVED WHEN DEPOSITS REACH APPROXIMATELY 1/3 HEIGHT OF BARRIER.
3. CLASS A RIPRAP (3"-8") NO SPECIFIC GRADATION IS REQUIRED, HOWEVER, THE VARIOUS SIZES OF STONE SHALL BE EQUALLY DISTRIBUTED WITHIN THE REQUIRED SIZE RANGE.

NOTE:
THESE DRAWINGS ARE BASED ON DRAWINGS PREPARED BY ENGINEER OF RECORD M-I-E EMPLOYED BY MOBIL ASSOCIATES, KENERVILLE, IN. TNCT DEPOT 7-11-2000 ROFC-0SWM PERMIT CONDITIONS (REGISTRATION NO. 4X 32-120).

PRIDDY ENGINEERING
221 GOLF COURSE DRIVE
SEVIERVILLE, TENNESSEE 37868
(865)428-7672 FAX (865) 774-0224 PRIDDYENGINEERING@ATT.NET

CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

DATE: SEPTEMBER 2002 (SEE NOTE)
SCALE: AS NOTED
REVISION: MAY 2003

MISCELLANEOUS DETAILS

SHEET 6 OF 6

MWPS007163

****
*** TX REPORT ***
****

TRANSMISSION OK

JOB NO.	0229
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PSWD/SUBADDRESS	
DESTINATION ID	
ST. TIME	06/12 14:40
USAGE T	00'41
PGS.	2
RESULT	OK

CT-263 REV 02-99

UNITED STATES PIPE AND FOUNDRY COMPANY
2501 CHESTNUT STREET, 37408
CHATTANOOGA, TENNESSEE 37401

FACSIMILE TRANSMISSION

Firm Name: CB&S

Attention: Rick Hitchcock

Fax Number: 508-1222

From: Danny Jennings

Special Instructions:

Number Of Pages To Follow: 1

Date: 6-12-06

Our Telephone Number: 423-752-3912
Our Fax Number: 423-752-3950

MESSAGE: Re: TVA 26a permit

McGill
ASSOCIATES

May 22, 1996

Mr. Jim Book
U.S. Pipe and Foundry Co.
P. O. Box 311
Chattanooga, Tennessee 37401-0311

RE: Class II Foundry Waste Landfill
Operations and Maintenance Manual

Dear Jim:

This letter is a follow up to the Operations and Maintenance Manual that you received this past Monday for review. We are especially interested in your comments related to the following items:

1. Section 2.1 - The TVA 26a permit is still an unresolved issue. Based on the present topography of the southern area, no fill below 640 will be required in the new design. The original 26a permit application described 0.24 acre-ft of fill between elevation 636 and 640 in the southern area. This apparently is no longer an issue. We will need to contact TVA and resolve this prior to submitting the Manual to the State.

2. Appendix VIII - The closure plan requires that we provide an estimate of the cost of hiring a third party to perform the closure activities, and to perform the post-closure care. Based on this estimate, the State will require U.S. Pipe to provide financial assurance, probably in the form of a bond, before the permit is issued. Please let us know if you see any way that we can lower the costs shown on pages 10-12 of the closure plan.

3. Section 8.0 - Administrative Guidelines. These were based on the draft report prepared by The EDGE Group in 1988. Please be sure that they still apply.

FedEx Express

PLEASE FOLD THIS SHIPPING DOCUMENT IN HALF AND PLACE IT IN A WAYBILL POUCH AFFIXED TO YOUR SHIPMENT SO THAT THE BAR-CODE PORTION OF THE LABEL CAN BE READ AND SCANNED. ***WARNING: USE ONLY THE PRINTED ORIGINAL LABEL FOR SHIPPING. USING A PHOTOCOPY OF THIS LABEL FOR SHIPPING PURPOSES IS FRAUDULENT AND COULD RESULT IN ADDITIONAL BILLING CHARGES, ALONG WITHTHE CANCELLATION OF YOUR FEDEX ACCOUNT NUMBER.

From: Origin ID: GKTA (865) 970-3115
TAMMY SOWLE
CONTINENTAL AERIAL SURVEYS INC
3356 REGAL DRIVE

ALCOA, TN 37701

FedEx Express

E

CLS0918/05/08/18

Ship Date: 16MAR06
Actual Wgt: 0.5 LB MAN
System#: 505519/CAFE2286
Account#: S 037900257

REF:

Delivery Address Bar Code

SHIP TO: (423) 752-3912 BILL SENDER

DANNY JENNINGS
US PIPE & FOUNDRY CO.
2701 CHESTNUT STR.

CHATTANOOGA, TN 37408

STANDARD OVERNIGHT

FRI
Deliver By:
17MAR06

TRK# 6974 8082 8837 FORM 0201

CHA A1

37408 -TN-US

XH CHAA

The World On Time

MWPS007166

CONCRETE
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N139000
N139500
N140000
N140500
N141000
N141500

MWPS007167

No: 5893

CONTINENTAL AERIAL SURVEYS

P.O. Box 300, Alcoa, TN 37701
Phone: (865) 970-3115 • Fax: (865) 984-7367

LETTER OF TRANSMITTAL

U.S. PIPE & FOUNDRY CO.
2701 CHESTNUT ST.
CHATTANOOGA, TN 37408

Phone (423) 752-3912

Date 3/16/06 Job No 06-1058
Attention DANNY JENNINGS
Re: TOPO MAPPING

We are sending you the following:

X CD Rom — X Contact Prints — X Control Reports — ___ Film
___ Control Prints — ___ Plots — ___ Enlargements — ___ Other

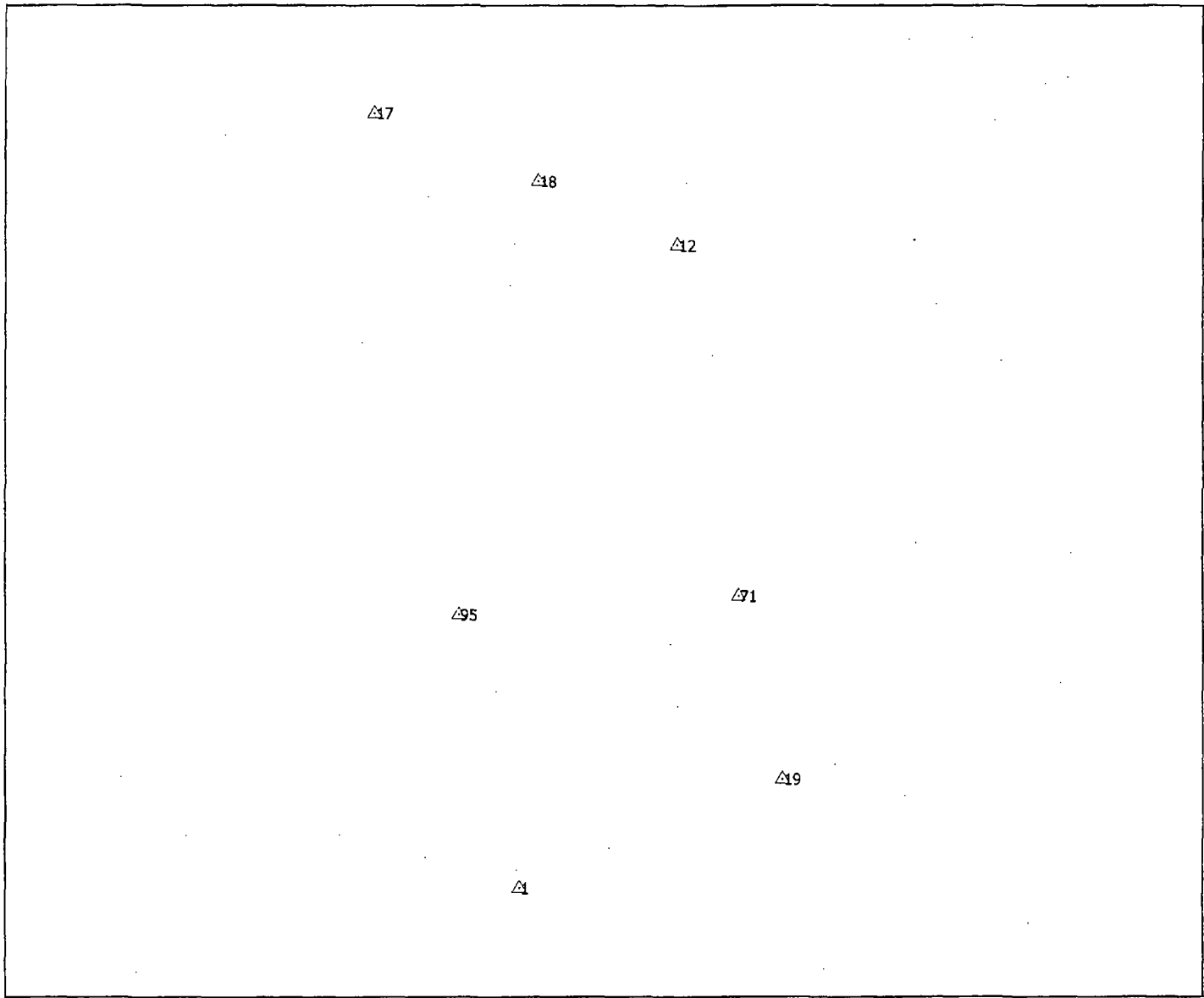
Items Being Delivered CD WITH DIGITAL TOPO MAPPING & DTM, 2 CONTACT PRINTS (589-214 & 216) AND A CONTROL REPORT

Remarks:

Copy to File

Signed:

MWPS007168



Client:
US Pipe & Foundry Company
Site Location:
Chattanooga, TN
Field surveyor:
JDA
Computer operator:
JDA

Scale 1" to 400 ft
0 750 sft
US survey feet

0°00'00"

Plot Scale: 1" to 400 ft
Printed on 2/16/2006, at 5:16:13 PM

Printed from Trimble Geomatics Office

Site: Not selected, System: US State Plane 1983
Zone: Tennessee 4100, Datum: NAD 1983 (Conus)

Project: 06-1058
USFeet Template

MWPS007169

Coordinate List

Project No: 06-1058

Client	US Pipe & Foundry Company		
Site Location	Chattanooga, TN		
Coordinate System	NAD 83	**Zone**	Tennessee 4100
Vertical Datum	NGVD 29	**Geoid model**	GEOID03 (Conus)
Date Surveyed	02/14/2006		
Coordinate Units	US survey feet		
Vertical Units	US survey feet		

Point listing

Name	Northing	Easting	Elevation	Feature Code
1	254175.483	2171128.319	684.181	TARGET-IP/AL.CAP
12	255991.205	2171576.638	666.401	PHOTO
17	256366.553	2170717.123	655.490	TARGET-M.NAIL
18	256172.690	2171181.717	660.797	TARGET-M.NAIL
19	254483.011	2171876.720	668.140	TARGET-M.NAIL
71	255000.992	2171752.015	664.664	CONTROL-SMALL PK
95 GPS	254947.130	2170956.616	688.888	TARGET-IP/AL.CAP

****
*** TX REPORT ***
****

TRANSMISSION OK

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PSWD/SUBADDRESS	
DESTINATION ID	
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USAGE T	00'36
PGS.	3
RESULT	OK

CONTINENTAL
AERIAL SURVEYS, INC

P.O. Box 300, Alcoa, TN 37701
Office (865) 970-3115 Fax (865) 984-7367 Toll Free (800) 388-6097
Physical Address: 3356 Regal Drive, Alcoa, TN 37701

FACSIMILE TRANSMITTAL COVER PAGE

FROM: ~~TO~~: Danny Jennings, US Pipe + Foundry
TO: ~~FROM~~: Kenneth H. Howard III, P.E.

COMPANY: U. S. Pipe and Foundry Co. DATE: February 9, 2006

FAX NUMBER: (423) 752-3950 NUMBER OF PAGES INCLUDING COVER PAGE: 3

RE: Chattanooga Pipe Landfill Quote

NOTES / COMMENTS

PLEASE NOTE: THE TERMS OF THIS PROPOSAL ARE C.O.D.

FULL PAYMENT IS REQUIRED BEFORE DELIVERY

IF YOU WISH TO APPLY FOR CREDIT, CONTACT TAMMY SOWLE AT (865)970-3115 Ext.18

CONTINENTAL
AERIAL SURVEYS, INC

P.O. Box 300, Alcoa, TN 37701
Office (865) 970-3115 Fax (865) 984-7367 Toll Free (800) 388-6097
Physical Address: 3356 Regal Drive, Alcoa, TN 37701

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IF YOU WISH TO APPLY FOR CREDIT, CONTACT TAMMY SOWLE AT (865)970-3115 ExL18

Signed Kenneth H Howard III

CONTINENTAL
AERIAL SURVEYS, INC

QUOTATION ACCEPTANCE AGREEMENT

Customer:	**U. S. Pipe and Foundry Co.** **2701 Chestnut St.** **Chattanooga, TN 37408**	**Date:** **Phone:** **Fax:**	**February 9, 2006** **(423) 752-3912** **(423) 752-3950**
Ordered By:	**Danny Jennings**	**P.O #**	
Ship To:	**Same As Above** ***& Priddy Engineering***		
Proposal #:	**P06-0104**		
Site:	**Chattanooga, Tm.**	**Acreage:**	**30**

Project Description:
B/W Aerial Photography will be flown at 3000 ft ft above ground level.
The negative scale of this Aerial Photography will be 1 in = 500 ft.
GPS will be utilized for 4 control point locations which will be marked and described on control prints.
Digital Topographic Mapping of 30 acres will be produced at a scale of 1" = 100' with a 2' Contour Interval.

Deliverables:
*One set of Contact Prints *A Ground Control Report *the Digital Topographic Mapping in AutoCad V2000 on CD

Schedule:

Flight will be completed within 2 weeks of notice to proceed (weather permitting).
Ground control will be completed within approximately 2 weeks.
Mapping will be completed within approximately 3 weeks after flight and completion of ground control.

Kenneth H. Howard III

Proposed By: **Kenneth H. Howard III, P.E.** **Price:** **$4,950.00**

Terms: ~~**C.O.D. - Full payment due upon completion of the project and prior to delivery. Terms available after credit approval.**~~ per Ken Howard

Delivery: **Shipping charges to be paid by customer (not included in quote). FedEx Standard Delivery unless otherwise specified.**

Other Terms and Conditions: **If accepted, this proposal is also subject to the terms and conditions stated on page 2 of this document.**

P.O. Box 300 Alcoa, TN 37701 Phone: (865) 970-3115 Fax: (865) 984-7367

Proposal # P06-0104 U. S. Pipe and Foundry Co. - Chattanooga, Tm. - Danny Jennings

TERMS AND CONDITIONS

1 Acceptance of this proposal by the party named below (the "Customer") shall constitute an agreement between Continental Aerial Surveys, Inc. ("Continental") and Customer (hereinafter the "Agreement"), which shall specifically include all terms and conditions recited herein or incorporated by reference. Price quotes herein, unless otherwise stated, are subject to change until accepted by Customer and are only valid for thirty (30) days from the date of this proposal.

2 If credit is extended, the terms of payment for the work described in this Agreement (the "Work") are net cash upon thirty (30) days of invoice, with a two percent (2%) discount if paid within fifteen (15) days of invoice. Continental shall be paid no later than 30 days after invoice date. Any payment not made when due shall accrue interest at the rate of 1.5% per month (eighteen percent (18%) per annum), or if lower, the highest lawful rate. If collected by or through an attorney, Customer shall also reimburse Continental for all reasonable attorney's fees and all other costs of collection reasonably and actually incurred by Continental. All taxes, federal, state and local, are to be paid by Customer and are not included in the cost quoted herein. Continental shall deliver the Work, at Customer's cost, as directed by Customer. The cost quoted herein does not include such shipping costs.

3 If credit is extended and Customer fails to make payment to Continental as herein provided, then Continental may stop all further Work without prejudice to any other remedy Continental may have against Customer. Notwithstanding any provision contained in this Agreement or any other contract documents between Customer and any landowner, contractor or lender, Continental also expressly reserves the right to file a lien or claim of lien for the Work in the event that any payment to Continental is not made in accordance with the terms of this Agreement.

4 Upon acceptance of this Agreement, Continental shall be given a reasonable time in which to commence and complete the performance of the Work. Continental shall not be responsible for delays or defaults where occasioned by causes of any kind and extent beyond its control, including but not limited to: delays caused by Customer, any landowner from whom access is required to perform the Work, any general contractor, architect and/or engineers whose services are required to perform the Work and who is not an employee of Continental; armed conflict or economic dislocation resulting therefrom; acts of terrorism or other criminal activity; embargoes; shortages of labor, equipment or material production facilities or transportation; labor difficulties; civil emergencies or disorders of any kind; action of civil or military authorities; vendor priorities and allocations; fires; floods; accidents; and acts of God. Customer shall provide Continental access to all locations required for the completion of the Work. Continental shall not be required to start or finish the Work if Customer is not able to provide or maintain such access.

5 **In no event shall Continental be responsible for special, incidental or consequential damages or lost profits arising out of or related to this Agreement, its performance or any breach thereof, even if Continental has been advised or noticed of the possibility thereof. Continental's maximum liability to Customer hereunder, arising from any cause whatsoever, whether based in contract, tort (including negligence), strict liability or any other theory of law, shall in no event exceed the total amount OF OUR FEE OR FIFTY THOUSAND ($50,000) DOLLARS, WHICHEVER IS GREATER FOR ANY CLAIM ARISING OUT OF NEGLIGENCE. Customer agrees that all suits based on any aforementioned cause of action shall be commenced within one year from the date said action accrues.**

6 This Agreement constitutes the sole and entire agreement between the parties hereto with regard to the subject matter hereof. No course of prior dealings between the parties and no usage of the trade shall be relevant or admissible to supplement, explain or vary any of the terms of this Agreement. Acceptance of, or acquiescence in, a course of performance rendered under this or any prior agreement shall not be relevant or admissible to determine the meaning of this Agreement even though the accepting or acquiescing party has knowledge of the nature of the performance and an opportunity to make objection. No other representations, understandings or agreements have been made or relied upon in the making of this Agreement other than those specifically set forth herein. This Agreement can be modified only by an instrument signed by the parties or their duly authorized agents.

7 All notices, requests, demands and other communications between Continental and Customer regarding this Agreement or its performance or administration shall be in writing and shall be deemed to have been given (i) when delivered in person; or (ii) when forwarded by a nationally recognized overnight courier service or mailed certified mail, return-receipt requested, to the regular business address of the respective party or to such changed address as the party may have noticed to the other party. Any notice of change of address shall only be effective, however, when received.

8 The remedies reserved to Continental herein shall be cumulative and in addition to all other or further remedies provided by law. No waiver by either party of any breach, default or violation of any term, warranty, representation, agreement, covenant, condition or provision hereof shall constitute a waiver of any subsequent breach, default or violation of the same or other term, warranty, representation, agreement, covenant, condition or provision. This Agreement is made in and shall be governed by the laws of the state of Tennessee, without giving effect to the conflict of laws provisions of said state.

NOTE: Any change or modifications to this proposal may result in a price change. This agreement is between Continental Aerial Surveys, Inc. and the Customer and is non-transferrable to any third party.

Your signature below i) authorizes Continental to proceed with the above-described services based on the quoted price and ii) constitutes Customer's agreement and acceptance of this Proposal, including all terms and conditions stated above and, if checked, any mapping specifications or supplemental specifications, conditions or requirements referenced herein. **This is not a valid contract unless signed by the Customer.**

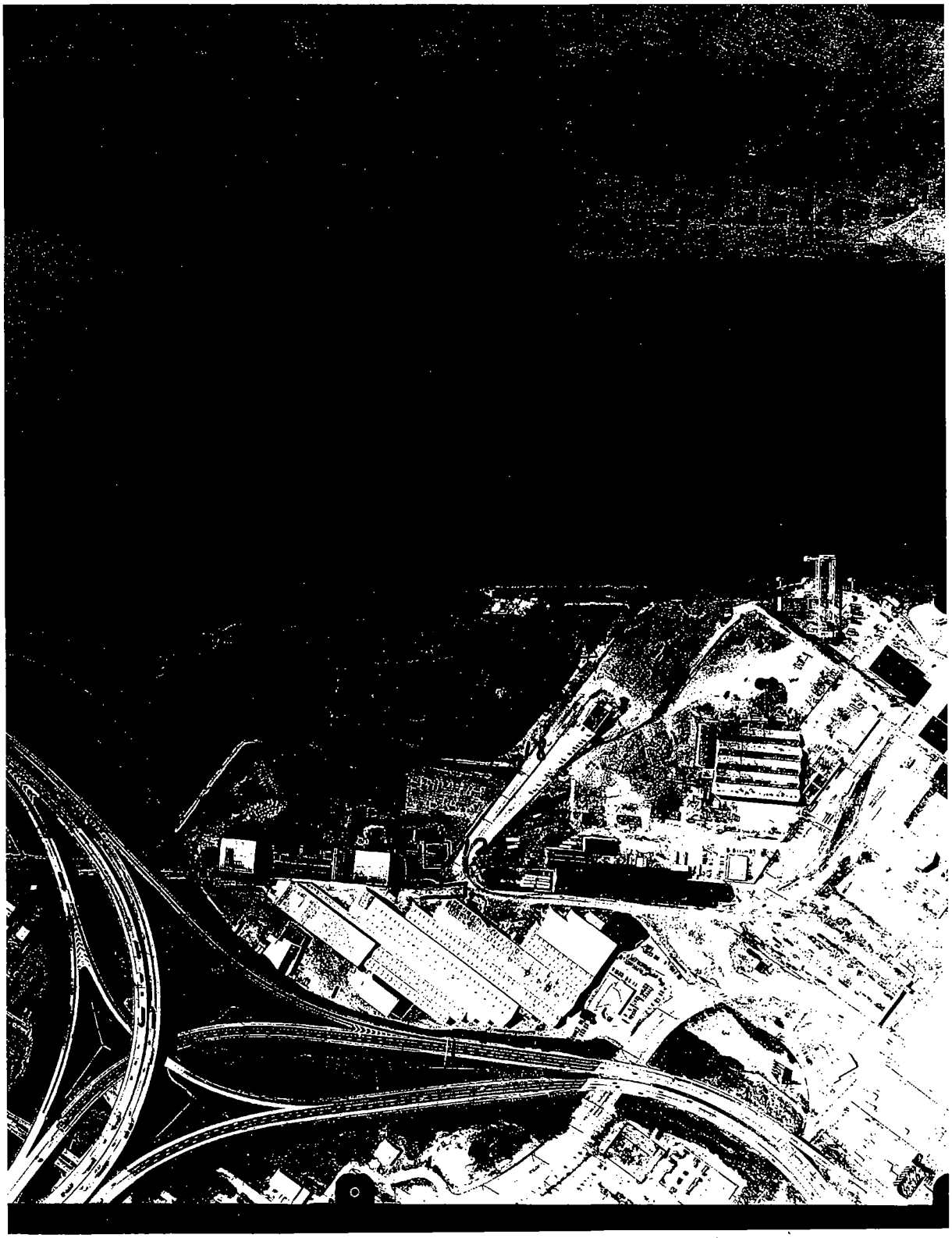
Person or Company Responsible for payment: US Pipe + Foundry

Name (please print) Danny Jennings Title: Facility Environmental Coordinator

Signature Date: 2/9/06

P.O. Box 300 Alcoa, TN 37701 Phone: (865) 07-3115 Fax: (865) 984-7367

MWPS007175



MWPS007176

OPERATIONS AND MAINTENANCE MANUAL

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

PREPARED BY:

MCGILL ASSOCIATES, P.A.
870 Winfield Dunn Parkway, Suite 6
Sevierville, Tennessee 37876

PROJECT NUMBER 95315.01

September 6, 1996

CHARLES F. PRIDDY, JR.
REGISTERED ENGINEER
AGRICULTURE
9-6-96
COMMISSION NO. 11993
STATE OF TENNESSEE

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APPENDIX IX	Groundwater Monitoring Program
APPENDIX X	TDEC Draft Policy - Beneficial Use of Non-toxic Spent Foundry Sand
ENCLOSURE	Construction Drawings

MWPS007180

1.0 BACKGROUND INFORMATION

U. S. Pipe and Foundry Company, Inc. (U.S. Pipe) operates a valve and fittings foundry in Chattanooga, Tennessee. Foundry sand, cupola slag, cupola baghouse dust, core sand and demolition wastes generated at the plant, along with various wastes from a previously operated soil pipe plant, have been disposed on plant property along the Tennessee River, (Nickajack Lake) for over forty years. The U.S. Pipe foundry waste landfill has been the subject of negotiation between U.S. Pipe and the Tennessee Department of Environment and Conservation (TDEC) as well as between U.S. Pipe and the U.S. Environmental Protection Agency (EPA). As a result of separate agreements with the TDEC and EPA, U.S. Pipe has reactivated efforts to permit the foundry landfill as a Class II Industrial Waste Disposal Facility in accordance with TDEC solid waste regulations.

The permitting process of a Class II landfill includes preparation of engineering plans, and a narrative description of the facility and operations, in accordance with Rules 1200-1-7.-04 (a) (b) and (c) of the TDEC solid waste regulations. This Operations and Maintenance Manual has been prepared to comply with these rules.

TDEC, Division of Solid Waste Management (DSWM), approved a Hydrogeological Report for the existing disposal site in April, 1995. A copy of this approval letter dated 4/26/95 has been provided by U.S.Pipe and is included in Appendix II. Based on the results of this Report, the DSWM requested that U.S. Pipe submit this Operations and Maintenance Manual for continued operation of the site. U.S. Pipe had submitted an Operation Manual to DSWM in January, 1988; however, that submittal was not reviewed by DSWM. This revised manual is being submitted at the request of DSWM.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SITE CONDITIONS

The landfill is located in Chattanooga along the east bank of the Tennessee River at mile 461.5, at Latitude N35° 01' 53" and Longitude W85° 19' 24". The landfill is located adjacent to the U.S. Pipe Valve and Fittings Plant at 2701 Chestnut Street, Chattanooga, Tennessee, 37408. The proposed landfill comprises approximately 33 acres consisting of the existing 21 acre landfill area, 8 acres of storage yard north of the existing landfill and 4 acres of presently undeveloped area located south of the existing landfill. The property is owned by U.S. Pipe and Foundry Company. A site location map is provided in Appendix I. Access to the site is by a road within the Plant.

The City of Chattanooga has installed a sanitary sewer collection system on the landfill site. There is a 36" diameter sanitary sewer line along the western (river) side of the landfill. On the eastern side, a 72" diameter combined (storm and sanitary) sewer enters a regulator chamber. During dry weather, all of the contents of the 72" sewer empty into a 21" diameter sanitary sewer at the regulator chamber, which runs under the existing landfill to the 36" sanitary sewer. During wet weather, the excess combined wastewater, which cannot enter the 21" sewer, overflows out of the regulator chamber into a ditch along the eastern border of the landfill, which previously ran along the southern edge of the landfill to the Tennessee River. In 1977, U.S. Pipe installed approximately 450' of 78" diameter corrugated metal pipe across the landfill to accommodate the combined sewer overflow to the river and to allow placement of waste over and south of the 78" pipe. This sewer system is shown on the construction plans. No

problems have been reported with the pipes under the landfill.

In November 1987, U.S. Pipe regraded the existing waste in accordance with site stabilization procedures requested by the DSWM. This work included grading the top of the landfill to prevent ponding and the outside slopes, with the exception of the river slope, to 2:1. The river slope was left alone, as vegetation had been established. A 12' wide access road has been cut along the west side of the regulator chamber drainage ditch. Two rock dams were constructed and the slopes were seeded with grass.

Based on information provided by the Tennessee Valley Authority, the elevation of the 100 year flood at the site is 656' mean sea level (MSL). TVA maintains floodway easement rights to elevation 636' MSL (normal pool) and recognizes elevation 640' as the maximum shoreline contour. Based on previous conversations with representatives of the City of Chattanooga and the Corps of Engineers, no permits would be required by these agencies for filling in the 100 year flood plain above elevation 636' provided that no structures are constructed. Copies of this correspondence have been provided by U.S. Pipe and are included in Appendix II. Due to the length of time since these contacts were made, several of these agencies were again contacted recently and copies of that correspondence are also included in Appendix II. The structure profile is elevation 668' MSL. Maximum utilization of the site requires filling below the 640' contour in one location, immediately south of the existing operations. A TVA Section 26A permit was previously determined to be required and application was made. This application was approved by TVA, however, U.S. Pipe chose not to execute the 26a Permit prior to approval of the landfill by the Division of Solid Waste Management. A copy of this original application and response from TVA has

been provided by U.S. Pipe and is included in Appendix II. Efforts are underway at this time to again obtain TVA approval of a 26a permit with the same terms as before. In general, no new waste will be placed within 50' of the 636' contour.

2.2 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

A hydrogeologic study was previously performed by Ogden Environmental and Energy Services Company for U.S. Pipe in February, 1995, and submitted to the DSWM. This report is written as a companion to the above referenced hydrogeologic study.

3.0 OPERATION AND DESIGN CRITERIA

Design criteria and construction estimates are based on an estimated volume of approximately 36,000 tons of foundry waste per year. Using an average waste density of 120 pounds per cubic foot (3240 pounds per cubic yard), the approximate yearly waste disposal volume is 22,200 cubic yards, or approximately 111 cubic yards per day (based on 50 weeks, 4 days/week). The landfill has received and will continue to receive wastes as listed in Table 1. This table does not include approximately two (2) tons per week of coke fines, which are recycled offsite.

Table 1

UNITED STATES PIPE AND FOUNDRY FACILITY
Chattanooga Valve and Fittings Plant
Composition of Wastes
Based on Information provided by U.S. Pipe dated 11/8/89

Waste Type	Tons/ Week	% of Total	
Direct Disposal Wastes			
1. Non-Isocure Foundry Sand and Core Butts	600.0	83.39	85.65
2. Slag	80.0	11.12	11.42
3. General Plant Demolition Debris (no asbestos)	5.0	0.69	0.71
4. Cleaning Room Wastes	1.5	0.21	0.21
5. Ductile Treating Baghouse Dust	2.0	0.28	0.29
6. Cement Lining Waste	2.0	0.28	0.29
7. Misc. Baghouse (grinding dust, cleaning machine dust)	10.0	1.39	1.43
Total Direct Disposal Wastes	700.5	97.36	100.00
Special Wastes			
1. Waste Isocure Sand and Core Butts	10.0	1.39	52.63
2. Cupola Baghouse Dust	8.0	1.11	42.11
3. Brass Melting and Grinding Baghouse Dust	1.0	0.14	5.26
Total Special Wastes	19.0	2.63	100.00
Total Tons per Week	719.5	100.00	
Total Tons per Year (50 Week Cycle)	35975.0		

U.S. Pipe currently stabilizes the cupola baghouse dust and brass melting and grinding baghouse dust with a "Solifix" treatment system, which has been operational since 1988. This system combines a mixture of lime kiln dust, baghouse dust, cement and a proprietary liquid called Solifix to make a non-leachable waste product. This stabilized waste is being disposed of in the foundry waste landfill. At the time that U.S. Pipe

receives registration of its landfill, it is planned to dispose of the waste isocure sand at an approved Sanitary Landfill.

Attached as Appendix III are copies of correspondence between U.S. Pipe and DSWM that describe in detail the physical/chemical characteristics of the waste stream from the plant. This correspondence contains references to waste stream products of the former soil pipe plant operation, which was closed in May 1990, as well as waste stream products from the currently operational Valve and Fittings Plant. Note that process wastewater treatment sludge is not produced by the Valve and Fittings Plant. Table 1 lists waste stream components of the Valve and Fittings Plant only. The landfill will be an area fill type operation which will have a groundwater monitoring system. The estimated life of the landfill is 41 years (See Section 5.0 of this report).

3.1 PRELIMINARY REGULATORY APPROVAL

U.S. Pipe has provided DSWM with the Hydrogeological Report, which was approved by DSWM on 4/26/95. A copy of the letter is provided in Appendix II.

3.2 REQUESTED VARIANCES AND WAIVERS

Following are requirements for which waivers are requested for this facility. As required in Rule 1200-1-7-.01 (5), Variances and Waivers, an explanation of the reason(s) why the requirement(s) should be considered inapplicable, inappropriate, or unnecessary, and/or a description of the alternative procedures or mechanisms to be utilized and why they should be considered equal in effect to the standard(s) proposed to be waived, is included.

1. Rule 1200-1-7-.04 (2) (e) Personnel Services.

1. Rule 1200-1-7-.04 (2) (e) Personnel Services.

   A waiver from this rule is requested due to the landfill being located adjacent to the U.S. Pipe and Foundry Facility where adequate personnel services are available.

2. Rule 1200-1-7-.04 (2) (f) Communications

   A waiver from this rule is requested due to the landfill being located adjacent to the U.S. Pipe and Foundry Facility where adequate communications are available.

3. Rule 1200-1-7-.04 (2) (h) Availability of Cover Material

   A waiver of the requirement for cover material to be stockpiled on site is requested for the reasons described below in the request for a waiver of Rule 1200-1-7-.04 (6) (b) 3.

4. Rule 1200-1-7-.04 (2) (m) 2 Endangered Species

   A waiver of the requirement that an endangered species survey be conducted is due to the fact that no undeveloped land is being disturbed.

5. Rule 1200-1-7-.04 (2) (n) Location in Floodplains

   A waiver of the requirement that none of the facility be located in the 100 year flood plain is requested due to the historically inert and stable nature of the foundry sand. All of the new fill will be located above the TVA maximum shoreline contour of 640 feet above msl except for a small area for which an application for a TVA Section 26a permit has been made.

6. Rule 1200-1-7-.04 (2) (p) Wetlands

   A waiver of the requirement that a wetlands assessment be conducted is due to the fact that no undeveloped land is being disturbed.

7. Rule 1200-1-7-.04 (2) (s) Random Inspection Program

   A waiver from this rule is requested due to the fact that no outside waste is being received at the facility. All of the waste disposed of in the facility is

from the foundry.

8. Rule 1200-1-7-.04 (3) (a) 1 Distance of Fill Areas from Property Lines
A waiver from the requirement that the fill areas be located a minimum of 100 feet from all property lines is requested due to the historically inert and stable nature of the landfill waste. The groundwater monitoring data (located in Appendix VII) does not indicate any relationship between the landfill and the test results.

9. Rule 1200-1-7-.04 (3) (a) 4 Distance of Fill Areas from Bodies of Water
A variance from the requirement that fill areas be located a minimum of 200 feet from the normal boundaries of springs, streams, lakes and other bodies of water is requested due to the same reasons as those listed in number 8 above. No new waste will be placed within 50 feet of the 636' contour along the river.

10. Rule 1200-1-7-.04 (4) (b) and paragraph (8) (c) 7 Engineered Liner, Geologic Buffer and Leachate Collection/Removal System
A waiver from this rule is requested due to the fact that the groundwater test data(located in Appendix VII) does not indicate any relationship between the landfill and the test results and also to the historically inert and stable nature of the foundry sand. There does not appear to be a need for the above referenced systems at this site. As stated in the policy currently being developed by TDEC on The Beneficial Use Of Nontoxic Spent Foundry Sand, foundry sand is actually suitable for use as a protective layer for the liner in landfills.

11. Rule 1200-1-7-.04 (5) (b) and paragraph (8) (c) 8 Gas Migration Control System

A waiver from this rule is requested due to the historically inert and stable nature of the foundry sand and the other materials disposed of in this landfill. No significant amount of gas will be generated by the buried waste.

12. Rule 1200-1-7-.04 (6) (b) 3 and paragraph (8) (c) 3 (i). Final Cover

A waiver from this rule is requested due to the low permeability of the foundry sand/clay mixture and the suitability of the mixture for the establishment of vegetative cover. As stated in the policy currently being developed by TDEC on The Beneficial Use Of Nontoxic Spent Foundry Sand, foundry sand is actually suitable for use as daily cover material in landfills.

13. 1200-1-7-.04 (7) (b). Groundwater Protection/Monitoring Standards

It is requested that no additional groundwater wells or groundwater studies be required. Groundwater monitoring of the parameters listed in this report will continue for the life of the landfill and throughout the closure/post closure care period on a semi-annual basis at the locations of the four monitoring wells shown on the construction drawings. It is also requested that there be no additional monitoring at the storm sewer outfall pipe due to the fact that the test results on record do not indicate any problems there. Furthermore, the City of Chattanooga monitors the previously discussed wastewater regulator chamber.

4.0 CONSTRUCTION AND OPERATION

The landfill will be used for disposal of waste generated at the Chattanooga Valve and Fittings Plant only. Further, the landfill will be constructed in a planned sequence, thereby allowing U.S. Pipe to reclaim (establish vegetative growth) disturbed areas as construction progresses. Outslopes will be constructed at the specified slopes provided in the construction plans. U.S. Pipe has provided a copy of the geotechnical engineering study previously performed by Geologic Associates, Inc., which includes a detailed stability analysis of the outslope material that evaluates the suitability of existing slopes and recommends safe slopes and specific operating criteria for continued landfilling. A copy of this report is provided in Appendix IV.

4.1 FILL OPERATIONS

The landfill is divided into three operational phases, following some minor grading and seeding of the existing fill to be done by U.S. Pipe personnel: I) the undeveloped area located immediately south of the existing landfill, II) the storage yard north of the existing landfill and III) the placement of wastes on top of Phase II and the existing fill. Phase III grading will include a 50' wide terrace along the western access edge of the landfill for added slope stability as discussed in the stability analysis (Appendix IV). This 50' terrace tapers into a 25' terrace that extends around the landfill. Phase II includes initial construction of a part of the 25' wide terrace for Phase III. Details for construction of each phase are provided in the Construction Plans, included at the conclusion of this report. Generally, in Phases I and II, the wastes will be dumped from the top of an existing fill area to the outslope of the existing fill, progressing outward to the landfill border. Phase III will be developed from one end of the landfill, with the

waste pushed and shaped to a working face, with "cells" constructed for additional waste placement to the final contours. Bulky waste core butts and dusts will be placed in the interior of the landfill, with foundry sand used for cover. Drainage ditches and rock dams will be installed for each phase as shown on the construction drawings. The drainage and sedimentation control facilities are more fully discussed in section 6.

4.2 COVER AND FINAL GRADING

Based on the composition of the wastes disposed, daily and final soil cover will not be required. This is addressed in correspondence from DSWM dated February 2, 1987. A copy of this correspondence has been provided by U.S. Pipe for this report and is included at the end of Appendix IV. The site will be graded in accordance with the final contours shown on Sheets 1, 2 and 3 of the plans.

The exterior limits of the site will be constructed to final grade as landfilling progresses upward. Foundry sand will be placed near the outslopes for added stability, while demolition debris and dust will be placed near the center of the fill. Wastes will be placed in lifts no thicker than 18 inches and compacted with the hauling and spreading equipment. In order to achieve added stability, outslopes will be shaped at a slightly steeper inclination than designed and compacted. The slopes would then be graded to their design configuration and immediately seeded and mulched. In this manner, wastes difficult to compact can be removed to prevent surficial sloughing of material. A detailed description of the outslope construction procedures is included in the appended geotechnical engineering report prepared by Geologic Associates, Inc. (see Appendix IV). Recommendations by the University of Tennessee Agricultural Extension Service

for seeding, fertilization and establishment of vegetative cover are also included at the end of Appendix IV. These recommendations have been successfully implemented in the past and should be followed unless problems related to the establishment of vegetative cover develop in the future.

4.3 ACCESS ROADS

In Phases I and II, waste will initially be placed to construct access roads, as indicated on the drawings. Roads providing access to the landfill will be constructed of compacted foundry sand. The access road slopes are to be a maximum of 5 - 6%, except as shown otherwise on the construction drawings. The roads will be maintained to provide all-weather access into the site and to safely accommodate truck traffic using the site. Only in-plant roads are used to transport material to the landfill.

4.4 BENEFICIAL REUSE OF FOUNDRY SAND

U.S. Pipe may, at any time during the operational periods, excavate and process the foundry sand for reuse as described in the TDEC Policy on the Beneficial Use of Nontoxic Spent Foundry Sand currently being developed. A draft copy of this policy is included in Appendix X. This type of activity may increase the life of the U.S. Pipe Foundry landfill by an amount of time that cannot presently be predicted accurately; however, the final contours as shown on the construction drawings will not change due to this type of activity.

5.0 PROJECTED REFUSE AND COVER VOLUMES

Based on our calculations, a total volume of approximately 909,736 cubic yards is available for disposal of industrial waste from the Chattanooga facilities. The undeveloped area located south of the existing fill represents approximately 110,672 cubic yards of this volume. Based on a yearly disposal volume of 22,200 cubic yards, the site could be used by U.S. Pipe for approximately 41 years. This is more fully tabulated in Table 2:

Table 2
Projected Landfill Capacities

PHASE	ACREAGE	VOLUME (Cubic Yards)	PROJECTED (Years)	ACREAGE USED EACH YEAR
Present	17.9	1,063,512	Filled	-
I	2.8	110,672	5.0	0.6
II	6.7	427,267	19.2	0.3
III	0	371,797	16.7	0
Subtotal	27.4	1,973,248	40.9	-
Other Areas (Non-Fill Access Roads, Rock Dams)	5.4	0	0	-
TOTAL	32.8	1,973,248	40.9	-

6.0 DRAINAGE FACILITIES

Drainage features for the landfill consist of terraces, ditches, culverts and rock dams. The site is graded to promote positive drainage and to prevent ponding. Timely vegetation will be used to reduce the amount of sediment generated.

The foundry sand in this landfill allows for a different approach for sediment control than might be used in a sanitary landfill. Because of the density of the material, a rock dam was previously constructed in order to obtain field experience in the adequacy of these structures, as well as to control sediment runoff during regrading operations. The rock dam allows water to "filter" through the rocks, thereby retaining sediment. As an added precaution, a smaller rock dam was constructed upstream of the larger rock dam (in the vicinity of Monitoring Well #1). It was observed during the occurrence of several heavy rainfall events totaling over 4 inches of precipitation, that sediment did not break through the small dam.

Two other dams were also constructed (see Sheet 2). One dam was placed where stabilization of the river slope was conducted and a second dam was placed to control run-off from the landfill access road and the adjoining property (Siskin Steel). Success over time with these structures is the basis for recommending these structures for sediment control. Three additional rock dams are proposed as shown on the drawings. It is proposed to size these structures as shown in Appendix VI. The structures are shown at their approximate scaled size on the drawings. If needed, the retention areas can be readily enlarged. Typical details of the dams are shown on Sheet 7 of the drawings. Silt should be removed from the dams when deposits reach approximately 1/3 height of barrier.

Drainage ditches and culverts have been designed to accommodate a peak runoff flow resulting from a 25-year, 24-hour storm. The retention areas have been sized to detain the water volume resulting from a 24-hour, 25-year storm and to divert through emergency spillways the peak flow resulting from a 24-hour, 100-year storm. Calculations for these facilities are provided in Appendix VI. Details are shown on Sheet 7 of the drawings.

It is proposed to line the ditches with rip-rap where necessary. Ditch construction during previous grading demonstrated that rip-rap lining of ditches is effective in controlling ditch erosion. Very steep ditches will be lined with rock as shown on the drawings.

7.0 LEACHATE COLLECTION SYSTEM

As described earlier in Section 3.2, item 10, a leachate collection system will not be necessary at this site due to the historically inert and stable nature of the foundry sand.

8.0 ADMINISTRATIVE GUIDELINES

8.1 PERSONNEL

The landfill is operated under the supervision of the Supervisor of Stores and Yard. The supervisor should verify that the site is operated in a safe and environmentally sound manner. The supervisor will be thoroughly familiar with the landfill construction plans and will be able to familiarize any operator with the plans.

8.2 FACILITIES

Landfill operating personnel will use existing plant structures for heat and toilet facilities. There are no permanent or portable structures within the landfill boundary.

8.3 LANDFILL EQUIPMENT

Waste from the plant is hauled throughout the operating day to the site with tandem axle dump trucks. In Phases I and II, the trucks will dump the waste from existing fill areas against the outer face. In Phase III, the trucks will dump the waste on top of the fill, with front end loaders shaping the waste into cells and berms. U.S. Pipe uses Dresser 580 or Caterpillar 920 front-end loaders to spread, grade and compact the waste and to construct berms. This machinery is available on a full-time basis. In the event of equipment breakdown, U.S. Pipe will use similar plant equipment or obtain suitable rental equipment.

8.4 ACCIDENT PREVENTION AND SAFETY

The supervisor has an obligation to maintain safe and secure working conditions for all landfill personnel. This obligation includes that plant safety rules are written, published and given to each employee. First aid supplies for treatment of routine minor injuries will be provided at the plant facilities located adjacent to the landfill site.

8.5 LANDFILL RECORDS AND REPORTS

Records of the activity at the landfill and inspection forms are maintained by the supervisor. Records of surface and groundwater analyses will be maintained and kept in the supervisor's office.

8.6 LANDFILL SIGN

A sign will be provided at the main entrance to the landfill for identification of acceptable wastes. The sign will also state that no sanitary, hazardous, liquid or unauthorized waste will be disposed of.

8.7 SITE ACCESS AND CONTROL

A chain link fence and the Tennessee River completely enclose the site. Access to the site is from plant property only, which is fenced and posted.

8.8 FUTURE PLANNING

Class II landfills do not require annual life reporting.

8.9 LANDFILL COMPLETION

Upon completion, the site shall be recorded with the Hamilton County Register of Deeds as a former landfill site.

9.0 ENVIRONMENTAL CONSIDERATIONS

9.1 DUST CONTROL

Grass will be planted over finished areas to minimize blowing dust. Water will be applied to the roads during abnormally dry conditions as needed to control excessive dust. Pre-treated baghouse dusts and other fines will be immediately covered with foundry sand for dust control.

9.2 BLOWING LITTER

Putrescible trash (litter) is not disposed in the landfill.

9.3 OPEN BURNING

No refuse will be burned at the landfill site. In the event accidental fires occur, the fire will be extinguished by smothering or by plant fire protection personnel.

9.4 SALVAGING

No salvaging will be allowed at the landfill site without obtaining prior permission from the DSWM. U.S. Pipe may request removal of foundry sand for beneficial reuse as described earlier in Section 4.4.

9.5 SPECIAL WASTE HANDLING

No special wastes other than the wastes approved for disposal by the DSWM will be accepted at the landfill.

9.6 VECTOR CONTROL

Putrescible waste is not disposed in the landfill.

9.7 ODOR CONTROL

Due to the nature of the wastes disposed, no odor problems are anticipated.

9.8 UNAUTHORIZED DUMPING

Unauthorized dumping will not be allowed.

9.9 DOMESTIC ANIMALS

Domestic animal access to the site is controlled by the chain link fence and the river enclosing the site. No domestic animals will be disposed at the site.

9.10 GAS MIGRATION CONTROL

As described earlier in section 3.2, item 12, a gas migration control system will not be necessary at this site due to the nature of the foundry waste. No significant amount of gas will be generated by the buried waste.

10.0 GROUNDWATER MONITORING

The four monitoring wells (one upgradient and three downgradient) will be used for monitoring of phenols and any other parameters deemed necessary by the DSWM. These wells will be used to monitor the quality of background groundwater that has not been affected by leakage from the landfill as well as to determine the quality of the groundwater that passes the compliance boundary downgradient. The locations of these wells are shown on the drawings. Monitoring will be conducted on a semi-annual basis. U.S. Pipe has provided a copy of an earlier report entitled "Monitoring Well Installation Report", which describes how the first two monitoring wells were installed in 1985. This report is included as Appendix V. Two additional downgradient monitoring wells were installed in 1994, in accordance with an EPA Consent Agreement and Final Order, dated December 5, 1990. Installation details for these two wells are included in the previously approved Hydrogeological Report.

The surface discharge pipe running under the present southern end of the landfill has also been sampled. Results of previous analyses from this point and the monitoring wells are presented in Appendix VII.

The following indicator parameters selected from Rule 1200-1-7-.04 (7) (a) 4 (i) (I) have been and will continue to be used in the sampling and analysis of groundwater:

Acidity
Alkalinity
Cadmium
Cyanide
Formaldehyde
Iron
Lead
pH
Phenols
Total Organic Carbon (TOC)
Toluene

This will by done in order to establish reliable background concentrations of values against which future comparisons can be made. A summary of the Groundwater Monitoring Program (Appendix IX) is presented herein.

10.1 SAMPLE COLLECTION

Before and immediately after purging or sampling at any well, the water level will be measured and recorded. The water level will be obtained using an electronic water level indicator. The well depth will be determined annually using a weighted measuring probe.

Prior to sampling, the wells will be purged of at least three well volumes, or to

dryness if insufficient water is present to yield the required purge volumes. This will stimulate groundwater flow into the well and provide a representative groundwater sample. To simulate a mini pumping test for each well, the static water level shall be measured prior to purging and immediately after purging.

Samples will be taken as soon as practical, after purging. Samples will be collected with a stainless steel or Teflon bailer or by using a submersible sample pump. The sample bottles will be filled directly from the sample device. Groundwater pH and temperature will be determined in the field after the samples have been collected. The pH meter shall be calibrated in accordance with manufacturer's operating instructions, prior to daily use. Thereafter, the meter shall be checked periodically against two buffers that bracket the expected values of the samples. The temperature measurement device will be initially calibrated at three temperatures covering the range of the device against a national Bureau of Standards (NBS) certified thermometer, and then cross-checked against a calibrated NBS certified thermometer at least semiannually.

10.2 SAMPLE IDENTIFICATION

Samples will be labeled in the field with the following information:

- Location
- Sample Number
- Date
- Time
- Intended Analysis
- Initials of Sampling Personnel

- Preservative

10.3 SAMPLE CONTAINERS AND PRESERVATION

Sample containers and preservation techniques shall conform to the requirements of Methods for Chemical Analysis of Water and Wastes, USEPA 600/4-79-020, revised March 1983, or equivalent.

10.4 DECONTAMINATION

To ensure the quality of samples by preventing cross-contamination between wells, all sampling equipment will be decontaminated before reuse. The equipment will be washed thoroughly with laboratory grade detergent, rinsed with appropriate solvents and deionized water, and allowed to air dry.

10.5 ANALYSIS

All analytical procedures will be conducted according to the protocols described in Methods for Chemical Analysis of Water and Wastes, USEPA 600/4-79-020, or equivalent. Each well will be sampled and analyzed for the parameters discussed in Section 10.0 at the frequencies indicated.

10.6 CHAIN OF CUSTODY

A chain-of-custody form will be used to track sample possession. The form will include sample type, sample number, intended analysis, sampling dates, times, and signatures of sampling and laboratory personnel.

10.7 RECORD KEEPING AND REPORTING

The operator must keep records of all groundwater sampling activities conducted, the sample analysis results, and the associated groundwater surface elevations throughout the active life of the facility and throughout the post-closure care period as well. Such records will be kept at the facility or at some other location within Tennessee as specified in the permit.

All groundwater sample analysis results and associated recordings of groundwater surface elevations will be submitted to the Commissioner within 30 days after completing the analysis. To facilitate handling and evaluation of this data, the Commissioner may specify in the permit the manner and form in which the data must be reported.

11.0 CLOSURE/POST CLOSURE

The facility will be closed in such a manner that the need for further maintenance is minimized. Closure and post closure care will minimize or eliminate escape of solid waste constituents to the ground or surface waters. Appendix VIII has the detailed Closure/Post Closure Plan.

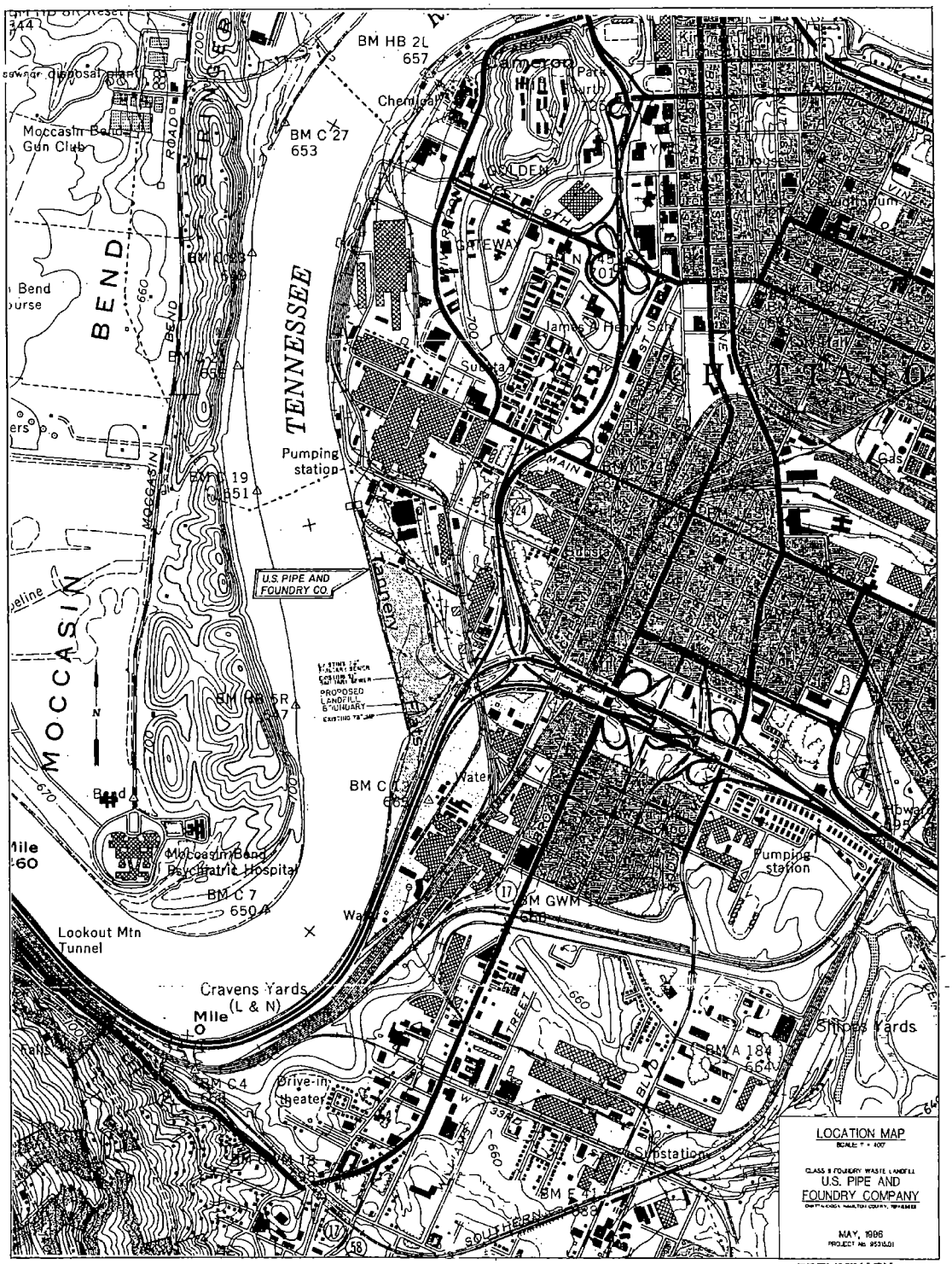
12.0 CONSTRUCTION QUALITY ASSURANCE PLAN

Due to the fact that the U.S. Pipe Class II Foundry Waste Landfill Facility will not require a liner system or final cover, a construction quality assurance plan will not be included in this report.

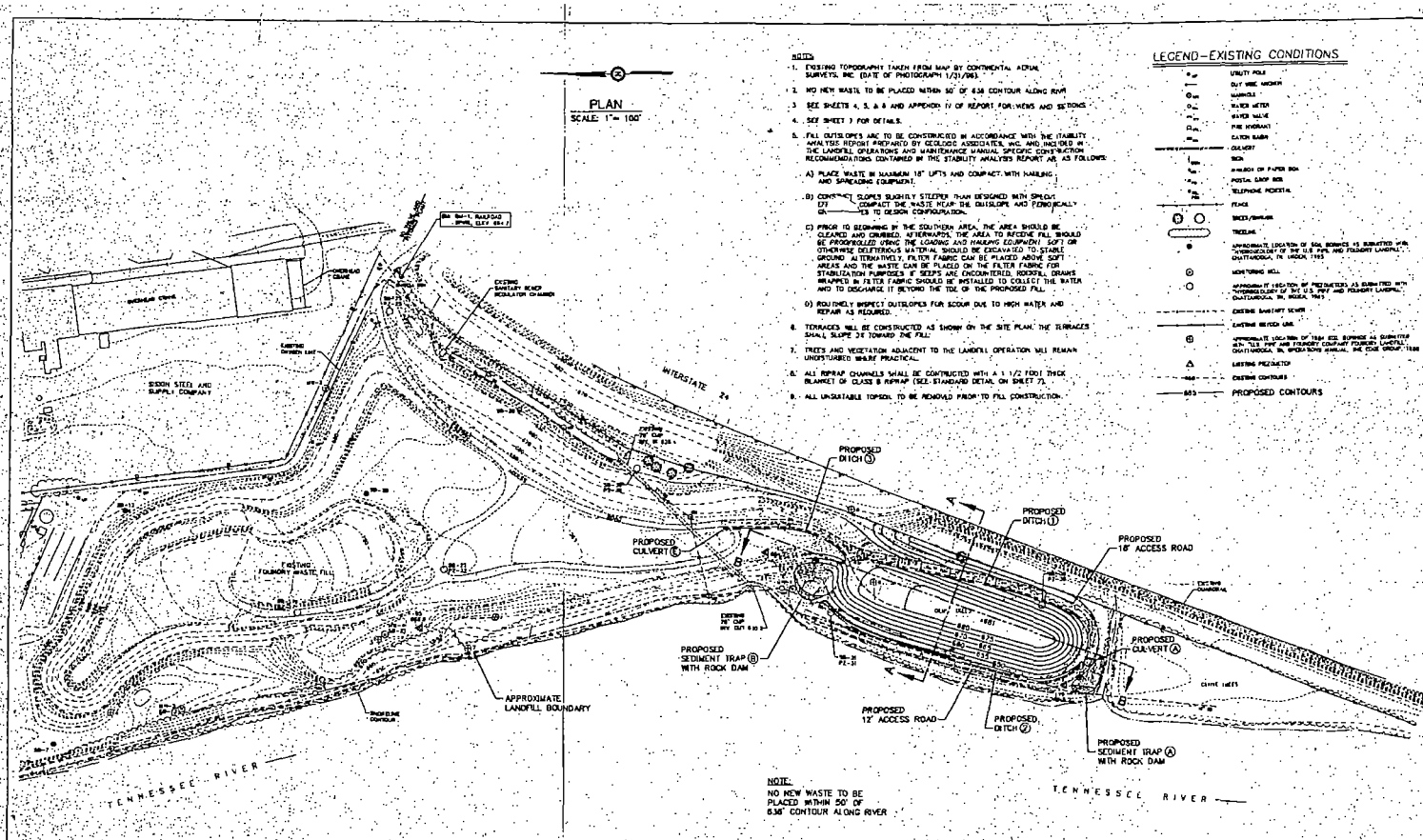
13.0 FUTURE USE OF SITE

There is no planned future use of site.

MWPS007206

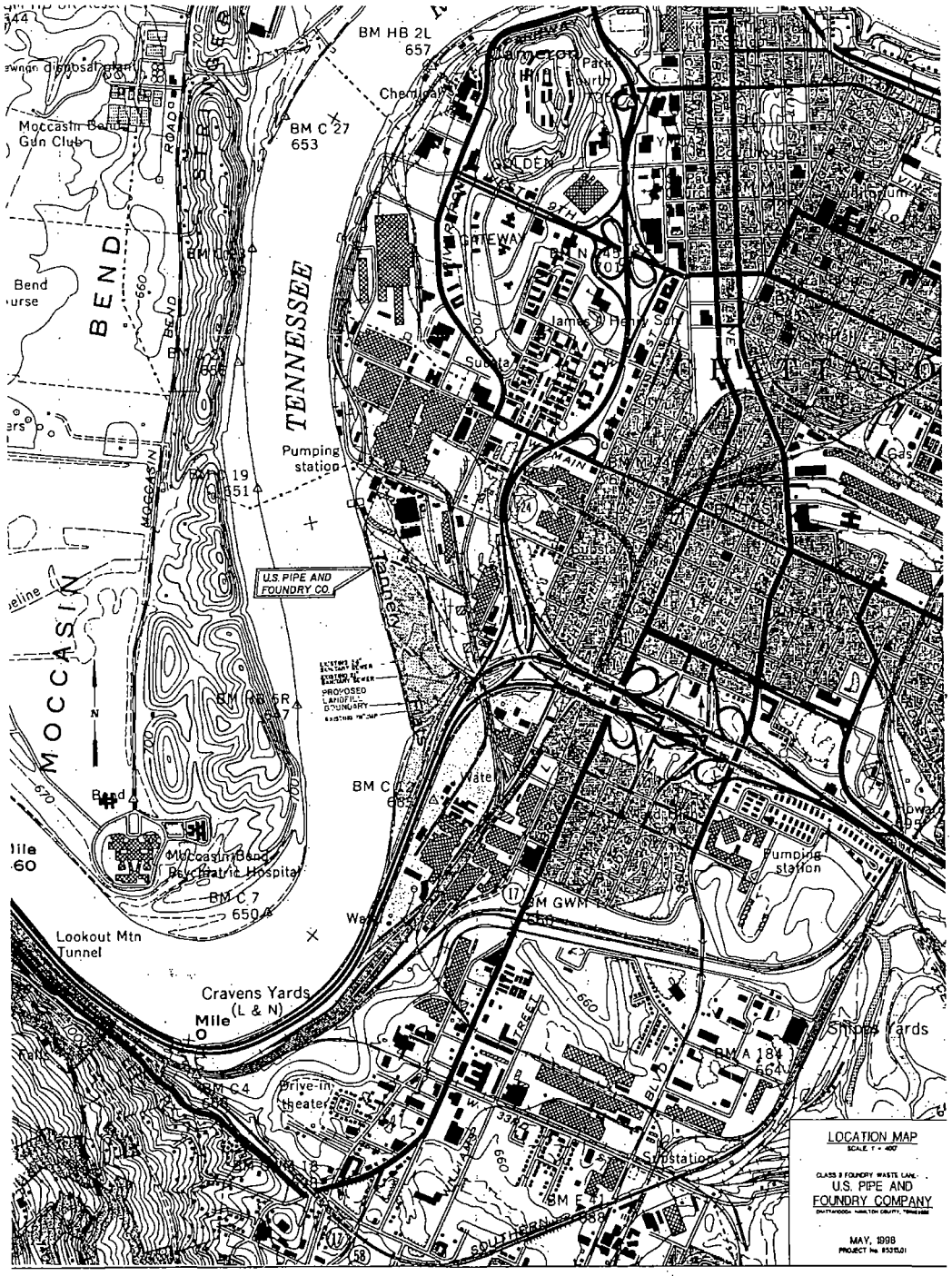


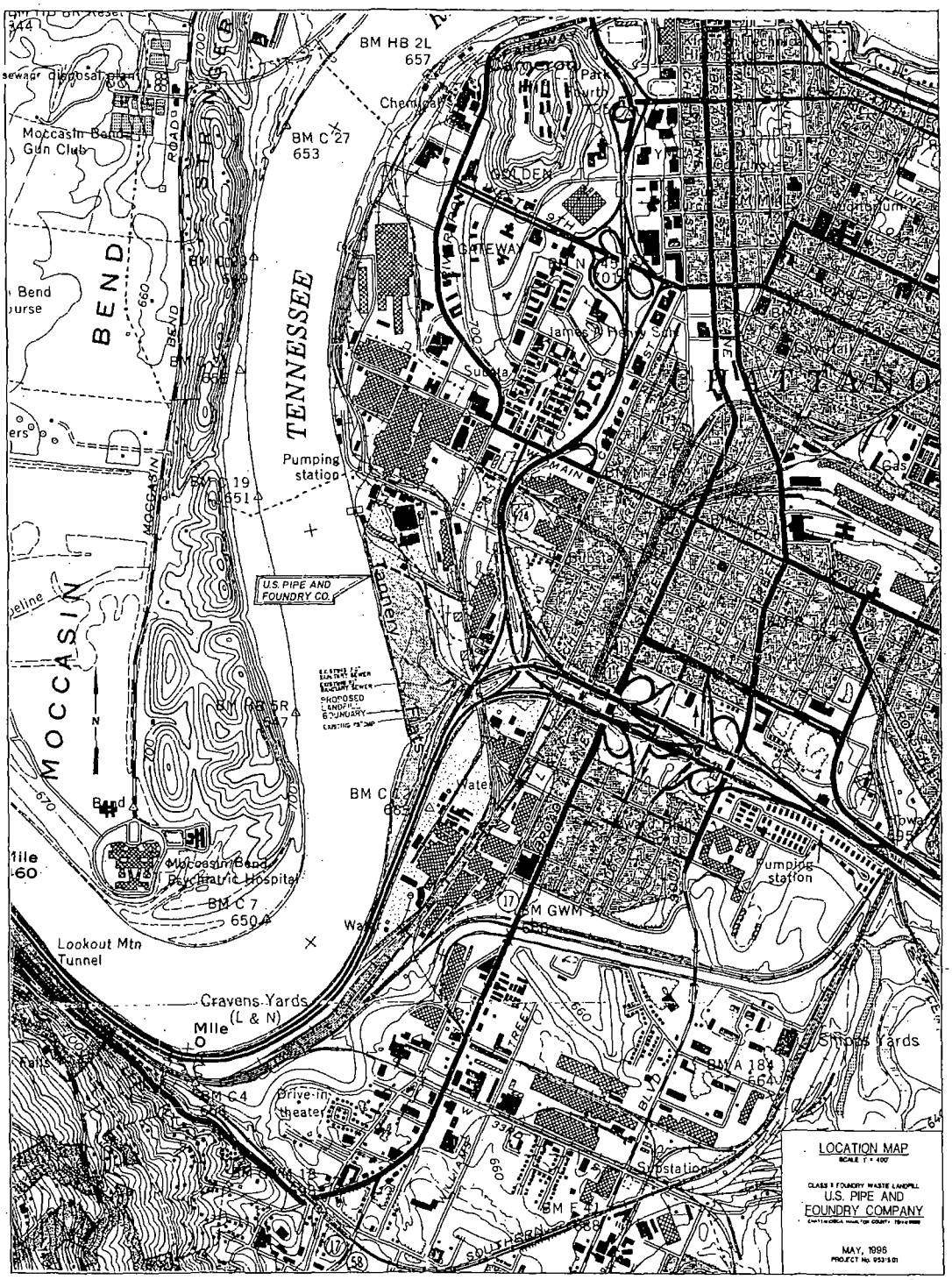
PRELIMINARY
NOT FOR
CONSTRUCTION


PLAN
SCALE: 1" = 100'
NOTE:
1. EXISTING TOPOGRAPHY TAKEN FROM MAP BY CONTINENTAL AERIAL SURVEYS, INC. (DATE OF PHOTOGRAPH 1/31/96).
2. NO NEW WASTE TO BE PLACED WITHIN 50' OF 638' CONTOUR ALONG RIVER.
3. SEE SHEETS 4, 5, & 6 AND APPENDIX IV OF REPORT FOR VIEWS AND SECTIONS.
4. SEE SHEET 7 FOR DETAILS.
5. FILL OUTSLOPES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STABILITY ANALYSIS REPORT PREPARED BY GEOLOGIC ASSOCIATES, INC. AND INCLUDED IN THE LANDFILL OPERATIONS AND MAINTENANCE MANUAL. SPECIFIC CONSTRUCTION RECOMMENDATIONS CONTAINED IN THE STABILITY ANALYSIS REPORT ARE AS FOLLOWS:
A) PLACE WASTE IN MAXIMUM 18" LIFTS AND COMPACT WITH HAULING AND SPREADING EQUIPMENT.
B) CONSTRUCT SLOPES SLIGHTLY STEEPER THAN DESIGNED WITH SPECIAL EQ COMPACT THE WASTE NEAR THE OUTSLOPE AND TERMINALLY TO DESIGN CONFIGURATION.
C) PRIOR TO BEGINNING IN THE SOUTHERN AREA, THE AREA SHOULD BE CLEARED AND GRUBBED. AFTERWARDS, THE AREA TO RECEIVE FILL SHOULD BE PROOFROLLED USING THE LOADING AND HAULING EQUIPMENT. SOFT OR OTHERWISE DELETERIOUS MATERIAL SHOULD BE EXCAVATED TO STABLE GROUND. ALTERNATIVELY, FILTER FABRIC CAN BE PLACED ABOVE SOFT AREAS AND THE WASTE CAN BE PLACED ON THE FILTER FABRIC FOR STABILIZATION PURPOSES. IF SEEPS ARE ENCOUNTERED, ROCKFILL DRAINS WRAPPED IN FILTER FABRIC SHOULD BE INSTALLED TO COLLECT THE WATER AND TO DISCHARGE IT BEYOND THE TOE OF THE PROPOSED FILL.
D) ROUTINELY INSPECT OUTSLOPES FOR SCOUR DUE TO HIGH WATER AND REPAIR AS REQUIRED.
6. TERRACES WILL BE CONSTRUCTED AS SHOWN ON THE SITE PLAN. THE TERRACES SHALL SLOPE 2% TOWARD THE FILL.
7. TREES AND VEGETATION ADJACENT TO THE LANDFILL OPERATION WILL REMAIN UNDISTURBED WHERE PRACTICAL.
8. ALL RIPRAP CHANNELS SHALL BE CONSTRUCTED WITH A 1 1/2 FOOT THICK BLANKET OF CLASS B RIPRAP (SEE STANDARD DETAIL ON SHEET 7).
9. ALL UNSUITABLE TOPSOIL TO BE REMOVED PRIOR TO FILL CONSTRUCTION.
LEGEND-EXISTING CONDITIONS
UTILITY POLE
GUY WIRE ANCHOR
MANHOLE
WATER METER
WATER VALVE
FIRE HYDRANT
CATCH BASIN
CULVERT
SIGN
MAILBOX OR PAPER BOX
POSTAL DROP BOX
TELEPHONE PEDESTAL
FENCE
TREES/BUSHES
TREELINE
APPROXIMATE LOCATION OF SOIL BORINGS AS SUBMITTED WITH "HYDROGEOLOGY OF THE U.S. PIPE AND FOUNDRY LANDFILL, CHATTANOOGA, TN. HAGGA, 1985"
MONITORING WELL
APPROXIMATE LOCATION OF PIEZOMETERS AS SUBMITTED WITH "HYDROGEOLOGY OF THE U.S. PIPE AND FOUNDRY LANDFILL, CHATTANOOGA, TN. HAGGA, 1985"
EXISTING SANITARY SEWER
EXISTING SERVICE LINE
APPROXIMATE LOCATION OF 1984 SOIL BORINGS AS SUBMITTED WITH "U.S. PIPE AND FOUNDRY COMPANY FOUNDRY LANDFILL, CHATTANOOGA, TN. SPECTRUM SERVICES, INC. FOUR GROUP, 1986"
EXISTING PIEZOMETER
EXISTING CONTOURS
PROPOSED CONTOURS
EXISTING FOUNDRY WASTE FILL
PROPOSED DITCH A
PROPOSED DITCH 1
PROPOSED DITCH 2
PROPOSED CULVERT B
PROPOSED CULVERT A
PROPOSED SEDIMENT TRAP B WITH ROCK DAM
PROPOSED SEDIMENT TRAP A WITH ROCK DAM
PROPOSED 18' ACCESS ROAD
PROPOSED 12' ACCESS ROAD
APPROXIMATE LANDFILL BOUNDARY
INTERSTATE 24
TENNESSEE RIVER
NOTE:
NO NEW WASTE TO BE PLACED WITHIN 50' OF 638' CONTOUR ALONG RIVER
NORMAL POOL ELEV. 638'
TVA BOUNDARY ELEV. 640'
100 YEAR FLOOD ELEV. 658'
STRUCTURE PROFILE ELEV. 660'
SCHEDULE OF DITCHES
DITCH | DEPTH
1 | 1.5'
2 | 1.5'
3 | 1.5'
SCHEDULE OF CULVERTS
CULVERT | SIZE | SLOPE
A | 24"x40' | 0.5%
B | 24"x40' | 0.5%
NOTE: CULVERT LENGTHS ARE APPROXIMATE. CONTRACTOR TO DETERMINE CORRECT LENGTH IN FIELD MEASUREMENT.
NOTE: TOPOGRAPHIC INFORMATION FROM AERIAL SURVEY, MAP DATE: 3/7/96 BY: CONTINENTAL AERIAL SURVEYS, INC., LOUISVILLE, TENNESSEE.
NOTE: LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
McGill ASSOCIATES
ENGINEERING · PLANNING · FINANCE
CLASS B FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE
PHASE I FILL AREA GRADING, DRAINAGE & EROSION CONTROL PLAN
SHEET 1 OF 7

MWPS007207

MWPS007208


BM HB 2L
657
BM C 27
653
Moccasin Bend Gun Club
BEND
TENNESSEE
Pumping station
U.S. PIPE AND FOUNDRY CO.
MOCCASIN
Moccasin Bend Psychiatric Hospital
BM C 7
650
Lookout Mtn Tunnel
Cravens Yards (L & N)
Mile 0
Drive-in theater
Pumping station
Shops Yards
Substation
LOCATION MAP
SCALE 1" = 400'
CLASS II FOUNDRY WASTE LANE
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE
MAY, 1998
PROJECT No. 93750.01



PRELIMINARY
NOT FOR
CONSTRUCTION

MWPS007209

RECEIVED
AUG 30 1983
Plant Engineering

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
SOUTHEAST REGIONAL OFFICE
2501 MILNE STREET
CHATTANOOGA, TENNESSEE 37406

August 9, 1983

CERTIFIED MAIL
P34 7955263

Mr. John H. Watson
Environmental Engineer
U. S. Pipe and Foundry Company
3300 First Avenue, North
Birmingham, Alabama 35202

Re: Geologic Approval - Foundry Sand Disposal Site
U. S. Pipe and Foundry Company
Chattanooga

Dear Mr. Watson:

This office has completed the geologic evaluation of an existing on-site foundry sand disposal area proposed for registration by U. S. Pipe and Foundry Company. The site, located on the east side of the Tennessee River at mile 461.5, was visited by Mr. Bill Krispin, staff geologist, on June 8, 1983.

Based on Mr. Krispin's evaluation, the site is considered geologically suitable, with certain restrictions, for disposal of the company's non-hazardous, foundry sand waste. (See enclosed geologic evaluation.)

In order to proceed with site registration, you must now submit detailed site construction and operational plans to this office for review. The plans must be designed to conform with the enclosed geologic restrictions as well as the requirements outlined in Mike Apple's memo dated July 28, 1983, which is also enclosed. Generally, such plans contain a manual outlining daily operational procedures, a plan review of the operation on a scale of one inch equals one hundred feet and cross sections of the site.

The above referenced plans must be submitted to this office within sixty (60) days of receipt of this writing.

If you have questions or need further assistance, please feel free to call me at 615/624-9921.

Cordially yours,

Steve Baxter
Environmental Consultant
Division of Solid Waste Management

SB/ss

enclosures

cc: Mike Apple, Division of Solid Waste Management, Nashville
Becky Harris, Division of Solid Waste Management, Nashville

MWPS007210

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

OFFICE CORRESPONDENCE

FROM	TO	DATE
SWM	Reg.	

DATE: July 28, 1983

TO: Regional Offices

FROM: J. M. Apple (Thru J. T. Tiesler)

SUBJECT: Foundary Sands

In the past several months the proper disposal of foundary sand has been an unresolved problem. The primary concern is that although the material is by definition a "solid waste" the volumes to be disposed, the generally inert characteristics (phenols being an exception), and the desirability as fill material has created a void in the Divisions permitting process. Therefore, the following guidance was drafted.

Potential problems:

1) Phenol release to the environment.
2) Siltation problems and general fill stabilization.
2) Final grade.

Fill requirements:

1) Material defined as non hazardous (i.e. E P Toxicity).
2) Phenols less than 15 ppm.
3) Fill not in ground or surface waters of the State (including floodplain unless proper permits obtained).
4) Vegetative stabilization of surface upon fill to final grade.

"Plan requirements"

1) Plan and profile of existing and final grade.
2) Fill sequence - objective of bringing areas to final grade as soon as possible.
3) Silt pond design to control runoff of entire site with quarterly. monitoring for phenols and any other parameters deemed necessary by review of casting process.

The above guidance is general and is to be used at the discretion of the field office manager. Requirements are at a minimum and may be expanded as necessary.

JMA/dlc 4-6

FROM	DATE
MA	
TO	

PH 0001

MWPS007211

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
CORDELL HULL BUILDING
NASHVILLE, TENNESSEE 37219

July 27, 1983

Hamilton County

Subject: Geologic evaluation of a foundry sand disposal site for US Pipe and Foundry in Hamilton county.

Date of Visit: June 8, 1983

Category: Industrial

Applicant: US Pipe and Foundry

Site Description

Facility: Existing

Waste Types: Foundry Sands

Location: Chattanooga Quadrangle (105-SE)
The site is located on the east side of the Tennessee River at mile 461.5.
Latitude: 35° 01' 55" Longitude: 85° 19' 25"

Topography: Most of the area has been filled with foundry sands so the natural topography has been changed. The area to the south of the sand is a very gentle, almost flat area. The sands are an estimated 30 feet or more in depth. Old sand areas are used for storage and parking facilities. The active disposal area is currently being mined to recover metal from the sands.

The slopes of the sand, near the river, are steep to very steep with an abundance of vegetation growing on them.

Geologic Setting

Bedrock: Mississippian age Fort Payne chert

Lithology: The Fort Payne is limestone and dolomite, highly siliceous, gray, fine to coarse grained, weathers to thick chert ledges. At the base is the Maury shale, a thin pale green shale.

Beaneath the Fort Payne is the Chattanooga shale which is shale,

brownish black, bituminous and fissle.

Because of the location, next to the river, the surface geology might consist of some alluvial material.

Structure: The beds should be dipping to the southeast. The area has undergone some faulting so the beds might be fractured. The Rockwood formation has been thrust over the Fort Payne chert.

(Geologic Map and Mineral Resources Summary of the Chattanooga Quadrangle, Tennessee.)

Unconsolidated Material: The Fort Payne is usually deeply weathered and consists of a rubble of chert in a silty clay soil. Any alluvium present will be poorly sorted and consist of sands, silts, clays and gravel.

The Soil Survey of Hamilton County lists the soil present as being the Huntington silt loam. It is derived from alluvium washed largely from soils underlain by limestone and exhibits a high water table.

Hydrology

Runoff Directions: Drainage from the sand will be to the west and east.

Receiving Stream: The site will drain to the Tennessee River. The small amount of runoff that flows to the east will enter a culvert beneath the sand and flow to the Tennessee River.

Flooding: The site is in the floodplain of the Tennessee River. According to the Environmental Geology of Hamilton County, Tennessee (Sitterly and Wilson, 1978), the site is within the 100 year flood boundary. Also, the following flood information has been provided by the Tennessee Valley Authority:

	Elevations	
Mile	100-Year Flood	Structure Profile
461.0	655.5	668.0
462.0	656.0	668.0

Other Surface Water Data: Older maps of the area show part of the site once contained backup water from the Tennessee River.

Ground Water: Ground water in the area should be shallow and will likely be affected by the river. Shallow ground water should be found in the alluvium and/or residuum. Ground water movement should be towards the river. Deeper water will be round in the Fort Payne (limestone and dolomite) and will probably be moving in a southeasterly direction.

No seeps were evident at the base of the sand.

Previous Investigation: During the Open Dump Inventory, the Division of Solid Waste Management reviewed this site. The site was found in noncompliance in the categories of floodplain and surface water discharge and put on a compliance schedule.

A 11/20/81 letter from this Division said the E P Toxicity test and the Phenol analysis indicated the waste does not pose a hazardous problem.

Recommendations

The site is only marginally suitable for use due to the flooding, shallow water and the soil and rock type present. However, due to the nature of the waste (foundry sands), the site presently being used as well as the area south of the sand is suitable for disposal. There are, however, some restrictions which must be placed on the site.

1) The site is only for the disposal of foundry sands. Some of the area contains demolition waste, trash, 55 gallon drums and ash.

2) No water should be allowed to pond on any portion of the site.

3) The site is to be properly stabilized to ensure against erosion and siltation and against possible washout due to flooding.

4) The Tennessee Valley Authority has flood easement rights in the area and they must be contacted for the proper permits, if necessary, for the filling a floodplain.

   Also, the City of Chattanooga must be contacted for permits, requirements, etc. the city might have in regards to filling a floodplain.

Recommendations concerning the suitability of the site may be changed upon review of additional information.

William Krispin

William Krispin
Geologist
Division of Solid Waste Management

WK/pas

Hamilton County
US Pipe and Foundry
Chattanooga Quadrangle (105-SE)
Foundry Sand Disposal

Location and boundaries are approximate.

MWPS007215

TENNESSEE VALLEY AUTHORITY
Cleveland, Tennessee 37311
66 Mouse Creek Road

July 22, 1983

Mr. Bill Krispin
Tennessee Department of Health & Environment
Division of Solid Waste Management
701 Broadway, B-30
Nashville, Tennessee 37203

Dear Bill:

This responds to your request for flood hazard information on property located on the right overbank of the Tennessee River between river miles 461.0 and 462.0. Listed below are the 100-year flood and Tennessee Valley Authority (TVA) Structure Profile elevation at the subject miles.

	Elevations	
Miles	100-Year Flood	Structure Profile
461.0	655.5	668.0
462.0	656.0	668.0

The TVA Structure Profile is a contour established by TVA which marks the elevation below which structures or any other forms of development that are subject to significant damage are prohibited on all lands which TVA either owns or has certain landrights. The profile was developed to avoid increasing the flood damage potential in areas affected by reservoir operations. According to our Office of Natural Resources (ONR), TVA has flood easement rights on some properties located on the east overbank. I would suggest that you contact Greg McKibben of ONR to ascertain information on the specific site with which you are concerned. Mr. McKibben can be reached by telephone at (615)745-1783.

Enclosed is a reproduced portion of the Floodway Flood Boundary Map (panel 20) prepared for Chattanooga, Tennessee. Shown thereon are the limits of the 100-year floodplain floodway, and floodway fringe. No development involving fill material is permitted within the floodway. Development requiring the use of fill material and structures are permitted within the floodway fringe. We would recommend that you contact Don Young of the Chattanooga Building Inspector's office to ascertain specific local building requirements. Mr. Young can be reached by telephone at (615)757-5105. Also enclosed for your information is a reproduced portion of the TVA Quadrangle Map (number 105-SE).

MWPS007217

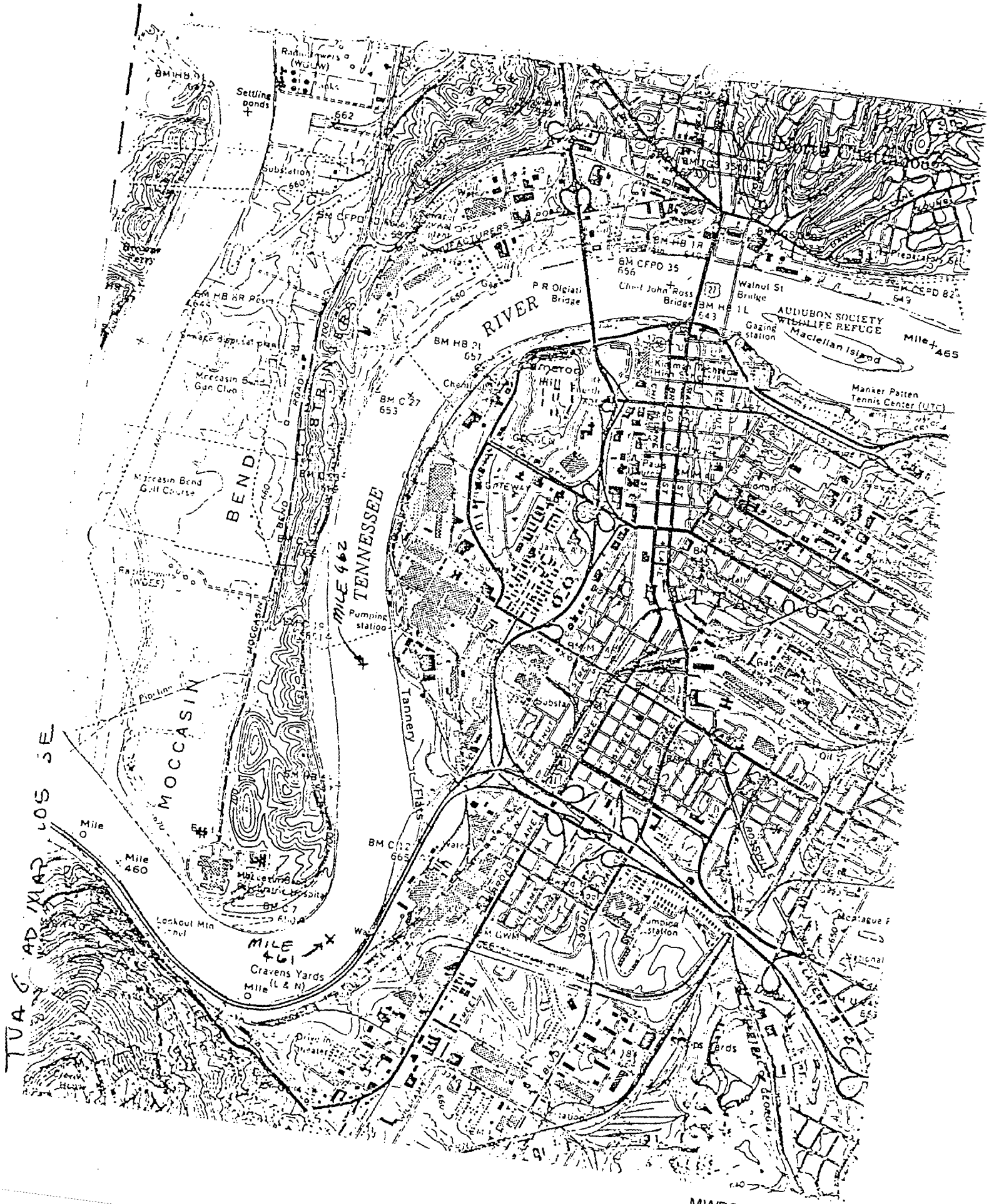
If I can be of further assistance feel free to call on me.

Sincerely,

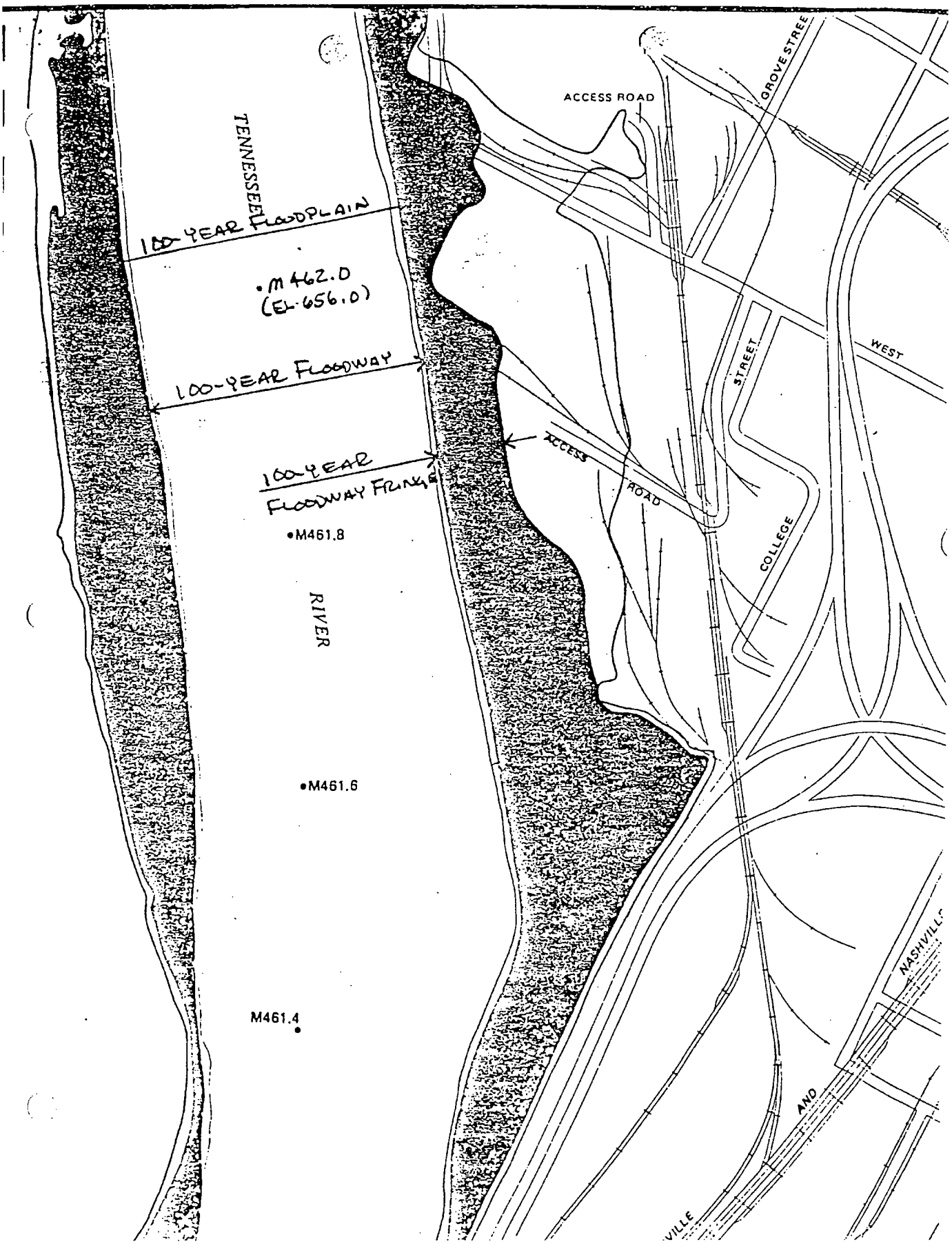
Treasure

Treasure H. Rogers, Jr.
Floodplain Specialist
Floodplain Management Branch

Enclosures
cc (Enclosures):
Mr. Don Young
Chattanooga Building Inspection Office
Room 44, City Hall
Chattanooga, TN 37402


TENNESSEE
RIVER
MOCCASIN
BEND
MILE 462
MILE 461
Pumping station
Tannery
Flats
Cravens Yards
Mile 460
Mile 465
Settling ponds
Substation
Moccasin Gun Club
Moccasin Bend Golf Course
P R Olgiati Bridge
Chief John Ross Bridge
Walnut St Bridge
AUDUBON SOCIETY WILDLIFE REFUGE
Maclellan Island
Gazing station
Manker Patten Tennis Center (UTC)
Lookout Mtn Tunnel
Drive-in theater
Pumping station
Oil
TUG ADMIRAL LOS JE

MWPS007219


TENNESSEE
RIVER
100-YEAR FLOODPLAIN
•M462.0
(EL-656.0)
100-YEAR FLOODWAY
100-YEAR
FLOODWAY FRINGE
•M461.8
•M461.6
M461.4
ACCESS ROAD
ACCESS
ROAD
GROVE STREE
WEST
STREET
COLLEGE
NASHVILLE
AND
VILLE

MWPS007220

APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY

FLOOD BOUNDARY AND FLOODWAY MAP

CITY OF

CHATTANOOGA, TENNESSEE

HAMILTON COUNTY

PANEL 20 OF 30

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
470072 0020 A

EFFECTIVE DATE:
SEPTEMBER 3, 1980

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

KEY TO MAP

500-Year Flood Boundary

100-Year Flood Boundary

FLOODWAY FRINGE

FLOODWAY

100-Year Flood Boundary

500-Year Flood Boundary

Approximate 100-Year Flood Boundary

Cross Section Line A A

Elevation Reference Mark RM7

River Mile • M1.5

NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Insurance Administration.

This map was prepared to support minimum flood plain management regulations; it may not show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

MWPS007221

McGill
ASSOCIATES

April 22, 1996

Mr. Jack Wilkinson
City of Chattanooga Public Works Department
Engineering Division
101 East 11th Street
Chattanooga, Tennessee 37402

RE: U.S. Pipe Class II Foundry Waste Landfill
Chattanooga, Tennessee

Dear Mr. Wilkinson:

I spoke with Ella Collum of the City Engineering Department this morning to determine if there are any City restrictions or permits required for filling adjacent to the Tennessee River at an elevation lower than the 100 year flood but above the designated floodway. She advised me to contact the City Stormwater Department for any possible permits. We have contacted Tom Scott in the Stormwater Department and he has indicated that he would like to review the landfill construction plans prior to making a determination regarding City permits.

I have also contacted the following individuals in regard to possible permit requirements:

Gloria Haney/Chattanooga Planning Commission
Paul McAllister/City of Chattanooga Building Inspection Department
Nancy Maynor/Hamilton County Engineers Office

In each case, I was told that no permits would be required by their respective agency. In regard to permit requirements by the City of Chattanooga, McGill Associates will proceed from this point forward with Tom Scott in the City Stormwater Department. Please contact me as soon as possible if you are not in agreement with the above or if their are additional City permit requirements. Thank you in advance for your help and cooperation.

Sincerely,

McGILL ASSOCIATES, P.A.

Robert B. Mason

Robert B. Mason

cc: Jim Book/U.S. Pipe and Foundry Company
95315.01

City of Chattanooga

April 30, 1996

MAY 1996
McGILL ASSOC
RECEIVED

Mr. Robert B. Mason
McGill Associates, P.A.
P. O. Box 4187
Sevierville, Tennessee 37864

Dear Mr. Mason:

This letter has reference to your correspondence regarding permit requirements for a foundry waste landfill to be located near the Tennessee River. In this connection, I wish to point out that permitting of the foundry waste landfill falls within the jurisdiction of the Solid Waste Management Department of the State of Tennessee. You may consult with them before proceeding with the project development.

The City of Chattanooga's Stormwater Management Division has authority to issue the erosion control permit and look for any violations during the construction stage.

If I can be of any further assistance, please call me.

Sincerely,

J. D. Wilkinson, Jr., P.E.
City Engineer

JDW:ch

cc: Tom Scott, Stormwater Management Manager

Department of Public Works
Suite 210, City Hall 37402 • (423) 757-5110

MCI/ CONSULTING ENGINEERS, INC.

P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

March 7, 1984

Mr. John Case
U.S. Corps of Engineers
Regulatory Branch
P.O. Box 1070
Nashville, TN 37202

RE: U.S. Pipe and Foundry Company
Industrial Landfill; MCI-83-592

Dear Mr. Case:

On January 10, 1984, I called to determine if a Corps of Engineers, 404 permit would be required for the referenced project. You advised that the permit would be required only if fill were discharged below ordinary high water of the Tennessee River. MCI has proceeded with design of the facility with all fill to be placed above the TVA flowage easement. The 404 permit should therefore not apply to the project and no application is planned.

Please contact me as soon as possible if you are not in agreement with the above.

Sincerely,

MCI/CONSULTING ENGINEERS, INC.

Marvin H. Bowers, P.E.
Senior Civil Engineer

MHB:jll

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
EASTERN PERMITS FIELD OFFICE
POST OFFICE BOX 465
LENOIR CITY, TENNESSEE 37771

ENVIRONMENTAL SERVICE
APR 11 1984

IN REPLY REFER TO:

April 9, 1984

ORNOP-F/E

SUBJECT: Proposed Landfill at Tennessee River Mile 461.7L, Hamilton County, Tennessee

Mr. John Watson
U.S. Pipe and Foundry Company
Post Office Box 10406
Birmingham, Alabama 35202

Dear Mr. Watson:

This is in regard to your recent application for Department of the Army approval of a landfill at your Chattanooga, Tennessee foundry. I have reviewed your application and plans and determined that a discharge of fill material will not occur below the 634 normal summer pool elevation. In this respect, a Department of the Army Permit is not required for your proposed work.

In order to prevent the erosion of the fill adjacent to the 634 elevation, you should take all necessary action to stabilize the landfill material. This may be accomplished by the use of vegetation and/or riprap. During construction, interim protective measures such as straw bales and silt fences should be utilized until permanent protection has been established.

In regard to your landfill operation and associated sedimentation pond, you should contact the Tennessee Department of Public Health, Water Management Division, 2501 Milne Avenue, Chattanooga, Tennessee 37406 about possible State permit requirements.

We appreciate the opportunity to review your proposed project. Should you have any questions or comments please contact me at the above address or telephone (615) 986-7296.

Sincerely,

Michael L. Davis
Regulatory Specialist
Operations Division

Copy Furnished:
Tennessee Department of Public Health
Water Management Division
2501 Milne Avenue, Chattanooga, Tennessee 37406

MCI/CONSULTING ENGINEERS, INC.
P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

March 7, 1984

Mr. Richard Tomshack
Tennessee Valley Authority
464 Lupton Building
Division of Land Management
Chattanooga, TN 37401

RE: U.S. Pipe and Foundry Company
Industrial Landfill; MCI-83-592

Dear Mr. Tomshack:

On January 17, 1984, I called to determine if a TVA Section 26A approval would be required for the referenced project. You advised that TVA maintained a flowage easement for the Tennessee River to Elevation 636 M.S.L. in the vicinity of the project and that no 26A approval would be required if all fill was placed above that contour. MCI has therefore proceeded with design based on all fill being placed above Elevation 636 M.S.L. and will not make application for section 26A approval.

Please contact me as soon as possible if you are not in agreement with the above.

Sincerely,

MCI/CONSULTING ENGINEERS, INC.

Marvin H. Bowers, P.E.
Senior Civil Engineer

MHB:jll

MCI/CONSULTING ENGINEERS, INC.
P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

March 21, 1984

Mr. John Watson
U. S. Pipe and Foundry Co.
P. O. Box 10406
Birmingham, AL 35202

Dear Mr. Watson:

RE: Industrial Landfill at
Chattanooga, TN. MCI 83-592

Enclosed is a completed TVA Section 26a application which is to be submitted for the referenced operation. Please complete the signature section and forward to:

Supervisor, Land and Facilities Mgmt. (East)
Division of Natural Resource Operations
P. O. Box 606
Athens, TN. 37303

744-5300

Please contact me if you have any questions.

Sincerely,

MCI/CONSULTING ENGINEERS, INC.

Marvin H. Bowers, P.E.
Senior Engineer

MHB:jzd

APPLICATION FOR

Department of the Army Permit and/or Tennessee Valley Authority Section 26a Approval

The Department of the Army (DA) permit program is authorized by Section 10 of the River and Harbor Act of 1899 and Section 404 of The Clean Water Act (P.L. 95-217). These laws require permits authorizing structures and work in or affecting navigable waters of the United States and the discharge of dredged or fill material into waters of the United States. Section 26a of the Tennessee Valley Authority Act, as amended, prohibits the construction, operation, or maintenance of any structure affecting navigation, flood control, or public lands or reservations across, along, or in the Tennessee River or any of its tributaries until plans for such construction, operation, and maintenance have been submitted to and approved by the Tennessee Valley Authority (TVA).

Two sets of original drawings on 8"x10-1/2" tracing paper or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings) and be submitted to the District Commander and appropriate TVA office at the addresses listed below. An application that is not complete will be returned for additional information. Information in the application is made a matter of public record through issuance of a public notice, if warranted. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the application. If necessary information is not provided, the application cannot be processed nor can a permit/approval be issued.

DA and TVA Main Office	TVA Office Location	Mailing Address
Commander, Nashville District U.S. Army Corps of Engineers Post Office Box 1070 Nashville, Tennessee 37202	202 West Blythe Street Paris, Tennessee Phone: 901-642-2041	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations Post Office Box 280 Paris, TN 38242-0280
	170 Office Service Warehouse Muscle Shoals, Alabama Phone: 205-386-2221	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations 170 Office Service Warehouse Muscle Shoals, AL 35660
Director of Land and Forest Resources Tennessee Valley Authority Norris, Tennessee 37828	1101 Congress Parkway Athens, Tennessee Phone: 615-745-1783	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations Post Office Box 606 Athens, Tennessee 37303
	2611 West Andrew Johnson Highway Morristown, Tennessee Phone: 615-586-8400	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations 2611 West Andrew Johnson Highway Morristown, Tennessee 37814

Name and Address of Applicant

U. S. Pipe and Foundry Co.
P. O. Box 10406
Birmingham, AL 35202
Attn: Mr. John Watson

Telephone Number
Home _____
Office 205-254-7434

Name, Address, and Title of Authorized Agent

N.A.

Telephone Number
Home _____
Office _____

Location where activity exists or will occur (include Stream Name and Mile, if known)

U. S. Pipe and Foundry Co.
Chattanooga, TN.

Tennessee River - Mile 461.7

Application submitted to TVA. Submit to DA if appropriate

DA ☐ Yes ☐ No TVA ☒ Yes ☐ No

Date activity is proposed to commence 1984

Date activity is proposed to be completed 2010

Names, addresses, and telephone numbers of adjoining property owners, lessees, etc., whose properties also join the waterway.

Property to the north and east is also owned by the permittee. Property along the southern and southeastern boundaries forms the right of way for Interstate 24.

List of previous DA/TVA permits/approvals None ☐ DA _____ (Permit Number) ☐ TVA _____ (Date)

DA/TVA JULY 1979

MWPS007228

Is any portion of the activity for which authorization is sought now complete? ☐ YES ☒ NO

If answer is "Yes" attach explanation. Month and year the activity was completed

_____. Indicate the existing work on the drawings. A large portion of the area has been landfilled over a 30 year period, but the landfill is not complete.

List all approvals or certifications required by other federal, interstate, state or local agencies for any structures, construction, discharges, deposits or other activities described in this application.

Issuing Agency	Type Approval	Identification No.	Date of Application	Date of Approval

U. S. Pipe and Foundry is in the process of securing registrations for operation by the TN. Dept. of Health and Environment, Division of Solid Waste Management. This permit will include any necessary accompanying permits, such as a discharge permit from the Division of Water Management.

Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein?

☐ Yes ☒ No (If "Yes" attach explanation)

Describe in detail the proposed activity, its purpose and intended use (private, public, commercial or other) including description of the type of structures, if any to be erected on fills, or pile or float-supported platforms, the type, composition and quantity of materials to be discharged or dumped and means of conveyance, and the source of discharge or fill material. If additional space is needed, please attach additional sheets.

Wastes associated with iron foundry operations have been disposed at this portion of the plant property along the Tennessee River for over 30 years by U. S. Pipe and Foundry. Reportedly, there were disposal operations at this location many years before aquisition by U. S. Pipe and Foundry. The proposed activity will consist of landfilling in a planned sequence, thereby allowing the establishment of vegetative growth on filled portions. Included in the operation will be corrective measures to provide greater stability of the sideslope, to preclude the sloughing of any materials into the river. To prevent sediment from washing off site, drainage will be directed towards a sedimentation pond which has been designed to accomodate the 10 year, 24 hour storm. The total yearly waste volume for the landfill is approximately 48,250 tons (30,000 cubic yards). The landfill is projected for completion in 2010. There will be 0.24 acre feet of fill between elevations 636 and 640.

Application is hereby made for approval of the activities described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

_____ Date

_____ Signature of Applicant or Authorized Agent

* The application must be signed by the applicant; however, it may be signed by a duly authorized agent if this form is accompanied by a statement by the applicant designating the agent and agreeing to furnish upon request, supplemental information in support of the application.

18 U. S. C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of The United States knowingly and willfully falsifies, conceals, or covers up by any trick scheme, or device a material fact of makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both. Do not send a permit processing fee with this application. The appropriate DA fee will be assessed when a permit is issued.

Exhibit 3

REPORT OF THE ANTICIPATED ENVIRONMENTAL CONSEQUENCES RESULTING FROM THE ERECTION OF THE PROPOSED STRUCTURE

Applicant must supply sufficient answers to the following five questions to enable TVA to determine if an environmental statement is required pursuant to Section 102 of the National Environmental Policy Act, Public Law 91-190.

1. What is the probable impact of the proposed structure on the environment?

   The majority of the fill is currently existing. The proposed operation will be beneficial to the environment, as modification of existing steep out slopes and the sequential establishment of vegetation will reduce siltation entering the Tennessee River at RM 461.5.

2. Are there any probable adverse environmental consequences which cannot be avoided?

   No

3. What are the alternatives to the proposed structure?

   The only alternative would be for U. S. Pipe and Foundry to discontinue use of the site and dispose of their foundry wastes elsewhere. Off-site would be cost prohibitive, and is therefore not a viable alternative. The disposal implementation of engineered filling operations is projected to have a positive effect on the environment, as stated in No. 1 above.

4. What is the relationship between the local short-term uses of the environment and the maintenance of long-term productivity which will result from the proposed structure?

   The landfill (structure) will have a long-term impact as landfilling is projected to continue until 2010. However, the impact to the environment is expected to be positive, with silt loads to the river being reduced by engineered construction and operations.

5. Is there any irreversible or irretrievable commitment of resources which would be involved by virtue of the proposed structure?

   The land that will be occupied by the landfill has been permanently committed.

TENNESSEE VALLEY AUTHORITY
DIVISION OF SERVICES AND FIELD OPERATIONS
Post Office Box 606
Athens, Tennessee 37303

April 20, 1984

Mr. J. H. Watson
Principal Environmental Engineer
United States Pipe and Foundry Company
3300 First Avenue North
Birmingham, AL 35202

Dear Mr. Watson:

NICKAJACK RESERVOIR - TRACT NO. HBA-419F - TENNESSEE RIVER MILE 461.7L - MAP NO. 14D

In accordance with your request, TVA authorizes you to place 0.24-acre feet of fill, hereinafter referred to as "facility," in accordance with the enclosed plans and location map, subject to the conditions attached hereto and made a part hereof. Please read the authorization, including the attached conditions carefully; and if acceptable, sign, date, and return the enclosed copy of this letter to my office. You should retain the extra copy for future reference. The authorization is not effective until the signed acceptance is received by TVA.

Please contact Greg McKibben of my staff at 745-1783 (Athens), 751-2088 (Chattanooga), or 632-2088 (Knoxville) if you have any questions about this matter.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Grover C. Whitley, Supervisor
Land and Facilities Management
Field Operations, Eastern Area

WGM:PL
Attachments
cc: U.S. Army Corps of Engineers
P.O. Box 465
Lenoir City, TN 37771

M. D. Ramsey, 238 NRB-N (Attachments)

Prepared by William G. McKibben

The aforesaid terms and conditions accepted this _____ day of _____ 1984.

_____
Signature

An Equal Opportunity Employer

AUTHORIZATION TO CONSTRUCT FACILITIES
AFFECTING TVA LANDS AND/OR LANDRIGHTS

General Conditions:

1. You agree to make every reasonable effort to construct and operate the facility authorized herein in a manner so as to minimize any adverse impact on water quality, fish, wildlife, and natural environmental values.

2. You are responsible for accurately locating your facility, and this authorization is valid and effective only if your facility is located on or fronting property you own or lease as shown on your application.

3. This permit may be revoked by TVA at any time by written notice mailed to you or posted on the premises or facility.

4. You agree to remove the facility or any part thereof at your sole expense promptly upon written notice from TVA to do so in the event that (1) this authorization is revoked; (2) the facility is not completed in accordance with approved plans; (3) the facility is not, in TVA's judgment, being maintained as provided herein; or (4) the facility is abandoned after completion. In the event you fail to carry out your responsibilities for removal in any part of these circumstances within 30 days of written notice to do so, TVA shall have the right to remove, or cause to be removed, the facility or any part thereof; and you agree, by your acceptance of this authorization, to reimburse TVA for all costs incurred in connection with such removal, including applicable overhead.

5. The facility will be maintained in a good state of repair and in good, safe, and substantial condition at all times.

6. The facility will not be altered, modified to enclose more space, or enlarged in any manner unless TVA's written approval of plans has been obtained prior to commencing such work.

7. You assume all risks to persons or property resulting from the maintenance and use of this facility. You also assume all risk of damages to facility or to property used, moored, or stored in connection therewith resulting from lake fluctuations, waves caused by wind or passing boats, or from any other causes.

8. You recognize and understand that this authorization conveys no property rights, grants no exclusive license, and in no way restricts the general public's privilege of using shoreland owned by or subject to public access rights owned by TVA. It is also subject to any existing rights of third parties.

9. You agree not to use or permit the use of the premises, facilities, or structures for any purposes that will result in the draining or dumping into the reservoir of any refuse, sewage, or other material in violation of applicable standards or requirements relating to pollution control of any kind now in effect or hereinafter established.

(Additional conditions on reverse side)

10. Any transfer of facility to a third party will automatically revoke this authorization unless prior written notice of such proposed transfer is given to the supervisor and the transferee agrees in writing to comply with all terms and conditions of this authorization.

11. For purposes of bank stabilization, no portion of the facility will be constructed in excess of two feet from the existing shoreline at normal maximum pool elevation of the reservoir.

12. Buildings or other enclosed structures containing sleeping or living accomodations, including toilets and related facilities, or that have enclosed floor area in excess of 25 square feet are prohibited.

13. Ski jumps will not be left unattended for extended periods of time. All facilities will be tied to the shoreline or to a boathouse or pier fronting your property at the completion of each day's activities.

14. All land disturbing activities shall be conducted in accordance with best management practices as defined by Section 208 of the Clean Water Act and implementing regulations to control erosion and sedimentation so as to prevent adverse water quality and related aquatic impacts. Such practices shall be consistent with sound engineering and construction principles; applicable Federal, State, and local statutes, regulations, or ordinances; and proven techniques for controlling erosion and sedimentation.

Special Conditions:

McGill
ASSOCIATES

Memorandum

DATE: March 8, 1996

TO: Rick Lance/TVA

FROM: Robert Mason/McGill Associates, P.A.

RE: U.S. Pipe and Foundry Co. - Section 26a Permit

CC: File

Message

As a follow up to our phone conversation earlier today, I a sending you a copy of the original application for a TVA Section 26a permit by the U. S. Pipe and Foundry Company. As we discussed, the permit was reviewed by TVA before, however, it was never signed by U.S. Pipe and Foundry due to the fact that they have been in the process since then of applying for a landfill permit from the State.

I am also including some related correspondence from TVA which may be useful to you at this time. We appreciate you providing us with the TVA flowage easement, 100 year flood and other information related to the permit informally at this time. This will allow us to confirm our design limitations prior to finalizing the plans and specifications. As we discussed yesterday, we will be submitting a final set of plans to you along with a letter asking whether or not our original permit application will suffice. Please do not hesitate to call me at 423-908-0575 if you have any questions or need additional information.

APPLICATION FOR

Department of the Army Permit and/or Tennessee Valley Authority Section 26a Approval

The Department of the Army (DA) permit program is authorized by Section 10 of the River and Harbor Act of 1899 and Section 404 of The Clean Water Act (P.L. 95-217). These laws require permits authorizing structures and work in or affecting navigable waters of the United States and the discharge of dredged or fill material into waters of the United States. Section 26a of the Tennessee Valley Authority Act, as amended, prohibits the construction, operation, or maintenance of any structure affecting navigation, flood control, or public lands or reservations across, along, or in the Tennessee River or any of its tributaries until plans for such construction, operation, and maintenance have been submitted to and approved by the Tennessee Valley Authority (TVA).

Two sets of original drawings on 8"x10-1/2" tracing paper or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings) and be submitted to the District Commander and appropriate TVA office at the addresses listed below. An application that is not complete will be returned for additional information. Information in the application is made a matter of public record through issuance of a public notice, if warranted. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the application. If necessary information is not provided, the application cannot be processed nor can a permit/approval be issued.

DA and TVA Main Office	TVA Office Location	Mailing Address
Commander, Nashville District U.S. Army Corps of Engineers Post Office Box 1070 Nashville, Tennessee 37202	202 West Blythe Street Paris, Tennessee Phone: 901-642-2041	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations Post Office Box 280 Paris, TN 38242-0280
	170 Office Service Warehouse Muscle Shoals, Alabama Phone: 205-386-2221	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations 170 Office Service Warehouse Muscle Shoals, AL 35660
Director of Land and Forest Resources Tennessee Valley Authority Norris, Tennessee 37828	1101 Congress Parkway Athens, Tennessee Phone: 615-745-1783	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations Post Office Box 606 Athens, Tennessee 37303
	2611 West Andrew Johnson Highway Morristown, Tennessee Phone: 615-586-8400	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations 2611 West Andrew Johnson Highway Morristown, Tennessee 37814

Name and Address of Applicant

U. S. Pipe and Foundry Co.
P. O. Box 10406
Birmingham, AL 35202
Attn: Mr. John Watson

Telephone Number
Home _____
Office 205-254-7434

Name, Address, and Title of Authorized Agent

N.A.

Telephone Number
Home _____
Office _____

Location where activity exists or will occur (include Stream Name and Mile, if known)

U. S. Pipe and Foundry Co.
Chattanooga, TN.

Tennessee River - Mile 461.7

Application submitted to TVA. Submit to DA if appropriate

DA ☐ Yes ☐ No TVA ☒ Yes ☐ No

Date activity is proposed to commence 1984

Date activity is proposed to be completed 2010

Names, addresses, and telephone numbers of adjoining property owners, lessees, etc., whose properties also join the waterway.

Property to the north and east is also owned by the permittee. Property along the southern and southeastern boundaries forms the right of way for Interstate 24.

List of previous DA/TVA permits/approvals None ☐ DA _____ (Permit Number) ☐ TVA _____ (Date)

DA/TVA JULY 1979

MWPS007235

Is any portion of the activity for which authorization is sought now complete? ☐ YES ☒ NO

If answer is "Yes" attach explanation. Month and year the activity was completed _____. Indicate the existing work on the drawings. A large portion of the area has been landfilled over a 30 year period, but the landfill is not complete.

List all approvals or certifications required by other federal, interstate, state or local agencies for any structures, construction, discharges, deposits or other activities described in this application.

Issuing Agency	Type Approval	Identification No.	Date of Application	Date of Approval
U. S. Pipe and Foundry is in the process of securing registrations for operation by the TN. Dept. of Health and Environment, Division of Solid Waste Management. This permit will include any necessary accompanying permits, such as a discharge permit from the Division of Water Management.				

Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein?

☐ Yes ☒ No (If "Yes" attach explanation)

Describe in detail the proposed activity, its purpose and intended use (private, public, commercial or other) including description of the type of structures, if any to be erected on fills, or pile or float-supported platforms, the type, composition and quantity of materials to be discharged or dumped and means of conveyance, and the source of discharge or fill material. If additional space is needed, please attach additional sheets.

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Application is hereby made for approval of the activities described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

_____ Date

_____ Signature of Applicant or Authorized Agent

The application must be signed by the applicant; however, it may be signed by a duly authorized agent if this form is accompanied by a statement by the applicant designating the agent and agreeing to furnish upon request, supplemental information in support of the application.

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Exhibit 3

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1. What is the probable impact of the proposed structure on the environment?

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   No

3. What are the alternatives to the proposed structure?

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5. Is there any irreversible or irretrievable commitment of resources which would be involved by virtue of the proposed structure?

   The land that will be occupied by the landfill has been permanently committed.

TENNESSEE VALLEY AUTHORITY
Cleveland, Tennessee 37311
66 Mouse Creek Road

July 22, 1983

Mr. Bill Krispin
Tennessee Department of Health & Environment
Division of Solid Waste Management
701 Broadway, B-30
Nashville, Tennessee 37203

Dear Bill:

This responds to your request for flood hazard information on property located on the right overbank of the Tennessee River between river miles 461.0 and 462.0. Listed below are the 100-year flood and Tennessee Valley Authority (TVA) Structure Profile elevation at the subject miles.

	Elevations	
Miles	100-Year Flood	Structure Profile
461.0	655.5	668.0
462.0	656.0	668.0

The TVA Structure Profile is a contour established by TVA which marks the elevation below which structures or any other forms of development that are subject to significant damage are prohibited on all lands which TVA either owns or has certain landrights. The profile was developed to avoid increasing the flood damage potential in areas affected by reservoir operations. According to our Office of Natural Resources (ONR), TVA has flood easement rights on some properties located on the east overbank. I would suggest that you contact Greg McKibben of ONR to ascertain information on the specific site with which you are concerned. Mr. McKibben can be reached by telephone at (615)745-1783.

Enclosed is a reproduced portion of the Floodway Flood Boundary Map (panel 20) prepared for Chattanooga, Tennessee. Shown thereon are the limits of the 100-year floodplain floodway, and floodway fringe. No development involving fill material is permitted within the floodway. Development requiring the use of fill material and structures are permitted within the floodway fringe. We would recommend that you contact Don Young of the Chattanooga Building Inspector's office to ascertain specific local building requirements. Mr. Young can be reached by telephone at (615)757-5105. Also enclosed for your information is a reproduced portion of the TVA Quadrangle Map (number 105-SE).

MWPS007238

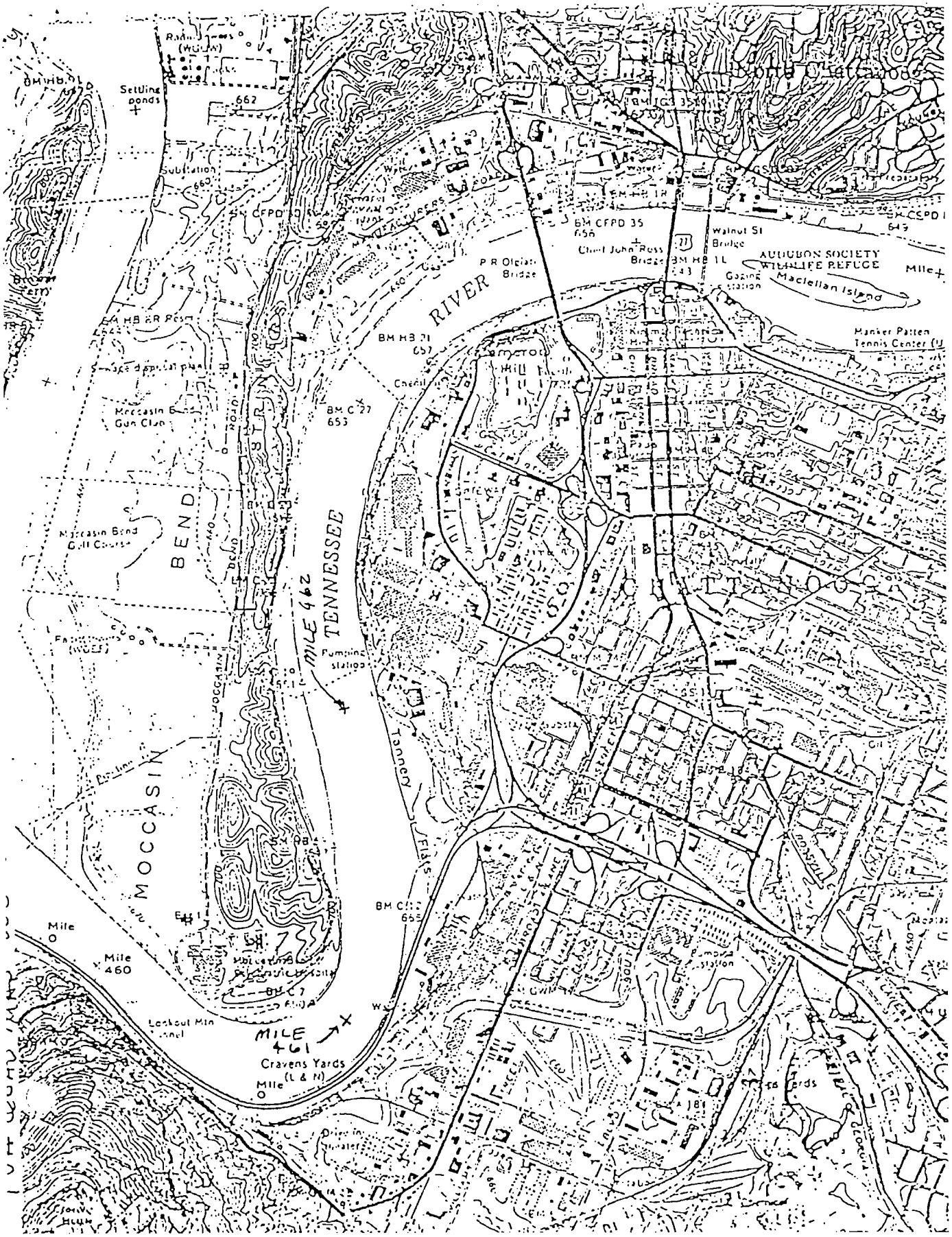
If I can be of further assistance feel free to call on me.

Sincerely,

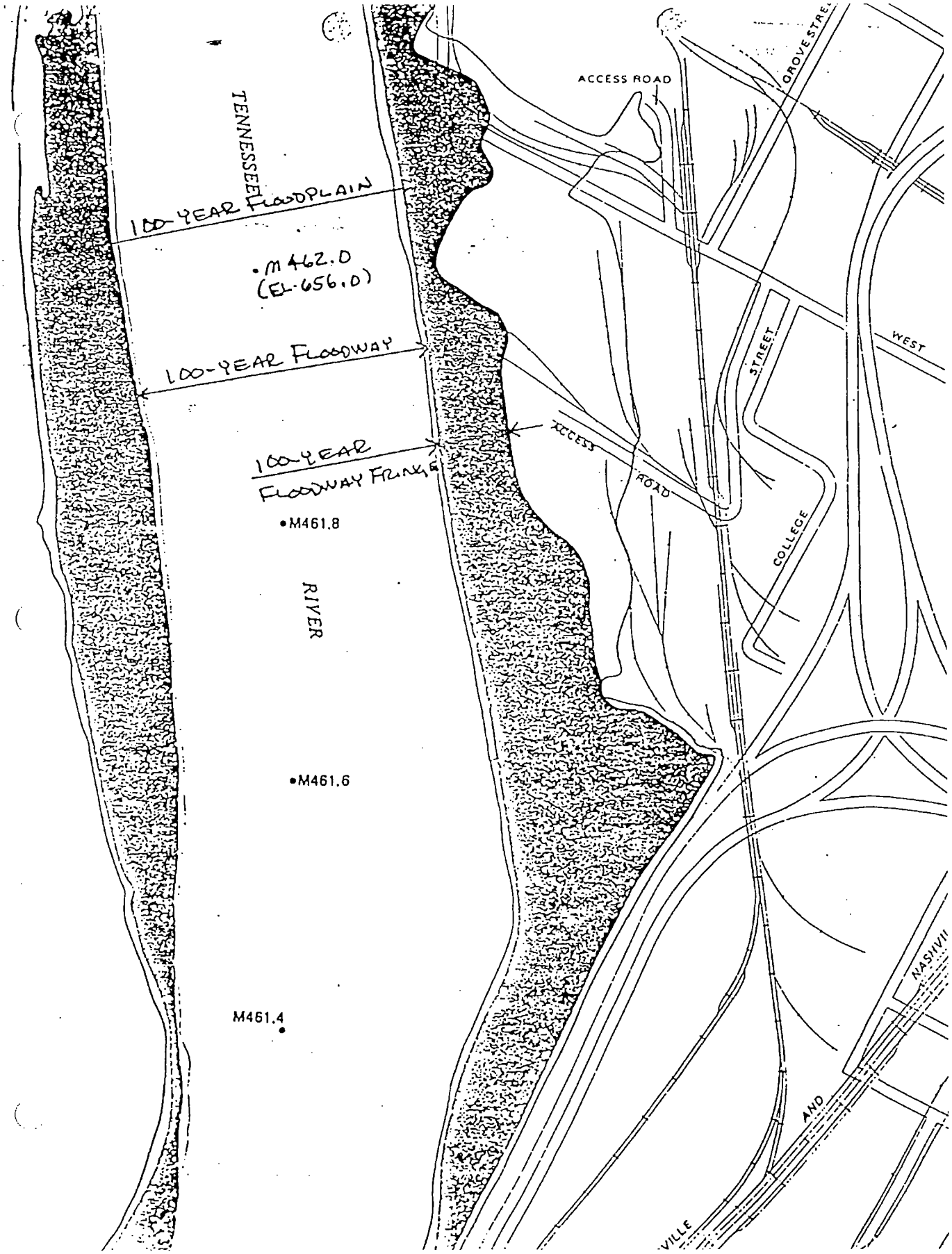
Treasure

Treasure H. Rogers, Jr.
Floodplain Specialist
Floodplain Management Branch

Enclosures
cc (Enclosures):
Mr. Don Young
Chattanooga Building Inspection Office
Room 44, City Hall
Chattanooga, TN 37402


Settling ponds
Substation
Chief John Ross Bridge
Walnut St Bridge
AUDUBON SOCIETY WILDLIFE REFUGE
Maclellan Island
Gaging station
P R Olgiati Bridge
RIVER
Moccasin Gun Club
Moccasin Bend Golf Course
BEND
MOCCASIN
TENNESSEE
MILE 462
Pumping station
Tannery Flats
Mile 460
Lookout Mtn Tunnel
MILE 461
Cravens Yards (L & N)
Mile 0
Marker Patten Tennis Center

MWPS007240


TENNESSEE
RIVER
100-YEAR FLOODPLAIN
M462.0
(EL-656.0)
100-YEAR FLOODWAY
100-YEAR
FLOODWAY FRINGE
M461.8
M461.6
M461.4
ACCESS ROAD
ACCESS
ROAD
GROVE STREET
WEST
COLLEGE
NASHVILLE
AND

MWPS007241

APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY

FLOOD BOUNDARY AND FLOODWAY MAP

CITY OF
CHATTANOOGA,
TENNESSEE
HAMILTON COUNTY

PANEL 20 OF 30
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
470072 0020 A

EFFECTIVE DATE:
SEPTEMBER 3, 1980

U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

500-Year Flood Boundary

100-Year Flood Boundary

FLOODWAY FRINGE

FLOODWAY

100-Year Flood Boundary

500-Year Flood Boundary

Approximate 100-Year Flood Boundary

Cross Section Line A A

Elevation Reference Mark RM7 ×

River Mile • M1.5

NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Insurance Administration.

This map was prepared to support minimum flood plain management regulations; it may not show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

MWPS007242

McGill Associates, P.A. P.O. Box 4187 Sevierville, TN 37864-4187

FAX

Faxed successfully 3/8/96 at 10:35 am RM

Date: 3/8/96

Number of pages including cover sheet: 10

To:
Rick Lance
TVA

Phone:
Fax phone: 423-954 3814
CC: File

From:
Robert Mason

Phone: 423-908-0575
Fax phone: 423-908-0110

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment

Hard copy mailed today
Thanks - Robert Mason

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
CHATTANOOGA ENVIRONMENTAL FIELD OFFICE
540 McCALLIE AVENUE, SUITE 550
CHATTANOOGA, TENNESSEE 37402-2013
(615) 634-5745 FAX (615) 634-6389

April 26, 1995

James Smallwood, Plant Engineer
U.S. Pipe and Foundry Corporation
P.O. Box 311
Chattanooga, Tennessee 37401

Re: Completeness/Technical Review
Hydrogeology/Geotechnical Report
U.S. Pipe and Foundry Proposed
Class II Landfill (File #33-138)

Dear Mr. Smallwood:

The Division of Solid Waste Management (DSWM) has reviewed the submitted Hydro-Geo report for completeness pursuant to Rule 1200-1-7-.07(6)(a)1. Our review has determined the report/study complete as per the aforementioned rule.

Please note that a technical review was also performed, and has determined it suitable with the following contingencies:

1) If a permit is required from T.V.A. to fill in the 100 year floodway, one must be obtained and submitted to the CFO no later than when submitting engineering plans.

2) If approval from the Corps of Engineers, or Water Pollution Control (DWPC) is required this must be obtained and submitted no later than when submitting engineering plans.

3) Variances must be obtained for Items #1 and 2 along with a variance for buffer standards for waste placed below the required distance above the seasonal high water table.

If questions arise, please feel free to contact David Smith at (615) 634-5776.

Sincerely,

Guy M. Moose
Field Office Manager
Division of Solid Waste Management

GMM/34025116

cc: James Book, Project Engineer, U.S. Pipe and Foundry
Frank Victory, DSWM, Nashville Central Office
DSWM, Central Files, Nashville

UNITED STATES PIPE AND FOUNDRY COMPANY

GENERAL OFFICE
3300 FIRST AVENUE NORTH • BIRMINGHAM, ALABAMA 35202

April 21, 1986

Mr. Steve Baxter, Environmental Specialist
Tennessee Department of Health and Environment
Division of Solid Waste Management
2501 Milne Street
Chattanooga, Tennessee 37406

Re: Chattanooga Plants Landfill
Waste Characterization

Dear Steve:

In accordance with your letter of January 24, 1986, we are hereby submitting the following additional data and comments as a follow-up to the physical/chemical waste characterization which was submitted on December 3, 1985. The following items are listed and numbered in the same order as outlined in your January 24 letter:

1. Desulfurizing ladle slag:

   The results of the Reactivity characteristic tests are shown on the attached data sheet and marked CVF#1. It is our opinion that the results indicate that this waste is not hazardous and would have minimal effects on human health and the environment. The acetylene gas generated (22ppm) is well below the lower explosive limit (lel) of 2.5% (25,000ppm) and should not present a problem on the landfill.

2. Waste core sand:

   The analytical data attached on three types of waste core sand are representative of all waste core sands generated at both CSP and CVF. These data sheets are marked CVF#2, 3, and 4. As you requested, these sand samples were tested directly for the items of concern rather than testing leachate samples from them. Please bear in mind that the concentrations found are not indicative of how much would be leached out by groundwater in a landfill situation. In fact, we are still of the opinion that waste core sand is relatively inert.

~~3. Process wastewater treatment sludge:~~

~~This sludge from CSP is dried to a range of 30 to 40% solids on a drying bed prior to being placed on the landfill. We did not perform the "paint filter test" you requested since we feel it is totally inappropriate for the following reasons.~~

Items 3 & 4 No Longer Exist

~~(a) The test is used in conjunction with RCRA Subtitle C hazardous waste regulations for determining the presence of "free liquids" being disposed of on a "hazardous waste" landfill. As you know, we do not operate a hazardous waste landfill.~~

~~(b) Even if the sludge were totally dry when placed on the landfill, it would be thoroughly wet down every time it rains. Thus, we will have "free liquids" on the landfill whether we put them there or not.~~

~~4. Wet collector sludge:~~

~~Our reasons for not performing the requested "paint filter test" on the sludge from CVF are those listed in 3 above.~~

5. Coke waste:

We did not test for volatile organics since the coke is basically a chemically inert product. The 0.5% volatiles reported previously are those detected by a "volatile matter" test procedure at a temperature of 1740° F. Our coke people do not know what the compounds are nor a test available to determine what they are. They have advised me that the coke is so inert that some batches have been weathered on the storage yard for up to 10 years with no detectable change in analysis during that time. Based on the above, it is doubtful there would be leaching potential in a landfill.

Yours truly,

John H Watson

John H. Watson
Principal Environmental Engineer

JHW/js

Encls.

bc: Mr. W. E. Fleck
Mr. C. N. Codding
Mr. D. C. Wallace
Mr. W. A. Berry
Mr. J. B. Dockery

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.
CHATTANOOGA, TENNESSEE 37405

MARTIN H. DAVIS
President

615/265-4533

ACCOUNT NO. 1182-001 **DATE** APRIL 14, 1986

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL DESULFURIZING LADLE SLAG

MARKED U.S. PIPE, CVF NO. 1

LABORATORY NO. 240,361

Acetylene Gas Formation

22 ppm Acetylene was liberated when the sample was mixed with water.

Heat

No heat was detected when the sample was mixed with water.

Corrosivity

0.028 mm/year

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Martin H. Davis

MARTIN H. DAVIS
President

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515 CHEROKEE BLVD.
CHATTANOOGA, TENNESSEE 37405

MARTIN H. DAVIS
President

615/265-4533

ACCOUNT NO. 1182-001 **DATE** APRIL 14, 1986

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL WASTE SHELL CORE SAND

MARKED U.S. PIPE, CVF NO. 2

LABORATORY NO. 240,362

ENVIRONMENTAL SERVICE
APR 17 1986

Phenols ppm	2.9 ✓
Formaldehyde ppm	0.2 ✓
Cyanide ppm	0.7
Ammonia Nitrogen ppm	16

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ACCOUNT NO. 1182-001 **DATE** APRIL 14, 1986

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL WASTE AIR SET SAND

MARKED U.S. PIPE, CVF NO. 3

LABORATORY NO. 240,363

Phenols ppm	1.1
Formaldehyde ppm	0.2
Cyanide ppm	0.2
Ammonia Nitrogen ppm	24

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MARTIN H. DAVIS
President

615/265-4533

ACCOUNT NO. 1182-001 **DATE** APRIL 14, 1986

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL WASTE ISOCURE SAND

MARKED U.S. PIPE, CVF NO. 4

LABORATORY NO. 240,364

Phenols ppm	16
Formaldehyde ppm	0.1
Cyanide ppm	0.1
Ammonia Nitrogen ppm	9.8

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President

ACCOUNT NO. 1182-001 DATE APRIL 18, 1985

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM BOOK

RECEIVED DATE 03/26/85

MATERIAL BAG HOUSE DUST - CVF source K(b)
V. P.

MARKED GRINDING - Brass Fdy

LABORATORY NO. 226,663

ENVIRONMENTAL SERVICE
APR 22 1985

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

Arsenic mg/l	0.037
Barium mg/l	0.068
Cadmium mg/l	0.14
Chromium mg/l	0.034
Lead mg/l	3.1
Mercury mg/l	0.006
Selenium mg/l	0.12
Silver mg/l	0.040

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Plant Engineering

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CHATTANOOGA, TENNESSEE 37405
615/265-4533

MARTIN H. DAVIS
President

ACCOUNT NO.	1182-001	DATE	APRIL 18, 1985
RECEIVED FROM	U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401 MR. JIM BOOK		
RECEIVED DATE	03/26/85		
MATERIAL	BAG HOUSE DUST - CVF source K(c) V.P.		
MARKED	MELTING - Brass Fdy.		
LABORATORY NO.	226,664		

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

Arsenic mg/l	0.069 ✓
Barium mg/l	0.079 ✓
Cadmium mg/l	0.064 ✓
Chromium mg/l	0.042 ✓
Lead mg/l	2.5 ✓
Mercury mg/l	0.001 ✓
Selenium mg/l	0.17 ✓
Silver mg/l	0.077 ✓

TECHNICAL LABORATORIES, INC.

Lewis E Cain for

MARTIN H. DAVIS
President

ibc

UNITED STATES PIPE AND FOUNDRY COMPANY

GENERAL OFFICE
3300 FIRST AVENUE NORTH • BIRMINGHAM, ALABAMA 35202

December 3, 1985

Mr. Steve Baxter, Environmental Specialist
Tennessee Department of Health and Environment
Division of Solid Waste Management
2501 Milne St.
Chattanooga, Tennessee 37406

Re: Chattanooga Plants Landfill

Dear Steve:

In accordance with your letter of October 22, 1985, and the results of our meeting at the Fittings Plant on November 7, 1985, please find attached the requested written physical/chemical characterization of waste streams from both plants.

Please note that the attached "Characterization" items are keyed to the eleven (11) "Classification of Foundry Waste" codes which we discussed in the meeting, copy of which is also attached. Also, please note that each waste stream listed from both plants is "keyed" back to the same waste code. A copy of these listed waste sources for both plants is also attached. EP toxicity test data on three of those sources is also attached. Should you have any questions on the attached, please let me know.

Yours truly,

John H. Watson

John H. Watson
Principal Environmental Engineer

JHW/js

Encls.

bc: Mr. W. E. Fleck
Mr. C. N. Codding
Mr. D. C. Wallace
Mr. W. A. Berry
Mr. J. B. Dockery
File: Donell-MCI

U. S. Pipe and Foundry Co. - Chattanooga Plants

Physical/Chemical Characterization of Foundry Solid Wastes

(Note: Following numbers "keyed" to attached "Classification of Foundry Wastes.")

1. Used refractories (cupola and ladle linings):

The materials are used in the form of bricks, castables, plastic mortar mixes, and gunning mixes for lining of the cupolas, holding ladles, transfer ladles, etc. Wastes landfilled would likely have the consistency of demolition debris from the destruction of a building of masonry construction. These materials are by their very nature (refractories) highly inert and should present no problems in a landfill. A review of the MSDS on the various products used indicate the following compounds are present in the approximate ranges given:

Aluminum oxide	-	17 to 95%
Silicon dioxide	-	25 to 54%
Calcium oxide	-	0 to 6%
Zirconium oxide	-	0 to 35%
Carbon	-	0 to 55%
Iron oxide	-	trace
Magnesium oxide	-	trace

2. Excess System Sand:

The Green Sand Systems contain (dry basis) over 99% sand (silicon dioxide) with the remainder composed of seacoal, bentonite, and wood flour.

This Process No Longer Exists

Seacoal	-	mixture of bituminous coal and styrene butadiene
Bentonite	-	colloidal clay (hydrous aluminum silicates)
Wood Flour	-	"Charbo," a pulverized cellulose and lignin compound

~~At Chattanooga Soil Pipe (CSP), dust from the Green Sand handling system is collected in the DCE Vokes baghouse and dust from the Disamatic metal pouring and shakeout is collected in the Griffin baghouse.~~

At Chattanooga Valve & Fittings (CVF), dust from the Green Sand handling system (#9 Unit) is collected in the apron conveyor baghouse,

and melting and pouring fumes from this unit are collected by a wet collector as a sludge. In addition, melting and pouring fumes from the valve plant brass foundry are collected in a baghouse located in that area. EP toxicity test data on this waste stream [CVF source K(c)] is attached.

We do not anticipate any environmental problems from the above wastes other than the possibility of their contributing to Total Organic Carbon (TOC) in the landfill groundwater due to the organic nature of seacoal and wood flour.

3. Core Sand:

A small portion of the core sand degrades and ends up in the system sand during shakeout and sand reconditioning, on those systems where sand reclaim is practiced. The core butts screened out during reclaim and the core sweepings, along with unused broken cores, becomes waste for landfilling.

Shell Cores ~~(Used at both CSP & CVF)~~

Shell core sand is primarily sand (91% sand, silicon dioxide) with the remainder consisting of the following:

Phenol - formaldehyde resin	-	3%
Hexamethylene - tetramine (HEXA)	-	0.85%
Iron Oxide	-	0.2%
Calcium Stearate (Calcium soap of stearic acid)	-	0.1%
Water	-	Remainder

Some of these shell cores will be coated with a "blacking" mix containing graphite and clay. At CSP, dust from the Shell Sand Coating System is collected in the Sly 79 baghouse.

Airset (and Pepset) Cores and Molds (CVF only)

The Airset sand cores and molds are primarily sand (98%) with the remainder consisting of the following:

Phenol - formaldehyde no-bake resin	-	1.5%
Benzene Sulfonic Acid	-	0.5%

Isocure Cores (CVF only)

The Isocure cores are primarily sand (98%) with the remaining 2% consisting of the following binders;

Part 1 - Phenolic resin	-	55% of binder
Part 2 - Polymeric isocyanate	-	45% of binder
Catalyst Gas - Triethylamine (TEA)		

Core sand being landfilled is relatively inert and stable since practically all of the organics are emitted either during core making operations or at the time of metal pouring and shakeout. Phenol and ammonia are emitted during core making, with phenol, ammonia, and formaldehyde emitted during metal pouring and shakeout.

4. Cleaning room waste:

No Longer Exists

~~At CSP, these wastes are collected as a fine dust in the Zurn baghouse. It is expected that the dust is composed primarily of sand, fine particles of cast iron, and abrasives from the grinding wheels. The spent steel shot (consistency of birdshot) is not collected by the baghouse, but is landfilled along with the other wastes. We do not anticipate any problems with organics or heavy metals from these waste streams.~~

These same type wastes are collected in the baghouses and rotoclones at the #1, 2, and 3 cleaning sheds at CVF. The grinder booth baghouse dust at the CVF brass foundry is a slightly different waste stream [CVF source K(b)] since it contains metal particles of brass rather than cast iron. EP toxicity test data on this waste stream is also attached.

5. Slag:

~~Both CSP &~~ CVF produce cupola and pouring ladle slag. This slag is a granular material and is considered to be inert. The following slag analysis is from our Bessemer, Alabama plant; however, we would expect both CSP and CVF slags to have similar constituents:

Silicon dioxide	-	48.5%
Iron Oxide	-	3.2%
Aluminum Oxide	-	16%
Calcium Oxide	-	24.4%
Magnesium Oxide	-	2.4%
Manganese Oxide	-	2.5%
Sulfur	-	0.2%

CVF also produces desulfurizing ladle slag, a byproduct of ductile iron operations. In this phase of the operation, the molten iron is treated with calcium carbide for the removal of sulfur. The resultant slag from the reaction of carbide with the molten metal is raked off the treating ladles and subsequently landfilled. A previous analysis of this slag indicated the presence of the following constituents:

Calcium sulfide	-	7%
Calcium oxide	-	19%
Calcium carbide	-	4%
Cast iron	-	70%

6. Cupola baghouse dust:

Data on this waste stream has been provided previously.

7. Coke:

Coke fines as well as unburned coke from the cupola bottom drops may be landfilled as necessary. This waste is also considered to be inert with the following typical analysis:

Fixed carbon	-	93%
Ash	-	6.5%
Volatiles	-	0.5%

8. Ductile treating baghouse dust:

This waste stream is present only at CVF. The molten iron (after desulfurization) is inoculated with a magnesium alloy which causes the graphite in the iron to form spheroidal particles thereby producing ductile iron. The fumes from this turbulent reaction are captured in the subject baghouse. Emission rates are estimated to be approximately 3.3 pounds of dust per ton of metal treated. The dust collected is very fine with the major constituent being magnesium oxide.

The remainder is composed of the following compounds:

Iron oxide
Silicon dioxide
Manganese oxide
Calcium oxide

9. Cement lining wastes:

This waste is present only at CVF. No data is being provided since this waste is simply a mixture of Portland cement, sand and water.

~~10. Paint wastes:~~

Hauled Away For Disposal

~~No data is being provided since the dry paint wastes at CSP are being disposed of by a contract hauler at the local municipal landfill. At CVF, these type wastes will be disposed of in a similar manner in the future.~~

~~11. Process wastewater treatment sludge:~~

No Longer Exists

~~This waste stream is present only at CSP. It is the result of solids removal from process wastewater prior to its recycle back into the plant with some of the clarified wastewater being discharged to the sanitary sewer. The sludge is composed primarily of a slurry mix used as a mold coating compound at the pipe casting machines [93% silica flour (silicon dioxide) and 7% bentonite (clay)] with some fines included from the cupola slagging system (see item 5 above). EP toxicity analytical data on this waste sludge is attached [CSP source H].~~

No Longer Exists

CHATTANOOGA VALVE & FITTINGS PLANT

Sources and Types of Waste For Disposal in "Permitted" Landfill

Source	Code*		Waste Type
A. Cupola Area	6	(a)	Cupola baghouse dust
	5a	(b)	Cupola slag
	7	(d)	Bottom drop coke
	1	(e)	Used refractories
B. Electric Furnaces (3) (Holding only-not melting)	8	(a)	Ductile treating baghouse dust
	5b	(b)	Desulfurizing ladle slag
	5a	(c)	Slag from treating, pouring ladles
	1	(d)	Used refractories (from furnaces & ladles)
C. #9 Unit (Green sand system)	2&3a	(b)	Recycling spillover sand
	2	(c)	Apron conveyor baghouse dust
	2	(d)	Waste binder additives (seacoal, bentonite, woodflour)
	-	(e)	Spilled iron
D. #3 Cleaning Shed	4c	(a)	Blast Cleaner baghouse dust
	4a	(b)	Grinding booths rotoclone dust
	4b	(c)	Steel shot (spent)
E. #1 Cleaning Shed	4c	(a)	Cabinet cleaner baghouse dust
	4a	(b)	Swing grinder rotoclone dust
	4b	(c)	Steel shot (spent)
F. #2 Cleaning Shed	4c	(a)	Blast cleaner baghouse dust
	4a	(b)	Grinding booths rotoclone dust
	4b	(c)	Spent steel shot
G. Coreroom	3b	(a)	Airset, Shell & Isocure scrap cores & sand
	3b	(b)	Airset cores - waste sand and scrap cores
H. #10 Unit (Air set system)	2&3a		Waste mold & core sand
I. #4 Unit (green sand system)	2&3a		Waste mold & core sand
J. Cement Lining	9	(a)	Waste cement mortar
K. Valve Plant, Brass (Foundry Area)	4c	(a)	Shot blast baghouse dust
	4a	(b)	Grinder booth baghouse dust
	2	(c)	Melting & pouring loop baghouse dust
	2&3a	(d)	Waste molding & core sand

	Source	Code*		Waste Type
L.	Demolition Debris (General Plant Areas)	1	(a)	Scrap refractories
		-	(b)	Concrete, old paving (asphaltic) excavated soil (may include anything found) - This area is all fill material!
M.	Sand Reclamation System	2		Resin and sand fines from #4 & #10 units -

* Note: Waste Classification Code - see attch. "A"

Classification of Foundry Wastes

1. Used refractories (cupola and ladle linings).

2. System Sand (molding and including core sand dilution).
   (This includes binder additives and dust collected during handling.)

3. Core Sand:
   a. Core butts - that which doesn't enter system sand.
   b. Core sweepings and broken cores.

4. Cleaning room waste:
   a. Grinding dust (abrasives and metal).
   b. Spent steel shot.
   c. Blast cleaner dust (dust from system and core sand).

5. Slag:
   a. Cupola plus holding and pouring ladle slag.
   b. Desulfurizing ladle slag (spent calcium carbide slag).
   c. Melting of non-ferrous metals.

6. Cupola baghouse dust (collected particulates including coke ash).

7. Coke (fines and cupola bottom drop).

8. Ductile treating baghouse dust.

9. Cement lining wastes (waste cement mortar).
   (Portland cement plus sand.)

After pre-mixing and stabilization

~~10. Paint wastes.~~ Hauled Away For Disposal

~~11. Process wastewater treatment sludge.~~

No Longer Exists

"Attch. A"

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CHATTANOOGA, TENNESSEE 37405
615/265-4533

MARTIN H. DAVIS
President

ACCOUNT NO. 1182-001 DATE APRIL 18, 1985

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM BOOK

RECEIVED DATE 03/26/85

MATERIAL BAG HOUSE DUST - CVF source K(b)
V. P.

MARKED GRINDING - Brass Fdy

LABORATORY NO. 226,663

ENVIRONMENTAL SERVICE
APR 22 1985

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

Arsenic mg/l	0.037 ✓
Barium mg/l	0.068 ✓
Cadmium mg/l	0.14 ✓
Chromium mg/l	0.034 ✓
Lead mg/l	3.1 ✓
Mercury mg/l	0.006 ✓
Selenium mg/l	0.12 ✓
Silver mg/l	0.040 ✓

TECHNICAL LABORATORIES, INC.

Lewis E Cain for

MARTIN H. DAVIS
President

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615/265-4533

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ACCOUNT NO. 1182-001 **DATE** APRIL 18, 1985

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM BOOK

RECEIVED DATE 03/26/85

MATERIAL BAG HOUSE DUST - CVF source K(c) V.P.

MARKED MELTING - Brass Fdy.

LABORATORY NO. 226,664

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

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Barium mg/l	0.079 ✓
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Chromium mg/l	0.042 ✓
Lead mg/l	2.5 ✓
Mercury mg/l	0.001 ✓
Selenium mg/l	0.17 ✓
Silver mg/l	0.077 ✓

TECHNICAL LABORATORIES, INC.

Louis E Cain for

MARTIN H. DAVIS
President

ibc

GEOTECHNICAL STUDY
U.S. PIPE INDUSTRIAL LANDFILL
CHATTANOOGA, TENNESSEE
GA FILE 87-0662

THE EDGe GROUP

MWPS007265

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LABORATORY TEST RESULTS.....Section II

CALCULATIONS AND DRAWINGS.....Section III

EDGe

Geologic Associates Division

January 11, 1988

THE EDGe GROUP

MCI/Consulting Engineers, Inc.
P.O. BOX 20301
Knoxville, Tennessee 37933

Attn: Mr. Chuck Priddy

RE: Geotechnical Study
U.S. Pipe Industrial Landfill
Chattanooga, Tennessee
GA File 87-0662

Gentlemen:

With reference to the above project, we have completed a modest geotechnical study and presented herewith are the data, our comments and recommendations. The purpose of this study is to assess the factors of safety against instability of the waste fill as it presently exists, and to propose a stable final configuration. Important information regarding the limitations of geotechnical studies is included as Section I.

INTRODUCTION

In 1984, we presented our initial study of the subject site which included the existing site conditions, drilling and testing information and subsurface conditions. This information is presented again in the following section herein for clarity. In that study, we recommended that a 25 foot bench be created along an existing 1.5 horizontal to 1 vertical slope adjacent to the river bank at approximately elevation 660. That provided a factor of safety of approximately 1.6 for static conditions and 1.2 during rapid drawdown. Since that initial study, we understand that U.S. Pipe does not wish to disturb this existing slope on the riverside of the land fill, and the Tennessee Division of Solid waste Management (DSWM) is agreeable to not disturbing this existing slope. Accordingly, you have redesigned the fill configuration with a 50 foot terrace above this slope at approximately elevation 680 to 695. Additionally, the State rejected the proposed 1.5 to 1 slope along the

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remaining sides of the fill, although they met the required factor of safety of 1.5. Therefore, the remaining slopes were redesigned at a 2 to 1 slope. Because these remaining slopes will be flatter than originally proposed, we do not feel that further analyses are necessary.

SITE CONDITIONS

As shown by the Plan (Section III), the site being used by U.S. Pipe for their landfilling operations consists of more than 22 acres within the southermost parcel of U.S. Pipe property. The site is located within the corporate limits of Chattanooga, Tennessee and is bounded on the east by Interstate Highway 24 and on the west by the Tennessee River. The location map included on the Plan shows the site's location with regard to nearby topographic and cultural features.

Presently, waste has been disposed within the northern three-fourths of the site. As shown on the appended Profiles, the crest of the waste fill ranged at the time of our field investigation from about elevation 695 feet at the southern end of the waste pile to approximately elevation 655 feet at the northern end. The outslope of the west end of the site has an inclination of about 1.5 horizontal to 1 vertical, where it rests on the bank of the Tennessee River (normal pool elevation is about 656 feet). Surface drainage in the area of the waste fill is fair to poor with the majority of the surface runoff flowing toward the river.

The southern one-fourth of the site is covered by dense vegetation and has a surface elevation ranging from 640 to 645 feet. Surface drainage in this undisturbed and unfilled area is good and toward the river.

EXPLORATION AND TESTING

Seven holes were drilled in conformance with ASTM D 1586 (Standard Penetration Test and Split-Barrel Sampling of Soils). In conjunction with this drilling, relatively undisturbed Shelby tube samples (ASTM D

1587) were recovered from selected borings. The locations of these borings and depths at which the samples were obtained are shown on the Plan and Profiles (Section III).

The soil and waste samples were visually classified by members of our professional staff. Representative samples were tested for grain size distribution, Atterberg limits, unit weight determinations and triaxial compressive strength. Results of the laboratory testing are included in Section II.

SUBSURFACE CONDITIONS

The fill, which consists of sand castings (i.e., sandstone-like fragments ranging in size from gravel to boulders), glass, sand, clay, bentonite, and debris, ranges in thickness from approximately 20 feet to 60 feet and is primarily medium dense to dense. Overall, the waste has a relatively high shear strength and a moderately high coefficient of permeability. Beneath the fill, at an average elevation of 635 feet, the borings encountered alluvial soil consisting of brown, silty, sandy, clay. The alluvail soil has a consistency which ranges from soft to stiff and extends to at least the bottom of our borings. Beneath the waste fill where the alluvium has consolidated to a stiff consistency, it possesses a relatively high shear strength.

Ground water was generally found to coincide with the level of the Tennessee River. Considering the permeability of the fill, we expect that the ground water will respond rapidly to fluctuations in the river level.

DESIGN CONSIDERATIONS

We have reviewed the drawings showing the existing site configuration and the preliminary drawings showing the proposed fill configuration as it will exist upon abandonment. Accordingly, the existing fill and the proposed final fill were analyzed for potential slope instability

during three conditions: (1) steady state seepage; (2) rapid drawdown; and (3) dynamic (earthquake) loading. Moreover, two slopes were analyzed as follows: 1) Section Y-Y, representative of the highest slopes in the new fill and, 2) Section X-X, representative of the steepest slope in the existing fill. Phreatic levels within the fill, as measured in 1984, are used in our assessment of stability during steady state seepage conditions. In our analysis of the rapid drawdown condition, we have used the 100-year flood elevation of 656 feet (as estimated by the Tennessee Valley Authority) for the Tennessee River and presumed that the fill becomes saturated to that level and then the lake drops to its normal pool level. Our estimation of the phreatic level within the pile during that condition is shown on the attached drawing. Finally, the site is situated in earthquake zone 2 (moderate risk) and an earthquake acceleration factor of 0.1 was used in our pseudo-static analysis.

The following analyses and recommendations are based on the preceding design considerations. Any changes in the slope configuration or waste composition and consistency will require our review of the recommendations.

STABILITY OF EXISTING WASTE FILL

A stability analysis was performed for the critical section of the existing fill as shown on the attached drawings using effective strength parameters as determined during the triaxial testing of undisturbed samples of waste and alluvial soil. Results of the laboratory testing of the waste indicate that it has an effective cohesion of 900 PSF and an effective angle of internal friction of 35°. However, in the stability analyses, we conservatively used an effective cohesion of 100 PSF and an effective angle of internal friction of 35° for the existing fill. For the alluvial soil, the measured effective cohesion of 0 PSF and effective angle of internal friction of 33° were used in the analyses.

The stability analysis was performed with the aid of a digital computer using the Janbu circular arc analysis and/or hand calculations using the simple method of slices. The computer program used is entitled STABL and was developed during the Joint Highway Research Project HRP-7906 by Purdue University and the Indiana State Highway Commission.

As previously described, the outslope of the waste fill near the river exists at an inclination of about 1.5 horizontal to 1 vertical. Table 1 contains a summary of the factors of safety against instability as calculated for the critical slope of the western face of the existing waste fill.

TABLE 1

Results of Stability Analysis for Existing Slope Configuration

Condition	Minimum Factor of Safety
Steady State Seepage	1.2
Rapid Drawdown	1.0
Dynamic (Earthquake) Loading	1.0

We previously recommended that a bench be excavated into the existing slope of the fill near the river. This bench would be 25 feet wide and would be excavated to an elevation of about 660 feet. Above the bench, the slope should be cut at an inclination of 2 horizontal to 1 vertical. However, as an alternative to disturbing this existing vegetated slope, you have redesigned the slope above the existing fill using a 50 foot wide bench and inclinations of 2 horizontal to 1 vertical on the west side near the river, and 2.0 horizontal to 1 vertical on the east side of the fill away from the river.

As will be described in the next section, the existing outslope near the river will have no significant adverse effect on the stability of the upper levels of the proposed. Consequently, considering that the existing slope has a factor of safety greater than 1.0 and presuming that U.S. Pipe is willing to accept the risk associated with possibly having to perform periodic maintenance and repair of the outslope, we believe that it is prudent not to disturb the slope as currently proposed.

STABILITY OF PROPOSED FINAL CONFIGURATION

The stability analyses were performed for the critical sections of the proposed configuration using effective strength parameters as described previously herein for existing fill and natural soil.

The factors of safety for potential failure surfaces passing through the new fill material will exhibit factors of safety shown in the table below.

TABLE 2

Results of Stability Analysis for Proposed Slope Configuration Above 50' Bench

Condition	Minimum Factor of Safety
Steady State Seepage	1.6
Rapid Drawdown	1.4
Dynamic (Earthquake) Loading	1.0

The locations of the critical failure circles corresponding to these factors of safety are included in Section III. Additionally, overall slope stability for the steady state seepage rapid drawdown, and dynamic

loading conditions were analyzed, and are shown on the Stability Analysis Sheets.

COMMENTS AND RECOMMENDATIONS

As shown by the analyses presented herein, failure arcs passing through the new fill material will have calculated factors of safety which are in accordance with current, prudent, engineering practice.

As more waste material is placed, U.S. Pipe should continue to use the disposal practices outlined in our original report and discussed below. Essentially, in placing the additional waste fill, we recommend that debris be placed toward the center of the fill and that only the foundary sand waste be placed near the outslopes. Moreover, the waste should be placed in maximum 18 inch thick lifts and it should be compacted with the hauling and spreading equipment. The ditches and the crest of the pile should be sloped to drain to reduce the possibility of ponded water on the fill.

Before the waste fill is extended to the southern part of the site, the area should be cleared and grubbed. Afterwards, the area to receive fill should be proofrolled using the loaded waste hauling equipment. Soft or otherwise deleterious material (organic, etc.) so delineated should be excavated to stable ground. As an alternative, filter fabric can be placed above soft areas and the waste can be placed on the filter fabric for stabilization purposes. Further, if seeps are found to be issuing from areas to receive fill, rockfill drains wrapped in filter fabric (see Sheet 4) should be installed to collect the water and to discharge it beyond the toe of the proposed fill. Fill placement procedures should follow those as described in the previous section.

Scour Protection

Scour of waste at the toe of the existing fill and at the toe of the proposed extension by the Tennessee River could have a detrimental

effect on the stability of the fill. Therefore, the outslopes should be routinely inspected at periodic intervals and following high river stages. Scour of the waste encountered during these inspections should be repaired immediately.

Geologic Associates appreciates this opportunity to be of service to you on this project. If you have any questions, please feel free to contact the writer.

Respectfully submitted,

GEOLOGIC ASSOCIATES

Luke C. Williams

Luke C. Williams, P.E.
Project Manager

LCW/mn16

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, thanks to the Association of Soil and Foundation Engineers (ASFE).

When ASFE was founded in 1969, subsurface problems were frequently being resolved through lawsuits. In fact, the situation had grown to such alarming proportions that consulting geotechnical engineers had the worst professional liability record of all design professionals. By 1980, ASFE-*member consulting soil and foundation engineers had the best professional liability record.* This dramatic turn-about can be attributed directly to client acceptance of problem-solving programs and materials developed by ASFE for its members' application. *This acceptance was gained because clients perceived the* ASFE *approach to be in their own best interests.* Disputes benefit only those who earn their living from others' disagreements.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of his report may affect his recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

A geotechnical engineer cannot accept responsibility for problems which may develop if he is not consulted after factors considered in his report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by the geotechnical engineer who then renders an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those opined to exist, because no geotechnical engineer, no matter how qualified; and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. For example, the actual interface between materials may be far more gradual or abrupt than the report indicates, and actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultant through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy

of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by the geotechnical engineer based upon his interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpretating the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report.* Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgement and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist the geotechnical engineer's liabilities onto someone else. Rather, they are definitive clauses which identify where the geotechnical engineer's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

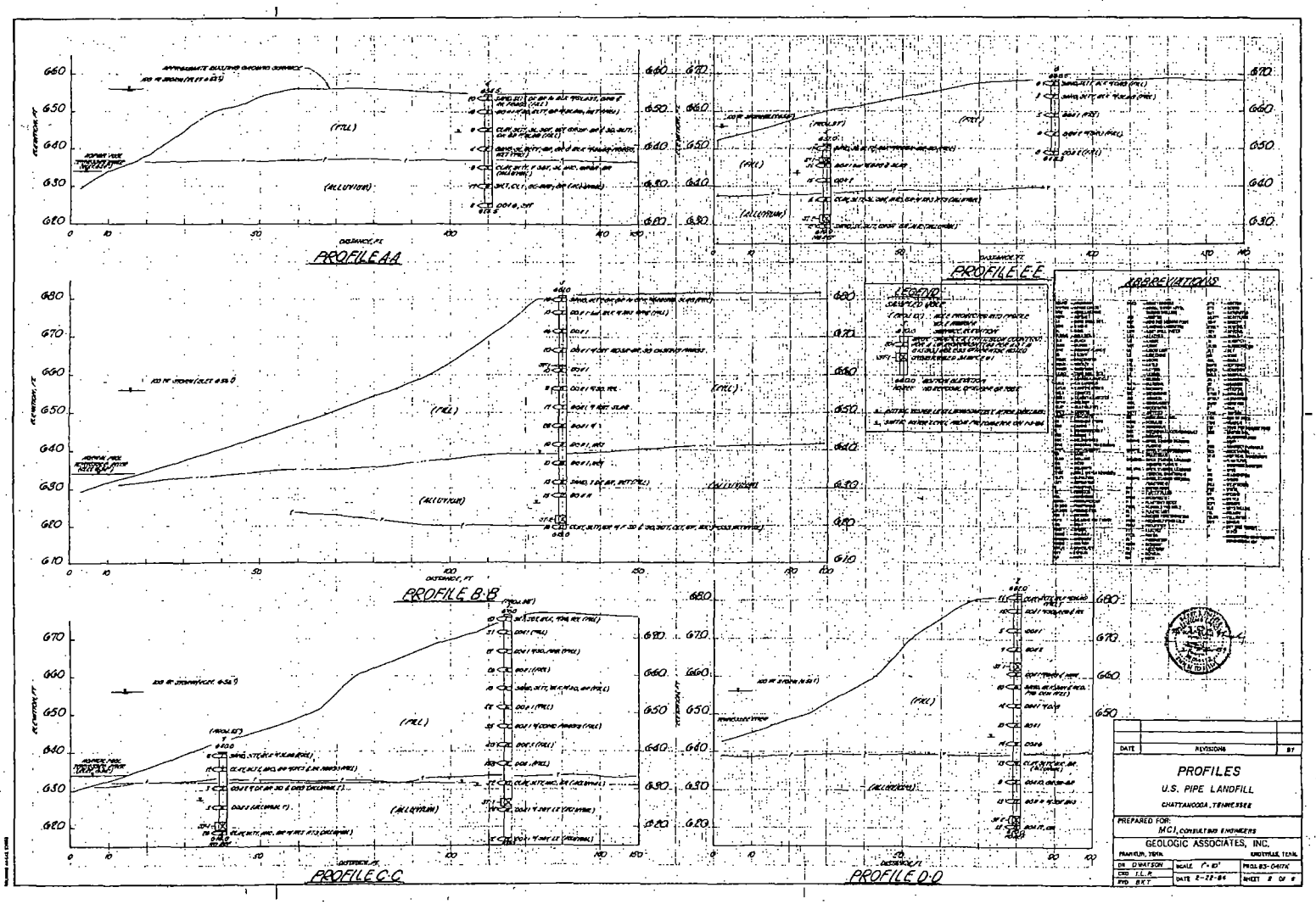
Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, the Association of Soil and Foundation Engineers has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

Published by

ASFE

ASSOCIATION OF SOIL AND FOUNDATION ENGINEERS

8811 Colesville Road/Suite 225
Silver Spring, Maryland 20910
301/565-2733


PROFILE A-A
PROFILE B-B
PROFILE C-C
PROFILE D-D
PROFILE E-E
LEGEND
ABBREVIATIONS
(FILL)
(ALLUVIUM)
ELEVATION, FT
DISTANCE, FT
PROFILES
U.S. PIPE LANDFILL
CHATTANOOGA, TENNESSEE
PREPARED FOR:
MCI, CONSULTING ENGINEERS
GEOLOGIC ASSOCIATES, INC.
DATE
REVISIONS
BY
SCALE 1" = 10'
DATE 2-22-84
PROJ. 83-0417K
SHEET 8 OF 8

MWPS007277

SUMMARY OF LABORATORY TEST RESULTS

Project U.S. Pipe Landfill
Project No. 83-0417 K
Date March 1, 1984

Hole No.	Sample No.	SAMPLE TYPE*	Depth (ft)	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, φ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
1	1	ST	48.5-50.5	31.1	117.2	89.4				**	**		SILT,sandy,micaceous,brown
2	1	ST	18.5-20.0	15.6	120.1	104.1	40	17	CL	**	**		CLAY,silty,black,with slag
2	10	SS	43.5-45.0	26.1									SAND,silty,black,with slag
4	5	SS	18.5-20.0	30.9			40	12	ML				SILT,clayey,very sandy,slightly micaceous, greyish-brown
5	4	SS	13.5-15.0	32.0			30	7	CL/ML			*** S	CLAY,silty,slightly sandy,micaceous grey
5	5	SS	20.5-22.0	32.3					SP/SM			S	SAND,slightly silty,micaceous,greyish brown
7	1	ST	18.5-20.5	31.5	121.1	92.4	44	16	CL/ML	**	**		CLAY,silty,micaceous,brown

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE
** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

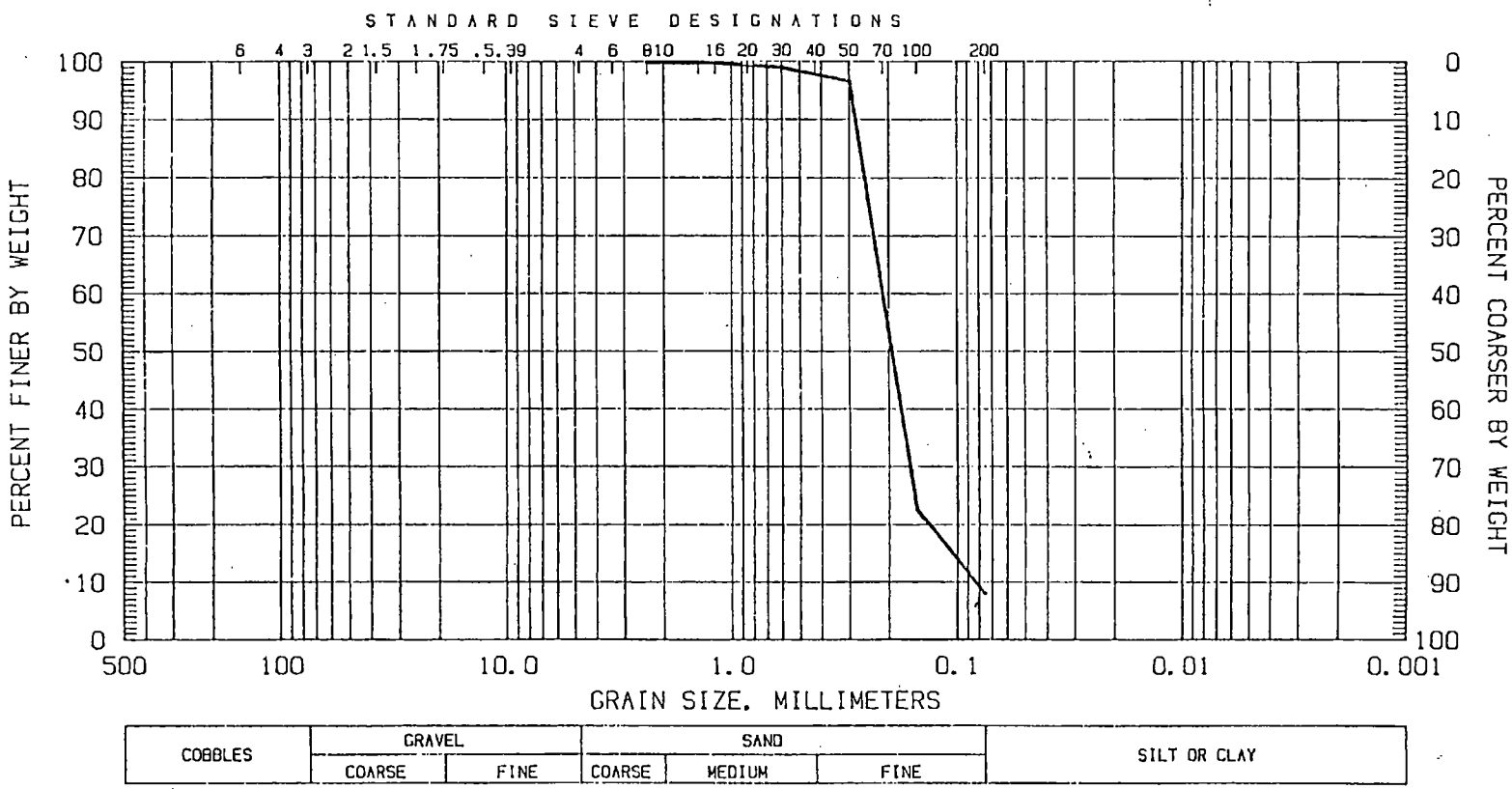
*** Sieve analysis indicates 66.7% passing #200 sieve

DATA CHECKED BY: HP

GEOLOGIC ASSOCIATES, INC.

MWPS007278

GRAIN SIZE ANALYSIS



PROJECT NO.: 83-0417
U.S. PIPE
MCI CONSULTING ENGINEERS
JANUARY 12, 1984
BORING: 5 SAMPLE: 5
DEPTH: 20.5-22.0 FT

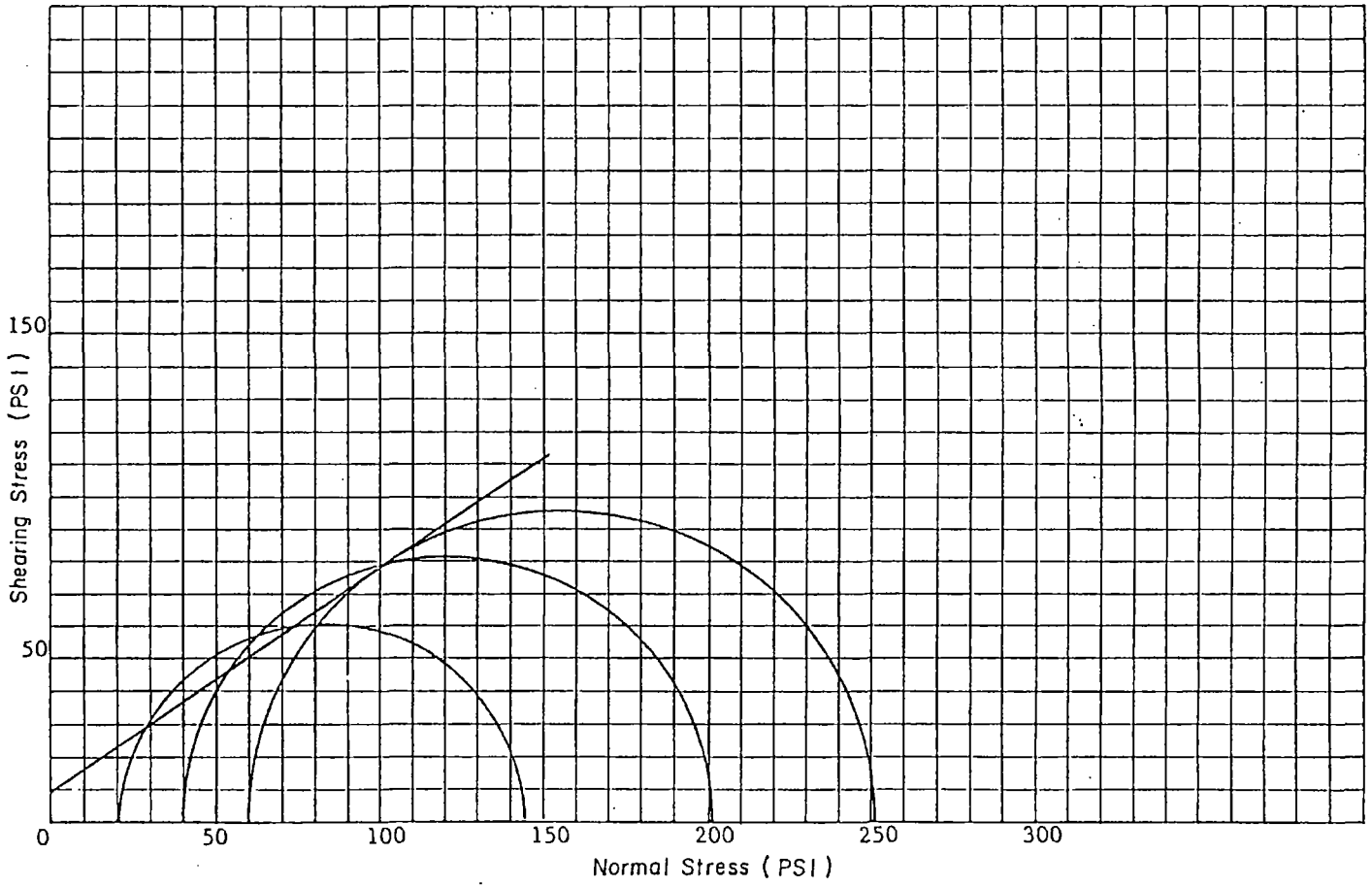
SAND, slightly silty, micaceous, grayish-brown
NATURAL MOISTURE CONTENT= 32.3 %
REMARKS: USC=SP/SM

GEOLOGIC ASSOCIATES, INC.

MWPS007279

MOHR DIAGRAMS — Φ

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)



COHESION (c) 9 PSI

ANGLE OF INTERNAL FRICTION (ϕ) 35°

PROJECT U.S. Pipe Stability Analysis

HOLE 2 SAMPLE WASTE

MWPS007280

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)

Client Mining Consultants, Inc.

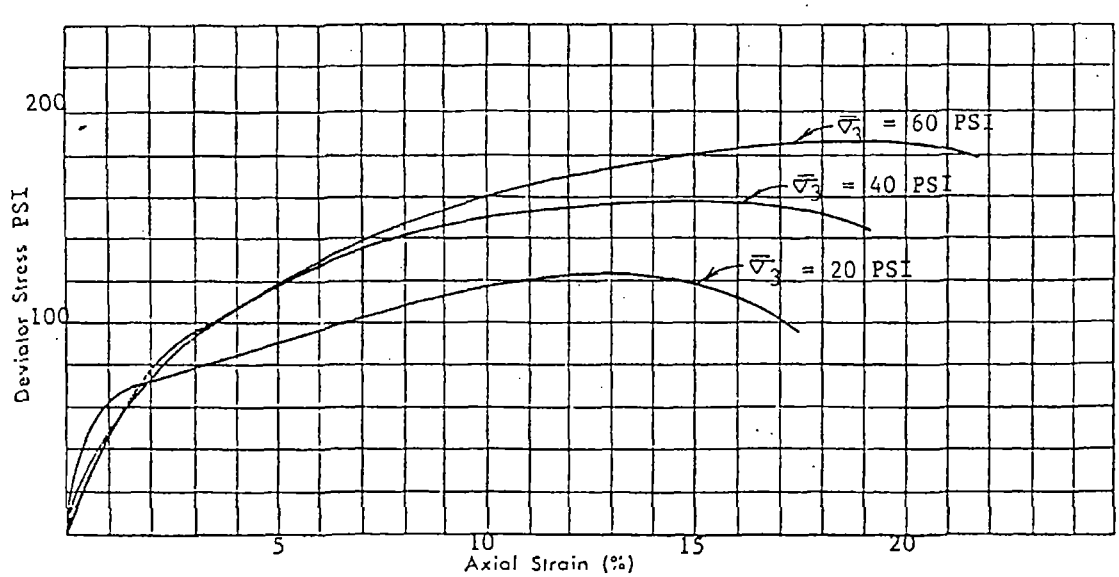
Project U.S. Pipe Landfill

Project No. 83-0417 DATE February, 1984

Sample Description Waste Material

INITIAL SAMPLE PROPERTIES

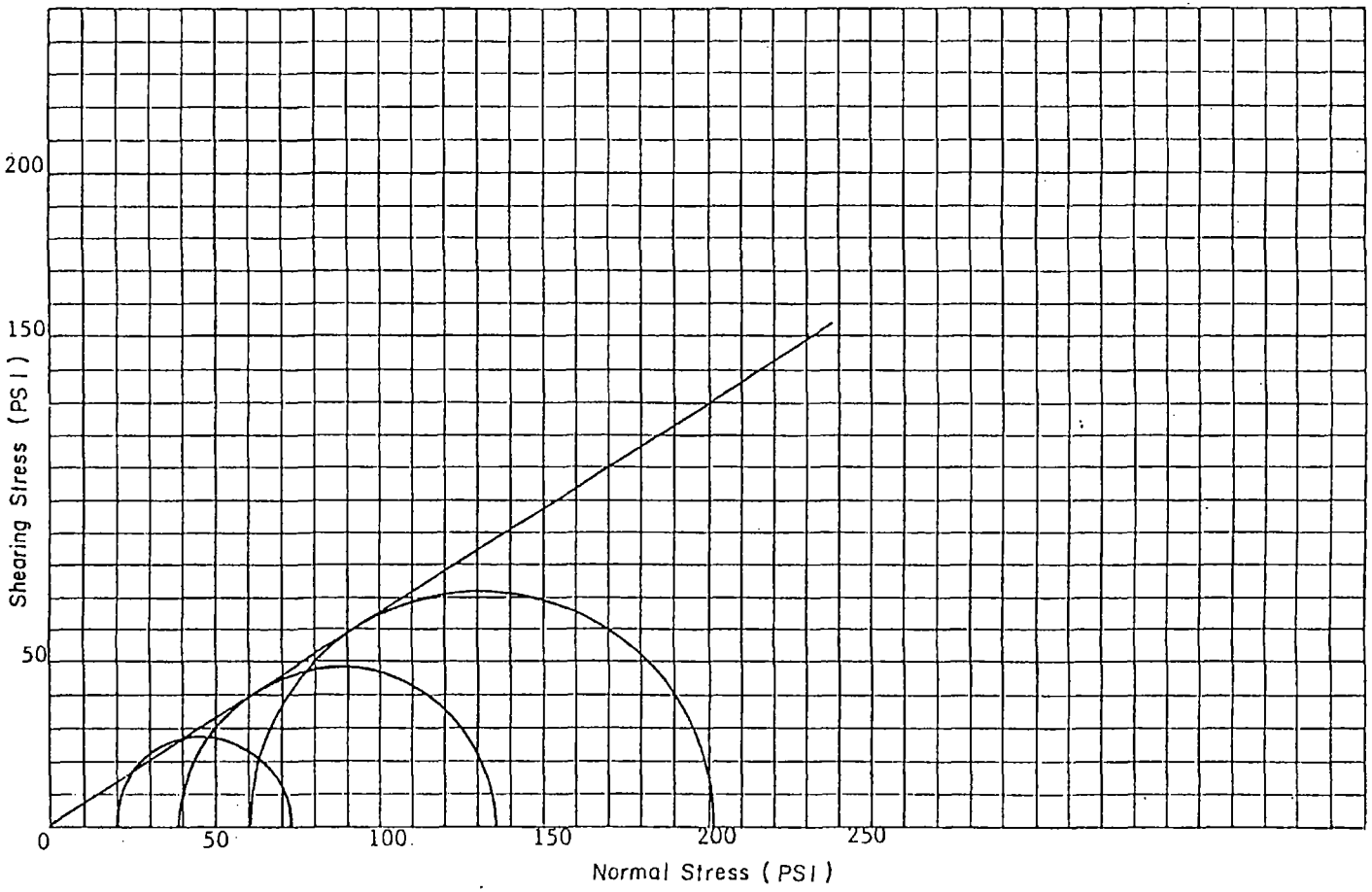
Property	Test 1	Test 2	Test 3
Boring No./Sample No.	2/St-1	2/St-1	Remolded Sample
Depth	18.0'-20.0'	18.0'-20.0'	
Consolidation Pressure PSI	20	40	60
Dry Unit Weight, PCF	97.9	110.3	105.1
Moisture Content, %	18.4	12.7	14.1
Volume, cu. ft.	.0223	.0214	.0199
Void Ratio	0.696	0.505	0.579
Saturation, %	70.4	67.0	64.8
Specific Gravity	2.66	2.66	2.66



STRESS — STRAIN CURVES

MOHR DIAGRAMS — Φ

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)



COHESION (c) 0 P.S.I.

ANGLE OF INTERNAL FRICTION (ϕ) 33°

PROJECT U.S. Pipe Stability Analysis

HOLE 1 & 7 SAMPLE Alluvium

MWPS007282

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)

Client Mining Consultants, Inc.

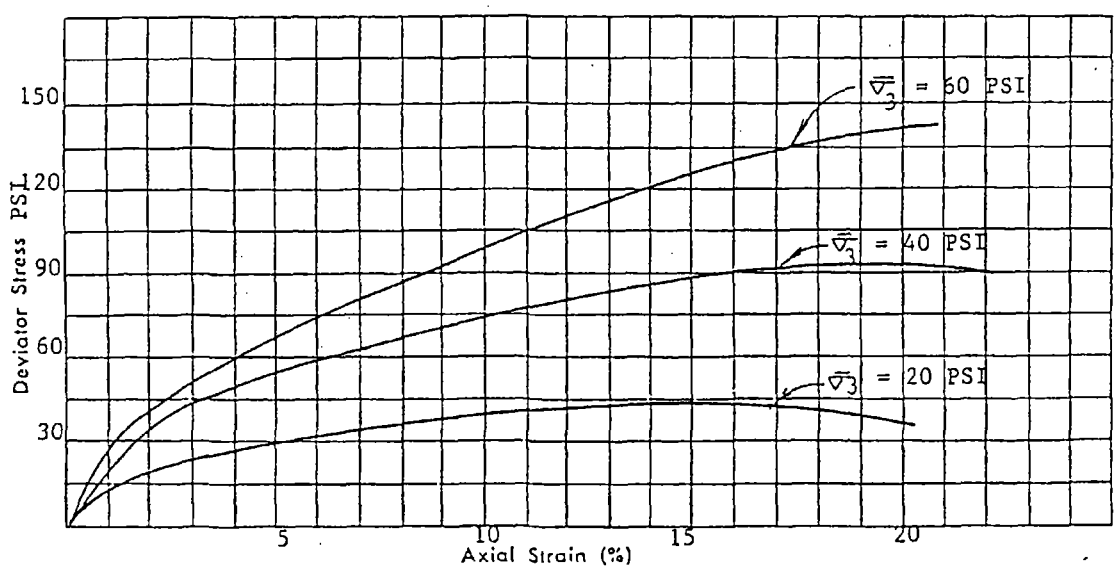
Project U.S. Pipe Landfill

Project No. 83-0417 DATE February, 1984

Sample Description Alluvial Soil

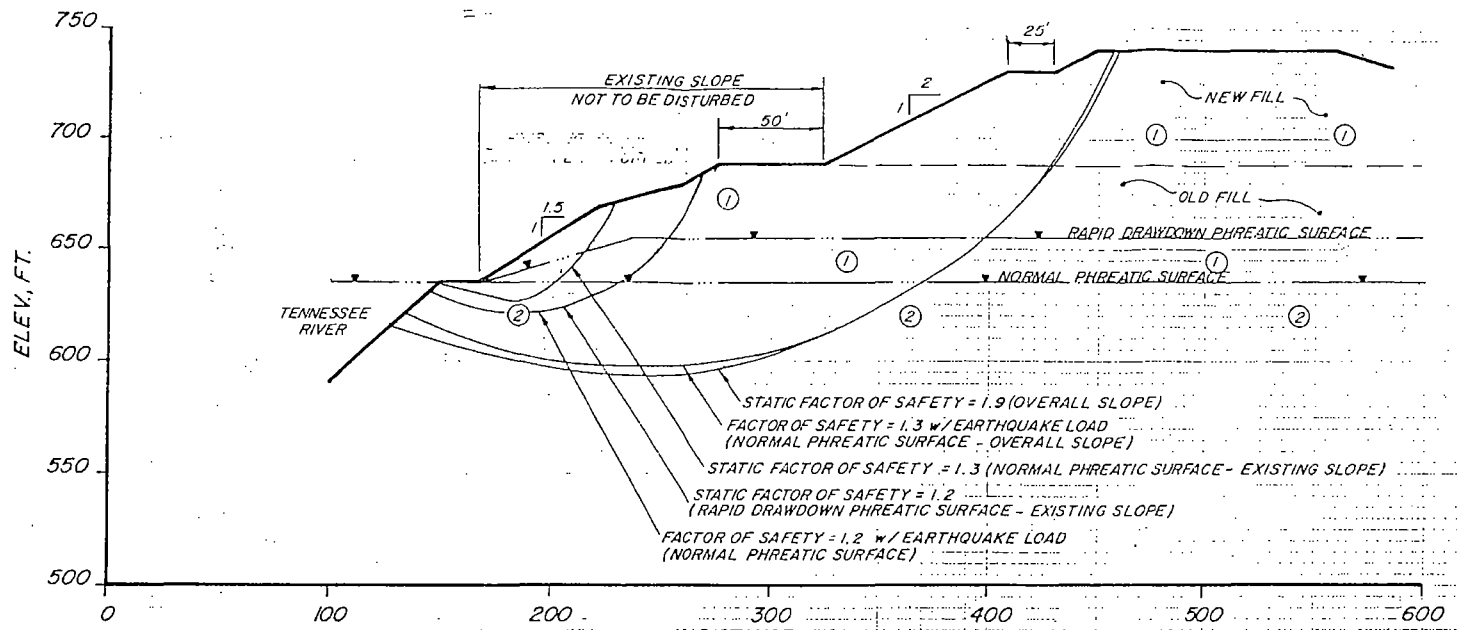
INITIAL SAMPLE PROPERTIES

Property	Test 1	Test 2	Test 3
Boring No./Sample No.	7/St-1	7/St-1	1/St-1
Depth	18.5'-20.5'	18.5'-20.5'	48.5'-50.5'
Consolidation Pressure PSI	20	40	60
Dry Unit Weight, PCF	100.1	84.8	89.4
Moisture Content, %	25.5	37.6	31.1
Volume, cu. ft.	.01998	.0203	.0201
Void Ratio	.696	1.00	.871
Saturation, %	99.7	1.00	95.8
Specific Gravity	2.72	2.72	2.68



STRESS — STRAIN CURVES

MWPS007283



SECTION Y-Y

REFUSE / SOIL PARAMETERS

MATERIAL	NO.	MOIST UNIT WEIGHT (pcf) γ_m	SATURATED UNIT WEIGHT (pcf) γ_s	EFFECTIVE COHESION (psf) c	EFFECTIVE ANGLE OF INTERNAL FRICTION (°)
WASTE FILL	1	120	125	100	35
ALLUVIAL	2	120	125	0	33

LUKE C. WILLIAMS
REGISTERED ENGINEER
No. 17690
STATE OF TENNESSEE
1/12/88

DATE	REVISIONS	BY

STABILITY ANALYSIS

U.S. PIPE LANDFILL

CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS, INC.

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR P. TROXEL	SCALE AS SHOWN	PROJ. 83-0417
CKD L.C.W.	DATE 12/22/87	SHEET 3 OF 6
RVD B.K.T.		

BRUNING 44-132 54194-10

MWPS007284

** PCSTABL4 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu Method of Slices
or Simplified Bishop Method

Run Date:
Time of Run:
Run By:
Input Data Filename: USPIP.IN
Output Filename: USPIP.OUT

PROBLEM DESCRIPTION FINAL SLOPE CONFIGURATION U.S. PIPE FOUNDRY

BOUNDARY COORDINATES

10 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	100.00	135.00	167.00	135.00	3
2	167.00	135.00	220.00	169.00	1
3	220.00	169.00	260.00	180.00	1
4	260.00	180.00	275.00	188.00	1
5	275.00	188.00	325.00	188.00	1
6	325.00	188.00	410.00	230.00	1
7	410.00	230.00	430.00	230.00	1
8	430.00	230.00	450.00	240.00	1
9	450.00	240.00	560.00	240.00	1
10	560.00	240.00	600.00	225.00	1
11	100.00	90.00	150.00	132.00	2
12	150.00	132.00	167.00	135.00	2
13	167.00	135.00	600.00	135.00	2

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	35.0	.00	.0	1
2	120.0	125.0	.0	33.0	.00	.0	1
3	62.4	62.4	.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	135.00
2	600.00	135.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 140.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 220.00 ft.
and X = 325.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

20.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And [illegible].

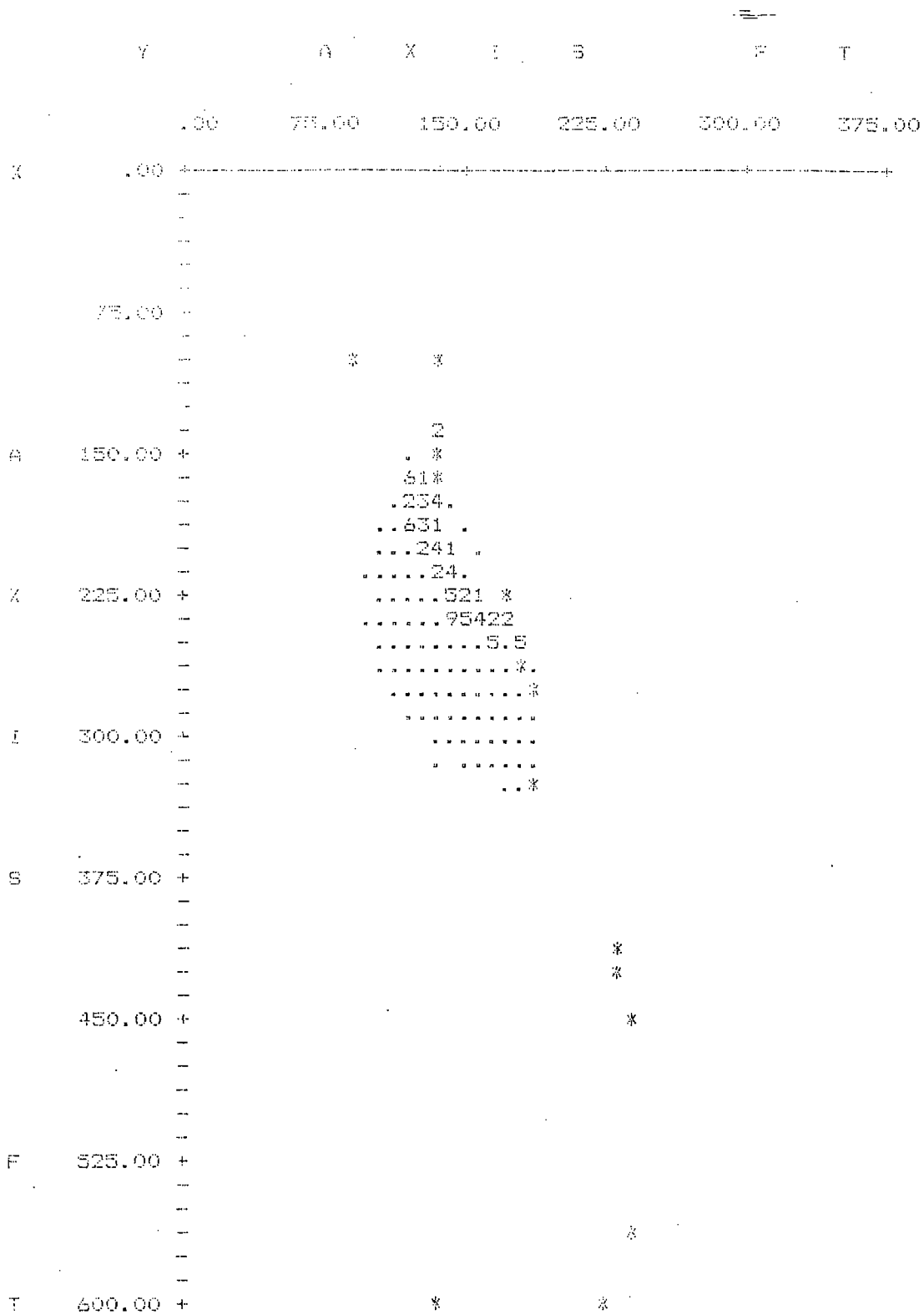
Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.67	133.00
2	166.15	130.49
3	186.05	132.48
4	204.25	140.78
5	218.81	154.49
6	227.61	171.09

*** 1.353 ***


Y
A
X
I
B
F
T
.00
75.00
150.00
225.00
300.00
375.00
X .00
75.00
A 150.00
X 225.00
I 300.00
S 375.00
450.00
F 525.00
T 600.00

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	135.00
2	167.00	135.00
3	235.00	156.00
4	600.00	156.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 140.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 220.00 ft.
and X = 325.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

20.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And .0 deg.

Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* Safety Factors Are Calculated By The Modified Janbu Method * *

The Arc Surface Described By 7 Coordinate Points

Point No.	X-Coord (ft)	Y-Coord (ft)
1	146.67	135.00
2	164.91	126.80
3	184.85	125.23
4	204.14	130.43
5	220.54	141.93
6	232.12	158.24
7	236.39	173.51

*** 1 146 ***

```
                 Y                A     /     I     S              F     T

                 .00      75.00    150.00    225.00    300.00    375.00

        .00  +-------------------------------------------------------------+
             -
             -
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             -
             -
      75.00  +
             -
             -            *      *
             -
             -
             -                     4
A    150.00  +                   5 *
             -                   .1*
             -                  .426.
             -                 ..713..
             -                .9412. .
             -               ...94832
X    225.00  +               .....51362*
             -               ....9.48W.1
             -               ......9..844
             -                ..........*.
             -                 ..........*
             -                  .........
I    300.00  +                    ........
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             -                        ...*
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S    375.00  +
             -
             -
             -                                  *
             -                                  *
             -
```

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Originate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 200.00 ft.

Each Slip Face Terminates Between X = 450.00 ft.
and X = 560.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

37.50 ft Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And .0 deg.

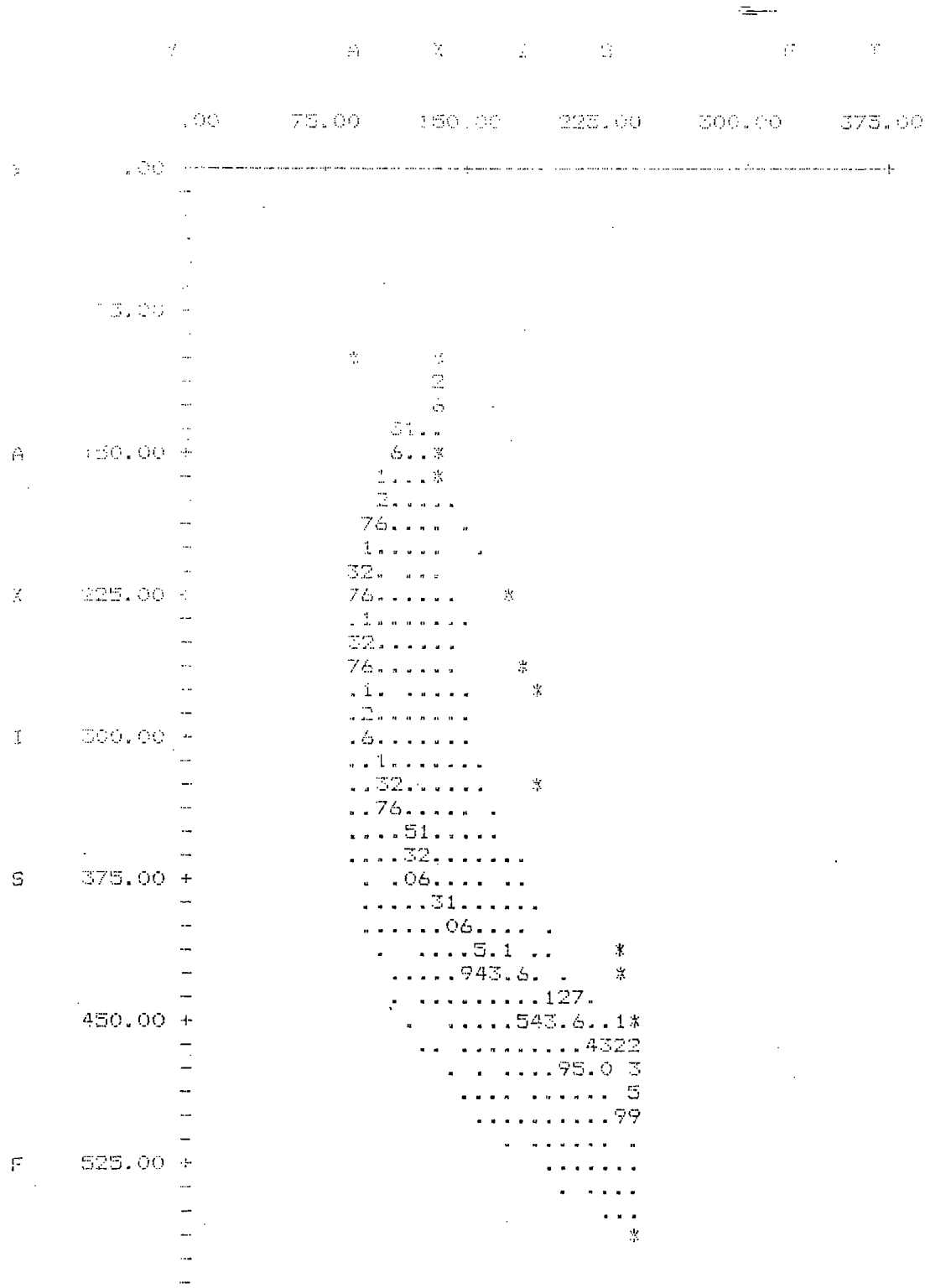
Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	135.00
2	132.75	116.72
3	167.92	103.71
4	204.67	96.23
5	242.13	94.60
6	279.41	98.72
7	315.60	108.53
8	349.05	123.90
9	381.34	144.17
10	409.31	169.15
11	433.09	198.14
12	452.12	230.46
13	455.91	240.00

*** 1.910 ***


.00
75.00
150.00
225.00
300.00
375.00
.00
150.00
225.00
300.00
375.00
450.00
525.00
600.00

A PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	135.00
2	600.00	135.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = 1700.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 140.00 ft.
and X = 177.00 ft.

Each Surface Terminates Between X = 260.00 ft.
and X = 325.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 10.0 deg.

Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	135.00
2	151.61	129.15
3	163.97	125.12
4	176.79	122.99
5	189.79	122.83
6	202.67	124.62
7	215.12	128.34
8	226.88	133.90
9	237.66	141.16
10	247.22	149.97
11	255.34	160.12
12	261.84	171.38
13	266.57	183.49
14	266.58	183.51

*** 1.153 ***

1

```
                Y            A     X     I     S            F     T

                .00       75.00   150.00  225.00  300.00  375.00
X          .00 +-------------------------------------------------------
                -
                -

                .
                ..
           75.00 +
                -
                -            *     *
                -
                -
                -                  I
A       150.00 +                  I*
                -                 41*
                -               . 516..
                -               5413..
                -               5471..
                -              .5.410..
X       225.00 +               .5.4613.   *
                -              .594613.
                -              ..5.461123
                -              ...55764.1*.
                -               ....575064*
                -                .....78555
I       300.00 +                 .......77
                -                  .......
                -                     ...*
                -
                -
                -
S       375.00 +
                -
                -
                -                                 *
                -                                 *
                -
        450.00 +                                   *
                -
                -
                -
                -
                -
F       525.00 +
                -
                -
                -                                  *
                -
                -
T       600.00 +                   *            *
```

MWPS007296

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 450.00 ft.
and X = 560.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

37.50 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And .0 deg.

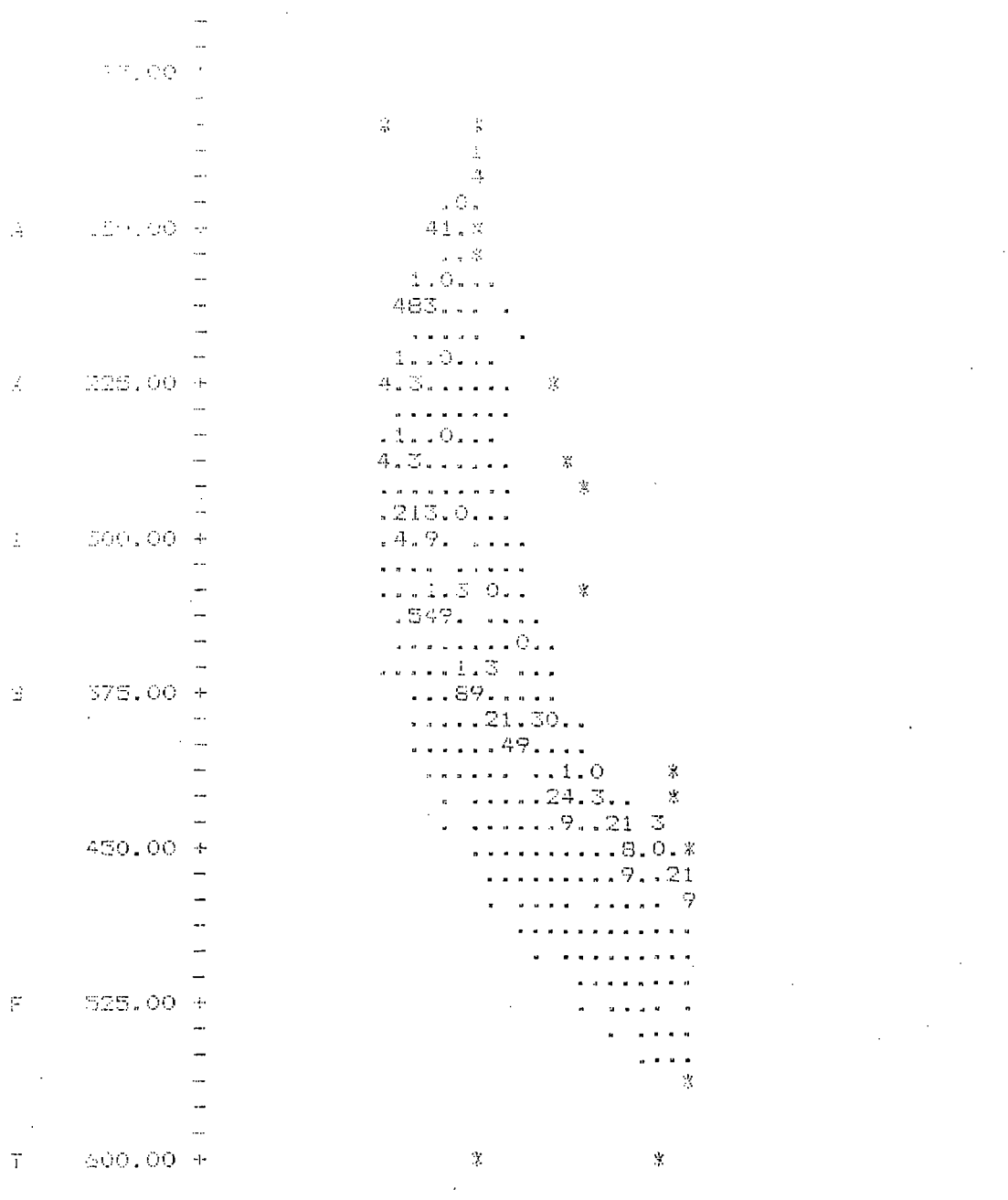
Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

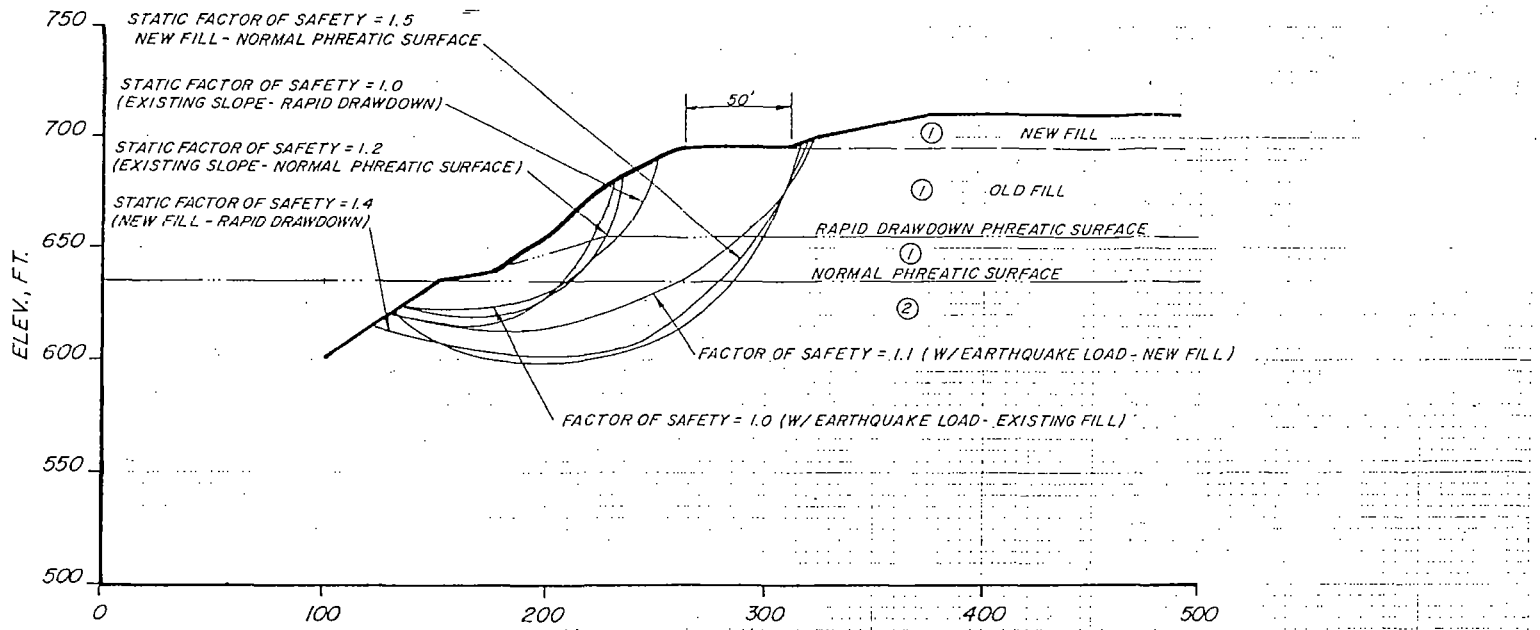
* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	135.00
2	144.15	117.26
3	179.56	104.91
4	216.47	98.28
5	253.96	97.51
6	291.11	102.63
7	326.99	113.51
8	360.73	129.89
9	391.48	151.35
10	419.48	177.37
11	441.07	207.31
12	458.47	240.00

*** 1.361 ***


.00
75.00
150.00
225.00
300.00
375.00
.00
225.00
300.00
375.00
450.00
525.00
600.00



SECTION X-X

REFUSE / SOIL PARAMETERS					
MATERIAL	NO.	MOIST UNIT WEIGHT (γ_m) (pcf)	SATURATED UNIT WEIGHT (γ_s) (pcf)	EFFECTIVE COHESION (c) (psf)	EFFECTIVE ANGLE OF INTERNAL FRICTION (ϕ) (°)
WASTE FILL	1	120	125	100	35
ALLUVIAL	2	120	125	0	33

LUKE C. WILLIAMS
REGISTERED ENGINEER
No. 17690
STATE OF TENNESSEE
1/12/88

DATE	REVISIONS	BY

STABILITY ANALYSIS

U.S. PIPE LANDFILL

CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS, INC.

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR P.TROXEL	SCALE AS SHOWN	PROJ. 83-0417
CKD L.C.W.	DATE 1/11/88	SHEET 4 OF 6
RVD B.K.T.		

BRUNING 44-132 54194-10

MWPS007299

** PCSTABL4 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu Method of Slices
or Simplified Bishop Method

Run Date:
Time of Run:
Run By:
Input Data Filename: USPIP2.IN
Output Filename: USPIP2.OUT

PROBLEM DESCRIPTION FINAL SLOPE CONFIGURATION U.S. PIPE FO
UNDRY

BOUNDARY COORDINATES

11 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	100.00	136.00	157.00	136.00	3
2	157.00	136.00	175.00	140.00	1
3	175.00	140.00	188.00	150.00	1
4	188.00	150.00	205.00	160.00	1
5	205.00	160.00	215.00	170.00	1
6	215.00	170.00	230.00	180.00	1
7	230.00	180.00	250.00	190.00	1
8	250.00	190.00	262.00	196.00	1
9	262.00	196.00	312.00	196.00	1
10	312.00	196.00	370.00	210.00	1
11	370.00	210.00	485.00	210.00	1
12	100.00	100.00	150.00	134.00	2
13	150.00	134.00	157.00	136.00	2
14	157.00	136.00	485.00	136.00	2

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	35.0	.00	.0	1
2	120.0	125.0	.0	33.0	.00	.0	1
3	62.4	62.4	.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	136.00
2	600.00	136.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 205.00 ft.
and X = 312.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	113.33	136.00
2	125.59	127.36
3	139.37	121.42
4	154.07	118.45
5	169.07	118.56
6	183.73	121.75
7	197.41	127.89
8	209.55	136.71
9	219.60	147.84
10	227.16	160.80
11	231.89	175.04
12	232.60	181.30

*** 1.224 ***

```
                Y            A     X     I     S            F     T

                .00      75.00    150.00    225.00    300.00    375.00

X          .00 +---------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
        75.00 +
               -
               -              *    *
               -                 01
               -                013
               -               .136
A     150.00 +               .013*
               -             ..023*
               -             ..0136*
               -             ..0123.*
               -             ..0.126.*
               -             ...0.132..*
X     225.00 +               ...0.7112.*
               -             .....0.47116
               -              .....0..74*7
               -              .......0.0.*
               -               ...........
               -                .........
I     300.00 +                   .......
               -                      ..*
               -
               -
               -
               -
S     375.00 +                           *
               -
               -
               -
               -
               -
        450.00 +
               -
               -
               -                  *          *
               -
               -
F     525.00 +
               -
               -
               -
               -
               -
T     600.00 +                  W
```

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 312.00 ft.
and X = 412.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 20.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	136.00
2	111.77	126.70
3	124.50	118.77
4	138.03	112.30
5	152.20	107.38
6	166.83	104.06
7	181.74	102.39
8	196.74	102.39
9	211.65	104.06
10	226.27	107.38
11	240.44	112.30
12	253.98	118.77
13	266.71	126.70
14	278.48	136.00
15	289.14	146.55
16	298.56	158.22
17	306.62	170.87
18	313.23	184.34
19	317.93	197.43

*** 1.574 ***

```
                 Y            A     X     I     S            F     T

                 .00      75.00    150.00    225.00    300.00    375.00

X          .00 +----------+---------+---------+---------+---------+
                -
                -
                -
                -
                -
        75.00 +
                -
                -             *    *
                -                17
                -              2104
                -             2104.
A     150.00 +                104.*
                -            2148.*
                -           324....*
                -           2718...  *
                -           .518....  *
                -           2518....    *
X     225.00 +              .2198...     *
                -           .2418....
                -           ..2418...     *
                -           ...241....     *
                -           ...7241....
                -            ....2041...
I     300.00 +               .....72414..
                -            .....7272141*
                -             .......562722
                -              .........655
                -               .............
                -                ...........
S     375.00 +                    ........*
                -                  .......
                -                    .....
                -                      ..
                -
                -
        450.00 +
                -
                -
                -                  *          *
                -
                -
F     525.00 +
                -
                -
                -
                -
                -
T     600.00 +                   W
```

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	136.00
2	167.00	136.00
3	225.00	156.00
4	485.00	156.00

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 205.00 ft.
and X = 312.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 20.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	106.67	136.00
2	119.90	128.93
3	134.07	124.01
4	148.83	121.36
5	163.83	121.03
6	178.69	123.05
7	193.06	127.36
8	206.58	133.85
9	218.93	142.37
10	229.79	152.71
11	238.92	164.61
12	246.08	177.79
13	250.50	190.25

*** .998 ***

```
                Y            A     X     I     S            F     T

                .00     60.63    121.25    181.88    242.50    303.13

X          .00 +----------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
        60.63 +
               -
               -
               -
               -                 *     *
               -                     21
A     121.25 +                     6215
               -                  ..1.4
               -                  62...
               -                 .6214*
               -                 6..14*.
               -                ...234W*
X     181.88 +                  ..6.13..
               -                ..6..18..*
               -                .....718..*.
               -                ....6.2.38..*
               -                .....6712.W833
               -                 ......671..28*
I     242.50 +                   .......671.1..
               -                  ..........756*7
               -                   ............5*
               -                    ............
               -                      ...........
               -                       ..........
S     303.13 +                          .......
               -                           ...*
               -
               -
               -
               -
        363.75 +
               -                                 *
               -
               -
               -
               -
F     424.38 +
               -
               -
               -
               -
               -
T     485.00 +                     *   W         *
```

1

MWPS007309

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 312.00 ft.
and X = 412.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	113.33	136.00
2	124.18	125.64
3	136.27	116.75
4	149.38	109.47
5	163.31	103.92
6	177.84	100.18
7	192.73	98.33
8	207.73	98.39
9	222.60	100.35
10	237.10	104.19
11	250.99	109.85
12	264.05	117.23
13	276.06	126.21
14	286.84	136.65
15	296.19	148.37
16	303.98	161.19
17	310.07	174.90
18	314.37	189.27
19	315.62	196.87

*** 1.430 ***

```
                 Y            A      X      I      S            F      T

                 .00      60.63    121.25    181.88    242.50    303.13

X          .00 +----------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
        60.63 +
               -
               -
               -
               -                 *      *
               -                      41
A     121.25 +                     4.15
               -                  41.58
               -                  3.58.
               -                 41.6.*
               -                41.56.*.
               -                .358..W*
X     181.88 +               .21.86..
               -              015..6... *
               -              .25.8....  *
               -              019.86...    *
               -              .21.86.... W
               -              ..15......     *
I     242.50 +               .743586 ...
               -              ..41..86...     *
               -              ...715..6..      *
               -              .....218... .
               -              ....04.216....
               -               .....743186. .
S     303.13 +                .......4.321.. .
               -                .......04.321.1*.
               -                 ........07.73633
               -                  .............7.4
               -                  ................
               -                   ...............
        363.75 +                     ...............
               -                       .. ........*
               -                         ..........
               -                           ........
               -                             ......
               -                                 ..
F     424.38 +
               -
               -
               -
               -
               -
T     485.00 +                     *   W        *
```

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	136.00
2	600.00	136.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = 1700.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 205.00 ft.
and X = 312.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	106.67	136.00
2	118.49	126.77
3	131.94	120.13
4	146.46	116.38
5	161.45	115.66
6	176.26	118.01
7	190.29	123.32
8	202.94	131.38
9	213.69	141.84
10	222.08	154.28
11	227.76	168.16
12	229.95	179.97

*** .860 ***

1

```
                Y            A     X     I     S            F     T

                .00      75.00   150.00   225.00   300.00   375.00

X          .00 +----------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
        75.00 +
               -
               -              *    *
               -                 11
               -                245
               -               .14.
A     150.00 +               .219*
               -             ..154*
               -             ..214.*
               -             ..8194.*
               -             ...321..*
               -             ...635142.*
X     225.00 +              ....6305112*
               -              ....6375....
               -               .....6375.*.
               -               .......3636*
               -                 ........83
               -                 .........
I     300.00 +                    .......
               -                       ...*
               -
               -
               -
               -
S     375.00 +                            *
               -
               -
               -
               -
               -
        450.00 +
               -
               -
               -                  *         *
               -
               -
F     525.00 +
               -
               -
               -
               -
               -
T     600.00 +                  W
```

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = 1700.0 psf

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 312.00 ft.
and X = 412.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 20.0 deg.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	136.00
2	113.24	128.95
3	127.09	123.19
4	141.42	118.75
5	156.10	115.69
6	171.01	114.03
7	186.01	113.77
8	200.96	114.94
9	215.74	117.51
10	230.21	121.46
11	244.25	126.75
12	257.72	133.35
13	270.51	141.19
14	282.50	150.20
15	293.59	160.30
16	303.68	171.40
17	312.67	183.40
18	320.50	196.20
19	321.52	198.30

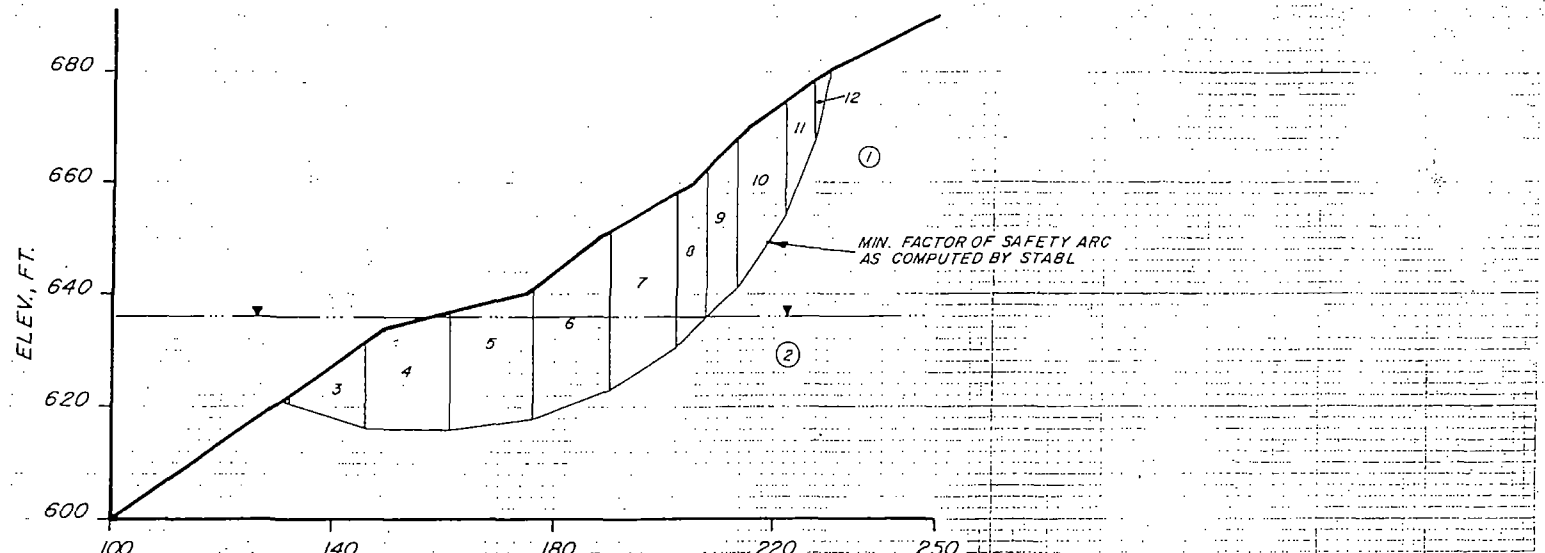
*** 1.144 ***

1

```
                 Y            A     X     I     S            F     T

                 .00     75.00    150.00    225.00    300.00    375.00

X          .00 +---------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
        75.00 +
               -
               -            *    *
               -                12
               -              3127
               -             391.8
A     150.00 +              31.8*
               -            942.8*
               -            3218..*
               -           93218...*
               -           37218... *
               -           63..1....  *
X     225.00 +            93.21...    *
               -           .642.8...
               -           .34.218...   *
               -           ..34.218...   *
               -           ...34.218. .
               -            ...354211..
I     300.00 +             ....6332.818
               -             .....953221.*
               -             ......9.633212
               -              .......99..66
               -               .........9.9.
               -                ..........
S     375.00 +                  .........*
               -                 ........
               -                  . .....
               -                      ...
               -
               -
        450.00 +
               -
               -
               -                *         *
               -
               -
F     525.00 +
               -
```



SECTION X-X

REFUSE / SOIL PARAMETERS

MATERIAL	NO.	MOIST UNIT WEIGHT (pcf) γ_m	SATURATED UNIT WEIGHT (pcf) γ_s	EFFECTIVE COHESION (psf) c	EFFECTIVE ANGLE OF INTERNAL FRICTION (Ø°)
WASTE FILL	1	120	125	100	35
ALLUVIAL	2	120	125	0	33

LUKE C. WILLIAMS
REGISTERED ENGINEER
No. 17690
STATE OF TENNESSEE
1/12/88

DATE	REVISIONS	BY

STABILITY ANALYSIS

U.S. PIPE LANDFILL

CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS, INC.

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR P. TROXEL	SCALE AS SHOWN	PROJ. 83-0417
CKD L.C.W.	DATE 1/11/88	SHEET 5 OF 6
RVD B.K.T		

BRUNING 44-132 54194-10

MWPS007318

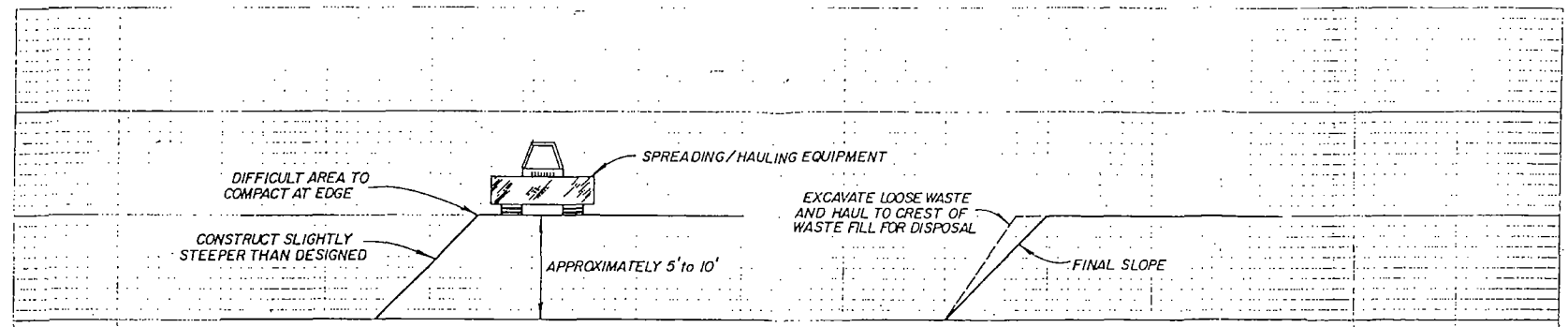
Job Name: U.S. PIPE STABILITY STUDY
Job Number: 37
Title: HAND CALCULATED DYNAMIC STABILITY ANALYSIS
Computed by: LCW Checked by: RKT
Date: 1/8/88 Sheet: Of:

(1) SLICE	(2) WT OF SLICE (SUBMURGED WT)	(3) ANGLE AT BOTTOM OF SLICE	(4) DRIVING FORCE (2) x Sin (3)	(5) TAN Ø ANGLE AT BOTTOM OF SLICE	(6) RESISTING FORCE 2 x Cos (3) x (6)
1					
2					
3	14,343 (7,183)	-14.481	-1,796	0.649	4516
4	34,687 (17,371)	- 2.75	- 833	0.649	11,268
5	50,025 (32,241)	9.016	5052	0.649	20,678
6	44,765 (31,229)	20.73	11,052	0.649	18,964
7	40,500 (33,761)	32.503	18,141	0.649	18,490
8	17,890 (17,031)	44.212	11,876	0.7	8545
9	17,820	44.212	12,426	0.7	8941
10	25,380	56.003	21,042	0.7	9,934
11	10,230	67.745	9,468	0.7	2,712
12	1,560	79.495	1,534	0.7	199
	257,199		87,962		104,258

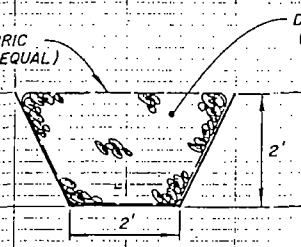
$$F.S.\ (\text{EQUAKE}) = \frac{\text{RESISTING FORCE}}{\text{DRIVING FORCE} + \text{ACCEL.}} = \frac{RF + \text{COHESION}}{DF + 0.1(WT)}$$

$$= \frac{104{,}258 + (150' \times 100\ \text{psf})}{87{,}962 + (0.1 \times 257{,}199)} = \frac{119258}{113{,}682} = 1.05$$

MWPS007319



SLOPE PREPARATION DETAIL



DRAIN DETAIL

BARRY K. THACKER REGISTERED ENGINEER AGRICULTURE COMMERCE NO. 014419 STATE OF TENNESSEE

DATE	REVISIONS	BY

DETAILS
U.S. PIPE LANDFILL
CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR D. WATSON	SCALE NO SCALE	PROJ. 83-0417K
CKD T.L.P.	DATE 2-22-84	SHEET 6 OF 6
RVD B.K.T.		

MWPS007320

RECEIVED
FEB 1987
M. C. I.

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
SOUTHEAST REGIONAL OFFICE
2501 MILNE STREET
CHATTANOOGA, TENNESSEE 37406-3399

February 2, 1987

Mr. John H. Watson
U.S. Pipe and Foundry Company
3300 First Avenue, North
Birmingham, Alabama 35202

Dear Mr. Watson:

Enclosed are the soil test results and recommendations as determined by the University of Tennessee Agricultural Extension Service for U.S. Pipe's solid waste disposal site. We will be referring to this report in our review and evaluation of this site.

If you have any questions, please feel free to call me at 624-9921.

Sincerely,

Janet Dutto

Janet Dutto
Environmental Engineer
Division of Solid Waste Management

JD:pph
Enclosure

cc: Jim Smallwood, U.S. Pipe and Foundry Co.
Chuck Priddy, MCI
Wayne McCoy, EDGE
Division of Solid Waste Management, Nashville
Bob Jerardi, Hamilton County Health Department

Agricultural Extension Service
University of Tennessee Institute of Agriculture

P. O. Box 1071
Knoxville, Tennessee 37901-1071

January 19, 1987

Mr. J.T. Haralson
Asst. Ext. Agent
110 Dayton Blvd.
Chattanooga, TN 37405

Dear Tim:

The establishment and maintenance of a permanent, erosion resistant ground cover at the U.S. Pipe Foundry location will be a challenging project. Enclosed, please find two publications which may be of value.

Based on the soil test report, the two samples you submitted contain high levels of phosphorus and medium to high levels of potassium (levels adequate for ground cover growth). Due to the high pH (01=pH 8.4, 02=pH 7.9), no limestone application was recommended. As you know, the availability of mineral elements in soil is greatly influenced by pH. Between a soil pH of 6.0 and 6.5, the essential soil elements are adequately available for optimal turfgrass growth. A sulfur application prior to planting may be required to reduce alkalinity and the potential for severe imbalances in nutrient availability.

Additional factors to consider regarding the dump site material include 1) heavy metal and 2) sodium content, and 3) salinity. Heavy metals (i.e. copper, nickel, lead,...) may interfere with normal, internal plant processes when toxic levels exist in soils.

Generally, sodium is considered as it relates to soil physical and chemical properties. Adverse physical and chemical conditions may exist in soils high in exchangeable sodium. Sodic soils may be reclaimed by replacing exchangeable sodium with calcium or magnesium and removing sodium by leaching. Gypsum ($CaSO_4$-$2H_2O$) may be used to remove exchangeable sodium from soil and replace it with calcium. The resultant soil is more friable and water infiltration and percolation rates increase.

The Agricultural Extension Service offers its programs to all eligible persons regardless of race, color, national origin, sex, or handicap and is an Equal Opportunity Employer.

THE UNIVERSITY OF TENNESSEE, THE U.S. DEPARTMENT OF AGRICULTURE, AND COUNTY GOVERNMENTS COOPERATING

One effect of a high soil salt concentration is to produce water stress which may cause the plant to wilt and/or die. If the salinity level is less than 1.0 mmhos/cm (determined by soluble salts test) the effect of soluble salts is negligible. A soluble salts level greater than 2.0 mmhos/cm may limit the selection of adapted plant species. Bermudagrasses are moderately tolerant of soluble salts. Soluble salts testing is now available at the University of Tennessee Diagnostic Laboratory, Nashville.

Several plant species may be adapted to the U.S. Pipe Foundry site (refer to pg. 4 in Revegetation and beautification of roadsides in Tennessee). Typically, species selection is influenced by planting date. A common bermudagrass plus annual lespedeza seed mixture may be seeded from April 15 to June 15, a tall fescue plus white clover mixture, February 15 to April 15 and August 15 to October 15.

Bermudagrass, a warm season, perennial sod-forming grass deserves consideration. Common bermudagrass spreads by both above ground (stolons) and below ground (rhizomes) runners and provides excellent erosion control when properly managed. Common bermudagrass can be seeded, sprigged (sprigs are individual plants or pieces of plants from which new plants develop which may be placed 4 to 6 inches apart in furrows 2 to 3 inches deep spaced on 6 to 12 inch centers), stolonized (sprigs uniformly broadcast over the soil surface - a disk is used to partially incorporate sprigs following stolonizing), plugged or sodded. Sodding is recommended on areas prone to erosion including extreme slopes, waterways and critical areas which may experience water moving at a high velocity.

Hydromulching (hydraulic broadcasting of seed and mulch over the soil surface) has been used effectively for ground cover establishment on steep slopes where seedbed preparation and use of conventional equipment is not possible. A seed mixture containing 67 percent (by weight) hulled bermudagrass and 33 percent annual lespedeza planted from

April 15 to June 15 at a rate of 21 pounds per acre may provide adequate erosion control. Annual lespedeza in combination with bermudagrass will provide temporary cover until bermudagrass becomes well established. Use of a mulch is recommended to absorb and retain moisture, reduce soil erosion and hold seed in place.

Tall fescue, a cool season, perennial bunch grass may be established in spring, late summer or early fall. Periodic fertilization and mowing are required to maintain adequate cover (tall fescue does not spread by rhizomes or stolons). A seed mixture containing 90 percent (by weight) tall fescue and 10 percent white clover has been recommended for revegetation of roadsides in Tennessee. Serecia lespedeza and crownvetch have also been used effectively (pg. 8 - Revegetation and beautification of roadsides in Tennessee).

Reducing steepness and length of slopes will make plant establishment and maintenance easier and prevent land slides. Thirty pounds of nitrogen, phosphate and potash per acre (200 lbs. 15-15-15 fertilizer/acre) should be broadcast and incorporated prior to planting bermudagrass or tall fescue. If bermudagrass is established prior to July 1, 44 lbs. nitrogen per acre (approximately 100 lbs. urea/acre or 125 lbs. ammonium nitrate/acre) should be applied six weeks after planting. Two-hundred-fifty pounds of 15-15-15 fertilizer (or equivalent) should be applied to bermudagrass each spring (May 1 to May 15). Spring plantings of tall fescue should be refertilized in the early fall (500 lbs. 6-12-12/acre or its equivalent). Refertilize fall plantings of tall fescue in the early spring (April 1-15). Tall fescue should be fertilized each spring (April 1-15) with 250 lbs. of 15-15-15 per acre to maintain cover.

Immediately after planting, the area should be irrigated frequently to maintain adequate moisture in the upper 1 to 2 inches of soil (630 gallons/1000 ft^2 is equivalent to a 1 inch rainfall). If possible, water should be applied slowly to prevent seed movement and reduce runoff. After developing plants have become well established, the practice

of light, daily applications of water can be discontinued. More water should be applied less frequently to increase rooting depth.

Due to the limited information available regarding response of several plant species to the material generated at the U.S. Pipe Foundry, I agree with John Jared and suggest that a small area be established for observation and evaluation before a major capital expenditure for the establishment of a vegetative canopy over the entire site.

Please don't hesitate to call if I may be of further assistance.

Sincerely,

Tom Samples

Tom Samples
Assistant Professor
Ornamental Horticulture and
Landscape Design

Enclosures

gi

A[illegible]cultural Extension [illegible]
Uni[illegible]ty of Tennessee Institute of Agriculture

TO: HARALSON, JOHN TIMOTHY
ASST. EXTENSION AGENT
1110 DAYTON BLVD.
CHATTANOOGA, TENNESSEE 37405

DATE: 11/07/86
COUNTY: HAMILTON
LAB NO: 65661

Nashville, TN 372[illegible]

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMM[illegible]DATIONS		
				Pounds Per Acre And Ratings										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K[illegible] Pot[illegible]
01	Grass Pasture est-renov.	8.4		68 H	190 H								0	30	30	3[illegible]
	Grass Pasture maintenance	8.4		68 H	190 H								0	30-60	0	
02	Crown Vetch	7.9		36 H	160 M								0	0-15	30	
	Crown Vetch maintenance	7.9		36 H	160 M								0	0	0	

Grass pasture est.-renov. notes:

Each pasture sample has two recommendations. The first should be used for new crops or to renovate an existing c[illegible] The second should be used for maintenance of an existing crop. For future maintenance of the new or renovated c[illegible] use the second recommendation and omit the lime.

If renovation involves the addition of legumes to grass pastures, the nitrogen should be omitted.

Grass pasture maintenance notes:

Apply recommended amounts of phosphate and potash in one application anytime during the year. For extra growth stockpiling in the fall, apply nitrogen August 15 to September 15 and from March 1 to March 30, if additional [illegible] is needed in the spring. If additional growth is only needed during one season, apply nitrogen for that season

If urea is the nitrogen source, especially for fall topdressing, some loss of nitrogen may occur if applied to soils followed by three or more days of rapidly drying conditions without rainfall.

Crown Vetch establishment notes:

Each crown vetch sample has two recommendations. The first should be used for new crops or to renovate an e[illegible] crop. The second should be used for maintenance of an existing crop. For future maintenance of the new or [illegible] crop, use the second recommendation and omit the lime.

*Ratings indicates relative availability of nutrients to plants: (L) = Low; (M) = Medium; (H) = High; (V) = Very High; (D) = Deficient; (S) = Suffi[illegible]
**PPM = Parts Per Million If you have questions about these recommendations, contact your Extension office.

MWPS007326

Agricultural Extension Service
University of Tennessee Institute of Agriculture

SOIL TEST REPORT

TO: HARALSON, JOHN TIMOTHY
(page 2, cont'd)

DATE:
COUNTY:
LAB NO:

FROM: John R. Jared
John R. Jared
Professor
Plant & Soil Science
P. O. Box 110019
Nashville, TN 37222-0019

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMMENDATIONS		
				Pounds Per Acre And Ratings										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash

Crown Vetch maintenance notes:

Apply recommended amounts of phosphate and potash in one application anytime during the year.

*Ratings: Indicates relative availability of nutrients to plants; (L) = Low; (M) = Medium; (H) = High; (V) = Very High; (D) = Deficient; (S) = Sufficient
**PPM = Parts Per Million — If you have questions about these results

MWPS007327

Agricultural Extension Service
University of Tennessee Institute of Agriculture

SOIL TEST REPORT

TO: HARALSON, JOHN TIMOTHY
ASST. EXTENSION AGENT
1110 DAYTON BLVD.
CHATTANOOGA, TENNESSEE 37405

DATE: 11/07/86
COUNTY: HAMILTON
LAB NO: 65661

FROM: John R. Jared
John R. Jared
Professor
Plant & Soil Science
P. O. Box 110019
Nashville, TN 37222-0019

SAMPLE INFORMATION				SOIL TEST RESULTS									RECOMMENDATIONS		
				Pounds Per Acre And Ratings*									Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Limestone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash
01	Grass Pasture est-renov.	8.4		68 H	190 H								0	30	30	30
	Grass Pasture maintenance	8.4		68 H	190 H								0	30-60	0	0
02	Crown Vetch	7.9		36 H	160 M								0	0-15	30	60
	Crown Vetch maintenance	7.9		36 H	160 M								0	0	0	30

The two samples you submitted to the Soil Testing Laboratory contain medium to high levels of potassium and high levels of phosphorus. Such levels would certainly be sufficient for grass or ground cover growth. However, water pH readings are higher than necessary and could perhaps cause problems. This is especially true for sample 01. Such high pH values could cause severe nutrient imbalances.

I would suggest that only a small area be established for observation before too many dollars are invested.

Sincerely,

/S/ John R. Jared
John R. Jared
Professor
Plant and Soil Science

JRJ:Mjw

cc: Debbie Brakefield

MWPS007328

*Ratings: Indicates relative availability of nutrients to plants: (L) = Low; (M) = Medium; (H) = High; (V) = Very High; (D) = Deficient; (S) = Sufficient
**PPM = Parts Per Million

MONITORING WELL INSTALLATION PROGRAM
U.S. PIPE & FOUNDRY COMPANY
CHATTANOOGA, TENNESSEE

Prepared for:

U.S. Pipe & Foundry Company
Birmingham, Alabama

Prepared by:

MCI Consulting Engineers, Inc.
Knoxville, Tennessee

May 6, 1985

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1.0 INTRODUCTION	1
2.0 MONITORING WELLS	1
2.1 Drilling	1
2.2 Installation	8
2.3 Development	9
3.0 SAMPLING AND ANALYTIC RESULTS	10

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Well Locations	2
Geologist's Log: Well 1	4
Geologist's Log: Well 2	5
Details of Monitoring Well Construction: Well 1	6
Details of Monitoring Well Construction: Well 2	7

APPENDIX I

Development Log: Well 1

Development Log: Well 2

Laboratory Analytic Sheet

1.0 INTRODUCTION

This report presents the details of U.S. Pipe & Foundry's monitoring well installation program at their Chattanooga, Tennessee landfill site. The well locations are shown on page 2 on a copy of a 1983 aerial photograph. Pursuant to approval of the well locations by the Tennessee Division of Solid Waste Management (TDSWM) in a letter dated March 22, 1985, U.S. Pipe & Foundry contracted with MCI Consulting Engineers, Inc. (MCI) for the installation, development, sampling, and analyses for two monitoring wells.

These activities are summarized as follows:

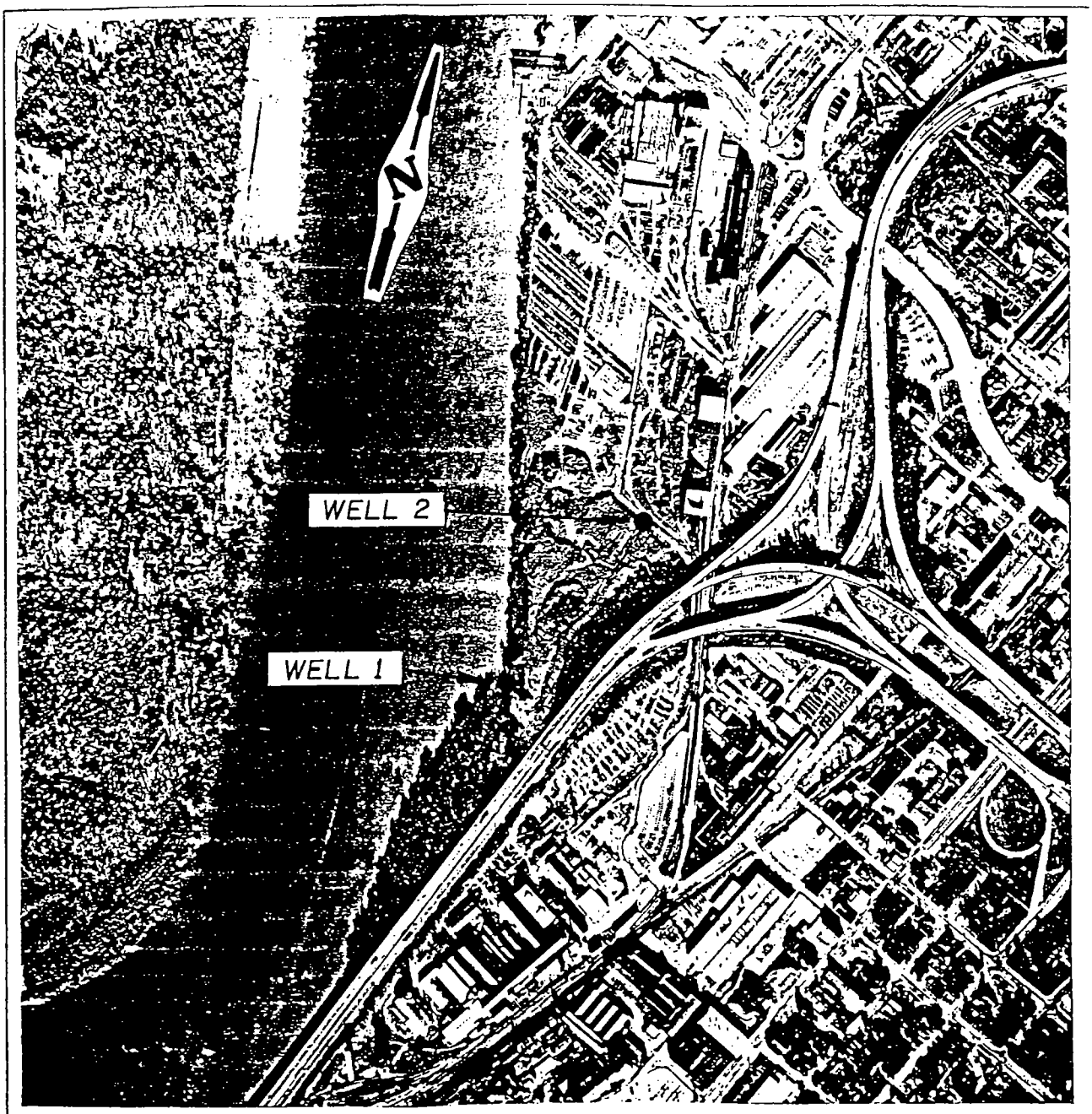
- Installation of wells: April 11, 12 and 16, 1985
- Development of wells: April 11, 12, 16 and 17, 1985
- Sampling of wells: April 24, 1985
- Analyses of samples: April 25, 26 and 29, 1985

Subsequent sections of this report provide specific information associated with each of the above referenced activities.

2.0 MONITORING WELLS

2.1 Drilling

Drilling was conducted with a CME-550 all terrain vehicle rig. Hollow stem augers with an internal diameter (ID) of 4 inches were utilized for Well 1. Because Well 2 had to be installed



Photograph was flown in October, 1983 by Continental Aerial Surveys for MCI Consulting Engineers, Inc. as part of the permit development for U.S. Pipe and Foundry's landfill.

DATE	REVISIONS	BY

LOCATION MAP FOR MONITORING WELLS

SCALE: NO SCALE

PREPARED FOR U.S. Pipe & Foundry
Chattanooga, Tennessee

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

MCI 2282220 DATE SHEET OF

approximately 45 feet below the water table, 6-inch ID augers were necessary for this installation. MCI's hydrogeologist logged all phases of the drilling and installation of the monitoring wells.

The drilling logs can be found on pages 4 and 5. As expected, Well 1, which is near the Tennessee River, penetrated alluvial sandy clays and fine-grained sands at shallow depths of 0.5 and 3.5 feet, respectively, below ground surface. In contrast, Well 2, which is along the landfill's eastern border, was drilled through 49 feet of foundry wastes overlying alluvial coarse-grained sands and gravels. A perched water table was encountered at a depth of approximately 14 feet below ground surface, and saturated conditions persisted throughout the drilling. However, it should be noted that observations made during the drilling and subsequent well development operations indicate that the perched water zone within the wastes is not hydraulically connected with the deeper, underlying ground water in the alluvium. This conclusion is based on the differences in the water levels of each zone. The perched zone exhibited a water level approximating 14 feet from ground surface, whereas the water level in the alluvium subsequent to well installation was about 28 feet below ground surface, or nearly at the river elevation. These two ground water zones may be hydraulically connected at other locations, however.

GEOLOGIST's LOG

Facility:	U.S. Pipe & Foundry Landfill
Location:	Chattanooga, TN
Date:	April 11, 1985
Hole:	1-downgradient
Logged by:	SBD
Drilling Method:	4-inch hollow stem augers

0-.5:	Veneer of foundry fill from pad construction.
.5-3.5:	Clay, silty, sandy, micaceous, brown. Very moist to wet.
3.5-4.0:	Sand, fine- to medium-grained, dark gray, with silt and clay laminae. Possible phenolic odor. Wet with soft returns.
4.0-14.5:	Sand, fine- to medium-grained, light gray, with less silt and clay below 10', micaceous. Wet with soft returns.
14.5-17.0:	Sand, fine- to medium-grained, light gray and brown, micaceous, with less silt and clay. Wet, flowing returns.
Total Depth:	17.0

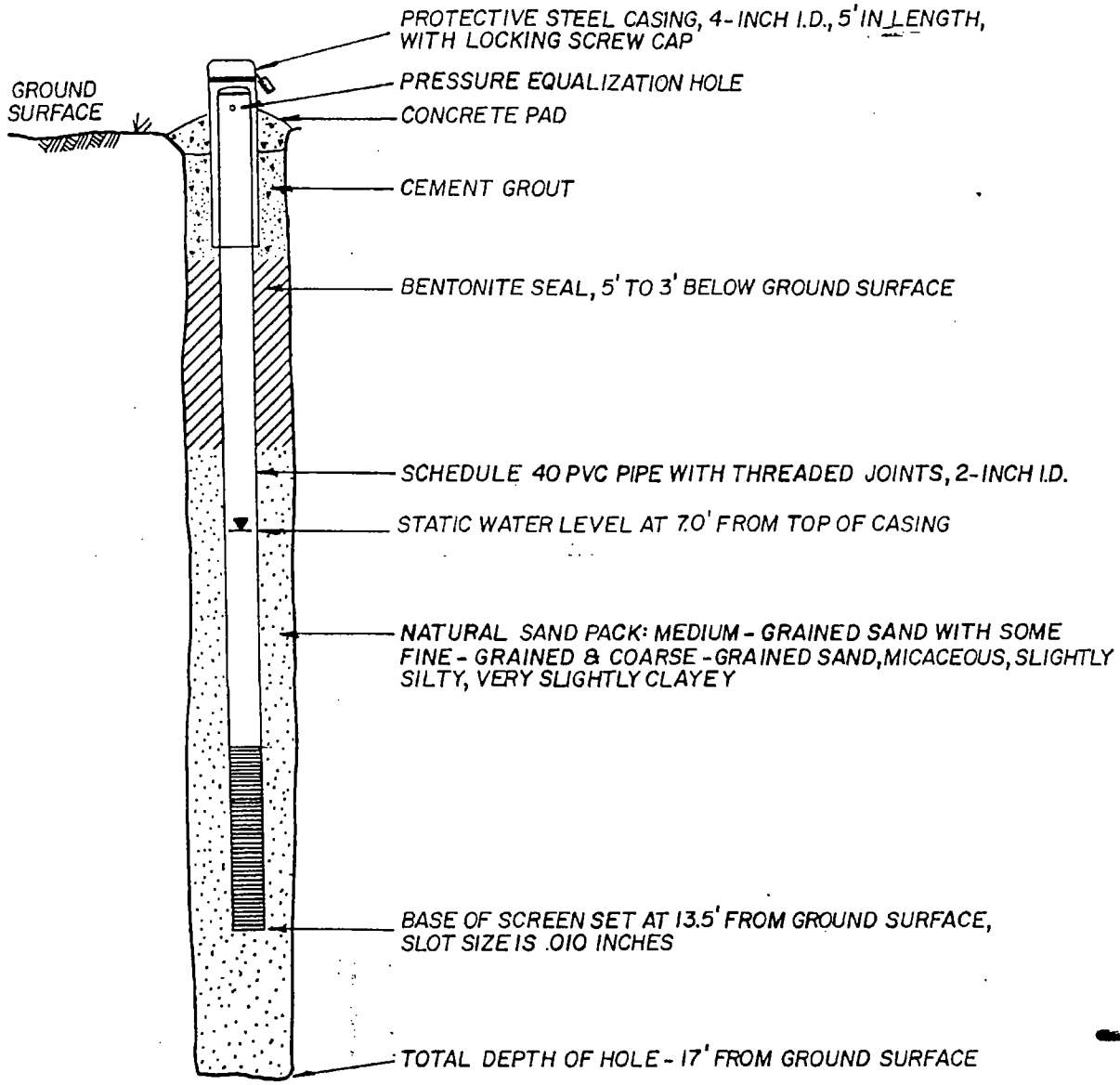
MCI
Consulting Engineers, Inc.

GEOLOGIST's LOG

Facility:	U.S. Pipe & Foundry Landfill
Location:	Chattanooga, TN
Date:	April 12 and 16, 1985
Hole:	2-upgradient
Logged by:	SBD
Drilling Method:	4-inch and 6-inch hollow stem augers

0-.3:	Soil with grass and roots.
.3-13.9:	Silt, sandy, black, dry, firm.
13.9-25.0:	Silt, sandy, black, wet, soft.
25.0-40.0:	Silt, sandy, black with yellow sand and scattered rubber and metal trash. Less saturated.
40.0-49.0:	No return. At 49.0 slightly rough drilling, believed to be contact between waste and alluvium.
49.0-55.0:	No return.
	Used rods and split-spoon sampler to clear plug within hollow stem augers. After plug was cleared, split-spoon sampler was driven to obtain in-situ sample. Sampler contained 8 inches of yellowish-brown sand, coarse- to very coarse-grained, with chert pebbles. Above the sand were 1 inch of orange and yellow clay laminae.
	Hole was deepened to 58.0 on April 16, 1985 with 6-inch hollow stem augers.
Total Depth:	58.0'

MCI
Consulting Engineers, Inc.



DATE	REVISION	BY

WELL No. 1
DETAILS OF MONITORING WELL CONSTRUCTION

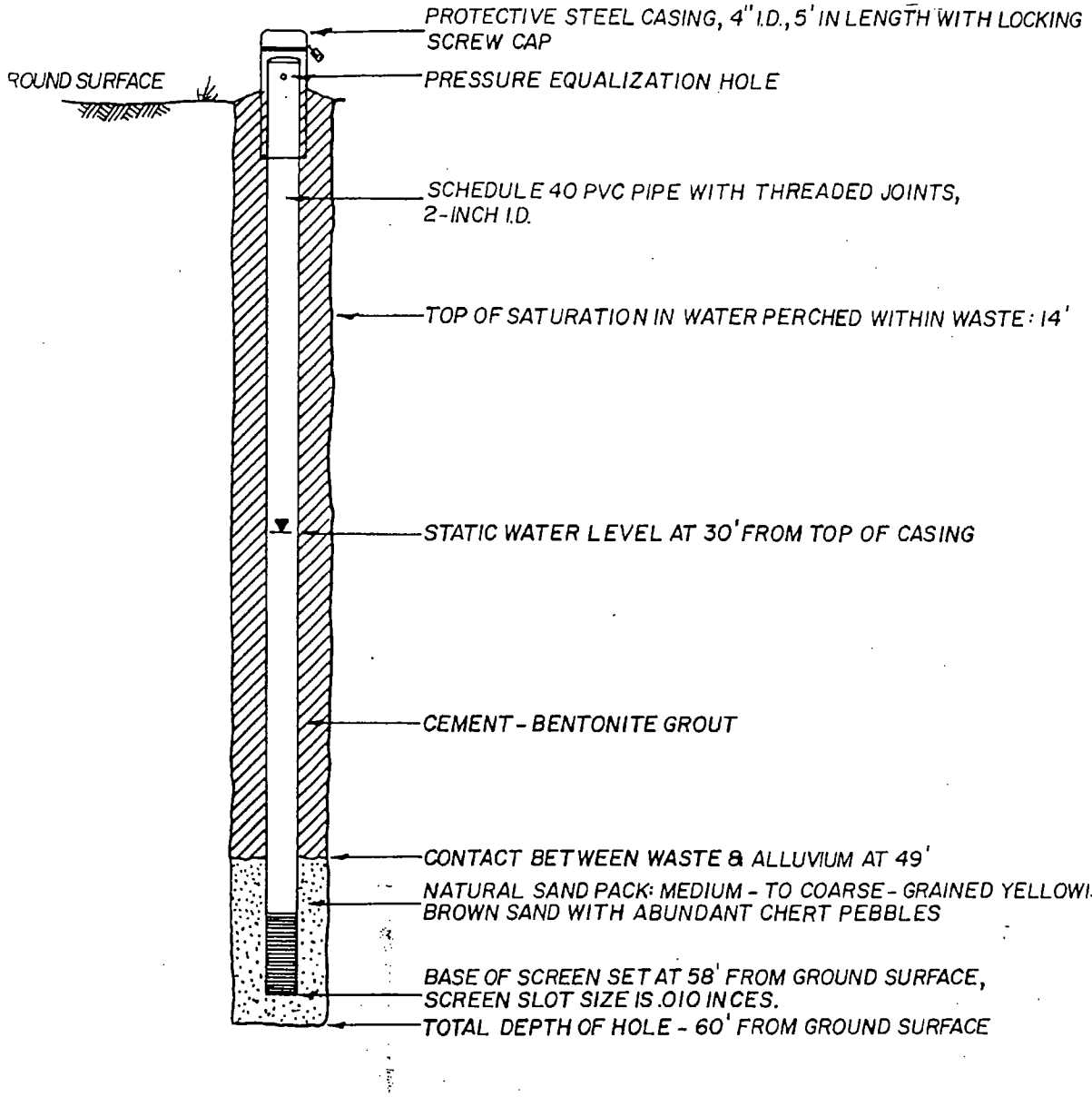
SCALE: NOT TO SCALE

PREPARED FOR U.S. PIPE and FOUNDRY
CHATTANOOGA, TENNESSEE

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

DATE 4/22/85 SHEET 6 OF 12

MWPS007336



DATE	REVISIONS	BY

WELL No. 2
DETAILS OF MONITORING WELL CONSTRUCTION

SCALE: NOT TO SCALE

PREPARED FOR U.S. PIPE and FOUNDRY
CHATTANOOGA, TENNESSEE

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

DATE 4/22/85 SHEET 7 OF 12

MWPS007337

2.2 Installation

As shown on the figures on pages 6 and 7, these wells are constructed of 2-inch ID Schedule 40 polyvinyl chloride (PVC), with threaded joints. The PVC Schedule 40 screens are 5-feet in length and have a slot size of .010 inches. The end of the screen is capped, as is the top of the PVC pipe, where a pressure equalization hole was drilled. Protective steel casing 5-feet in length extends approximately 2.5 feet above ground surface, and has a locking cap. The protective casings are painted fluorescent orange for maximum visibility.

The alluvial sands form a natural sand pack around and slightly above the screens. Well 1 is sealed with a layer of bentonite 2 feet in thickness, above which is neat cement grout. Well 2 is sealed with a cement-bentonite grout mixture from the top of the sand pack to the ground surface.

In Well 2, a drilling mud was used to provide greater hole stability and to prevent the foundry wastes from circulating and/or collapsing into the screened interval. The screen and pipe were installed within the 6-inch ID hollow stem augers. The tools were raised 5 feet to allow collapse of the alluvial sands and gravels for a natural sand pack. Subsequently, the cement-bentonite grout

was immediately pumped after the tools were raised in increments of 5 feet.

2.3 Development

Development of a monitoring well is a very important process for the following reasons:

- removes drilling products from the area around the well screen
- removes fine-grained materials from the sand pack and the adjacent areas around the well screen
- promotes flow of ground water to the well
- provides that ground water representative of the aquifer is sampled

The development of these wells was accomplished by using a bottom-discharging PVC bailer 3-feet in length, 1.25 inches ID, and with threaded joints. Each well had its own dedicated bailer and polyethylene rope. A large plastic sheet was laid by the well so that the rope would not contact the ground surface.

Typically a well is evacuated several times the well volume during development. A well volume is defined as the volume of water contained within the screen, casing, and also within the sand pack. During the evacuation process surge bailing is also used to agitate

the water and cause it to move in and out of the screen and sand pack. This action helps remove fines from the sand pack so they can be bailed out. In Well 2 fines were not a problem because of the coarse nature of the sands and the minor amount of silt and clay present. However, Well 1 was installed within fine-grained sands, some of which entered the well via the screen slots.

During development, field measurements for pH, specific conductance, and temperature were taken. Appendix I provides these measurements and visual observations during both development and also the pre-sampling purge. Persistent trends noted include a high specific conductance and a sulfur odor in Well 1, and a relatively low specific conductance in Well 2.

3.0 SAMPLING AND ANALYTIC RESULTS

Each dedicated bailer and rope was washed and triple rinsed with distilled water prior to the pre-sampling purge. The field measurements indicated when the ground water had reached stability, which was after approximately 1.5 well volumes for both wells. Samples were collected from within the screened interval and were carefully poured into bottles supplied by IT Analytical Services of Knoxville. Each bottle was tagged with the necessary information, and the bottles were stored on ice in a cooler. The samples were transported to the laboratory on the same day. Written instructions to the laboratory included that samples be filtered

so that the metals reported would be dissolved metals and not total metals. A copy of the laboratory's analytic sheet can be found in Appendix I.

Parameter (mg/l)	MCI-1	MCI-2
Phenols	0.05	0.01
pH (standard units)	7.60	7.79
Total Organic Carbon	278	15
Cadmium	<0.001	0.001
Iron	2.4	4.4
Lead	<0.01	<0.01

Iron exceeds the standard of 0.3 mg/l (National Secondary Drinking Water Standards). However, ground water within alluvium quite often exhibits high concentrations of iron, these concentrations are not believed to be significant. Both the lead and cadmium are well below their respective standards of 0.05 mg/l and 0.010 mg/l (National Interim Primary Drinking Water Standards). Although there is no standard for phenols, the Environmental Protection Agency (EPA) has developed criteria for the protection of human health for certain inorganic and organic contaminants (Federal Register, November 28, 1980). Based on available toxicity data, EPA's derived level for the protection of human health is 3.5 mg/l. However, to control the undesirable taste and odor quality of ambient water, EPA's estimated level is 0.3 mg/l. Samples from both wells are well below even the more restrictive phenol criterion.

The Total Organic Carbon (TOC) value exhibited by Well 1 is 278 mg/l, and is excessive, although there is no standard for comparison. This TOC concentration could be a one-time anomalous elevation, or it could be attributable to the leaching of organic resins and binders from old wastes. A series of samplings and analyses should determine the actual TOC concentration and establish if this initial concentration is an anomalous value.

U.S. PIPE & FOUNDRY
CHATTANOOGA, TN
WELL DEVELOPMENT RECORD
WELL NO. 1: DOWNGRADIENT

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
4-11-85/ Development	7.5	17.0	89	1	-	-	-	-	Very dark gray water with abundant brown and black (minor) sand. No film or odor.
				49	9.5	-	-	-	Water improved to medium grayish-tan. No film or odor.
4-12-85	7.8	15.4	86	1	-	12.3	6.68	2530	Clear water, except for gray, sandy water from base of screen. No film or odor.
				35	6.8	12.9	6.87	2420	Grayish water with sand. No film or odor.
				35	6.7	13.1	6.90	2150	Light gray, slightly turbid water with less sand. No film or odor.
				51	9.7	13.1	6.60	2100	Less turbid water. No odor or film.
4-16-85/ Development	8.1	16.4	86	1	-	13.3	6.76	2330	Slightly turbid with a faint greenish-yellow tint. No film or odor.

WELL NO. 1: DOWNGRADIENT (continued)

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
				39	7.6	13.6	6.15	2310	Turbid with grayish color due to fine-grained sediment. Possible slight sulfur odor. No film.
				50	9.5	13.5	6.20	2460	Turbid with grayish color. Possible slight sulfur odor. No film.
				45	8.6	13.5	6.20	2510	Turbid with slight grayish color. Definite sulfur odor. No film.
				45	8.6	13.6	6.20	2490	Turbid with slight grayish color. Definite sulfur odor. No film.
4-24-85/ Pre-Sampling Purge	7.0	17.0	89	1	-	13.4	6.80	2200	Clear, strong sulfur odor, no film.
				39	7.6	13.6	6.08	2420	Turbid, grayish from clay and silt. Contains fine-grained brown sand. Slight sulfur odor, no film.
				48	9.1	13.9	6.27	2310	Turbid, grayish from clay and silt. Some fine-grained brown sand. Slight sulfur odor, no film.
				44	8.4	13.9	6.25	2300	Turbid, grayish. Some fine-grained brown sand. Slight sulfur odor, no film.

U.S. PIPE & FOUNDRY
CHATTANOOGA, TN
WELL DEVELOPMENT RECORD
WELL NO. 2: UPGRADIENT

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
4-17-85/ Development	30.0	32.2	169	200	28.5	-	-	-	Bailed to remove drilling mud fluid from well column and sand pack. (Bailer held approximately 75% of its volume.)
				1	-	16.9	7.29	654	Slightly turbid water with small amount of very fine-grained sand. No film or odor.
									Added 3/4 quart of bleach and 3 gallons of distilled water after bailing down to top of screen. Agitated water column with bailer and continued bailing to remove water with floccules.
				75	14.4	17.2	7.16	719	Slightly turbid with brownish-black floating floccules. No odor, slight film.
				80	15.2	18.2	7.14	696	Slightly turbid with much less floccules. No odor, slight film.

WELL NO. 2: UPGRADIENT (continued)

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
				80	15.2	17.3	7.03	694	Slightly turbid with only a very small amount of floccules. No odor and no film.
4-24-85/ Pre-Sampling Purge	30.3	32.2	169	1	-	16.7	7.76	685	Turbid with some suspended matter. No odor, no film.
				84	16.2	16.3	7.13	636	Clear with a small amount of suspended matter. No odor, no film.
				85	16.2	16.2	7.10	674	Clear with a small amount of suspended matter. No odor, no film.
				85	16.2	16.2	7.10	669	Clear with a small amount of suspended matter. No odor, no film.

HYDROLOGIC CALCULATIONS
DITCH DESIGN

		DITCH CHARACTERISTICS				DESIGN		ANALYSIS	
Ditch	Peak Flow (cfs)	Length (feet)	Elevation Difference (feet)	Slope (feet/feet)	Mannings Coefficient	Flow Depth (feet)	Velocity (feet/sec.)	Ditch Depth (feet)	Ditch Capacity (CFS)
1	3	590	30.00	0.051	0.04	0.6	3.6	1.5	28.9
2	4	630	4.00	0.006	0.04	1.1	1.8	1.5	10.2
3	8	320	25.00	0.078	0.04	0.9	5.5	1.5	35.8
4	7	790	4.00	0.005	0.04	1.4	1.9	1.5	9.1
5	12	1445	8.00	0.006	0.04	1.6	2.2	2.0	20.5
6	8	950	30.00	0.032	0.04	1.0	3.9	1.5	22.8
7	6	670	15.00	0.022	0.04	1.0	3.2	1.5	19.2
8	14	150	41.00	0.273	0.04	0.8	10.1	1.5	67.0
9	5	450	2.25	0.005	0.04	1.2	1.7	1.5	9.1
10	4	560	17.00	0.030	0.04	0.8	3.2	1.5	22.3
11	5	740	45.00	0.061	0.04	0.8	4.4	1.5	31.6
12	9	200	18.00	0.090	0.04	0.9	5.9	1.5	38.4
13	4	950	49.00	0.052	0.04	0.7	3.9	1.5	29.1
14	14	600	44.00	0.073	0.04	1.1	6.1	1.5	34.7
15	3	515	16.00	0.031	0.04	0.7	3.0	1.5	22.6
16	3	285	20.00	0.070	0.04	0.6	4.1	1.5	33.9
17	5	760	14.00	0.018	0.04	0.9	2.8	1.5	17.4

Notes:

a. Calculations based on Manning's Formula
b. $Q_3 = Q_{15} + Q_{17}$
c. $Q_8 = Q_6 + Q_7$
d. Peak flow in Ditch 12 includes the flows from ditches 11 & 16
e. Peak flow in Ditch 14 includes the flows from ditches 10 & 13

HYDROLOGIC CALCULATIONS
CULVERT DESIGN

Culvert	Ditch	Flow (cfs)	Mannings Coefficient	Pipe Length (feet)	Slope (%)	Calculated Diameter (inches)	Actual Diameter (inches)
A	1 & 2	7	0.024	40	0.5%	22.1	24
B	9 & 12	14	0.024	50	0.5%	28.7	30
C	4, 5 & 8	33	0.024	40	0.5%	39.6	42
D	13	4	0.024	50	0.5%	17.9	18
E	3	8	0.024	40	0.5%	23.3	24

NOTE: Calculations based on Mannings Formula

HYDROLOGIC CALCULATIONS

SEDIMENT TRAPS

Sediment Trap	Drainage Area (acres)	Runoff Depth (inches)	25 year/24 hour Storm Volume (cubic feet)	Required Size (square feet)
A	2.23	2.0	16271	2712
B	2.95	2.0	21524	3587
C	15.46	2.0	112801	18800
D	3.82	2.0	27872	4645
E	2.95	2.0	21524	3587

SPILLWAYS FOR SEDIMENT TRAPS A - E

Difference Between 25 and 100 Year Flows (cfs)	Length (feet)	Slope (feet/feet)	Mannings Coefficient	Width (feet)	Depth (feet)	Flow Capacity (CFS)	Comments
2	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
6	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
13	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
2	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
5	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement

Notes:

1. Sediment traps are typically 6 feet deep
2. Sediment traps are shown on drawings at approximate scale.
3. Spillways are typically 1 foot deep and 5 feet wide

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #1

Data: Drainage Area : .93 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.697
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #2

Data: Drainage Area : 1.3 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.377
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #4

Data: Drainage Area : 3.43 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.24 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.071
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	7

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #5

Data: Drainage Area : 7.89 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.48 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	0.763
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	12

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #6

Data: Drainage Area : 2.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.628
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #7

Data: Drainage Area : 1.74 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.628
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #9

Data: Drainage Area : 1.71 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.377
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #10

Data: Drainage Area : 1.32 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.697
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #11

Data: Drainage Area : 1.36 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.775
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #12

Data: Drainage Area : .26 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.973
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #13

Data: Drainage Area : 1.1 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.973
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #14

Data: Drainage Area : 1.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.02 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	2.263
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #15

Data: Drainage Area : 1.01 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.697
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #16

Data: Drainage Area : .95 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.775
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #17

Data: Drainage Area : 1.94 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.377
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100 YEAR, 24 HOUR STORM - DITCH #1

Data: Drainage Area : .93 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.707
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #2

Data: Drainage Area : 1.3 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.400
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #4

Data: Drainage Area : 3.43 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.24 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.097
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	10

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #5

Data: Drainage Area : 7.89 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.48 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	0.787
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	17

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #6

Data: Drainage Area : 2.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.642
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	11

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #7

Data: Drainage Area : 1.74 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.642
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #9

Data: Drainage Area : 1.71 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.400
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	7

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #10

Data: Drainage Area : 1.32 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.707
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #11

Data: Drainage Area : 1.36 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.781
Pond and Swamp Factor (0.0% Ponds Used	1.00
Peak Discharge (cfs)	7

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #12

Data: Drainage Area : .26 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.961
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #13

Data: Drainage Area : 1.1 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.961
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #14

Data: Drainage Area : 1.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.02 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	2.210
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	9

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
S title: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #15

Data: Drainage Area : 1.01 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.707
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #16

Data: Drainage Area : .95 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.781
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Sub title: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #17

Data: Drainage Area : 1.94 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.400
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

* - Value(s) provided from TR-55 system routines

stability requirement, use retardance for newly mowed condition (generally C or D). To determine channel capacity, use at least one retardance class higher.

b. Determine *n* from Figure 8.05c.

Step 7. Calculate the actual channel velocity, V, using Manning's equation (Figure 8.05a), and calculate channel capacity, Q, using the continuity equation.

Step 8. Check results against permissible velocity and required design capacity to determine if design is acceptable.

Step 9. If design is not acceptable, alter channel dimensions as appropriate. For trapezoidal channels, this adjustment is usually made by changing the bottom width.

Table 8.05b
Manning's *n* for Structural Channel Linings

Channel Lining	Recommended *n* values
Asphaltic concrete, machine placed	0.014
Asphalt, exposed prefabricated	0.015
Concrete	0.015
Metal, corrugated	0.024
Plastic	0.013
Shotcrete	0.017
Gabion	0.030
Earth	0.020

Source: American Society of Civil Engineers (modified)

Exhibit 8

Abbreviated Table of Values of Manning Roughness Coefficients.

Description of Lining	n
Reinforced concrete pipe	0.013
Corrugated metal pipe	0.024
Concrete, trowelled finish	0.013
Concrete, float finish	0.015
Street gutter or paved channel	0.015
Earth, straight and uniform	0.022
Grass-lined swales	0.030
Unmaintained brushy channel	0.080
Stone-lined channel (4-inch)	0.028
Stone-lined channel (6-in)	0.030
Stone-lined channel (9-in)	0.032
Stone-lined channel (12-in)	0.034
Stone-lined channel (15-in)	0.035
Stone-lined channel (18-in)	0.036

TABLE 21-11 Values of the Roughness Coefficient n for Use in the Manning Equation

	Min	Avg	Max
A. Open-channel flow in closed conduits			
1. Corrugated-metal storm drain	0.021	0.024	0.030
2. Cement-mortar surface	0.011	0.013	0.015
3. Concrete (unfinished)			
a. Steel form	0.012	0.013	0.014
b. Smooth wood form	0.012	0.014	0.016
c. Rough wood form	0.015	0.017	0.020
B. Lined channels			
1. Metal			
a. Smooth steel (unpainted)	0.011	0.012	0.014
b. Corrugated	0.021	0.025	0.030
2. Wood			
a. Planed, untreated	0.010	0.012	0.014
3. Concrete			
a. Float finish	0.013	0.015	0.016
b. Gunite, good section	0.016	0.019	0.023
c. Gunite, wavy section	0.018	0.022	0.025
4. Masonry			
a. Cemented rubble	0.017	0.025	0.030
b. Dry rubble	0.023	0.032	0.035
5. Asphalt			
a. Smooth	0.013	0.013	
b. Rough	0.016	0.016	
C. Unlined channels			
1. Excavated earth, straight and uniform			
a. Clean, after weathering	0.018	0.022	0.025
b. With short grass, few weeds	0.022	0.027	0.033
c. Dense weeds, high as flow depth	0.050	0.080	0.120
d. Dense brush, high stage	0.080	0.100	0.140
2. Dredged earth			
a. No vegetation	0.025	0.028	0.033
b. Light brush on banks	0.035	0.050	0.060
3. Rock cuts			
a. Smooth and uniform	0.025	0.035	0.040
b. Jagged and irregular	0.035	0.040	0.050

use 0.04 for ditches

critical-depth line C.D.L. The N.D.L. and C.D.L. are identical for a channel of critical slope and the N.D.L. is replaced by a horizontal line, at an arbitrary elevation, for the channel of horizontal or adverse slope.

There are three types of surface-profile curves possible in channels of mild or steep slope and two types for channels of critical, horizontal, and adverse slope.

The M1 curve is the familiar surface profile from which all backwater curves derive their name and is the most important from a practical point of view. It forms above the normal-depth line and occurs when water is backed up a stream by high water in the downstream channel, as shown in Fig. 21-46*a* and *b*.

The M2 curve forms between the normal- and critical-depth lines. It occurs under conditions shown in Fig. 21-46*c* and *d*, corresponding to an increase in channel width or slope.

The M3 curve forms between the channel bottom and critical-depth line. It terminates in a hydraulic jump, except where a drop-off in the channel occurs before a jump can form. Examples of the M3 curve are in Fig. 21-46*e* and *f* (a partly opened sluice gate and a decreased channel slope, respectively).

The S1 curve begins at a hydraulic jump and extends downstream, becoming tangent to a horizontal line (Fig. 21-46*g* and *h*) under channel conditions corresponding to those for Fig. 21-46*a* and *b*.

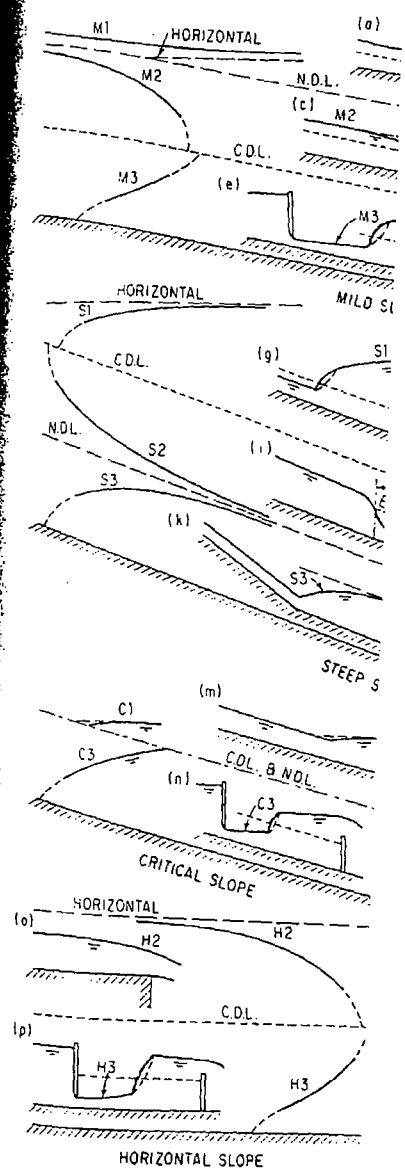
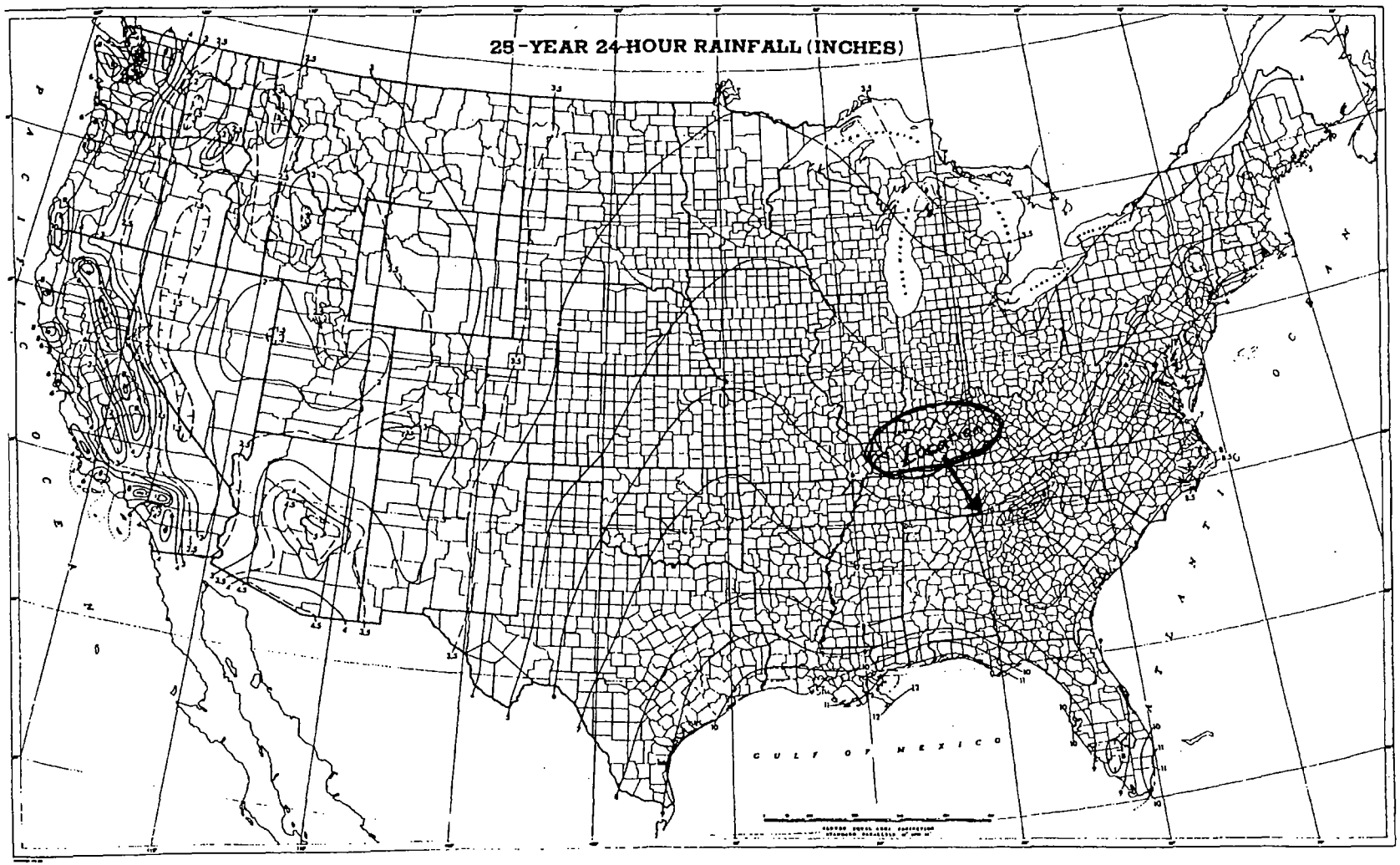
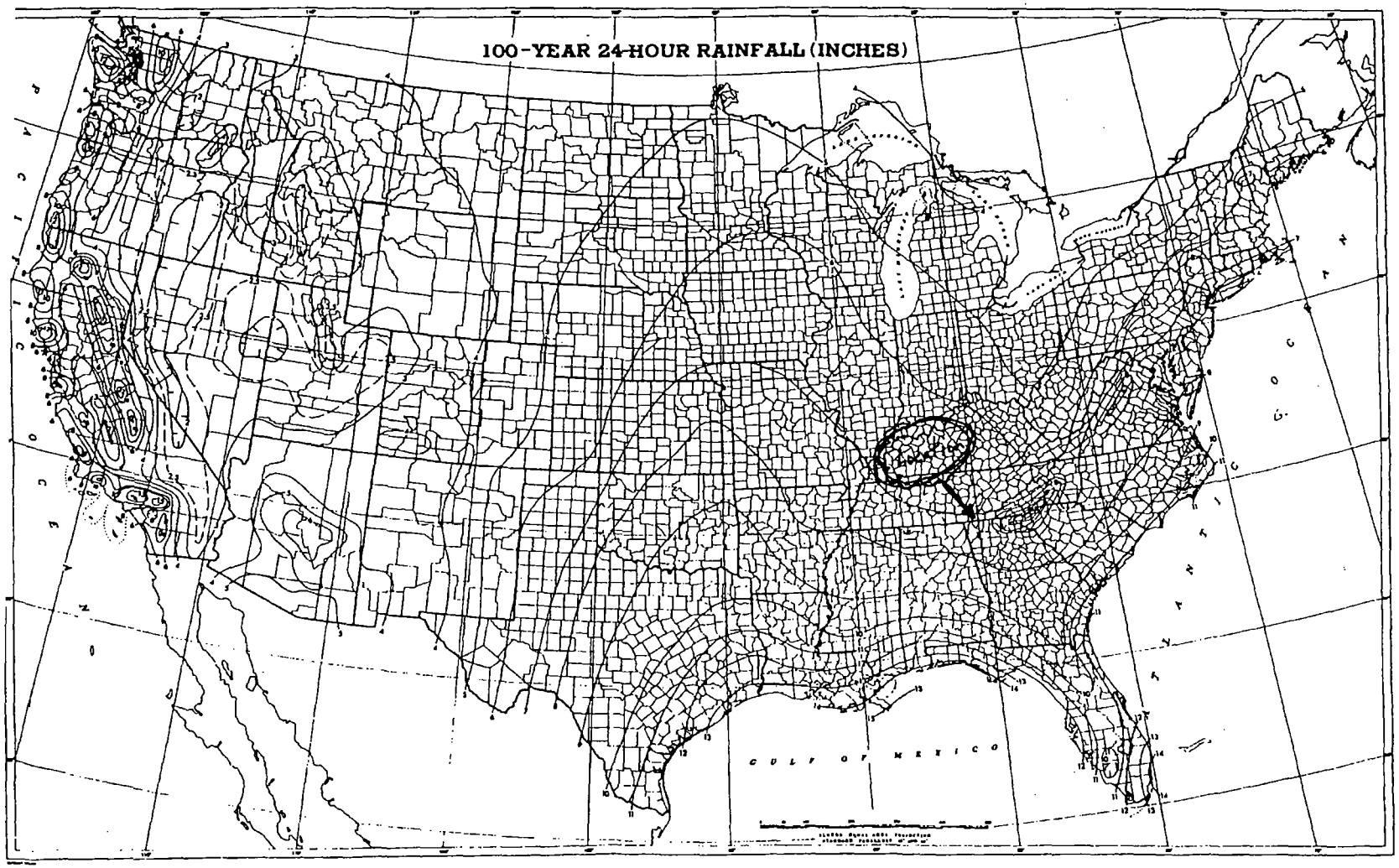


Fig. 21-46. Typical flow profiles for chann depth line; C.D.L., critical-depth line.



MWPS007382



MWPS007383

U. S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No. 1

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
10/27/87			0.009	0.01	0.1	15	0.14		0.020	210	<0.0001
3/8/88	22	1220	0.015	<0.01	<1	16	0.001	7.1	0.025	290	0.0001
5/4/88	303	1260	0.004	<0.01	<1	19	0.071	6.8	0.021	290	0.0001
7/19/88	199	1230	0.001	<0.01	<1	14	0.015	7.1	0.008	15	0.0002
9/27/88	12	164	0.020	<0.01	<1	31	0.1	6.1	<0.001	44	<0.0005
1/4/89	151	173	<0.001	<0.01	<1	0.31	0.015	6.5	0.001	11	<0.0005
4/6/89	41	172	0.022	0.01	<1	21	0.03	7.0	0.001	29	0.0010
8/9/89	14	895	<0.001	<0.01	<1	6.6	0.004	7.1	0.016	70	1.8
10/5/89	123	736	0.003	0.01	<1	32	0.04	7.1	0.008	40	2.1
1/4/90	146	172	0.016	<0.01	<1	0.69	0.027	6.7	0.06	130	0.0035
4/10/90	199	1380	0.015	<0.01	<1	4.6	0.006	7.1	0.022	180	<0.0005
8/16/90	157	1130	0.003	<0.01	<1	5.9	0.024	7.2	0.004	100	0.0048
10/25/90	116	1220	0.002	0.01	<1	1.5	0.006	7.4	0.006	52	<0.0005
10/17/91	20	190	<0.004	<0.02	<1	11.53	<0.042	6.4	0.726	21.4	<0.002
4/8/92	72.5	741	<0.004	<0.02	<1	14.6	<0.042	7.0	0.027	228	<0.002
9/3/92	74	716	<0.004	<0.02	<1	2.72	<0.042	6.9	<0.005	27.3	<0.002
2/5/93	228	639	<0.004	<0.02	<1	3.91	<0.042	6.8	0.007	39.8	<0.002
5/7/93	170	976	<0.004	<0.02	<1	4.74	<0.042	6.75	0.012	38.1	<0.002
7/8/93	154	577	<0.004	<0.02	<1	6.29	<0.042	6.5	0.020	80.3	<0.002
10/1/93	140	177	<0.004	<0.02	<1	6.16	<0.042	6.5	<0.005	51.6	<0.002
1/6/94	20.2	196	<0.004	<0.02	<1	6.83	<0.042	6.8	<0.005	33.2	<0.002
6/1/94	200	687	<0.004	<0.02	<1	8.15	<0.042	6.9	<0.005	8.5	<0.002
9/26/94	5.93	4.07	<0.004	<0.02	<1	8.58	<0.042	7.1	<0.005	6.2	<0.002
12/30/94	180	440	<0.004	<0.02	<1	9.74	<0.042	6.9	<0.005	9.4	<0.002
3/27/95	907	230	<0.004	<0.02	<1	10.7	<0.042		<0.005	55	<0.002
6/30/95	95	932	<0.004	<0.02	<1	8.80	<0.042		<0.005	57	<0.002
9/29/95	100	591	<0.004	<0.02	<1	13.0	<0.042		<0.005	33.1	<0.002

U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No. 2 - Background

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
10/27/87			0.007	0.03	0.1	34	0.22		0.007	35	<0.0001
3/8/88	70	264	0.001	<0.01	<1	18	0.001	6.8	0.001	54	0.0001
5/4/88	112	249	0.007	<0.01	<1	72	0.099	6.6	0.001	35	0.0001
7/19/88	102	209	0.005	0.01	<1	33	0.063	6.6	0.002	12	0.0002
9/27/88	34	1170	0.011	<0.01	<1	21	0.079	6.8	0.040	26	<0.0005
1/4/89	303	1174	<0.001	<0.01	<1	0.31	0.006	6.9	0.009	8	0.0012
4/6/89	204	1070	0.10	<0.01	<1	8.2	0.032	7.2	0.007	550	0.0007
8/9/89	5	169	<0.001	<0.01	<1	23	0.038	6.8	<0.001	10	0.25
10/5/89	104	180	0.011	<0.01	<1	14	0.005	6.7	0.005	16	0.84
1/4/90	344	1180	0.004	0.01	<1	5.7	0.018	7.2	0.003	<1	<0.0005
4/10/90	83	190	0.011	<0.01	<1	33	0.012	6.7	0.001	60	<0.0005
8/16/90	96	166	0.006	<0.01	<1	13	0.034	6.7	<0.001	4	<0.0005
10/25/90	59	187	0.003	<0.01	<1	3.4	0.016	6.9	<0.001	260	<0.0005
10/17/91	203	959.5	<0.004	0.02	2	16.2	<0.042	6.6	0.0347	123	<0.002
4/8/92	23.7	114	<0.004	<0.02	<1	1.70	<0.042	6.6	<0.005	35.1	<0.002
9/3/92	49.3	111	<0.004	<0.02	<1	11.4	<0.042	6.5	<0.005	5.2	<0.002
2/5/93	45.6	91.3	<0.004	<0.02	<1	8.74	<0.042	6.3	<0.005	4.7	<0.002
5/7/93	85	244	<0.004	<0.02	<1	8.99	<0.042	6.0	0.007	4.80	<0.002
7/8/93	51.2	81.6	<0.004	<0.02	<1	13.1	0.073	5.8	<0.005	16.1	<0.002
10/1/93	100	98	<0.004	<0.02	<1	13.5	<0.042	5.7	<0.005	7.8	<0.002
1/6/94	110	8.96	<0.004	<0.02	<1	15.4	<0.042	5.8	<0.005	3.7	<0.002
6/1/94	150	540	<0.004	<0.02	<1	17.0	<0.042	6.5	<0.005	7.7	<0.002
9/26/94	5.97	4.16	<0.004	<0.02	<1	34.9	0.428	6.2	<0.005	2.4	<0.002
12/30/94	210	120	<0.004	<0.02	<1	15.1	<0.042	6.8	<0.005	6.7	<0.002
3/27/95	100	200	<0.004	<0.02	<1	14.4	<0.042		<0.005	218	<0.002
6/30/95	50	110	<0.004	<0.02	<1	17.9	<0.042		<0.005	36	<0.002
9/29/95	30	85	<0.004	<0.02	<1	5.39	<0.042		<0.005	3.5	<0.002

U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Outfall Pipe

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
10/27/87			0.001	0.01	<0.1	2.1	0.061		0.007	44	0.0010
3/8/88	40	257	<0.001	<0.01	<1	2.4	0.001	7.1	0.074	35	0.0002
5/4/88	55	266	0.003	<0.01	<1	1.8	0.048	7.0	0.002	8	0.0001
7/19/88	38	239	0.001	0.01	<1	4.1	0.014	7.1	0.01	10	0.013
1/4/89	44	173	<0.001	<0.01	<1	0.28	0.003	7.1	0.001	12	<0.0005
4/10/90	20	314	0.011	<0.01	<1	2.7	0.004	7.6	0.004	60	<0.0005
8/16/90	44	270	0.003	<0.01	<1	2.3	0.011	7.2	0.002	25	0.0007
10/25/90	36	284	0.006	0.01	<1	2.4	0.012	7.4	<0.001	8	<0.0005
10/17/91	30	190	<0.004	<0.02	5	0.402	<0.042	6.6	0.0218	31.9	<0.002
4/8/92	47.4	204	<0.004	<0.02	<1	2.31	<0.042	6.9	0.008	64.8	<0.002
9/3/92	49.3	199	<0.004	<0.02	<1	3.75	<0.042	6.6	<0.005	11.3	<0.002
2/5/93	91.3	319	<0.004	<0.02	<1	3.66	<0.042	6.9	0.009	28.9	<0.002
5/7/93	34	195	<0.004	<0.02	<1	3.79	<0.042	6.7	<0.005	24.6	0.005
7/8/93	68	249	<0.004	<0.02	<1	2.93	<0.042	6.6	0.027	30.3	<0.002
10/1/93	120	118	<0.004	<0.02	<1	4.52	<0.042	6.6	<0.005	26.6	<0.002
1/6/94	16.9	98	<0.004	<0.02	<1	2.08	<0.042	6.6	<0.005	10.5	<0.002
6/1/94	120	392	<0.004	<0.02	<1	2.60	<0.042	7.0	<0.005	11.8	0.067
9/26/94	4.27	3.79	<0.004	<0.02	<1	2.58	<0.042	7.1	<0.005	2.1	0.004
12/30/94	100	340	<0.004	<0.02	<1	3.58	<0.042	7.4	<0.005	14	0.003
3/27/95	160	30	<0.004	<0.02	<1	2.69	<0.042		<0.005	127	0.005
6/30/95	80	261	<0.004	<0.02	<1	5.21	<0.042		<0.005	33	0.003
9/28/95	30	130	<0.004	<0.02	<1	219	0.561		<0.005	42.9	<0.002
9/29/95	60	220	<0.004	<0 .02	<1	1.73	<0.042		<0.005	23.8	0.024

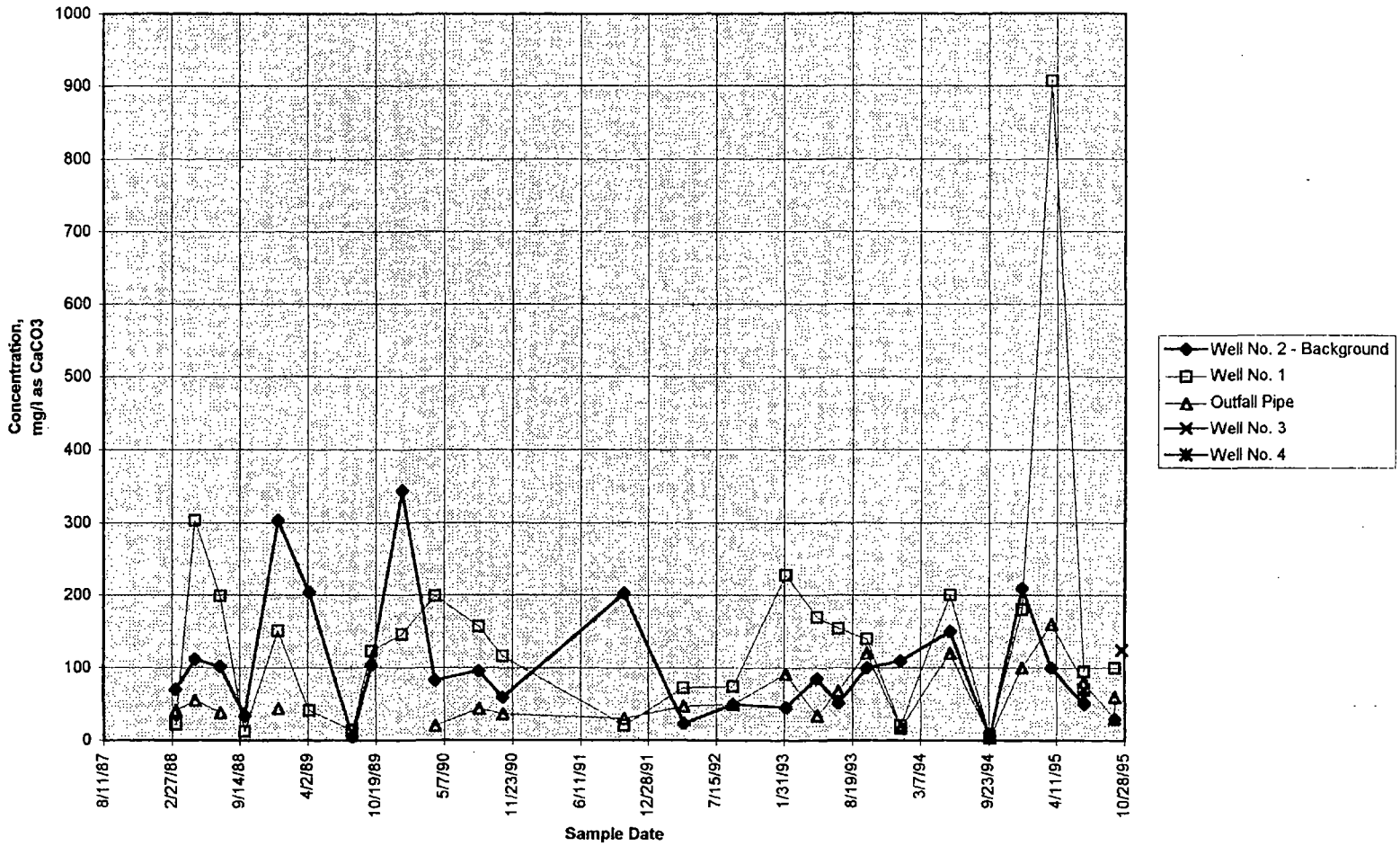
U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No.3

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
6/30/95	70	180	<0.004	<0.02	<1	49.0	0.081		<0.005	50	<0.002
10/19/95	125	396	<0.004	<0.02	<1	15.5	<0.042		<0.005	17.6	<0.002

U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No.4

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
6/30/95	60	501	<0.004	<0.02	<1	41.4	0.342		<0.005	36	<0.002

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Acidity



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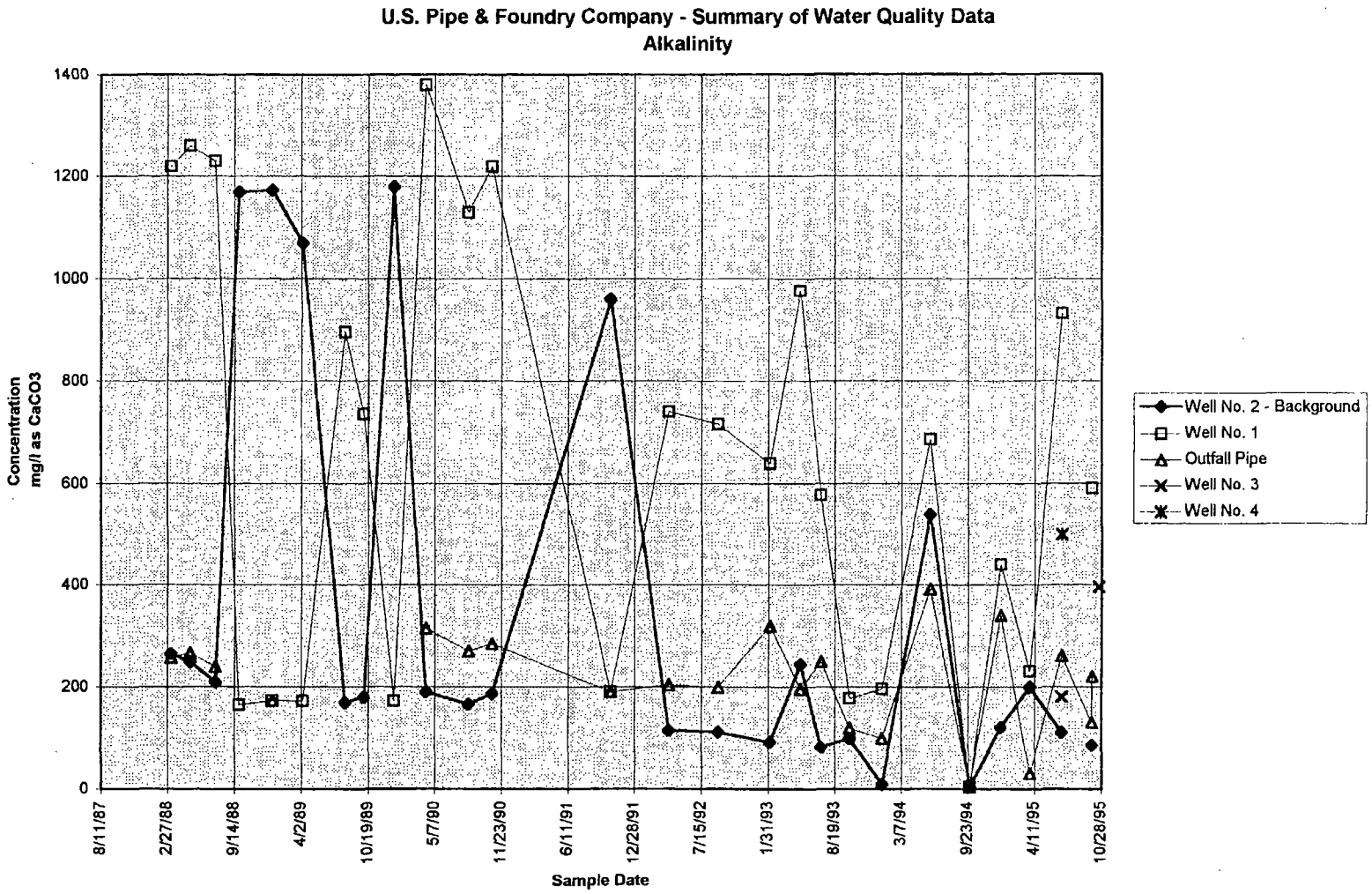
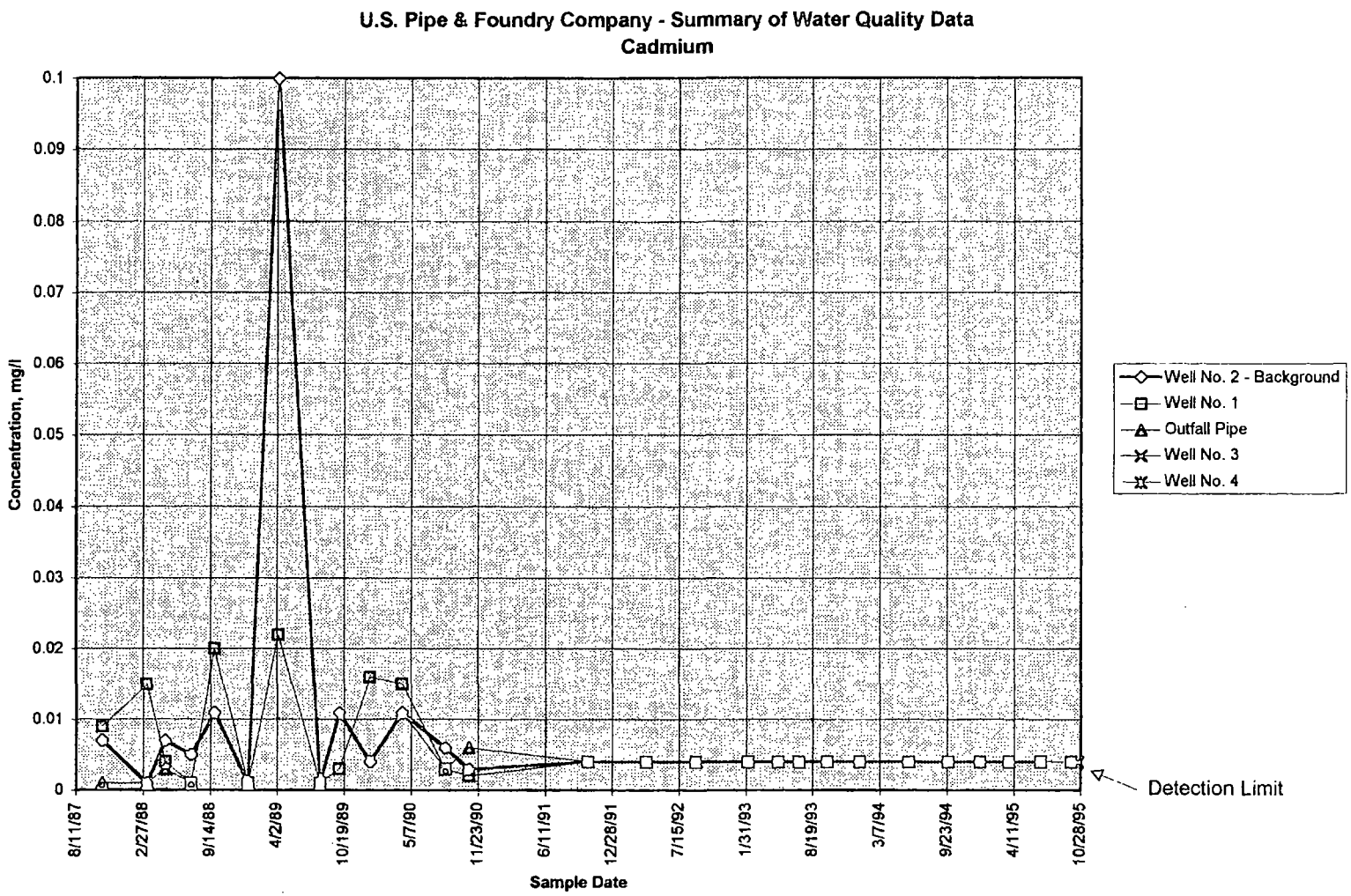
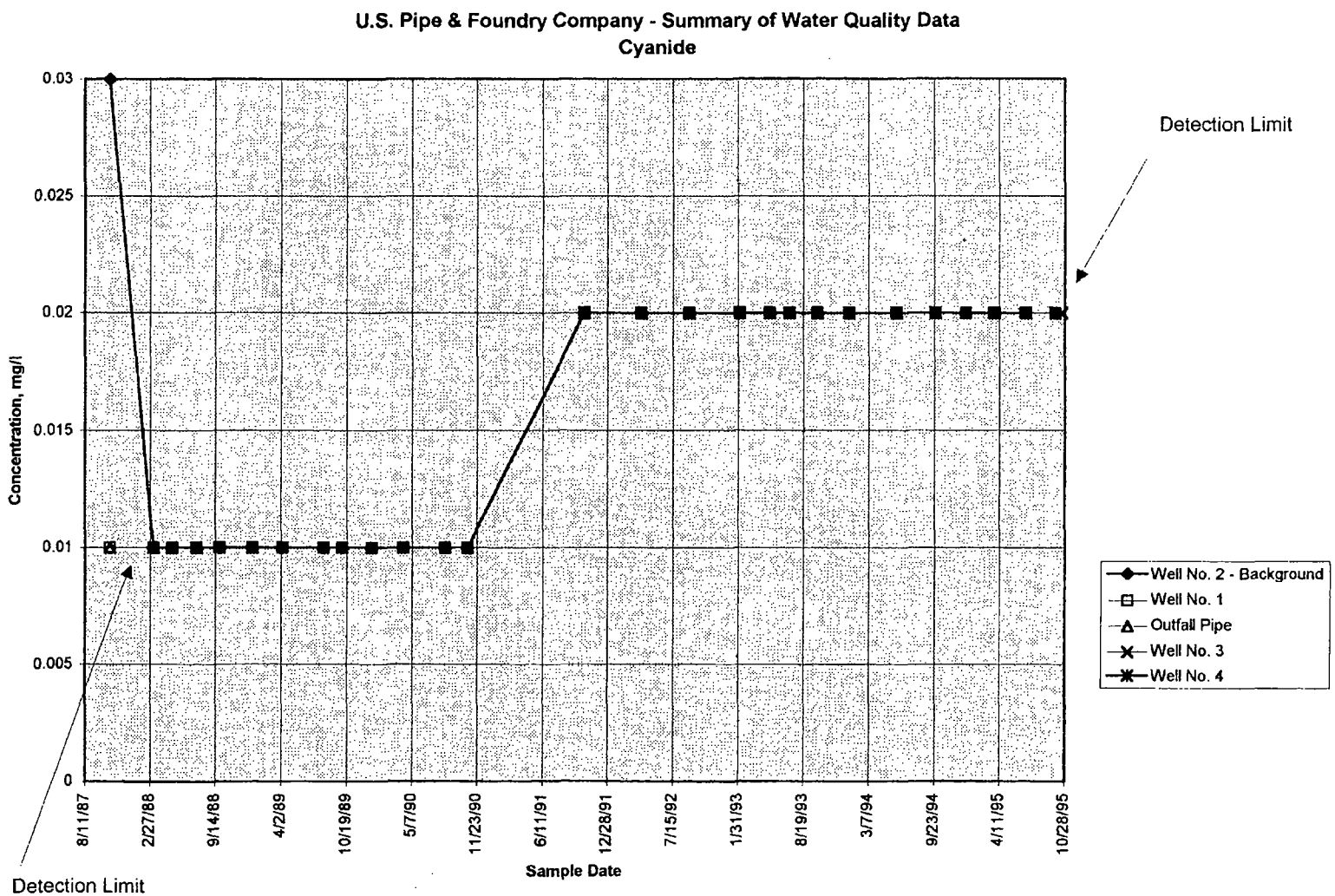

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Alkalinity
Concentration
mg/l as CaCO3
1400
1200
1000
800
600
400
200
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

MWPS007390

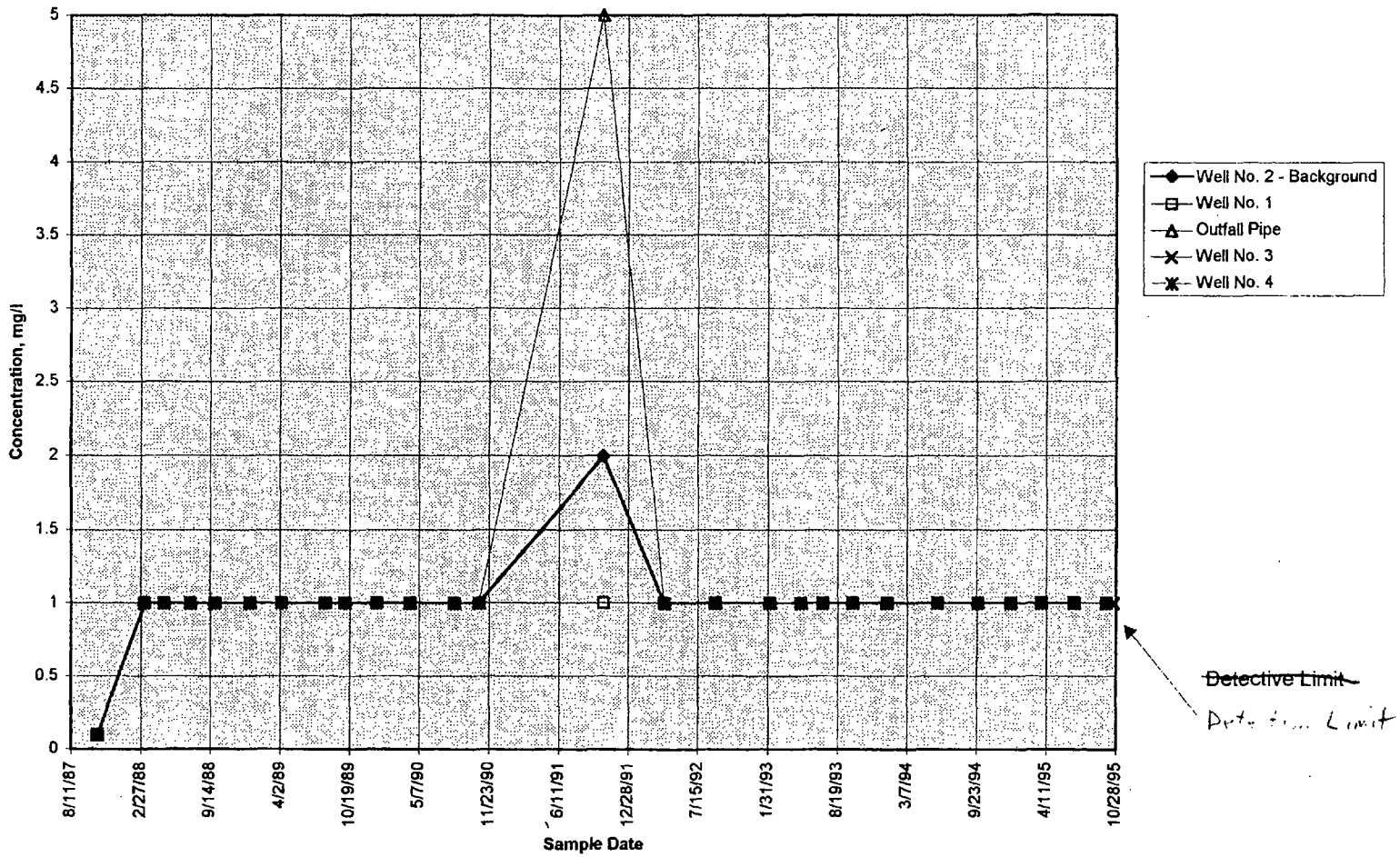

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Cadmium
Concentration, mg/l
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4
Detection Limit

MWPS007391


U.S. Pipe & Foundry Company - Summary of Water Quality Data
Cyanide
Concentration, mg/l
0.03
0.025
0.02
0.015
0.01
0.005
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Detection Limit
Detection Limit
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

MWPS007392

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Formaldehyde



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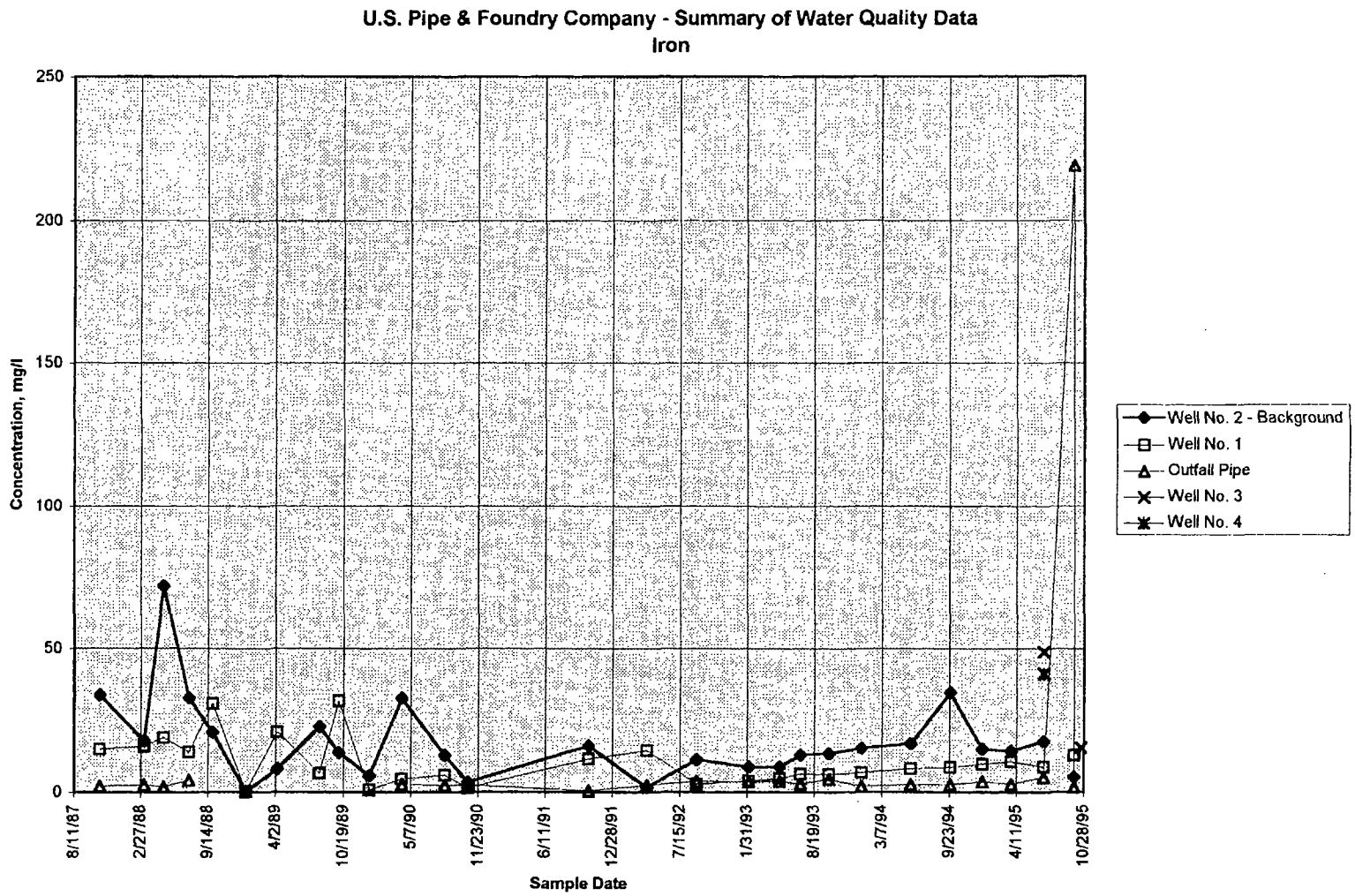
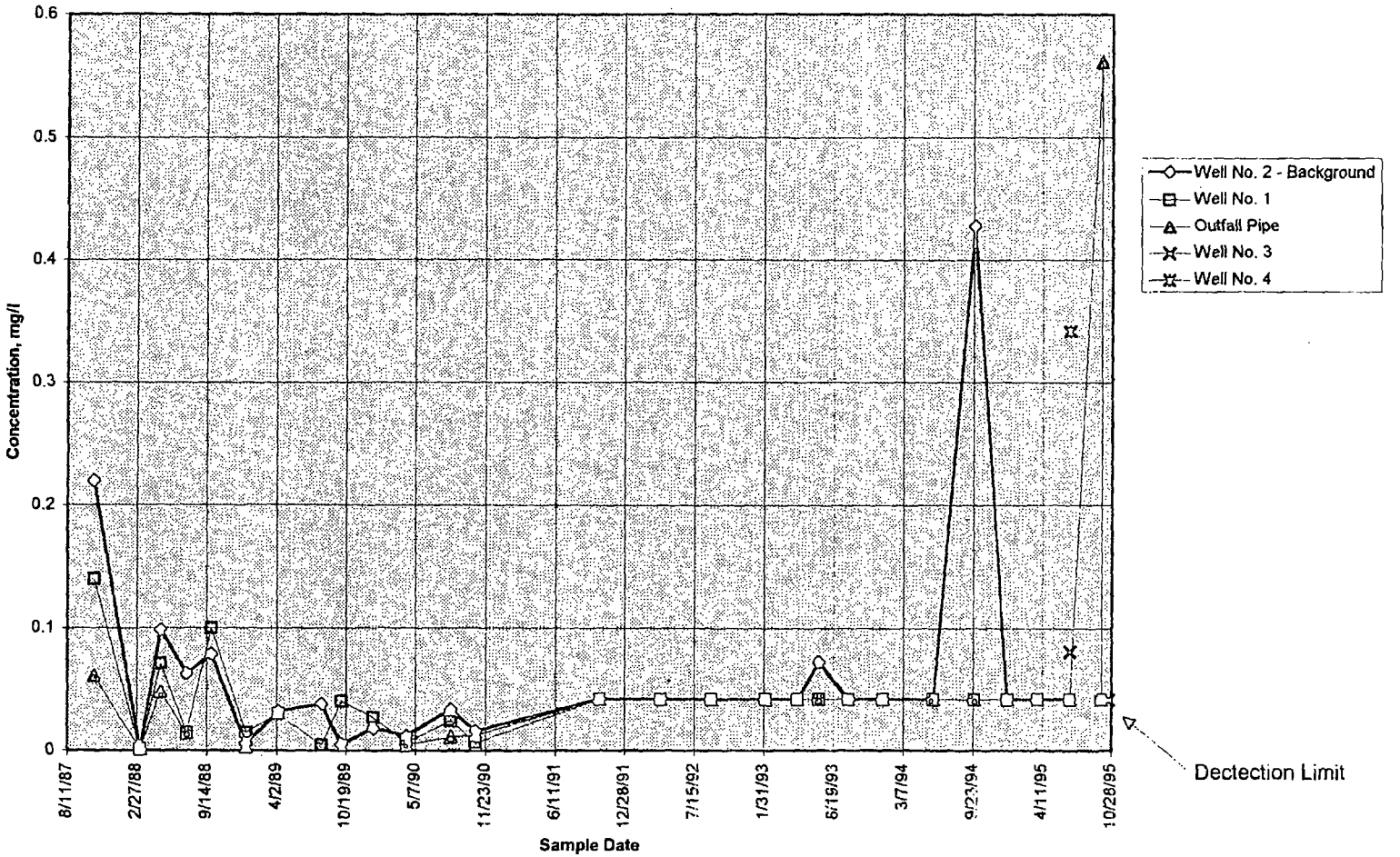

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Iron
Concentration, mg/l
250
200
150
100
50
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

MWPS007394

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Lead



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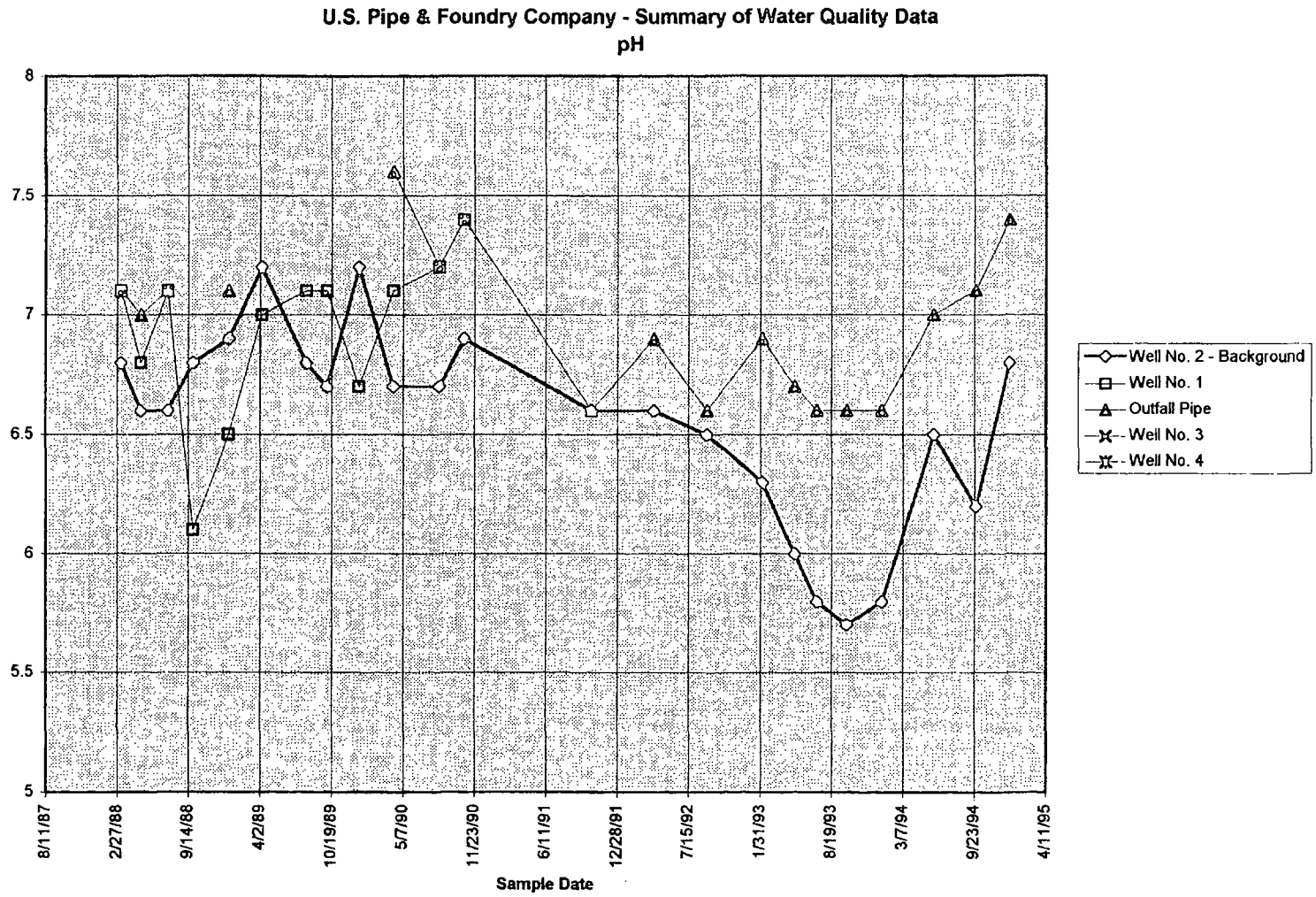
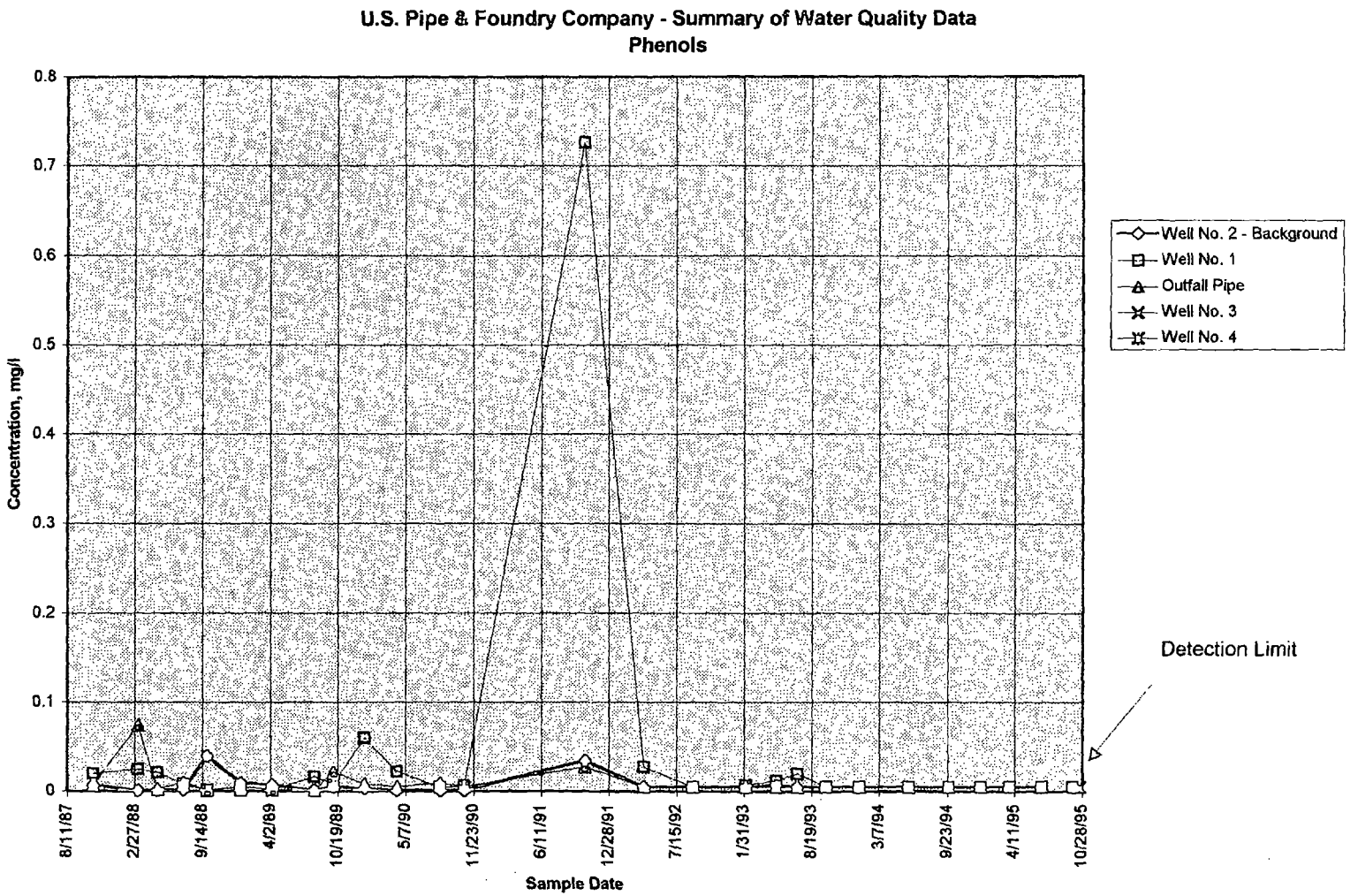
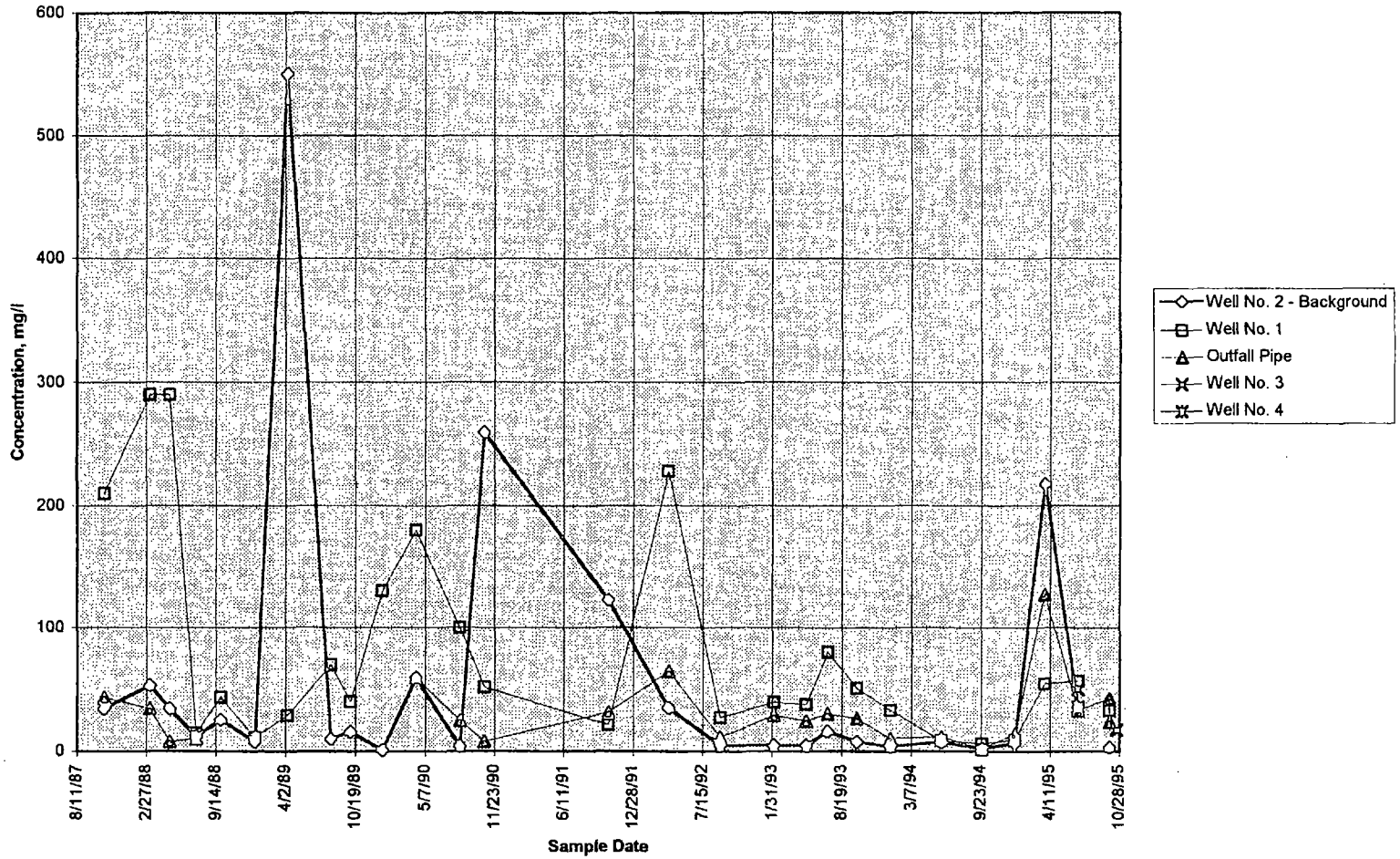

U.S. Pipe & Foundry Company - Summary of Water Quality Data
pH
8
7.5
7
6.5
6
5.5
5
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

MWPS007396


U.S. Pipe & Foundry Company - Summary of Water Quality Data
Phenols
Concentration, mg/l
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4
Detection Limit

MWPS007397

U.S. Pipe & Foundry Company - Summary of Water Quality Data
TOC



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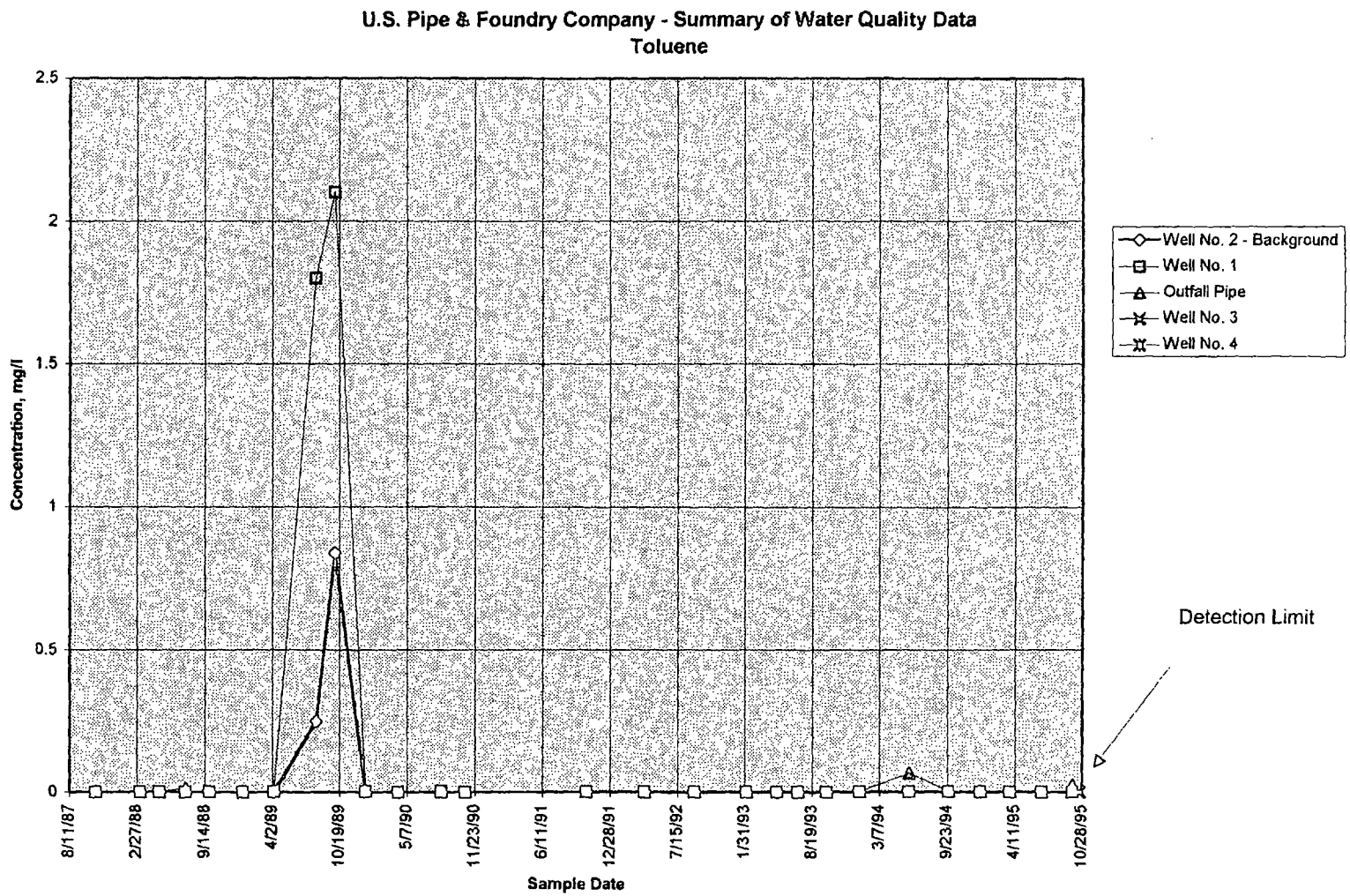
U.S. Pipe & Foundry Company - Summary of Water Quality Data
Toluene
Concentration, mg/l
2.5
2
1.5
1
0.5
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4
Detection Limit

MWPS007399

CLOSURE/POST CLOSURE PLAN

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

PREPARED BY:

MCGILL ASSOCIATES, P.A.
870 Winfield Dunn Parkway, Suite 6
Sevierville, Tennessee 37876

PROJECT NUMBER 95315.01

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1.0 INTRODUCTION

The following text details closure and post-closure activities to be conducted at the U.S. Pipe and Foundry Company (U.S. Pipe) Class II Foundry Waste Landfill. This plan has been prepared in accordance with Rule 1200-1-7, Solid Waste Processing and Disposal, promulgated under the authority of the Tennessee Department of Environment and Conservation (TDEC) Division of Solid Waste Management (DSWM), with an effective date of September 2, 1993.

1.1 FACILITY DESCRIPTION

This landfill is located along the east bank of the Tennessee River at mile 461.5, at Latitude N35° 01' 53" and Longitude W85° 19' 24". The landfill is located adjacent to the U.S. Pipe valve and fittings facility at 2701 Chestnut Street, Chattanooga, Tennessee. It will be on property owned by U.S. Pipe, and will serve only U.S. Pipe. The landfill comprises approximately 33 acres consisting of the existing 21 acre landfill area, 8 acres of storage yard north of the existing landfill and 4 acres of presently undeveloped area located south of the existing landfill and is accessible only by roads within the U.S. pipe facility. A site location map is provided in Appendix I.

The completed fill area will essentially be two mounds with sides sloped at two horizontal to one vertical and an approximately rectangular, slightly sloping top. These mounds will be constructed in three phases, as described in the Operations and Maintenance Manual, and will contain terraces as shown on the construction drawings for added stability.

1.2 EXPECTED LANDFILL LIFE

This landfill, in which only U.S. Pipe foundry waste will have been deposited, has a projected life of 41 years under the expected operating parameters. Therefore, with the facility currently being operational, the year of closure is expected to be 2037.

1.3 FACILITY CONTACT

Supervisor of Stores and Yard
U.S. Pipe and Foundry Company
2701 Chestnut Street
Chattanooga, Tennessee 37408
Phone (423)752-3800

2.0 FACILITY CLOSURE

In general, facility closure will consist of grading the site to the final contours shown on the construction drawings, the establishment of vegetation, and the modification of drainage systems as necessary to control run-on, run-off, and sedimentation in off-site water courses. These activities will be implemented to achieve the following closure performance standards as specified in TN Rule 1200-1-7-.04 (8):

1. Minimize the need for further maintenance.

2. Protect public health and the environment by controlling, minimizing, or eliminating the post-closure escape of solid waste or solid waste constituents,

including leachate, contaminated run-off, or waste decomposition products, to surface waters, groundwater or the atmosphere.

3. Provide for the post-closure care of the facility as necessary to ensure the above performance standards are attained.

Specific closure procedures pertaining to partial and complete facility closure are provided in Sections 2.1 and 2.2.

2.1 PARTIAL CLOSURE

Closure of the U.S. Pipe Class II Foundry Waste Landfill prior to exhausting all permitted disposal capacity is not intended. In the event that closure of the existing fill area is required prior to reaching permitted capacity, the following activities will be implemented to ensure that a complete closure of the facility is achieved:

1. DSWM will be notified at least 60 days before the date of facility closure.

2. The approved closure plan will be revised to address any final grading or drainage modifications necessary to ensure complete closure in accordance with existing regulations.

3. Drainage facilities will be inspected at the time of closure and stabilized, if necessary, in accordance with Section 2.2.2.

4. A groundwater monitoring system is in place and operational. Inspection and maintenance will be conducted during closure activities.

5. DSWM will be provided with certification that all closure activities have been completed in accordance with the approved plans.

2.2 COMPLETE CLOSURE

2.2.1 FINAL COVER

As described earlier in section 4.2, final soil cover will not be required. Recommendations by the University of Tennessee Agricultural Extension Service for seeding, fertilization and establishment of vegetative cover (Appendix IV) have been successful implemented in the past at this site and it is recommended that they be followed in the future for the establishment of cover vegetation. A survey performed by a surveyor licensed in Tennessee will be conducted to verify that the final contours are established as shown on the plans. Survey reports will be included in the final closure report.

2.2.2 DRAINAGE SYSTEM

The existing drainage facilities at the U.S. Pipe Foundry Waste Class II Landfill will be enhanced as needed to ensure compliance with the drainage system requirements identified in TN Rule 1200-1-7-.04 (8) (c) 4. These requirements specify that the final surface of the disposal facility shall be graded and/or provided with drainage facilities in a manner that:

- Minimizes precipitation run-on from adjacent areas onto the disposal facility;

- Minimizes erosion
- Optimizes drainage of precipitation falling on the disposal facility; and
- Provides a surface drainage system which is consistent with the surrounding area and does not adversely affect proper drainage from the adjacent land.

2.2.3 LEACHATE COLLECTION

As described earlier in Section 7.0 of the Operations and Maintenance Manual, a leachate collection system will not be necessary at this site.

2.2.4 GAS MONITORING

As described earlier in Section 9.11 of the Operations and Maintenance Manual, no significant amount of gas will be generated by the foundry waste; therefore, no gas monitoring will be necessary at this site.

2.2.5 NOTIFICATION AND CERTIFICATION

In accordance with TN Rule 1200-1-7-.04 (8) (c) 9, written notification will be provided by U.S. Pipe to the DSWM upon completion of closure of the U.S. Pipe Class II Foundry Waste Landfill. This notification will include a certification that the disposal facility has been closed in accordance with the approved closure/post-closure plan. Within 21 days after TDEC receives this notification, the DSWM is required to inspect the facility to verify that closure has been completed in accordance with the approved plan. If proper closure is verified, the DSWM will notify U.S. Pipe within 10 days that closure has been approved. This final

notification will constitute final approval, and acknowledgment by the state that closure of the U.S. Pipe Class II Foundry Waste Landfill has been completed.

2.2.6 CLOSURE SCHEDULE

The anticipated closure schedule for the U.S. Pipe Class II Foundry Waste Landfill is provided in Table 1. It is anticipated that the landfill will be closed within 120 days from start of closure, if unfavorable weather is not encountered that would impact construction activities.

TABLE 1. U.S. PIPE CLASS II LANDFILL CLOSURE SCHEDULE

ACTIVITY	SCHEDULE
Notification of intent to close	-60
Begin final grading	0
Revegetation	90
Complete closure activities	120

3.0 POST-CLOSURE ACTIVITIES

The post-closure activities planned for the U.S. Pipe Class II Foundry Waste Landfill include post-closure maintenance and inspection, and recording of a notification on the property deed that the site has been used as a disposal facility.

3.1 POST-CLOSURE CARE

Subparagraph (d) of TN Rule 1200-1-7-.04 (8) states that post-closure care activities at disposal facilities such as the U.S. Pipe Class II Landfill will be conducted for 30 years. The primary requirements for this post-closure care are to maintain the approved final contours (with prevention of ponding on the surface), drainage system, and healthy vegetative cover (once it is established). The objective of these requirements is to ensure the integrity of the final cover and thereby minimize the potential for future releases of waste or waste constituents from the facility.

3.1.1 INSPECTIONS

A program of quarterly inspections will be conducted to check for settlement, erosion, insufficient vegetative cover, and other defects. Any observed defects will be corrected. Normal maintenance activities, such as grass mowing and drainage ditch maintenance, will also be performed on a regular basis. Post-closure care will be provided on an as-needed basis throughout the post-closure period to ensure the long-term integrity of the final contours.

3.1.2 WATER MONITORING ACTIVITIES

3.1.2.1 SURFACE WATER

Surface water monitoring will be accomplished in compliance with U.S. Pipe's Stormwater Discharge Permit system.

3.1.2.2 GROUNDWATER

Groundwater monitoring will continue using the same wells and the same sampling procedures and schedule used during the active life of the landfill. These wells, procedures, and schedule are described in the Operating and Maintenance Manual. The compliance monitoring boundary is also shown on the construction drawings.

3.1.3 GAS MONITORING ACTIVITIES

This landfill should not generate significant amounts of gas. No gas probes are proposed for this facility.

3.1.4 POST CLOSURE LAND USE

There is no planned future use of the site.

3.2 DEED NOTIFICATION

Within 60 days of completing final closure at the U.S. Pipe Class II Foundry Waste Landfill, U.S. Pipe will record a notation on the deed to the property (or other instrument which is normally examined during a title search). This notation will in perpetuity notify any person conducting a title search that the area associated with the U.S. Pipe Class II Foundry Waste Landfill has been used as a disposal facility.

3.3 BENEFICIAL REUSE OF FOUNDRY SAND

U.S. Pipe may, at any time during the post closure period, excavate and process the foundry sand for reuse as described in the TDEC Policy on the Beneficial Use of Nontoxic Spent Foundry Sand currently being developed. The surface will be regraded, seeded and mulched after any such activity as necessary to maintain good surface drainage as specified in TN Rule 1200-1-7-.04 (8).

4.0 COST ESTIMATE AND FINANCIAL ASSURANCE

4.1 CLOSURE

The cost of hiring a third party to perform the closure activities, including the effects of inflation over the projected life of the landfill, is shown in Table 2. The cost of operating the facility for 30 days prior to closure is not included due to the characteristics of the waste stream to the landfill. The landfill serves only U.S. Pipe, and in the event that U.S. Pipe is unable to perform the closure activities, the landfill will stop receiving new waste. Based on the changes in the Consumer Price Index from 1982 to 1988, an average annual inflation rate of 4% was selected for the calculations in Table 2.

Table 2
Costs Associated With Closure

YEAR	CLOSURE COST	YEAR	CLOSURE COST
1996	$15,721	2017	$35,825
1997	$16,350	2018	$37,257
1998	$17,004	2019	$38,748
1999	$17,684	2020	$40,298
2000	$18,391	2021	$41,910
2001	$19,127	2022	$43,586
2002	$19,892	2023	$45,329
2003	$20,688	2024	$47,143
2004	$21,515	2025	$49,028
2005	$22,376	2026	$50,989
2006	$23,271	2027	$53,029
2007	$24,202	2028	$55,150
2008	$25,170	2029	$57,356
2009	$26,177	2030	$59,650
2010	$27,224	2031	$62,036
2011	$28,313	2032	$64,518
2012	$29,445	2033	$67,099
2013	$30,623	2034	$69,783
2014	$31,848	2035	$72,574
2015	$33,122	2036	$75,477
2016	$34,447	2037	$78,496

4.2 POST CLOSURE

It is estimated that the quarterly inspections and associated maintenance activity should cost approximately $1000 per year. This figure includes the cost of maintaining the vegetative cover as well as periodic cleaning of the erosion control facilities.

The cost of the semi-annual groundwater monitoring program is currently $2,400 per year.

The cost of hiring a third party to perform the post closure activities listed above, including the effects of inflation throughout the 30 year post closure period, is listed in Table 3.

Table 3
Costs Associated With Post Closure

YEAR	COST	YEAR	COST
1996	$ 3,500	2032	$14,364
1997	$ 3,640	2033	$14,938
1998	$ 3,786	2034	$15,536
1999	$ 3,937	2035	$16,157
2000	$ 4,095	2036	$16,804
2001	$ 4,258	2037	$17,476
2002	$ 4,429	2038	$18,175
2003	$ 4,606	2039	$18,902
2004	$ 4,790	2040	$19,658
2005	$ 4,982	2041	$20,444
2006	$ 5,181	2042	$21,262
2007	$ 5,388	2043	$22,112
2008	$ 5,604	2044	$22,997
2009	$ 5,828	2045	$23,917
2010	$ 6,061	2046	$24,873
2011	$ 6,303	2047	$25,868
2012	$ 6,555	2048	$26,903
2013	$ 6,818	2049	$27,979
2014	$ 7,090	2050	$29,098
2015	$ 7,374	2051	$30,262
2016	$ 7,669	2052	$31,473
2017	$ 7,976	2053	$32,732
2018	$ 8,295	2054	$34,041
2019	$ 8,627	2055	$35,403
2020	$ 8,972	2056	$36,819
2021	$ 9,330	2057	$38,291
2022	$ 9,704	2058	$39,823
2023	$10,092	2059	$41,416
2024	$10,495	2060	$43,073
2025	$10,915	2061	$44,796
2026	$11,352	2062	$46,587
2027	$11,806	2063	$48,451
2028	$12,278	2064	$50,389
2029	$12,769	2065	$52,404
2030	$13,280	2066	$54,501
2031	$13,811	2067	$56,681

4.3 FINANCIAL ASSURANCE

As stated in TN Rule 1200-1-7-.03 (3) (c), "Within 10 days after his final decision to issue a permit for a new facility, the Commissioner shall notify the operator in writing of the amount of financial assurance required (as established by subparagraph (b) of this paragraph). The operator must, before the permit can be effective, file with the commissioner financial assurance meeting the requirements of this paragraph...".

Note: Calculations for the preceding tables are included following this page.

McGill ASSOCIATES
Engineering • Planning • Finance
McGill Associates, P.A. • P.O. Box 4187, Sevierville, TN 37864
Winfield Dunn Parkway, Suite 6, Sevierville, TN 37876
423-908-0575 • FAX 423-908-0110

JOB U.S. Pipe Class II Foundry Waste Landfill
SHEET NO. 1 OF 1
CALCULATED BY RBM DATE 4-23-96
DESCRIPTION Cost Estimate of Closure Activity
SCALE N/A PROJECT NO. 95315.01

1. Final Grading

	(U.S. Average Rate / 1000 SF)	x (City Factor for Knoxville Tennessee)	x (Payroll Tax & Insurances, Fringe Benefits)	= Local Rate / 1000 SF
Bulldozer	$ 27.37	x 0.637	x 1.0	= 17.43
Labor	$ 22.00	x 0.637	x 1.3	= 18.22
Bulldozer Operator	$ 25.96	x 0.637	x 1.3	= 21.50
Subtotal				57.15
Add Subcontractor Overhead and Profit at 25 %				14.29
Total Cost Per 1000 SF				71.44

Total Cost Per SF $ 0.07/SF

* Crew production is 6500 SF/8 Hour Day

2. Landscaping

Hydroseeding with mulch $ 0.035/SF
* Based on current subcontractor Price Quotes

Total Cost Per SF $ 0.105/SF

3. Drainage System Maintenance

Clean Culverts and Check Dams $ 1000 Lump Sum

NOTES

1. Grading calculations based on Walker's Building Estimator's Reference Book, 25th Ed.

2. It is assumed that 3 acres are disturbed at time closure activity begins

$$3 \text{ ac.} \times \frac{43560 \text{ SF}}{1 \text{ ac.}} \times (0.105) + 1000 = \$ 14,721$$ (To Complete Closure)

* Add $1000 to the total cost for an engineers certification that the facility has been

GROUNDWATER MONITORING PROGRAM

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

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PROJECT NUMBER 95315.01

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MWPS007417

INTRODUCTION

The Groundwater Monitoring Program (GMP) presented herein, is provided as part of the plan for the U.S. Pipe and Foundry Company Class II Foundry Waste Landfill, located in Chattanooga, Tennessee. The facility is owned and operated by U.S. Pipe and Foundry Company (U.S. Pipe). The GMP has been prepared in accordance with the criteria established by the State of Tennessee Department of Environment and Conservation (TDEC), Solid Waste Management Regulations (TN Rule Chapter 1200-1-7, Solid Waste Management) and in accordance with the related guidance document issued by the Offices of Solid and Hazardous Waste of the TDEC.

The Groundwater Monitoring Program presented herein includes: definition of the compliance groundwater monitoring boundary, description of the groundwater monitoring system, description of the detection monitoring program (i.e., groundwater sampling and analysis procedures), and record keeping and reporting procedures. The following issues have been addressed in detail with respect to the groundwater sampling and analysis procedures described in the GMP:

(a) Sample Collection

- Order of Sampling
- Measurement of Static Water Level and Well Depth
- Well Evacuation
- Sample Withdrawal

(b) Sample Preservation and Handling

- Sample Container and Preservation
- Sample Handling Considerations

(c) Chain-of-Custody

- Sample Labels
- Sample Seals
- Field Logbook
- Chain-of-Custody Record

(d) Analytical Procedures

- Analytical Parameters and Methods
- Quality Assurance/Quality Control Samples

MWPS007419

1.0 SITE LOCATION AND HYDROGEOLOGIC CONDITIONS

U. S. Pipe and Foundry Company, Inc. (U.S. Pipe) operates a valve and fittings foundry in Chattanooga, Tennessee. Foundry sand, cupola slag, cupola baghouse dust, dried sludge, non-isocure core sand and demolition wastes generated at the plant and a previously operated soil pipe plant have been disposed on plant property along the Tennessee River, (Nickajack Lake) for over forty years. The U.S. Pipe foundry waste landfill has been the subject of negotiation between U.S. Pipe and the Tennessee Department of Environment and Conservation (TDEC) as well as between U.S. Pipe and the U.S. Environmental Protection Agency (EPA). As a result of separate agreements with the TDEC and EPA, U.S. Pipe has reactivated efforts to permit the foundry landfill as a Class II Industrial Waste Disposal Facility in accordance with TDEC Solid Waste Regulations.

The landfill is located in Chattanooga along the east bank of the Tennessee River at mile 461.5, at Latitude N35° 01' 53" and Longitude W85° 19' 24". The landfill is located adjacent to the U.S. Pipe Valve and Fittings operation at 2701 Chestnut Street, Chattanooga, Tennessee, 37408. A site location map is provided in Appendix I. Access to the site is by roads within the U.S. Pipe and Foundry plant.

Site topography has been altered due to the many years of landfilling, grading, revegetation, and other improvements. Outslope relief toward the river ranges from flat or gently sloping in the northern and southern extremities to steep in the central area of the site.

A hydrogeologic study was previously performed by Ogden Environmental and Energy Services Company for U.S. Pipe in March, 1995, and submitted to the TDEC. The study

indicates that site groundwater recharges by way of precipitation infiltration, passing through the landfill, and discharges into the Tennessee River. The landfill material is generally dark in color and should absorb a significant amount of sunlight and a substantial amount of water will be released back into the atmosphere reducing the total amount of infiltration to the water table.

Extensive site improvements have removed any surficial features that may have indicated natural recharge and/or discharge points. This applies not only to the landfill site but also the remainder of the adjacent area known as Tannery Flats. Much of the area has been subjected to river channelization and road improvements stemming from Interstate Highway I-24. These have significantly altered the original topography.

Generally for the region, groundwater recharges by way of precipitation and/or stream flow infiltration from the east near Missionary Ridge (most likely the eastern groundwater drainage divide), flows westward, and discharges into the Tennessee River. See the above mentioned Hydrogeologic Report for further information.

2.0 GROUNDWATER MONITORING SYSTEM

The proposed groundwater monitoring system will consist of four monitoring well locations. Groundwater monitoring will be conducted for the one existing upgradient monitoring well and the three downgradient monitoring wells. The monitoring well locations are shown on Sheets 1, 2 and 3 of the drawings. Monitoring well details and construction data for the four wells are provided in Appendix V and in the Hydrgeologic Report.

3.0 GROUNDWATER SAMPLING AND ANALYSIS PROCEDURES

3.1 SAMPLING STRATEGY

Class II facilities are required to establish reliable background concentrations of values against which future comparisons can be made. All Monitoring Wells (MWs) will have water samples taken semi-annually and analyzed for the following parameters:

Acidity
Alkalinity
Cadmium
Cyanide
Formaldehyde
Iron
Lead
pH
Phenols
Total Organic Carbon (TOC)
Toluene

Groundwater monitoring will be conducted throughout the active life and post-closure care period of the facility. The regulations place the burden of establishing background values and evaluating statistical increases on the regulatory authority, the TDEC.

3.2 QUALITY ASSURANCE PLAN

The laboratory performing the groundwater analyses should supply most of the necessary sample collection equipment and documentation forms. Other equipment may be dedicated to the facility or supplied by the sampler.

Prior to sampling, the sampling project leader should identify the following information requirements.

A. Sample point identification (i.e., well number, well diameter, depth of well, well casing stick-up, details of sampling equipment, etc.).

B. Sampling point accessibility

C. Recommended constituent storage and holding time, preservative and analytical method.

D. Analyte collection order.

E. Quality control samples, as necessary.

F. Required documentation of field activities, including field measurements and calibration of field equipment, chain of custody, sample labels, and instructions to the laboratory (if necessary).

3.3 LOGGING OF FIELD ACTIVITIES

A Field Logbook will be used to record field events, observations, and other pertinent information (e.g., well evacuation and sampling). The Logbook consisting of a bound notebook with consecutively numbered pages is desirable. A separate Field Log for each well may be maintained. Entries will be legibly printed or written in waterproof ink, dated and signed. The Field Logbook shall contain the following minimum information:

- Project number and facility name;
- Site location (city, state);
- Date and time work initiated/completed
- Personnel involved and roles (e.g., collector's name);
- Weather and other field conditions;
- Location of sampling point (e.g., well/spring number, code or name);
- Field measurements made (e.g., well depth, static water level depth, pH, temperature), including results and a general description of the methods used (including instrument make and model), and type and date of calibrations made;
- Well condition (e.g., no cap, broken casing, grout deterioration);
- Description of well purging and sample collection activities, including results and a general description of the methods used;
- Description of how samples were handled;
- Description of and justification for any deviations from planned activities and procedures;
- Pertinent field observations, including extraordinary factors that may affect the analytical results; and

- Incidents and observations concerning personnel health and safety.

The completed Field Logbook(s) (or, alternatively, the Field Logs) will be retained in the project files.

3.4 SAMPLE COLLECTION

3.4.1 ORDER OF SAMPLING

Each well (and spring if applicable) in the system will be sampled during each sampling event, but all procedures will be initiated with the upgradient locations to minimize potential cross-contamination.

3.4.2 MEASUREMENTS OF STATIC WATER LEVEL AND WELL DEPTH

Prior to purging or sampling any well, the static water levels in and the depth of all wells will be measured and recorded. The static water level will be measured using a pre-cleaned and calibrated electronic water level indicator, and well depth will be measured using a weighted measuring tape.

It is recommended that these activities will be performed as follows:

A. Obtain keys from office to unlock and open well; observe condition of well and don clean gloves.

B. Record well number, date, time, weather conditions, condition of the well, and any other pertinent well-specific information.

C. Locate reference mark at top of well casing. If reference mark is not present, make one on side of casing and alert management. [Note that the mark should have been surveyed to determine elevation by a licensed surveyor.]

D. Obtain water level measurement(s) as follows:

1) Check battery on electronic water level indicator and on alarm.

2) Lower electronic water level indicator probe into well making sure the cord on the probe does not scrape the sides of the well casing. When the alarm sounds and/or the red light illuminates, stop lowering the probe. Pull up on the probe until alarm no longer sounds.

3) Lower probe again slowly. Stop at the instant the alarm sounds and/or the light comes on and stays on. Hold cord to side of casing where reference mark is etched, and mark cord with thumb where it touches the reference mark.

4) Use measuring device to determine distance from last marked increment to marked point on cord. Depth to water is the distance from top of casing to the water level.

5) Record measurement to the nearest 0.01 foot as depth to water in Field Logbook.

6) Repeat steps (2) - (5) three times for consistency.

7) Subtract distance from mark on casing to water level from the elevation of the mark on casing to get the elevation of the groundwater level: elevation of water level = (elevation of well) - (depth to water level).

8) After each measurement, rinse the probe with distilled water to avoid possible cross-contamination.

E. Obtain well depth measurement as follows:

1) Lower a weighted measuring tape until refusal.

2) Measure and record the distance from the well bottom to the top of the well casing.

3) Take all measurements to the nearest 0.01 foot.

4) After each measurement rinse tape with distilled water to avoid possible cross-contamination.

After rinsing, the water level indicator probe and the measuring tape will be wrapped in clean aluminum foil or polyethylene to keep it clean between uses. At each well, clean, new plastic will be used to provide a clean surface on which to lay decontaminated equipment.

3.4.3 WELL EVACUATION

No immiscible layers are expected. Therefore, each monitoring well will be purged prior to sampling in order to remove stagnant water from the casing and draw a representative sample from the aquifer. The pH and temperature will be measured during the purging process. Each well will be purged either to dryness or until at least three (3) well volumes of water have been removed.

Purging may be performed using one of the following: dedicated PVC bailers (or other TDEC approved material), dedicated electrically powered Teflon/stainless steel submersible pumps; or dedicated gas operated positive displacement (bladder or piston) Teflon/stainless steel pumps. If a pump system is used, the discharge tube and fittings will be of Teflon or high density polyethylene. The exact purging device selected will depend on the expected yield of the wells, water levels, and other site-specific factors, and upon device availability at the time of purging. Regardless of the device used, the rate of purging will be regulated to minimize agitation of the groundwater.

It is recommended that purging be performed as follows:

A. Ensure that purging equipment has been properly decontaminated, and ensure that measuring instruments are properly calibrated.

B. Record well number, date, time, weather conditions, condition of the well, and other pertinent well-specific information.

C. In the Field Logbook, use the depth to water and well depth measurements to calculate the water column length (h), in feet, and well volume (v), in gallons, as follows:

h = length of water column (in feet) = (depth of well) - (distance to water level).
V = well volume (in gallons) = 0.16 (gal/ft) x h (ft).

D. Unlock and open well, don clean gloves.

E. Begin purging, measuring and recording times and gallons removed. Measure initial pH and record. If applicable, measure initial temperature, and record, and measure pH, and temperature after one well volume has been removed. Repeat until at least three volumes have been removed, or until the well is dry if sufficient water is not present to yield required purge volumes. Measure water level and record time after purging.

F. Unless well yield is sufficient to allow sampling to be performed promptly, close and lock the well cap.

Purged water will be discharged onto the ground at a distance away from the well to prevent infiltration back into the well.

3.4.4 SAMPLE WITHDRAWAL

Groundwater samples obtained from wells will be collected after purging as soon as possible, but within 24 hours. For rapidly recovering wells, it is recommended that the time interval between well evacuation and sampling is considerably less than 24 hours. Samples may be collected using dedicated, PVC (or other approved material) bottom-loading bailers constructed with non-adhesive joints (bailers constructed from the same material as the well casing), or positive displacement (bladder or piston) Teflon/stainless steel pumps. Bailers used to purge the wells may be used for collecting the sample. The bailer will not be decontaminated between purging and sampling unless fouled. The pH will be measured before the sample collection.

Any groundwater samples obtained from springs will be collected directly into the sampling bottle by holding the bottle just below the water surface with the bottle opening pointing upstream. In a case where the water is too shallow to submerge the bottle, water samples will be collected using a clean glass baker or stainless steel bucket from which they will be transferred to the sample bottle.

All samples will be preserved in accordance with the procedures described in Section 3.5. Samples may also be collected for dissolved metals analysis. Any samples collected for dissolved metals analysis may be immediately filtered through a 0.45 micron glass filter or membrane filter prior to transfer to the sample container and preservation. Samples that will be transported to the laboratory within 2-3 hours after collection, may be filtered in the laboratory. The preservative will be added after the sample is filtered in the laboratory. It is recommended that sample collection be performed as follows:

A. Record well number, date, time weather conditions, condition of well, and any other pertinent well-specific information.

B. Place clean, plastic sheeting around well and work area, unlock and open well, and don clean gloves.

C. Obtain water level measurements as described in Section 3.4.2.

D. The following procedures are to be followed, as applicable, when bailers or pumps are used:

1) If a bailer is used, lower bailer slowly to the water level and allow to submerge slowly to the approximate bottom of the well. Allow bailer to fill with a minimum of surface disturbance in order to prevent aeration of the water sample. Raise bailer to surface, taking care that neither the cord or bailer contact the ground.

2) If the gas driven piston pump is used, lower the pump into the well to the desired level, if the pump is not dedicated. Connect air lines from regulated compressed air source to pump. Start air flow. Adjust flow rate with throttle knob found on pump regulator.

3) If a bladder pump is used, attach air lines, sample lines and lifting lines to pump. Lifting lines should bear the weight of the pump with air and sample lines should be attached to lifting lines approximately every 10 feet with appropriate inert devices. Lower pump in well to desired level, if pump is not dedicated. Connect battery, if required. Start air flow. Adjust flow rate with throttle knob found on control box. To control discharge and refill cycle rate of the bladder, use the discharge and refill control knobs located on the control box. Equal length discharge and refill cycles are generally desirable, but individual well conditions may dictate otherwise.

E. Release samples directly (from the bailer or pump system) into the sample container as follows:

1) Remove the cap from the sample container, and hold the container slightly tilted.

2) Release the sample slowly down the inside of the sample container, avoiding splashing of the sample and ensuring that any suspended matter in the sample is also transferred (in approximate proportions) to the sample containers. [Note: Typically, sample is released from the bailer by carefully depressing the bottom ball valve slightly with a gloved finger. However, exact technique may depend upon bailer design.]

3) Fill the container completely.

4) Place the cap on the filled container and screw on tightly. Handle closed container as described in Sections 3.5 and 3.6.

F. Record sampling results in the Field Logbook. Repeat steps D and E until all sample containers are filled. Take final water level reading and record time.

G. Close and lock well.

H. Clean work area.

3.4.5 FIELD MEASUREMENT PROCEDURES

Measurements of the pH and temperature will be obtained in the field. These measurements may serve two purposes. First, both parameters may be used to determine when purging of a well is complete by indicating consistent water quality. Second, the parameter pH is a required groundwater monitoring parameter, and it is most easily and accurately measured in the field. Both parameters may be measured using portable, direct-reading, electronic instruments equipped with remote probes. To obtain a reading (measurement), the probe will be immersed in a container holding sample groundwater that has been freshly removed from the well. The following procedures describe how these measurements may be obtained. However, any other approved procedures may also be followed.

A. pH (Hydrogen Ion Concentration) may be measured using a pH meter that also reads sample temperature and provides automatic temperature compensation.

1) Prior to field activity, ensure that meter is in proper operating condition--check for mechanical and electrical failures, weak batteries, and cracked or fouled electrodes and correct such problems.

2) Prior to using, ensure that meter is properly calibrated in accordance with manufacturer's instructions by testing against standard buffer solutions. While in the field, the meter will be periodically (e.g., daily) checked against

standard buffer solutions and recalibrated as necessary, also in accordance with manufacturer's instructions. These field checks will be recorded in the Field Logbook.

3) Allow the meter to equilibrate to ambient temperature when it is removed from a field vehicle.

4) Rinse the electrode (probe) with distilled water and allow excess water to drain. [Note: this rinsing will be performed prior to and after immersion in each buffer solution and sample.] Collect a fresh sample of groundwater in the container. Immerse the electrode in the sample and swirl it in the sample (or swirl the sample around the electrode) at a slow constant rate until the meter reading reaches equilibrium. Note and record pH reading to nearest 0.1 pH unit in Field Logbook. Discard sample.

5) Repeat step (4) four times. Rinse electrode with distilled water and store in appropriate storage solution in accordance with manufacturer's instructions. Repack instrument. [Note: Poorly buffered solutions with low specific conductance values (less than 200 μmhos) may cause fluctuations in the pH readings. In such case, the electrode may be equilibrated by immersing in three or four portions of sample before taking pH measurements on fresh portions.]

B. Temperature may be measured using the pH meter each time a pH measurement is made and recorded in the Field Logbook.

3.5 SAMPLE PRESERVATION AND HANDLING

Refer to *Methods for Chemical Analysis of Water and Wastes*, USEPA 600/4-79-020, revised March 1983 for sample container, preservative, storage time, and analysis requirements. The containers for the samples will be obtained from the analytical laboratory in "clean" condition or will be newly-purchased "clean" containers.

Samples shall be kept cool (4° C) prior to analysis. This will be achieved through the use of cooled portable ice chests in the field and during transport, and by refrigeration in the laboratory.

3.6 CHAIN-OF-CUSTODY

3.6.1 SAMPLE DESIGNATION AND STORAGE

Each sample will have an identification code which will be used throughout the sampling/analysis/reporting process associated with a sampling event. All containers of groundwater samples collected from a well during a sampling event will be designated with the well or spring number (e.g., "W-1"). Trip blanks will be designated with the label "equipment blank". The recommended frequency of trip blanks is one per sampling/shipment event. Equipment blanks "rinsate samples" shall be

taken for each well sampled. Only one randomly selected sample should be shipped for testing. Should any well produce a distinguishable contaminant odor, the equipment blank for this event shall be selected for testing.

As soon as practicable after filling, sample containers will be wiped clean with disposable rags or paper towels (preceded by a distilled water rinse as necessary); labeled as described in Section 3.6.2; secondarily contained in clean, new, leak-proof plastic bags; and, as appropriate, placed in a cooled ice chest for storage and delivery to the laboratory (with cushioning material as necessary).

3.6.2 CONTAINER LABELS AND SEALS

Each sample container, either before or shortly after filling, will be labeled with the following minimum information:

- Sample identification number
- Project number
- Site name
- Date and time of collection
- Sampler's name
- Parameter(s) requested (if space permits)
- Preservation information

Labels will be obtained from the analytical laboratory (or container vendor) along with the sample containers. Labels will be completed

legibly using waterproof ink. Container seals may not be utilized, if shipment of the samples to the laboratory is not necessary. However, if shipment of the samples to the laboratory is necessary and container seals are used, they will be completed legibly using waterproof ink.

3.6.3 CHAIN-OF-CUSTODY RECORD

At the conclusion of each day's sampling activities, all collected samples will be transported or shipped to the analytical laboratory along with a completed Chain-of-Custody Record(s). The completed record will include the following minimum information:

- Sample identification number(s)
- Signature of sampler
- Date and time of collection
- Sample type (e.g., groundwater)
- Number of containers
- Dated signature of persons involved in the chain of possession (showing transfer of custody).

This form may also serve as the analysis request form, showing the analyses to be performed on each sample. After obtaining the dated signature of the receiving laboratory official, the sampler(s) will obtain a copy of the completed Chain-of-Custody Record(s) for retention in the project files.

3.7 EQUIPMENT DECONTAMINATION

In order to preclude cross contamination between wells and/or sampling points, all sampling equipment (i.e., bailer, pump, tubing, etc.) which comes into direct contact with the groundwater will be decontaminated prior to reuse. Decontamination may be performed by cleaning equipment with a solution of tap water and non-metallic or non-phosphatic detergent and rinsing with tap water and subsequently with distilled (or deionized) water. The equipment may subsequently be rinsed with an organic solvent such as isopropanol and allowed to air dry prior to use. Distilled (or deionized) water may always be substituted for tap water.

3.8 ANALYTICAL PROCEDURES

3.8.1 ANALYTICAL PARAMETERS AND METHODS

Groundwater samples will be analyzed for the parameters listed in Section 3.1 in accordance with EPA 600/4-79-020 and in accordance with the strategy described in Section 3.8. Upon receipt from the laboratory, the analytical results will be made a part of the permanent project file.

3.8.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

In addition to actual groundwater samples, one set of trip blanks and one set of equipment blanks will also be collected and analyzed for each sampling event (or for each day that groundwater monitoring wells are sampled - for equipment blanks) to provide Quality Assurance/Quality

Control (QA/QC) information relative to the sample collection and handling process. Trip blanks will account for any contamination that may occur as a result of the containers, the sample cooler, the cleaning operations or the chemical preservatives. Equipment blanks are primarily used to check the effectiveness of the equipment decontamination process, but the equipment blank analytical results will also reflect contamination that may have resulted from onsite contamination or the use of contaminated distilled (or deionized) water or inadequately cleaned sample containers.

The trip blank samples will be prepared in the laboratory by filling the appropriate clean sample bottles with Type II reagent grade water. These bottles will then be labeled "trip blank", the analyses to be performed will be indicated on each, and they will be placed in the appropriate sample shuttle cooler(s) to be utilized for sample transport to the field and back to the laboratory.

Equipment blank samples will be prepared in the field immediately following decontamination cleaning procedures and before new or non-dedicated equipment is used for evacuation, sampling, or sample preparation. Non-dedicated sampling devices may be considered possible sources of cross contamination. Following decontamination, the sampling device will be filled with Type II reagent grade water, or Type II reagent grade water will be pumped through the device. Then the Type II reagent grade water will be transferred to the sample container(s) (i.e., bottles) and returned to the laboratory for analysis.

4.0 RECORD KEEPING AND REPORTING PROCEDURES

U.S. Pipe will maintain records of all groundwater sampling activities conducted, the sample analysis results, and the associated groundwater surface elevations throughout the active life of the facility and post-closure period. All records will be maintained at the U.S. Pipe Plant Office of the Supervisor of Stores and Yard.

U.S. Pipe will submit to the regulatory authority all groundwater sample analysis results and associated recordings of groundwater surface elevations, within thirty days after receiving the results of analysis.

DRAFT

Tennessee Department of Environment and Conservation

BENEFICIAL USE OF NONTOXIC SPENT FOUNDRY SAND

POLICY

I. PURPOSE

This policy was developed by the Tennessee Division of Solid Waste Management (the Division) to facilitate the beneficial use of nontoxic spent foundry sand and to assure that such uses do not cause environmental harm.

Generators of spent foundry sand are encouraged to actively explore and implement economically feasible alternatives to reduce the volume and toxicity of foundry sand produced, as well as on-site recycling, or recovery, before evaluating potential beneficial uses.

II. SCOPE

This policy sets forth beneficial uses of nontoxic spent foundry sand from iron and aluminum foundries. It describes notification requirements, lists uses which do not require Division review or approval, lists examples of uses which require project specific Division review, and outlines record keeping requirements.

III. APPLICABILITY

This policy applies to nontoxic spent sand from iron and aluminum foundries used or proposed to be used for a particular beneficial purpose in lieu of a competing raw material or finished product. This policy does not apply to waste disposal or indiscriminate dumping/filling.

IV. INITIAL DOCUMENTATION REQUIRED

For a beneficial reuse of foundry sand to be covered by this policy, the foundry which generates the sand must provide documentation to the Division that the sand is "nontoxic" and has been "processed for reuse". For the purposes of this policy, "nontoxic" means that the foundry sand is non-hazardous and contains chemical constituents in concentrations equal to or less than those outlined in Table I. Also, for the purposes of this policy, "processed for reuse" means that the sand has been subjected to a process by which metal and trash are removed. Metal or trash removal is not required provided the foundry can demonstrate that these materials are not present in their sand in significant quantities.

For uses outlined in Part V, items A through E, of this policy, initial documentation is not required. However, if the foundry wishes to be covered by this policy, documentation may be submitted.

V. USES NOT REQUIRING DIVISION REVIEW

The following uses do not require prior Division review or approval:

A. *Manufacturing another product:* The use as a raw material in manufacturing another final product, including, but not limited to, grout, cement, flowable fill, lightweight aggregate, concrete block, bricks, asphalt, roofing materials, plastics, paint, glass, fiberglass, ornamental ceramics and other non-land applications, or as a substitute for a product (e.g. blasting grit), excluding soil products.

B. *Stabilization/solidification of other waste (for disposal):* The use as a stabilization/solidification agent, singly or in combination with other additives or agents, for other wastes which will be disposed of at an approved disposal facility.

C. *Use in a composting process:* The use in a composting process when the process is performed in accordance with applicable composting regulations. This term does not include the use as a post-composting additive, or land application.

D. *Daily cover/final cover at landfill:* Uses as daily cover/final cover at a solid waste landfill, meeting all technical requirements for daily cover/final cover and approved by a permit. The amount of daily cover/final cover shall not exceed the amount under an approved permit.

Landfill Liner protective layer: Use as a protective layer for landfill liners as part of an approved permit for the landfill.

E. ~~Soil Blending~~ . . .

F. *Small Construction Projects:* Uses outlined in Part VI of this policy when the amount used for any single project does not exceed 200 tons and is stabilized. The project must not impact streams, wetlands, or other waters of the State. For small construction projects to be covered under this policy, the generator must provide the "initial documentation" to the Division.

VI. USES REQUIRING DIVISION REVIEW TO PARTICIPATE UNDER THIS POLICY

The following uses require prior Division project review for concurrence. Notification shall be by the attached form.

A. *Structural fill:* An engineered use of nontoxic spent foundry sand structural fills for the following: building or equipment supportive base or foundation, foundation backfill, construction material for road bases and subbase, overpasses, embankments, parking lots, dams, retaining walls, dikes, levees; as a construction fill material for planned commercial and residential projects including office parks, commercial plazas, malls, industrial parks, institutions, subdivisions, apartments, duplexes, condominiums; as bedding and backfill material for sanitary sewer lines and other utility lines; or as a construction fill material for planned recreational type uses which include tennis courts and other public park applications below surface grade. Note that all above applications will be below surface grade when completed.

B. *Mines/Strip Mine Reclamation:* Beneficial uses to fill abandoned or closed mines or strip mine areas. The intent is to fill the areas to the original topography, cover with one foot of soil and vegetate, thus restoring the land to its original contours and adding to it's value.

C. *Other uses:* The Director may approve other uses on an individual basis if they are consistent with this policy and protective of human health and the environment.

VII. RECORD KEEPING REQUIREMENTS

Each foundry subject to this policy must maintain the following records:

1. The amount of sand used;

2. The nature, purpose, and location of the projects;

3. Chemical analysis documenting the "nontoxic" nature of their sand; ~~and~~ (Such analysis must be completed every two years or whenever process changes occur which may affect composition of the sand, whichever is more frequent);
4. Any written approval/concurrence by DSWM where required for participation under this policy.

Tom Tiesler, Director
Tennessee Division of Solid Waste Management

(date)

DRAFT

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ATTACHMENT 1

Foundry Sand Beneficial Use Notification Form

GENERAL INFORMATION:

1.) Name of Project: _____

2.) Entity Requesting Review: _____

3.) Proposed Generator: _____

4.) Proposed Use As: _____

5.) Proposed Use Location (Enclose topographical map showing material placement boundaries. Include lowest elevation of material placement): _____

6.) Name and address of property owner: _____

7.) Amount of Nontoxic Spent Foundry Sand to be Used: _____

ENVIRONMENTAL CONSIDERATIONS:

1.) Is the proposed use location subject to flooding? YES NO
(Attach map indicating 100-year flood plains.)

2.) Distance from proposed location to nearest surface water: _____
(On the map, show any nearby perennial (blue line) streams, ponds, wetlands, etc.)

3.) Describe runoff/silt control: _____

4.) Indicate on the map approximate location of monitoring and/or potable water supply wells in the area.

5.) What are the adjacent land uses? _____

_____

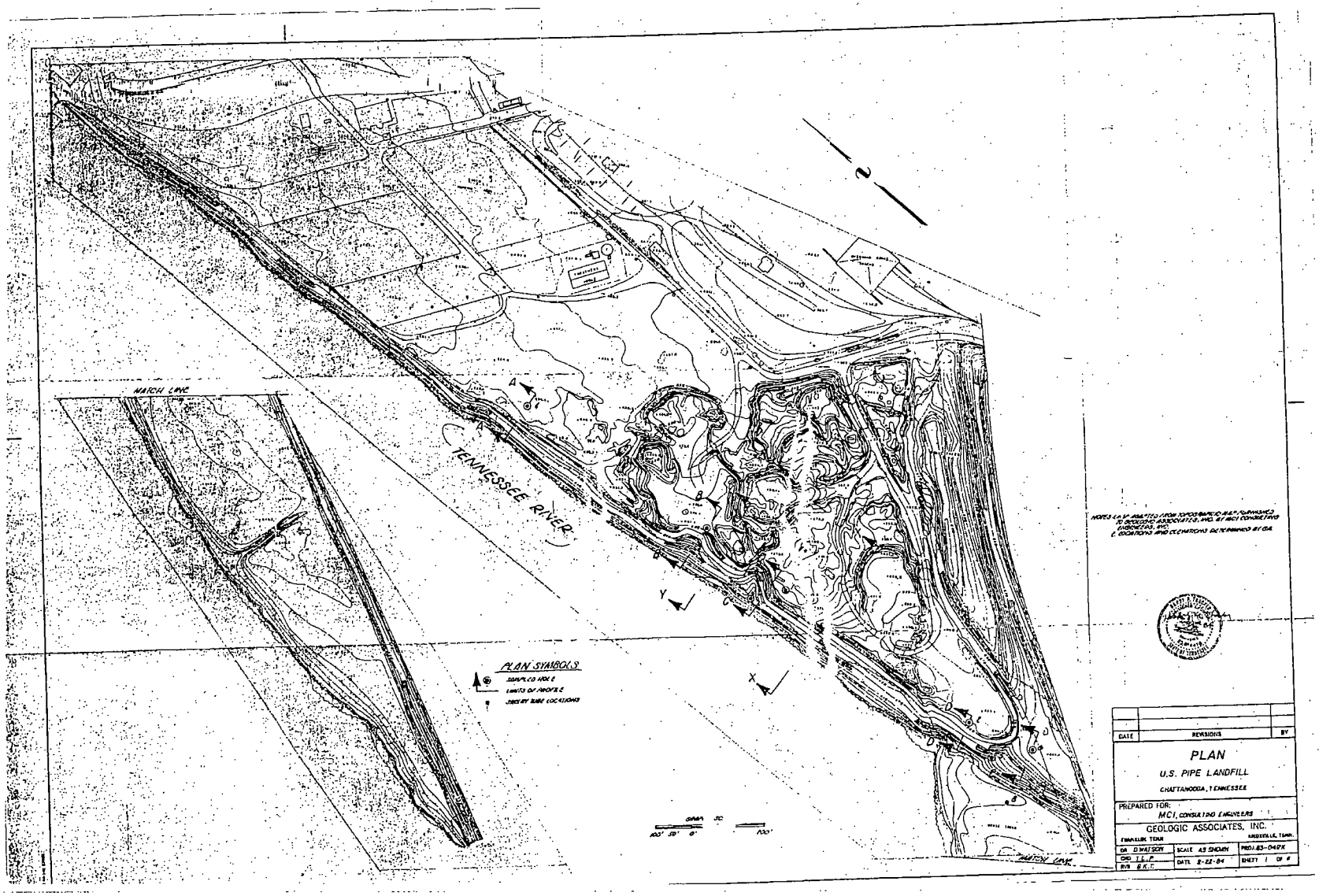
6.) Are you aware of any potential (attributable to this project) or existing public water supply or groundwater quality degradation in the area? YES NO
Explain: _____

_____

7.) Indicate the area USGS soil type classification: _____

This signature shall constitute personal affirmation that all statements or assertions of fact made in this proposal are true and complete and shall be subject to applicable state laws for false or misleading statements.

_____	_____
Signature of Project Manager	Name of Property Owner
_____	_____
Company	Signature
_____	_____
Title	Date
_____	
Date	


MARCH LANE
TENNESSEE RIVER
PLAN SYMBOLS
SAMPLED HOLE
LIMITS OF PROFILE
SHEET BY SHEET LOCATIONS
A
B
X
Y
GRAPH SC
100' 50' 0' 100'
MARCH LANE
NOTES: 1. A.P. ADAPTED FROM TOPOGRAPHIC MAP, CONTRACTS TO GEOLOGIC ASSOCIATES, INC. BY MCI CONSULTING ENGINEERS, INC.
2. LOCATIONS AND ELEVATIONS DETERMINED BY GA.
DATE
REVISIONS
BY
PLAN
U.S. PIPE LANDFILL
CHATTANOOGA, TENNESSEE
PREPARED FOR:
MCI, CONSULTING ENGINEERS
GEOLOGIC ASSOCIATES, INC.
KNOXVILLE, TENN.
DR D.WATSON
SCALE AS SHOWN
PROJ. 83-040K
CHD T.L.P.
DATE 2-22-84
SHEET 1 OF 4
RVD B.K.T.

MWPS007447

OPERATIONS AND MAINTENANCE MANUAL

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

PREPARED BY:

MCGILL ASSOCIATES, P.A.
870 Winfield Dunn Parkway, Suite 6
Sevierville, Tennessee 37876

PROJECT NUMBER 95315.01

September 6, 1996

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MWPS007452

1.0 BACKGROUND INFORMATION

U. S. Pipe and Foundry Company, Inc. (U.S. Pipe) operates a valve and fittings foundry in Chattanooga, Tennessee. Foundry sand, cupola slag, cupola baghouse dust, core sand and demolition wastes generated at the plant, along with various wastes from a previously operated soil pipe plant, have been disposed on plant property along the Tennessee River, (Nickajack Lake) for over forty years. The U.S. Pipe foundry waste landfill has been the subject of negotiation between U.S. Pipe and the Tennessee Department of Environment and Conservation (TDEC) as well as between U.S. Pipe and the U.S. Environmental Protection Agency (EPA). As a result of separate agreements with the TDEC and EPA, U.S. Pipe has reactivated efforts to permit the foundry landfill as a Class II Industrial Waste Disposal Facility in accordance with TDEC solid waste regulations.

The permitting process of a Class II landfill includes preparation of engineering plans, and a narrative description of the facility and operations, in accordance with Rules 1200-1-7.-04 (a) (b) and (c) of the TDEC solid waste regulations. This Operations and Maintenance Manual has been prepared to comply with these rules.

TDEC, Division of Solid Waste Management (DSWM), approved a Hydrogeological Report for the existing disposal site in April, 1995. A copy of this approval letter dated 4/26/95 has been provided by U.S.Pipe and is included in Appendix II. Based on the results of this Report, the DSWM requested that U.S. Pipe submit this Operations and Maintenance Manual for continued operation of the site. U.S. Pipe had submitted an Operation Manual to DSWM in January, 1988; however, that submittal was not reviewed by DSWM. This revised manual is being submitted at the request of DSWM.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SITE CONDITIONS

The landfill is located in Chattanooga along the east bank of the Tennessee River at mile 461.5, at Latitude N35° 01' 53" and Longitude W85° 19' 24". The landfill is located adjacent to the U.S. Pipe Valve and Fittings Plant at 2701 Chestnut Street, Chattanooga, Tennessee, 37408. The proposed landfill comprises approximately 33 acres consisting of the existing 21 acre landfill area, 8 acres of storage yard north of the existing landfill and 4 acres of presently undeveloped area located south of the existing landfill. The property is owned by U.S. Pipe and Foundry Company. A site location map is provided in Appendix I. Access to the site is by a road within the Plant.

The City of Chattanooga has installed a sanitary sewer collection system on the landfill site. There is a 36" diameter sanitary sewer line along the western (river) side of the landfill. On the eastern side, a 72" diameter combined (storm and sanitary) sewer enters a regulator chamber. During dry weather, all of the contents of the 72" sewer empty into a 21" diameter sanitary sewer at the regulator chamber, which runs under the existing landfill to the 36" sanitary sewer. During wet weather, the excess combined wastewater, which cannot enter the 21" sewer, overflows out of the regulator chamber into a ditch along the eastern border of the landfill, which previously ran along the southern edge of the landfill to the Tennessee River. In 1977, U.S. Pipe installed approximately 450' of 78" diameter corrugated metal pipe across the landfill to accommodate the combined sewer overflow to the river and to allow placement of waste over and south of the 78" pipe. This sewer system is shown on the construction plans. No

problems have been reported with the pipes under the landfill.

In November 1987, U.S. Pipe regraded the existing waste in accordance with site stabilization procedures requested by the DSWM. This work included grading the top of the landfill to prevent ponding and the outside slopes, with the exception of the river slope, to 2:1. The river slope was left alone, as vegetation had been established. A 12' wide access road has been cut along the west side of the regulator chamber drainage ditch. Two rock dams were constructed and the slopes were seeded with grass.

Based on information provided by the Tennessee Valley Authority, the elevation of the 100 year flood at the site is 656' mean sea level (MSL). TVA maintains floodway easement rights to elevation 636' MSL (normal pool) and recognizes elevation 640' as the maximum shoreline contour. Based on previous conversations with representatives of the City of Chattanooga and the Corps of Engineers, no permits would be required by these agencies for filling in the 100 year flood plain above elevation 636' provided that no structures are constructed. Copies of this correspondence have been provided by U.S. Pipe and are included in Appendix II. Due to the length of time since these contacts were made, several of these agencies were again contacted recently and copies of that correspondence are also included in Appendix II. The structure profile is elevation 668' MSL. Maximum utilization of the site requires filling below the 640' contour in one location, immediately south of the existing operations. A TVA Section 26A permit was previously determined to be required and application was made. This application was approved by TVA, however, U.S. Pipe chose not to execute the 26a Permit prior to approval of the landfill by the Division of Solid Waste Management. A copy of this original application and response from TVA has

been provided by U.S. Pipe and is included in Appendix II. Efforts are underway at this time to again obtain TVA approval of a 26a permit with the same terms as before. In general, no new waste will be placed within 50' of the 636' contour.

2.2 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

A hydrogeologic study was previously performed by Ogden Environmental and Energy Services Company for U.S. Pipe in February, 1995, and submitted to the DSWM. This report is written as a companion to the above referenced hydrogeologic study.

3.0 OPERATION AND DESIGN CRITERIA

Design criteria and construction estimates are based on an estimated volume of approximately 36,000 tons of foundry waste per year. Using an average waste density of 120 pounds per cubic foot (3240 pounds per cubic yard), the approximate yearly waste disposal volume is 22,200 cubic yards, or approximately 111 cubic yards per day (based on 50 weeks, 4 days/week). The landfill has received and will continue to receive wastes as listed in Table 1. This table does not include approximately two (2) tons per week of coke fines, which are recycled offsite.

Table 1

UNITED STATES PIPE AND FOUNDRY FACILITY
Chattanooga Valve and Fittings Plant
Composition of Wastes
Based on Information provided by U.S. Pipe dated 11/8/89

Waste Type	Tons/ Week	% of Total	
Direct Disposal Wastes			
1. Non-Isocure Foundry Sand and Core Butts	600.0	83.39	85.65
2. Slag	80.0	11.12	11.42
3. General Plant Demolition Debris (no asbestos)	5.0	0.69	0.71
4. Cleaning Room Wastes	1.5	0.21	0.21
5. Ductile Treating Baghouse Dust	2.0	0.28	0.29
6. Cement Lining Waste	2.0	0.28	0.29
7. Misc. Baghouse (grinding dust, cleaning machine dust)	10.0	1.39	1.43
Total Direct Disposal Wastes	700.5	97.36	100.00
Special Wastes			
1. Waste Isocure Sand and Core Butts	10.0	1.39	52.63
2. Cupola Baghouse Dust	8.0	1.11	42.11
3. Brass Melting and Grinding Baghouse Dust	1.0	0.14	5.26
Total Special Wastes	19.0	2.63	100.00
Total Tons per Week	719.5	100.00	
Total Tons per Year (50 Week Cycle)	35975.0		

U.S. Pipe currently stabilizes the cupola baghouse dust and brass melting and grinding baghouse dust with a "Solifix" treatment system, which has been operational since 1988. This system combines a mixture of lime kiln dust, baghouse dust, cement and a proprietary liquid called Solifix to make a non-leachable waste product. This stabilized waste is being disposed of in the foundry waste landfill. At the time that U.S. Pipe

receives registration of its landfill, it is planned to dispose of the waste isocure sand at an approved Sanitary Landfill.

Attached as Appendix III are copies of correspondence between U.S. Pipe and DSWM that describe in detail the physical/chemical characteristics of the waste stream from the plant. This correspondence contains references to waste stream products of the former soil pipe plant operation, which was closed in May 1990, as well as waste stream products from the currently operational Valve and Fittings Plant. Note that process wastewater treatment sludge is not produced by the Valve and Fittings Plant. Table 1 lists waste stream components of the Valve and Fittings Plant only. The landfill will be an area fill type operation which will have a groundwater monitoring system. The estimated life of the landfill is 41 years (See Section 5.0 of this report).

3.1 PRELIMINARY REGULATORY APPROVAL

U.S. Pipe has provided DSWM with the Hydrogeological Report, which was approved by DSWM on 4/26/95. A copy of the letter is provided in Appendix II.

3.2 REQUESTED VARIANCES AND WAIVERS

Following are requirements for which waivers are requested for this facility. As required in Rule 1200-1-7-.01 (5), Variances and Waivers, an explanation of the reason(s) why the requirement(s) should be considered inapplicable, inappropriate, or unnecessary, and/or a description of the alternative procedures or mechanisms to be utilized and why they should be considered equal in effect to the standard(s) proposed to be waived, is included.

1. Rule 1200-1-7-.04 (2) (e) Personnel Services.

1. Rule 1200-1-7-.04 (2) (e) Personnel Services.

   A waiver from this rule is requested due to the landfill being located adjacent to the U.S. Pipe and Foundry Facility where adequate personnel services are available.

2. Rule 1200-1-7-.04 (2) (f) Communications

   A waiver from this rule is requested due to the landfill being located adjacent to the U.S. Pipe and Foundry Facility where adequate communications are available.

3. Rule 1200-1-7-.04 (2) (h) Availability of Cover Material

   A waiver of the requirement for cover material to be stockpiled on site is requested for the reasons described below in the request for a waiver of Rule 1200-1-7-.04 (6) (b) 3.

4. Rule 1200-1-7-.04 (2) (m) 2 Endangered Species

   A waiver of the requirement that an endangered species survey be conducted is due to the fact that no undeveloped land is being disturbed.

5. Rule 1200-1-7-.04 (2) (n) Location in Floodplains

   A waiver of the requirement that none of the facility be located in the 100 year flood plain is requested due to the historically inert and stable nature of the foundry sand. All of the new fill will be located above the TVA maximum shoreline contour of 640 feet above msl except for a small area for which an application for a TVA Section 26a permit has been made.

6. Rule 1200-1-7-.04 (2) (p) Wetlands

   A waiver of the requirement that a wetlands assessment be conducted is due to the fact that no undeveloped land is being disturbed.

7. Rule 1200-1-7-.04 (2) (s) Random Inspection Program

   A waiver from this rule is requested due to the fact that no outside waste is being received at the facility. All of the waste disposed of in the facility is

from the foundry.

8. Rule 1200-1-7-.04 (3) (a) 1 Distance of Fill Areas from Property Lines
A waiver from the requirement that the fill areas be located a minimum of 100 feet from all property lines is requested due to the historically inert and stable nature of the landfill waste. The groundwater monitoring data (located in Appendix VII) does not indicate any relationship between the landfill and the test results.

9. Rule 1200-1-7-.04 (3) (a) 4 Distance of Fill Areas from Bodies of Water
A variance from the requirement that fill areas be located a minimum of 200 feet from the normal boundaries of springs, streams, lakes and other bodies of water is requested due to the same reasons as those listed in number 8 above. No new waste will be placed within 50 feet of the 636' contour along the river.

10. Rule 1200-1-7-.04 (4) (b) and paragraph (8) (c) 7 Engineered Liner, Geologic Buffer and Leachate Collection/Removal System
A waiver from this rule is requested due to the fact that the groundwater test data(located in Appendix VII) does not indicate any relationship between the landfill and the test results and also to the historically inert and stable nature of the foundry sand. There does not appear to be a need for the above referenced systems at this site. As stated in the policy currently being developed by TDEC on The Beneficial Use Of Nontoxic Spent Foundry Sand, foundry sand is actually suitable for use as a protective layer for the liner in landfills.

11. Rule 1200-1-7-.04 (5) (b) and paragraph (8) (c) 8 Gas Migration Control System

A waiver from this rule is requested due to the historically inert and stable nature of the foundry sand and the other materials disposed of in this landfill. No significant amount of gas will be generated by the buried waste.

12. Rule 1200-1-7-.04 (6) (b) 3 and paragraph (8) (c) 3 (i). Final Cover

A waiver from this rule is requested due to the low permeability of the foundry sand/clay mixture and the suitability of the mixture for the establishment of vegetative cover. As stated in the policy currently being developed by TDEC on The Beneficial Use Of Nontoxic Spent Foundry Sand, foundry sand is actually suitable for use as daily cover material in landfills.

13. 1200-1-7-.04 (7) (b). Groundwater Protection/Monitoring Standards

It is requested that no additional groundwater wells or groundwater studies be required. Groundwater monitoring of the parameters listed in this report will continue for the life of the landfill and throughout the closure/post closure care period on a semi-annual basis at the locations of the four monitoring wells shown on the construction drawings. It is also requested that there be no additional monitoring at the storm sewer outfall pipe due to the fact that the test results on record do not indicate any problems there. Furthermore, the City of Chattanooga monitors the previously discussed wastewater regulator chamber.

4.0 CONSTRUCTION AND OPERATION

The landfill will be used for disposal of waste generated at the Chattanooga Valve and Fittings Plant only. Further, the landfill will be constructed in a planned sequence, thereby allowing U.S. Pipe to reclaim (establish vegetative growth) disturbed areas as construction progresses. Outslopes will be constructed at the specified slopes provided in the construction plans. U.S. Pipe has provided a copy of the geotechnical engineering study previously performed by Geologic Associates, Inc., which includes a detailed stability analysis of the outslope material that evaluates the suitability of existing slopes and recommends safe slopes and specific operating criteria for continued landfilling. A copy of this report is provided in Appendix IV.

4.1 FILL OPERATIONS

The landfill is divided into three operational phases, following some minor grading and seeding of the existing fill to be done by U.S. Pipe personnel: I) the undeveloped area located immediately south of the existing landfill, II) the storage yard north of the existing landfill and III) the placement of wastes on top of Phase II and the existing fill. Phase III grading will include a 50' wide terrace along the western access edge of the landfill for added slope stability as discussed in the stability analysis (Appendix IV). This 50' terrace tapers into a 25' terrace that extends around the landfill. Phase II includes initial construction of a part of the 25' wide terrace for Phase III. Details for construction of each phase are provided in the Construction Plans, included at the conclusion of this report. Generally, in Phases I and II, the wastes will be dumped from the top of an existing fill area to the outslope of the existing fill, progressing outward to the landfill border. Phase III will be developed from one end of the landfill, with the

waste pushed and shaped to a working face, with "cells" constructed for additional waste placement to the final contours. Bulky waste core butts and dusts will be placed in the interior of the landfill, with foundry sand used for cover. Drainage ditches and rock dams will be installed for each phase as shown on the construction drawings. The drainage and sedimentation control facilities are more fully discussed in section 6.

4.2 COVER AND FINAL GRADING

Based on the composition of the wastes disposed, daily and final soil cover will not be required. This is addressed in correspondence from DSWM dated February 2, 1987. A copy of this correspondence has been provided by U.S. Pipe for this report and is included at the end of Appendix IV. The site will be graded in accordance with the final contours shown on Sheets 1, 2 and 3 of the plans.

The exterior limits of the site will be constructed to final grade as landfilling progresses upward. Foundry sand will be placed near the outslopes for added stability, while demolition debris and dust will be placed near the center of the fill. Wastes will be placed in lifts no thicker than 18 inches and compacted with the hauling and spreading equipment. In order to achieve added stability, outslopes will be shaped at a slightly steeper inclination than designed and compacted. The slopes would then be graded to their design configuration and immediately seeded and mulched. In this manner, wastes difficult to compact can be removed to prevent surficial sloughing of material. A detailed description of the outslope construction procedures is included in the appended geotechnical engineering report prepared by Geologic Associates, Inc. (see Appendix IV). Recommendations by the University of Tennessee Agricultural Extension Service

for seeding, fertilization and establishment of vegetative cover are also included at the end of Appendix IV. These recommendations have been successfully implemented in the past and should be followed unless problems related to the establishment of vegetative cover develop in the future.

4.3 ACCESS ROADS

In Phases I and II, waste will initially be placed to construct access roads, as indicated on the drawings. Roads providing access to the landfill will be constructed of compacted foundry sand. The access road slopes are to be a maximum of 5 - 6%, except as shown otherwise on the construction drawings. The roads will be maintained to provide all-weather access into the site and to safely accommodate truck traffic using the site. Only in-plant roads are used to transport material to the landfill.

4.4 BENEFICIAL REUSE OF FOUNDRY SAND

U.S. Pipe may, at any time during the operational periods, excavate and process the foundry sand for reuse as described in the TDEC Policy on the Beneficial Use of Nontoxic Spent Foundry Sand currently being developed. A draft copy of this policy is included in Appendix X. This type of activity may increase the life of the U.S. Pipe Foundry landfill by an amount of time that cannot presently be predicted accurately; however, the final contours as shown on the construction drawings will not change due to this type of activity.

5.0 PROJECTED REFUSE AND COVER VOLUMES

Based on our calculations, a total volume of approximately 909,736 cubic yards is available for disposal of industrial waste from the Chattanooga facilities. The undeveloped area located south of the existing fill represents approximately 110,672 cubic yards of this volume. Based on a yearly disposal volume of 22,200 cubic yards, the site could be used by U.S. Pipe for approximately 41 years. This is more fully tabulated in Table 2:

Table 2
Projected Landfill Capacities

PHASE	ACREAGE	VOLUME (Cubic Yards)	PROJECTED (Years)	ACREAGE USED EACH YEAR
Present	17.9	1,063,512	Filled	-
I	2.8	110,672	5.0	0.6
II	6.7	427,267	19.2	0.3
III	0	371,797	16.7	0
Subtotal	27.4	1,973,248	40.9	-
Other Areas (Non-Fill Access Roads, Rock Dams)	5.4	0	0	-
TOTAL	32.8	1,973,248	40.9	-

6.0 DRAINAGE FACILITIES

Drainage features for the landfill consist of terraces, ditches, culverts and rock dams. The site is graded to promote positive drainage and to prevent ponding. Timely vegetation will be used to reduce the amount of sediment generated.

The foundry sand in this landfill allows for a different approach for sediment control than might be used in a sanitary landfill. Because of the density of the material, a rock dam was previously constructed in order to obtain field experience in the adequacy of these structures, as well as to control sediment runoff during regrading operations. The rock dam allows water to "filter" through the rocks, thereby retaining sediment. As an added precaution, a smaller rock dam was constructed upstream of the larger rock dam (in the vicinity of Monitoring Well #1). It was observed during the occurrence of several heavy rainfall events totaling over 4 inches of precipitation, that sediment did not break through the small dam.

Two other dams were also constructed (see Sheet 2). One dam was placed where stabilization of the river slope was conducted and a second dam was placed to control run-off from the landfill access road and the adjoining property (Siskin Steel). Success over time with these structures is the basis for recommending these structures for sediment control. Three additional rock dams are proposed as shown on the drawings. It is proposed to size these structures as shown in Appendix VI. The structures are shown at their approximate scaled size on the drawings. If needed, the retention areas can be readily enlarged. Typical details of the dams are shown on Sheet 7 of the drawings. Silt should be removed from the dams when deposits reach approximately 1/3 height of barrier.

Drainage ditches and culverts have been designed to accommodate a peak runoff flow resulting from a 25-year, 24-hour storm. The retention areas have been sized to detain the water volume resulting from a 24-hour, 25-year storm and to divert through emergency spillways the peak flow resulting from a 24-hour, 100-year storm. Calculations for these facilities are provided in Appendix VI. Details are shown on Sheet 7 of the drawings.

It is proposed to line the ditches with rip-rap where necessary. Ditch construction during previous grading demonstrated that rip-rap lining of ditches is effective in controlling ditch erosion. Very steep ditches will be lined with rock as shown on the drawings.

7.0 LEACHATE COLLECTION SYSTEM

As described earlier in Section 3.2, item 10, a leachate collection system will not be necessary at this site due to the historically inert and stable nature of the foundry sand.

8.0 ADMINISTRATIVE GUIDELINES

8.1 PERSONNEL

The landfill is operated under the supervision of the Supervisor of Stores and Yard. The supervisor should verify that the site is operated in a safe and environmentally sound manner. The supervisor will be thoroughly familiar with the landfill construction plans and will be able to familiarize any operator with the plans.

8.2 FACILITIES

Landfill operating personnel will use existing plant structures for heat and toilet facilities. There are no permanent or portable structures within the landfill boundary.

8.3 LANDFILL EQUIPMENT

Waste from the plant is hauled throughout the operating day to the site with tandem axle dump trucks. In Phases I and II, the trucks will dump the waste from existing fill areas against the outer face. In Phase III, the trucks will dump the waste on top of the fill, with front end loaders shaping the waste into cells and berms. U.S. Pipe uses Dresser 580 or Caterpillar 920 front-end loaders to spread, grade and compact the waste and to construct berms. This machinery is available on a full-time basis. In the event of equipment breakdown, U.S. Pipe will use similar plant equipment or obtain suitable rental equipment.

8.4 ACCIDENT PREVENTION AND SAFETY

The supervisor has an obligation to maintain safe and secure working conditions for all landfill personnel. This obligation includes that plant safety rules are written, published and given to each employee. First aid supplies for treatment of routine minor injuries will be provided at the plant facilities located adjacent to the landfill site.

8.5 LANDFILL RECORDS AND REPORTS

Records of the activity at the landfill and inspection forms are maintained by the supervisor. Records of surface and groundwater analyses will be maintained and kept in the supervisor's office.

8.6 LANDFILL SIGN

A sign will be provided at the main entrance to the landfill for identification of acceptable wastes. The sign will also state that no sanitary, hazardous, liquid or unauthorized waste will be disposed of.

8.7 SITE ACCESS AND CONTROL

A chain link fence and the Tennessee River completely enclose the site. Access to the site is from plant property only, which is fenced and posted.

8.8 FUTURE PLANNING

Class II landfills do not require annual life reporting.

8.9 LANDFILL COMPLETION

Upon completion, the site shall be recorded with the Hamilton County Register of Deeds as a former landfill site.

9.0 ENVIRONMENTAL CONSIDERATIONS

9.1 DUST CONTROL

Grass will be planted over finished areas to minimize blowing dust. Water will be applied to the roads during abnormally dry conditions as needed to control excessive dust. Pre-treated baghouse dusts and other fines will be immediately covered with foundry sand for dust control.

9.2 BLOWING LITTER

Putrescible trash (litter) is not disposed in the landfill.

9.3 OPEN BURNING

No refuse will be burned at the landfill site. In the event accidental fires occur, the fire will be extinguished by smothering or by plant fire protection personnel.

9.4 SALVAGING

No salvaging will be allowed at the landfill site without obtaining prior permission from the DSWM. U.S. Pipe may request removal of foundry sand for beneficial reuse as described earlier in Section 4.4.

9.5 SPECIAL WASTE HANDLING

No special wastes other than the wastes approved for disposal by the DSWM will be accepted at the landfill.

9.6 VECTOR CONTROL

Putrescible waste is not disposed in the landfill.

9.7 ODOR CONTROL

Due to the nature of the wastes disposed, no odor problems are anticipated.

9.8 UNAUTHORIZED DUMPING

Unauthorized dumping will not be allowed.

9.9 DOMESTIC ANIMALS

Domestic animal access to the site is controlled by the chain link fence and the river enclosing the site. No domestic animals will be disposed at the site.

9.10 GAS MIGRATION CONTROL

As described earlier in section 3.2, item 12, a gas migration control system will not be necessary at this site due to the nature of the foundry waste. No significant amount of gas will be generated by the buried waste.

10.0 GROUNDWATER MONITORING

The four monitoring wells (one upgradient and three downgradient) will be used for monitoring of phenols and any other parameters deemed necessary by the DSWM. These wells will be used to monitor the quality of background groundwater that has not been affected by leakage from the landfill as well as to determine the quality of the groundwater that passes the compliance boundary downgradient. The locations of these wells are shown on the drawings. Monitoring will be conducted on a semi-annual basis. U.S. Pipe has provided a copy of an earlier report entitled "Monitoring Well Installation Report", which describes how the first two monitoring wells were installed in 1985. This report is included as Appendix V. Two additional downgradient monitoring wells were installed in 1994, in accordance with an EPA Consent Agreement and Final Order, dated December 5, 1990. Installation details for these two wells are included in the previously approved Hydrogeological Report.

The surface discharge pipe running under the present southern end of the landfill has also been sampled. Results of previous analyses from this point and the monitoring wells are presented in Appendix VII.

The following indicator parameters selected from Rule 1200-1-7-.04 (7) (a) 4 (i) (I) have been and will continue to be used in the sampling and analysis of groundwater:

Acidity
Alkalinity
Cadmium
Cyanide
Formaldehyde
Iron
Lead
pH
Phenols
Total Organic Carbon (TOC)
Toluene

This will by done in order to establish reliable background concentrations of values against which future comparisons can be made. A summary of the Groundwater Monitoring Program (Appendix IX) is presented herein.

10.1 SAMPLE COLLECTION

Before and immediately after purging or sampling at any well, the water level will be measured and recorded. The water level will be obtained using an electronic water level indicator. The well depth will be determined annually using a weighted measuring probe.

Prior to sampling, the wells will be purged of at least three well volumes, or to

dryness if insufficient water is present to yield the required purge volumes. This will stimulate groundwater flow into the well and provide a representative groundwater sample. To simulate a mini pumping test for each well, the static water level shall be measured prior to purging and immediately after purging.

Samples will be taken as soon as practical, after purging. Samples will be collected with a stainless steel or Teflon bailer or by using a submersible sample pump. The sample bottles will be filled directly from the sample device. Groundwater pH and temperature will be determined in the field after the samples have been collected. The pH meter shall be calibrated in accordance with manufacturer's operating instructions, prior to daily use. Thereafter, the meter shall be checked periodically against two buffers that bracket the expected values of the samples. The temperature measurement device will be initially calibrated at three temperatures covering the range of the device against a national Bureau of Standards (NBS) certified thermometer, and then cross-checked against a calibrated NBS certified thermometer at least semiannually.

10.2 SAMPLE IDENTIFICATION

Samples will be labeled in the field with the following information:

- Location
- Sample Number
- Date
- Time
- Intended Analysis
- Initials of Sampling Personnel

- Preservative

10.3 SAMPLE CONTAINERS AND PRESERVATION

Sample containers and preservation techniques shall conform to the requirements of Methods for Chemical Analysis of Water and Wastes, USEPA 600/4-79-020, revised March 1983, or equivalent.

10.4 DECONTAMINATION

To ensure the quality of samples by preventing cross-contamination between wells, all sampling equipment will be decontaminated before reuse. The equipment will be washed thoroughly with laboratory grade detergent, rinsed with appropriate solvents and deionized water, and allowed to air dry.

10.5 ANALYSIS

All analytical procedures will be conducted according to the protocols described in Methods for Chemical Analysis of Water and Wastes, USEPA 600/4-79-020, or equivalent. Each well will be sampled and analyzed for the parameters discussed in Section 10.0 at the frequencies indicated.

10.6 CHAIN OF CUSTODY

A chain-of-custody form will be used to track sample possession. The form will include sample type, sample number, intended analysis, sampling dates, times, and signatures of sampling and laboratory personnel.

10.7 RECORD KEEPING AND REPORTING

The operator must keep records of all groundwater sampling activities conducted, the sample analysis results, and the associated groundwater surface elevations throughout the active life of the facility and throughout the post-closure care period as well. Such records will be kept at the facility or at some other location within Tennessee as specified in the permit.

All groundwater sample analysis results and associated recordings of groundwater surface elevations will be submitted to the Commissioner within 30 days after completing the analysis. To facilitate handling and evaluation of this data, the Commissioner may specify in the permit the manner and form in which the data must be reported.

11.0 CLOSURE/POST CLOSURE

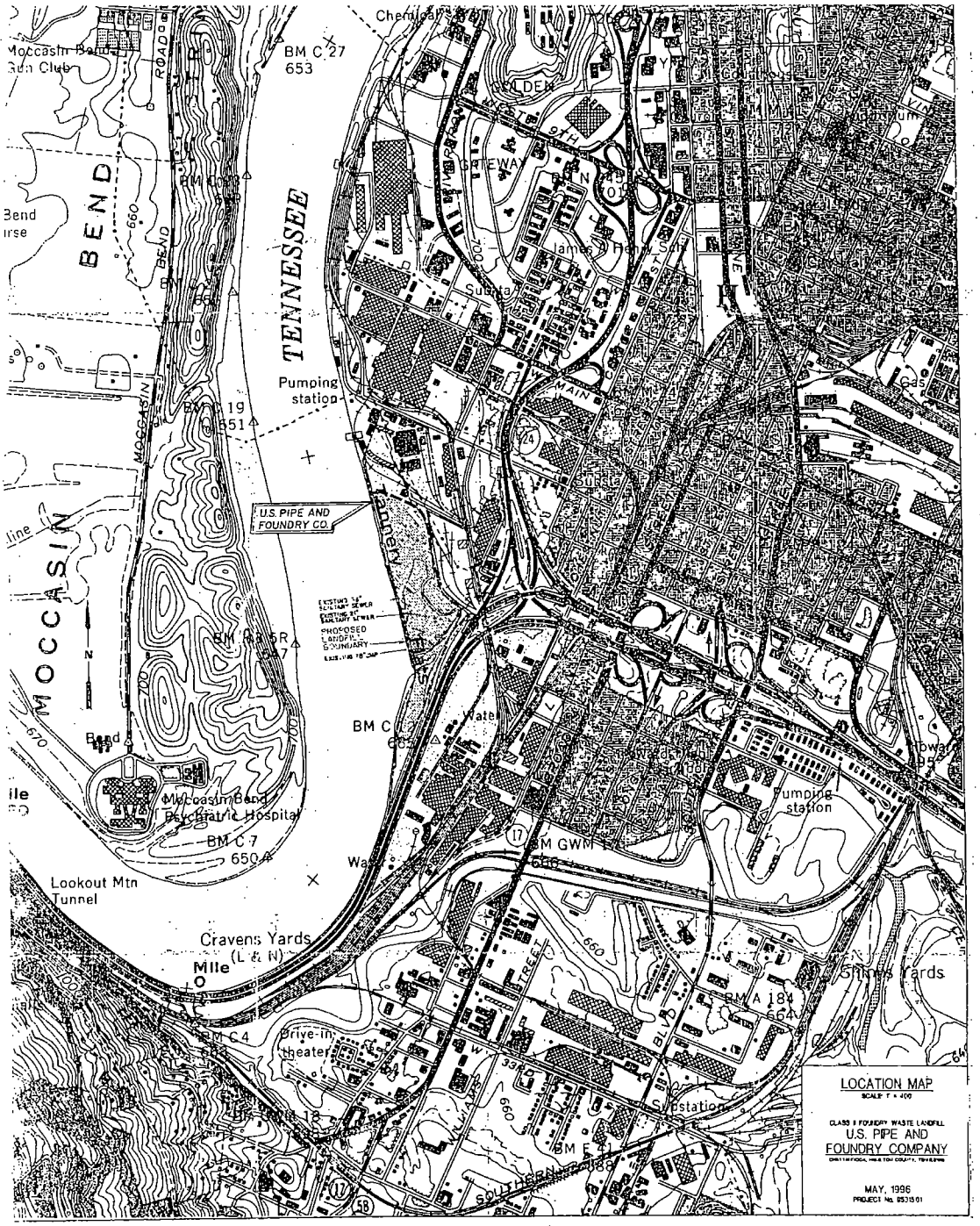
The facility will be closed in such a manner that the need for further maintenance is minimized. Closure and post closure care will minimize or eliminate escape of solid waste constituents to the ground or surface waters. Appendix VIII has the detailed Closure/Post Closure Plan.

12.0 CONSTRUCTION QUALITY ASSURANCE PLAN

Due to the fact that the U.S. Pipe Class II Foundry Waste Landfill Facility will not require a liner system or final cover, a construction quality assurance plan will not be included in this report.

13.0 FUTURE USE OF SITE

There is no planned future use of site.


Moccasin Bend Gun Club
BM C 27
653
Chemical
BEND
TENNESSEE
Pumping station
U.S. PIPE AND FOUNDRY CO.
MOCCASIN
Moccasin Bend Psychiatric Hospital
BM C 7
650A
Lookout Mtn Tunnel
Cravens Yards (L & N)
Mile
Drive-in theater
Pumping station
BM GWM
Shops Yards
BM A 184
664
Substation
LOCATION MAP
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
MAY, 1996

MWPS007478

RECEIVED
AUG 30 1983
Plant Engineering

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
SOUTHEAST REGIONAL OFFICE
2501 MILNE STREET
CHATTANOOGA, TENNESSEE 37406

August 9, 1983

CERTIFIED MAIL
234 7955263

Mr. John H. Watson
Environmental Engineer
U. S. Pipe and Foundry Company
3300 First Avenue, North
Birmingham, Alabama 35202

Re: Geologic Approval - Foundry Sand Disposal Site
U. S. Pipe and Foundry Company
Chattanooga

Dear Mr. Watson:

This office has completed the geologic evaluation of an existing on-site foundry sand disposal area proposed for registration by U. S. Pipe and Foundry Company. The site, located on the east side of the Tennessee River at mile 461.5, was visited by Mr. Bill Krispin, staff geologist, on June 8, 1983.

Based on Mr. Krispin's evaluation, the site is considered geologically suitable, with certain restrictions, for disposal of the company's non-hazardous, foundry sand waste. (See enclosed geologic evaluation.)

In order to proceed with site registration, you must now submit detailed site construction and operational plans to this office for review. The plans must be designed to conform with the enclosed geologic restrictions as well as the requirements outlined in Mike Apple's memo dated July 28, 1983, which is also enclosed. Generally, such plans contain a manual outlining daily operational procedures, a plan review of the operation on a scale of one inch equals one hundred feet and cross sections of the site.

The above referenced plans must be submitted to this office within sixty (60) days of receipt of this writing.

If you have questions or need further assistance, please feel free to call me at 615/624-9921.

Cordially yours,

Steve Baxter

Steve Baxter
Environmental Consultant
Division of Solid Waste Management

SB/ss

enclosures

cc: Mike Apple, Division of Solid Waste Management, Nashville
Becky Harris, Division of Solid Waste Management, Nashville

MWPS007479

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

OFFICE CORRESPONDENCE

FROM	TO	DATE
SWM	Reg.	

DATE: July 28, 1983

TO: Regional Offices

FROM: J. M. Apple (Thru J. T. Tiesler)

SUBJECT: Foundary Sands

In the past several months the proper disposal of foundary sand has been an unresolved problem. The primary concern is that although the material is by definition a "solid waste" the volumes to be disposed, the generally inert characteristics (phenols being an exception), and the desirability as fill material has created a void in the Divisions permitting process. Therefore, the following guidance was drafted.

Potential problems:

1) Phenol release to the environment.
2) Siltation problems and general fill stabilization.
2) Final grade.

Fill requirements:

1) Material defined as non hazardous (i.e. E P Toxicity).
2) Phenols less than 15 ppm.
3) Fill not in ground or surface waters of the State (including floodplain unless proper permits obtained).
4) Vegetative stabilization of surface upon fill to final grade.

"Plan requirements"

1) Plan and profile of existing and final grade.
2) Fill sequence - objective of bringing areas to final grade as soon as possible.
3) Silt pond design to control runoff of entire site with quarterly. monitoring for phenols and any other parameters deemed necessary by revlew of casting process.

FROM	DATE
JMA	
TO	
JT	

The above guidance is general and is to be used at the discretion of the field office manager. Requirements are at a minimum and may be expanded as necessary.

JMA/dlc 4-6

PH 0001

MWPS007480

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
CORDELL HULL BUILDING
NASHVILLE, TENNESSEE 37219

July 27, 1983

Hamilton County

Subject: Geologic evaluation of a foundry sand disposal site for US Pipe and Foundry in Hamilton county.

Date of Visit: June 8, 1983

Category: Industrial

Applicant: US Pipe and Foundry

Site Description

Facility: Existing

Waste Types: Foundry Sands

Location: Chattanooga Quadrangle (105-SE)
The site is located on the east side of the Tennessee River at mile 461.5.
Latitude: 35° 01' 55" Longitude: 85° 19' 25"

Topography: Most of the area has been filled with foundry sands so the natural topography has been changed. The area to the south of the sand is a very gentle, almost flat area. The sands are an estimated 30 feet or more in depth. Old sand areas are used for storage and parking facilities. The active disposal area is currently being mined to recover metal from the sands.

The slopes of the sand, near the river, are steep to very steep with an abundance of vegetation growing on them.

Geologic Setting

Bedrock: Mississippian age Fort Payne chert

Lithology: The Fort Payne is limestone and dolomite, highly siliceous, gray, fine to coarse grained, weathers to thick chert ledges. At the base is the Maury shale, a thin pale green shale.

Beaneath the Fort Payne is the Chattanooga shale which is shale,

brownish black, bituminous and fissle.

Because of the location, next to the river, the surface geology might consist of some alluvial material.

Structure: The beds should be dipping to the southeast. The area has undergone some faulting so the beds might be fractured. The Rockwood formation has been thrust over the Fort Payne chert.

(Geologic Map and Mineral Resources Summary of the Chattanooga Quadrangle, Tennessee.)

Unconsolidated Material: The Fort Payne is usually deeply weathered and consists of a rubble of chert in a silty clay soil. Any alluvium present will be poorly sorted and consist of sands, silts, clays and gravel.

The Soil Survey of Hamilton County lists the soil present as being the Huntington silt loam. It is derived from alluvium washed largely from soils underlain by limestone and exhibits a high water table.

Hydrology

Runoff Directions: Drainage from the sand will be to the west and east.

Receiving Stream: The site will drain to the Tennessee River. The small amount of runoff that flows to the east will enter a culvert beneath the sand and flow to the Tennessee River.

Flooding: The site is in the floodplain of the Tennessee River. According to the Environmental Geology of Hamilton County, Tennessee (Sitterly and Wilson, 1978), the site is within the 100 year flood boundary. Also, the following flood information has been provided by the Tennessee Valley Authority:

	Elevations	
Mile	100-Year Flood	Structure Profile
461.0	655.5	668.0
462.0	656.0	668.0

Other Surface Water Data: Older maps of the area show part of the site once contained backup water from the Tennessee River.

Ground Water: Ground water in the area should be shallow and will likely be affected by the river. Shallow ground water should be found in the alluvium and/or residuum. Ground water movement should be towards the river. Deeper water will be round in the Fort Payne (limestone and dolomite) and will probably be moving in a southeasterly direction.

No seeps were evident at the base of the sand.

Previous Investigation: During the Open Dump Inventory, the Division of Solid Waste Management reviewed this site. The site was found in noncompliance in the categories of floodplain and surface water discharge and put on a compliance schedule.

A 11/20/81 letter from this Division said the E P Toxicity test and the Phenol analysis indicated the waste does not pose a hazardous problem.

Recommendations

The site is only marginally suitable for use due to the flooding, shallow water and the soil and rock type present. However, due to the nature of the waste (foundry sands), the site presently being used as well as the area south of the sand is suitable for disposal. There are, however, some restrictions which must be placed on the site.

1) The site is only for the disposal of foundry sands. Some of the area contains demolition waste, trash, 55 gallon drums and ash.

2) No water should be allowed to pond on any portion of the site.

3) The site is to be properly stabilized to ensure against erosion and siltation and against possible washout due to flooding.

4) The Tennessee Valley Authority has flood easement rights in the area and they must be contacted for the proper permits, if necessary, for the filling a floodplain.

   Also, the City of Chattanooga must be contacted for permits, requirements, etc. the city might have in regards to filling a floodplain.

Recommendations concerning the suitability of the site may be changed upon review of additional information.

William Krispin
Geologist
Division of Solid Waste Management

WK/pas

Hamilton County
US Pipe and Foundry
Chattanooga Quadrangle (105-SE)
Foundry Sand Disposal

Location and boundaries are approximate.

MWPS007484

TENNESSEE VALLEY AUTHORITY
Cleveland, Tennessee 37311
66 Mouse Creek Road

July 22, 1983

Mr. Bill Krispin
Tennessee Department of Health & Environment
Division of Solid Waste Management
701 Broadway, B-30
Nashville, Tennessee 37203

Dear Bill:

This responds to your request for flood hazard information on property located on the right overbank of the Tennessee River between river miles 461.0 and 462.0. Listed below are the 100-year flood and Tennessee Valley Authority (TVA) Structure Profile elevation at the subject miles.

	Elevations	
Miles	100-Year Flood	Structure Profile
461.0	655.5	668.0
462.0	656.0	668.0

The TVA Structure Profile is a contour established by TVA which marks the elevation below which structures or any other forms of development that are subject to significant damage are prohibited on all lands which TVA either owns or has certain landrights. The profile was developed to avoid increasing the flood damage potential in areas affected by reservoir operations. According to our Office of Natural Resources (ONR), TVA has flood easement rights on some properties located on the east overbank. I would suggest that you contact Greg McKibben of ONR to ascertain information on the specific site with which you are concerned. Mr. McKibben can be reached by telephone at (615)745-1783.

Enclosed is a reproduced portion of the Floodway Flood Boundary Map (panel 20) prepared for Chattanooga, Tennessee. Shown thereon are the limits of the 100-year floodplain floodway, and floodway fringe. No development involving fill material is permitted within the floodway. Development requiring the use of fill material and structures are permitted within the floodway fringe. We would recommend that you contact Don Young of the Chattanooga Building Inspector's office to ascertain specific local building requirements. Mr. Young can be reached by telephone at (615)757-5105. Also enclosed for your information is a reproduced portion of the TVA Quadrangle Map (number 105-SE).

MWPS007486

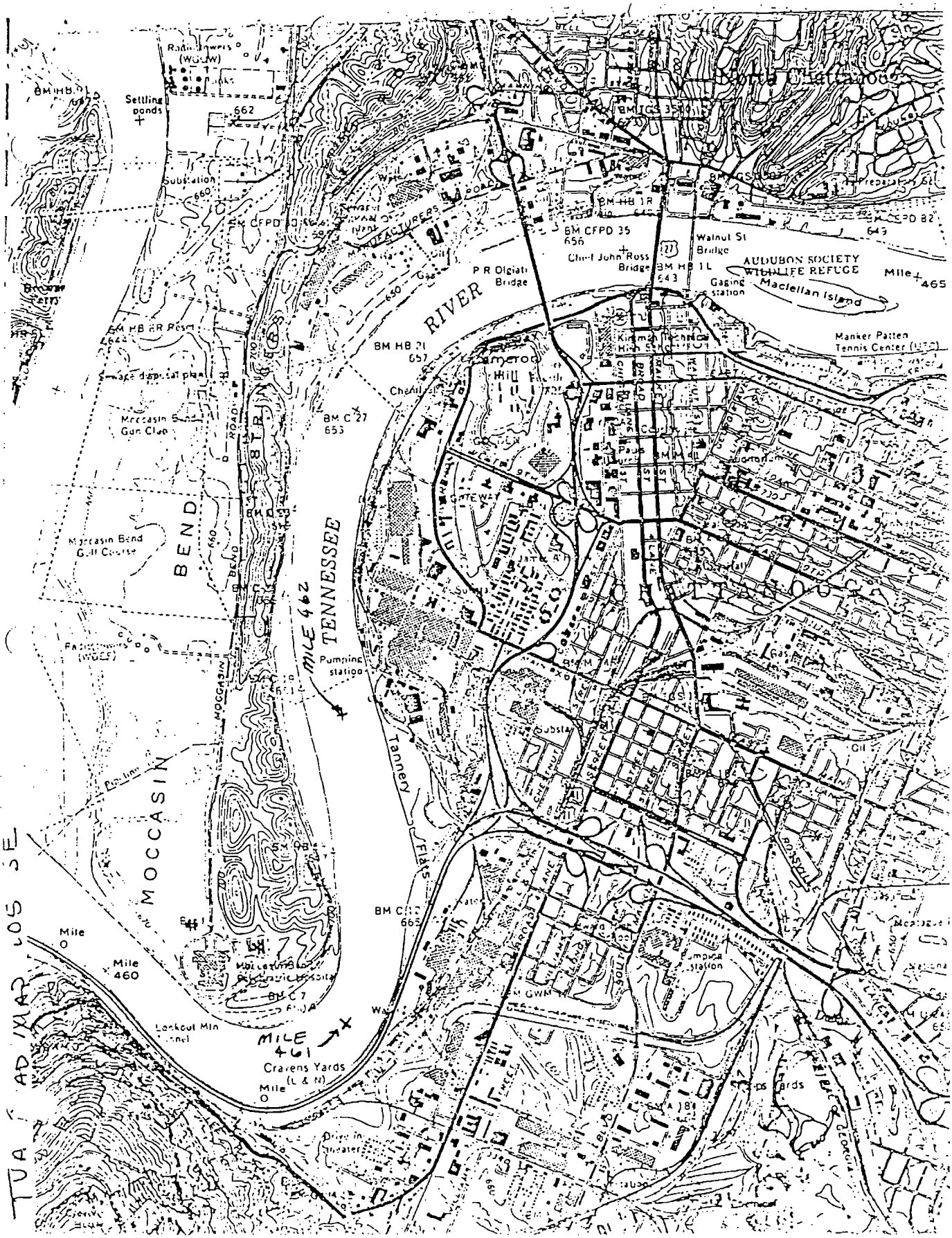
If I can be of further assistance feel free to call on me.

Sincerely,

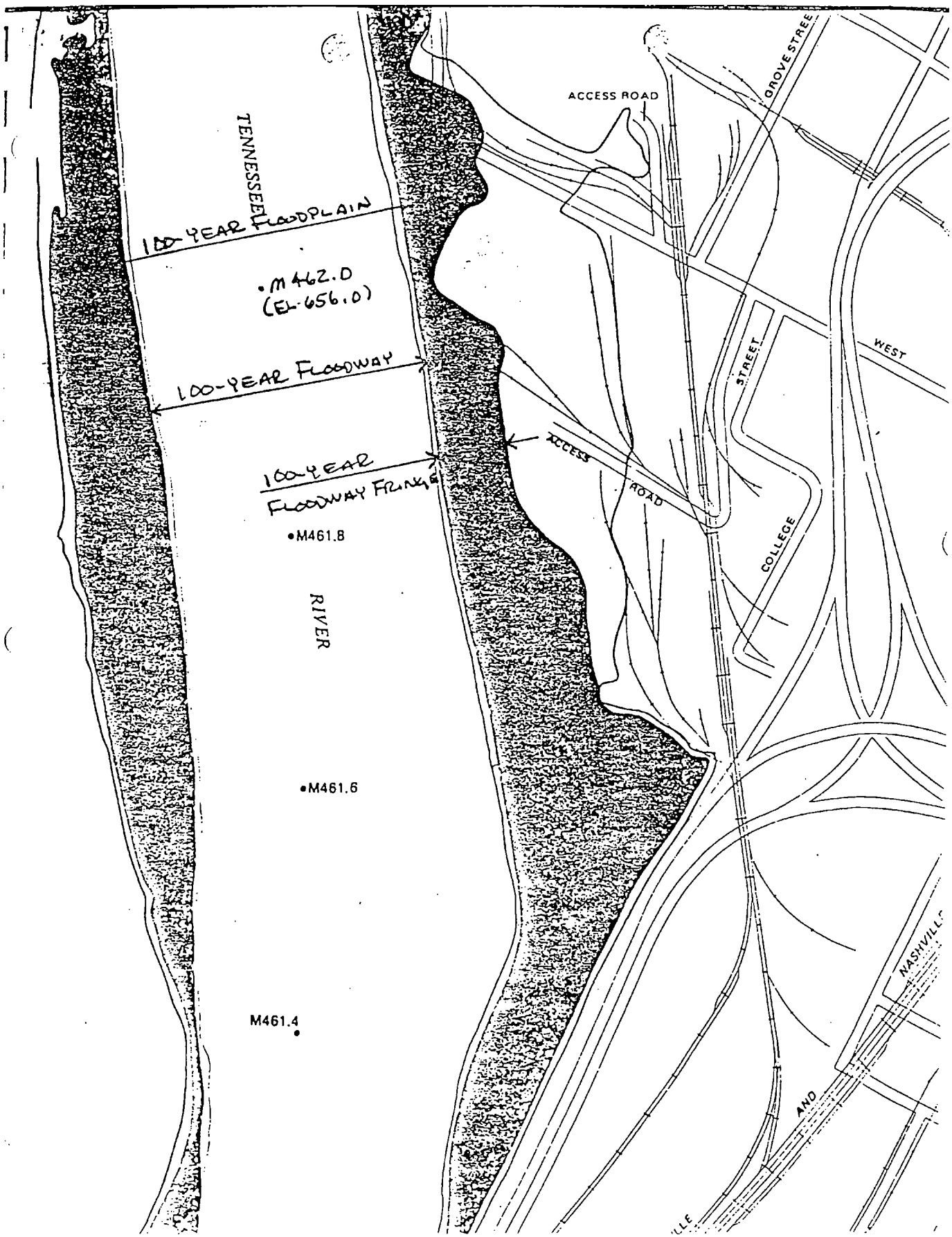
Treasure

Treasure H. Rogers, Jr.
Floodplain Specialist
Floodplain Management Branch

Enclosures
cc (Enclosures):
Mr. Don Young
Chattanooga Building Inspection Office
Room 44, City Hall
Chattanooga, TN 37402


Settling ponds
Substation
BM CFPD 35
656
Chief John Ross Bridge
Walnut St Bridge
AUDUBON SOCIETY WILDLIFE REFUGE
Maclellan Island
Mile 465
P R Olgiati Bridge
RIVER
BM HB 21
657
Manker Patten Tennis Center
Moccasin Gun Club
BM C 27
653
BEND
Moccasin Bend Golf Course
TENNESSEE
MILE 462
Pumping station
Tannery Flats
MOCCASIN
Mile 460
Lookout Mtn Tunnel
MILE 461
Cravens Yards (L & N)
Mile 0
Pumping station
Drive in theater

MWPS007488


TENNESSEE
RIVER
100-YEAR FLOODPLAIN
•M462.0
(EL-656.0)
100-YEAR FLOODWAY
100-YEAR
FLOODWAY FRINGE
•M461.8
•M461.6
M461.4
ACCESS ROAD
ACCESS
ROAD
GROVE STREET
WEST
STREET
COLLEGE
NASHVILLE
AND

MWPS007489

APPROXIMATE SCALE

600 0 500 FEET

500-Year Flood Boundary

100-Year Flood Boundary

FLOODWAY FRINGE

FLOODWAY

100-Year Flood Boundary

500-Year Flood Boundary

Approximate 100-Year Flood Boundary

Cross Section Line

Elevation Reference Mark RM7

River Mile • M1.5

NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Insurance Administration.

This map was prepared to support minimum flood plain management regulations; it may not show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY

FLOOD BOUNDARY AND FLOODWAY MAP

CITY OF

CHATTANOOGA, TENNESSEE

HAMILTON COUNTY

PANEL 20 OF 30

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER

470072 0020 A

EFFECTIVE DATE:

SEPTEMBER 3, 1980

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

FEDERAL INSURANCE ADMINISTRATION

MWPS007490

McGill
ASSOCIATES

April 22, 1996

Mr. Jack Wilkinson
City of Chattanooga Public Works Department
Engineering Division
101 East 11th Street
Chattanooga, Tennessee 37402

RE: U.S. Pipe Class II Foundry Waste Landfill
Chattanooga, Tennessee

Dear Mr. Wilkinson:

I spoke with Ella Collum of the City Engineering Department this morning to determine if there are any City restrictions or permits required for filling adjacent to the Tennessee River at an elevation lower than the 100 year flood but above the designated floodway. She advised me to contact the City Stormwater Department for any possible permits. We have contacted Tom Scott in the Stormwater Department and he has indicated that he would like to review the landfill construction plans prior to making a determination regarding City permits.

I have also contacted the following individuals in regard to possible permit requirements:

Gloria Haney/Chattanooga Planning Commission
Paul McAllister/City of Chattanooga Building Inspection Department
Nancy Maynor/Hamilton County Engineers Office

In each case, I was told that no permits would be required by their respective agency. In regard to permit requirements by the City of Chattanooga, McGill Associates will proceed from this point forward with Tom Scott in the City Stormwater Department. Please contact me as soon as possible if you are not in agreement with the above or if their are additional City permit requirements. Thank you in advance for your help and cooperation.

Sincerely,

McGILL ASSOCIATES, P.A.

Robert B. Mason

Robert B. Mason

cc: Jim Book/U.S. Pipe and Foundry Company
95315.01

City of Chattanooga

April 30, 1996

MAY 1996
McGILL ASSOC
RECEIVED

Mr. Robert B. Mason
McGill Associates, P.A.
P. O. Box 4187
Sevierville, Tennessee 37864

Dear Mr. Mason:

This letter has reference to your correspondence regarding permit requirements for a foundry waste landfill to be located near the Tennessee River. In this connection, I wish to point out that permitting of the foundry waste landfill falls within the jurisdiction of the Solid Waste Management Department of the State of Tennessee. You may consult with them before proceeding with the project development.

The City of Chattanooga's Stormwater Management Division has authority to issue the erosion control permit and look for any violations during the construction stage.

If I can be of any further assistance, please call me.

Sincerely,

J. D. Wilkinson, Jr., P.E.
City Engineer

JDW:ch

cc: Tom Scott, Stormwater Management Manager

Department of Public Works
Suite 210, City Hall 37402 • (423) 757-5110

MCI/CONSULTING ENGINEERS, INC.
P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

March 7, 1984

Mr. John Case
U.S. Corps of Engineers
Regulatory Branch
P.O. Box 1070
Nashville, TN 37202

RE: U.S. Pipe and Foundry Company
Industrial Landfill; MCI-83-592

Dear Mr. Case:

On January 10, 1984, I called to determine if a Corps of Engineers, 404 permit would be required for the referenced project. You advised that the permit would be required only if fill were discharged below ordinary high water of the Tennessee River. MCI has proceeded with design of the facility with all fill to be placed above the TVA flowage easement. The 404 permit should therefore not apply to the project and no application is planned.

Please contact me as soon as possible if you are not in agreement with the above.

Sincerely,

MCI/CONSULTING ENGINEERS, INC.

Marvin H. Bowers, P.E.
Senior Civil Engineer

MHB:jll

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
EASTERN PERMITS FIELD OFFICE
POST OFFICE BOX 465
LENOIR CITY, TENNESSEE 37771

IN REPLY REFER TO:

April 9, 1984

ENVIRONMENTAL SERVICE

APR 11 1984

ORNOP-F/E

SUBJECT: Proposed Landfill at Tennessee River Mile 461.7L, Hamilton County, Tennessee

Mr. John Watson
U.S. Pipe and Foundry Company
Post Office Box 10406
Birmingham, Alabama 35202

Dear Mr. Watson:

This is in regard to your recent application for Department of the Army approval of a landfill at your Chattanooga, Tennessee foundry. I have reviewed your application and plans and determined that a discharge of fill material will not occur below the 634 normal summer pool elevation. In this respect, a Department of the Army Permit is not required for your proposed work.

In order to prevent the erosion of the fill adjacent to the 634 elevation, you should take all necessary action to stabilize the landfill material. This may be accomplished by the use of vegetation and/or riprap. During construction, interim protective measures such as straw bales and silt fences should be utilized until permanent protection has been established.

In regard to your landfill operation and associated sedimentation pond, you should contact the Tennessee Department of Public Health, Water Management Division, 2501 Milne Avenue, Chattanooga, Tennessee 37406 about possible State permit requirements.

We appreciate the opportunity to review your proposed project. Should you have any questions or comments please contact me at the above address or telephone (615) 986-7296.

Sincerely,

Michael L. Davis
Regulatory Specialist
Operations Division

Copy Furnished:
Tennessee Department of Public Health
Water Management Division
2501 Milne Avenue, Chattanooga, Tennessee 37406

MCI/ CONSULTING ENGINEERS, INC.

P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

March 7, 1984

Mr. Richard Tomshack
Tennessee Valley Authority
464 Lupton Building
Division of Land Management
Chattanooga, TN 37401

RE: U.S. Pipe and Foundry Company
Industrial Landfill; MCI-83-592

Dear Mr. Tomshack:

On January 17, 1984, I called to determine if a TVA Section 26A approval would be required for the referenced project. You advised that TVA maintained a flowage easement for the Tennessee River to Elevation 636 M.S.L. in the vicinity of the project and that no 26A approval would be required if all fill was placed above that contour. MCI has therefore proceeded with design based on all fill being placed above Elevation 636 M.S.L. and will not make application for section 26A approval.

Please contact me as soon as possible if you are not in agreement with the above.

Sincerely,

MCI/CONSULTING ENGINEERS, INC.

Marvin H. Bowers, P.E.
Senior Civil Engineer

MHB:jll

MCI/ CONSULTING ENGINEERS, INC.

P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

March 21, 1984

Mr. John Watson
U. S. Pipe and Foundry Co.
P. O. Box 10406
Birmingham, AL 35202

Dear Mr. Watson:

RE: Industrial Landfill at
Chattanooga, TN. MCI 83-592

Enclosed is a completed TVA Section 26a application which is to be submitted for the referenced operation. Please complete the signature section and forward to:

Supervisor, Land and Facilities Mgmt. (East)
Division of Natural Resource Operations
P. O. Box 606
Athens, TN. 37303

744-5300

Please contact me if you have any questions.

Sincerely,

MCI/CONSULTING ENGINEERS, INC.

Marvin H. Bowers, P.E.
Senior Engineer

MHB:jzd

APPLICATION FOR

Department of the Army Permit and/or Tennessee Valley Authority Section 26a Approval

The Department of the Army (DA) permit program is authorized by Section 10 of the River and Harbor Act of 1899 and Section 404 of The Clean Water Act (P.L. 95-217). These laws require permits authorizing structures and work in or affecting navigable waters of the United States and the discharge of dredged or fill material into waters of the United States. Section 26a of the Tennessee Valley Authority Act, as amended, prohibits the construction, operation, or maintenance of any structure affecting navigation, flood control, or public lands or reservations across, along, or in the Tennessee River or any of its tributaries until plans for such construction, operation, and maintenance have been submitted to and approved by the Tennessee Valley Authority (TVA).

Two sets of original drawings on 8"x10-1/2" tracing paper or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings) and be submitted to the District Commander and appropriate TVA office at the addresses listed below. An application that is not complete will be returned for additional information. Information in the application is made a matter of public record through issuance of a public notice, if warranted. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the application. If necessary information is not provided, the application cannot be processed nor can a permit/approval be issued.

DA and TVA Main Office	TVA Office Location	Mailing Address
Commander, Nashville District U.S. Army Corps of Engineers Post Office Box 1070 Nashville, Tennessee 37202	202 West Blythe Street Paris, Tennessee Phone: 901-642-2041	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations Post Office Box 280 Paris, TN 38242-0280
	170 Office Service Warehouse Muscle Shoals, Alabama Phone: 205-386-2221	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations 170 Office Service Warehouse Muscle Shoals, AL 35660
Director of Land and Forest Resources Tennessee Valley Authority Norris, Tennessee 37828	1101 Congress Parkway Athens, Tennessee Phone: 615-745-1783	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations Post Office Box 606 Athens, Tennessee 37303
	2611 West Andrew Johnson Highway Morristown, Tennessee Phone: 615-586-8400	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations 2611 West Andrew Johnson Highway Morristown, Tennessee 37814

Name and Address of Applicant

U. S. Pipe and Foundry Co.
P. O. Box 10406
Birmingham, AL 35202
Attn: Mr. John Watson

Telephone Number
Home
Office 205-254-7434

Name, Address, and Title of Authorized Agent

N.A.

Telephone Number
Home
Office

Location where activity exists or will occur (include Stream Name and Mile, if known)

U. S. Pipe and Foundry Co.
Chattanooga, TN.

Tennessee River - Mile 461.7

Application submitted to TVA. Submit to DA if appropriate

DA ☐ Yes ☐ No TVA ☒ Yes ☐ No

Date activity is proposed to commence 1984

Date activity is proposed to be completed 2010

Names, addresses, and telephone numbers of adjoining property owners, lessees, etc., whose properties also join the waterway.

Property to the north and east is also owned by the permittee. Property along the southern and southeastern boundaries forms the right of way for Interstate 24.

List of previous DA/TVA permits/approvals None ☐ DA _____ Permit Number ☐ TVA _____ Date

DA/TVA JULY 1979

MWPS007497

Is any portion of the activity for which authorization is sought now complete? ☐ YES ☒ NO

If answer is "Yes" attach explanation. Month and year the activity was completed

_____. Indicate the existing work on the drawings. A large portion of the area has been landfilled over a 30 year period, but the landfill is not complete.

List all approvals or certifications required by other federal, interstate, state or local agencies for any structures, construction, discharges, deposits or other activities described in this application.

Issuing Agency	Type Approval	Identification No.	Date of Application	Date of Approval
U. S. Pipe and Foundry is in the process of securing registrations for operation by the TN. Dept. of Health and Environment, Division of Solid Waste Management. This permit will include any necessary accompanying permits, such as a discharge permit from the Division of Water Management.				

Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein?

☐ Yes ☒ No (If "Yes" attach explanation)

Describe in detail the proposed activity, its purpose and intended use (private, public, commercial or other) including description of the type of structures, if any to be erected on fills, or pile or float-supported platforms, the type, composition and quantity of materials to be discharged or dumped and means of conveyance, and the source of discharge or fill material. If additional space is needed, please attach additional sheets.

Wastes associated with iron foundry operations have been disposed at this portion of the plant property along the Tennessee River for over 30 years by U. S. Pipe and Foundry. Reportedly, there were disposal operations at this location many years before aquisition by U. S. Pipe and Foundry. The proposed activity will consist of landfilling in a planned sequence, thereby allowing the establishment of vegetative growth on filled portions. Included in the operation will be corrective measures to provide greater stability of the sideslope, to preclude the sloughing of any materials into the river. To prevent sediment from washing off site, drainage will be directed towards a sedimentation pond which has been designed to accomodate the 10 year, 24 hour storm. The total yearly waste volume for the landfill is approximately 48,250 tons (30,000 cubic yards). The landfill is projected for completion in 2010. There will be 0.24 acre feet of fill between elevations 636 and 640.

Application is hereby made for approval of the activities described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

_____ Date

_____ Signature of Applicant or Authorized Agent

* The application must be signed by the applicant; however, it may be signed by a duly authorized agent if this form is accompanied by a statement by the applicant designating the agent and agreeing to furnish upon request, supplemental information in support of the application.

18 U. S. C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of The United States knowingly and willfully falsifies, conceals, or covers up by any trick scheme, or device a material fact of makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both. *Do not send a permit processing fee with this application. The appropriate DA fee will be assessed when a permit is issued.*

Exhibit 3

REPORT OF THE ANTICIPATED ENVIRONMENTAL CONSEQUENCES RESULTING FROM THE ERECTION OF THE PROPOSED STRUCTURE

Applicant must supply sufficient answers to the following five questions to enable TVA to determine if an environmental statement is required pursuant to Section 102 of the National Environmental Policy Act, Public Law 91-190.

1. What is the probable impact of the proposed structure on the environment?

   The majority of the fill is currently existing. The proposed operation will be beneficial to the environment, as modification of existing steep out slopes and the sequential establishment of vegetation will reduce siltation entering the Tennessee River at RM 461.5.

2. Are there any probable adverse environmental consequences which cannot be avoided?

   No

3. What are the alternatives to the proposed structure?

   The only alternative would be for U. S. Pipe and Foundry to discontinue use of the site and dispose of their foundry wastes elsewhere. Off-site would be cost prohibitive, and is therefore not a viable alternative. The disposal implementation of engineered filling operations is projected to have a positive effect on the environment, as stated in No. 1 above.

4. What is the relationship between the local short-term uses of the environment and the maintenance of long-term productivity which will result from the proposed structure?

   The landfill (structure) will have a long-term impact as landfilling is projected to continue until 2010. However, the impact to the environment is expected to be positive, with silt loads to the river being reduced by engineered construction and operations.

5. Is there any irreversible or irretrievable commitment of resources which would be involved by virtue of the proposed structure?

   The land that will be occupied by the landfill has been permanently committed.

TENNESSEE VALLEY AUTHORITY
DIVISION OF SERVICES AND FIELD OPERATIONS
Post Office Box 606
Athens, Tennessee 37303

April 20, 1984

Mr. J. H. Watson
Principal Environmental Engineer
United States Pipe and Foundry Company
3300 First Avenue North
Birmingham, AL 35202

Dear Mr. Watson:

NICKAJACK RESERVOIR - TRACT NO. DBA-419F - TENNESSEE RIVER MILE 461.7L - MAP NO. 14D

In accordance with your request, TVA authorizes you to place 0.24-acre feet of fill, hereinafter referred to as "facility," in accordance with the enclosed plans and location map, subject to the conditions attached hereto and made a part hereof. Please read the authorization, including the attached conditions carefully; and if acceptable, sign, date, and return the enclosed copy of this letter to my office. You should retain the extra copy for future reference. The authorization is not effective until the signed acceptance is received by TVA.

Please contact Greg McKibben of my staff at 745-1783 (Athens), 751-2088 (Chattanooga), or 632-2088 (Knoxville) if you have any questions about this matter.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Grover C. Whitley, Supervisor
Land and Facilities Management
Field Operations, Eastern Area

WGM:PL
Attachments
cc: U.S. Army Corps of Engineers
P.O. Box 465
Lenoir City, TN 37771

M. D. Ramsey, 238 NRB-N (Attachments)

Prepared by William G. McKibben

The aforesaid terms and conditions accepted this _____ day of _____ 1984.

_____
Signature

An Equal Opportunity Employer

AUTHORIZATION TO CONSTRUCT FACILITIES
AFFECTING TVA LANDS AND/OR LANDRIGHTS

General Conditions:

1. You agree to make every reasonable effort to construct and operate the facility authorized herein in a manner so as to minimize any adverse impact on water quality, fish, wildlife, and natural environmental values.

2. You are responsible for accurately locating your facility, and this authorization is valid and effective only if your facility is located on or fronting property you own or lease as shown on your application.

3. This permit may be revoked by TVA at any time by written notice mailed to you or posted on the premises or facility.

4. You agree to remove the facility or any part thereof at your sole expense promptly upon written notice from TVA to do so in the event that (1) this authorization is revoked; (2) the facility is not completed in accordance with approved plans; (3) the facility is not, in TVA's judgment, being maintained as provided herein; or (4) the facility is abandoned after completion. In the event you fail to carry out your responsibilities for removal in any part of these circumstances within 30 days of written notice to do so, TVA shall have the right to remove, or cause to be removed, the facility or any part thereof; and you agree, by your acceptance of this authorization, to reimburse TVA for all costs incurred in connection with such removal, including applicable overhead.

5. The facility will be maintained in a good state of repair and in good, safe, and substantial condition at all times.

6. The facility will not be altered, modified to enclose more space, or enlarged in any manner unless TVA's written approval of plans has been obtained prior to commencing such work.

7. You assume all risks to persons or property resulting from the maintenance and use of this facility. You also assume all risk of damages to facility or to property used, moored, or stored in connection therewith resulting from lake fluctuations, waves caused by wind or passing boats, or from any other causes.

8. You recognize and understand that this authorization conveys no property rights, grants no exclusive license, and in no way restricts the general public's privilege of using shoreland owned by or subject to public access rights owned by TVA. It is also subject to any existing rights of third parties.

9. You agree not to use or permit the use of the premises, facilities, or structures for any purposes that will result in the draining or dumping into the reservoir of any refuse, sewage, or other material in violation of applicable standards or requirements relating to pollution control of any kind now in effect or hereinafter established.

(Additional conditions on reverse side)

10. Any transfer of facility to a third party will automatically revoke this authorization unless prior written notice of such proposed transfer is given to the supervisor and the transferee agrees in writing to comply with all terms and conditions of this authorization.

11. For purposes of bank stabilization, no portion of the facility will be constructed in excess of two feet from the existing shoreline at normal maximum pool elevation of the reservoir.

12. Buildings or other enclosed structures containing sleeping or living accomodations, including toilets and related facilities, or that have enclosed floor area in excess of 25 square feet are prohibited.

13. Ski jumps will not be left unattended for extended periods of time. All facilities will be tied to the shoreline or to a boathouse or pier fronting your property at the completion of each day's activities.

14. All land disturbing activities shall be conducted in accordance with best management practices as defined by Section 208 of the Clean Water Act and implementing regulations to control erosion and sedimentation so as to prevent adverse water quality and related aquatic impacts. Such practices shall be consistent with sound engineering and construction principles; applicable Federal, State, and local statutes, regulations, or ordinances; and proven techniques for controlling erosion and sedimentation.

Special Conditions:

McGill
ASSOCIATES

Memorandum

DATE: March 8, 1996

TO: Rick Lance/TVA

FROM: Robert Mason/McGill Associates, P.A.

RE: U.S. Pipe and Foundry Co. - Section 26a Permit

CC: File

Message

As a follow up to our phone conversation earlier today, I a sending you a copy of the original application for a TVA Section 26a permit by the U. S. Pipe and Foundry Company. As we discussed, the permit was reviewed by TVA before, however, it was never signed by U.S. Pipe and Foundry due to the fact that they have been in the process since then of applying for a landfill permit from the State.

I am also including some related correspondence from TVA which may be useful to you at this time. We appreciate you providing us with the TVA flowage easement, 100 year flood and other information related to the permit informally at this time. This will allow us to confirm our design limitations prior to finalizing the plans and specifications. As we discussed yesterday, we will be submitting a final set of plans to you along with a letter asking whether or not our original permit application will suffice. Please do not hesitate to call me at 423-908-0575 if you have any questions or need additional information.

APPLICATION FOR

Department of the Army Permit and/or Tennessee Valley Authority Section 26a Approval

The Department of the Army (DA) permit program is authorized by Section 10 of the River and Harbor Act of 1899 and Section 404 of The Clean Water Act (P.L. 95-217). These laws require permits authorizing structures and work in or affecting navigable waters of the United States and the discharge of dredged or fill material into waters of the United States. Section 26a of the Tennessee Valley Authority Act, as amended, prohibits the construction, operation, or maintenance of any structure affecting navigation, flood control, or public lands or reservations across, along, or in the Tennessee River or any of its tributaries until plans for such construction, operation, and maintenance have been submitted to and approved by the Tennessee Valley Authority (TVA).

Two sets of original drawings on 8"x10-1/2" tracing paper or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings) and be submitted to the District Commander and appropriate TVA office at the addresses listed below. An application that is not complete will be returned for additional information. Information in the application is made a matter of public record through issuance of a public notice, if warranted. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the application. If necessary information is not provided, the application cannot be processed nor can a permit/approval be issued.

DA and TVA Main Office	TVA Office Location	Mailing Address
Commander, Nashville District U.S. Army Corps of Engineers Post Office Box 1070 Nashville, Tennessee 37202	202 West Blythe Street Paris, Tennessee Phone: 901-642-2041	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations Post Office Box 280 Paris, TN 38242-0280
	170 Office Service Warehouse Muscle Shoals, Alabama Phone: 205-386-2221	Supv., Land and Facilities Mgmt. (West) Division of Natural Resource Operations 170 Office Service Warehouse Muscle Shoals, AL 35660
Director of Land and Forest Resources Tennessee Valley Authority Norris, Tennessee 37828	1101 Congress Parkway Athens, Tennessee Phone: 615-745-1783	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations Post Office Box 606 Athens, Tennessee 37303
	2611 West Andrew Johnson Highway Morristown, Tennessee Phone: 615-586-8400	Supv., Land and Facilities Mgmt. (East) Division of Natural Resource Operations 2611 West Andrew Johnson Highway Morristown, Tennessee 37814

Name and Address of Applicant

U. S. Pipe and Foundry Co.
P. O. Box 10406
Birmingham, AL 35202
Attn: Mr. John Watson

Telephone Number
Home _____
Office 205-254-7434

Name, Address, and Title of Authorized Agent

N.A.

Telephone Number
Home _____
Office _____

Location where activity exists or will occur (include Stream Name and Mile, if known)

U. S. Pipe and Foundry Co.
Chattanooga, TN.

Tennessee River - Mile 461.7

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List of previous DA/TVA permits/approvals None ☐ DA _____ (Permit Number) ☐ TVA _____ (Date)

DA/TVA JULY 1979

MWPS007504

Is any portion of the activity for which authorization is sought now complete? ☐ YES ☒ NO

If answer is "Yes" attach explanation. Month and year the activity was completed _____. Indicate the existing work on the drawings. A large portion of the area has been landfilled over a 30 year period, but the landfill is not complete.

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Describe in detail the proposed activity, its purpose and intended use (private, public, commercial or other) including description of the type of structures, if any to be erected on fills, or pile or float-supported platforms, the type, composition and quantity of materials to be discharged or dumped and means of conveyance, and the source of discharge or fill material. If additional space is needed, please attach additional sheets.

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_____ Date

_____ Signature of Applicant or Authorized Agent

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   The land that will be occupied by the landfill has been permanently committed.

TENNESSEE VALLEY AUTHORITY
Cleveland, Tennessee 37311
66 Mouse Creek Road

July 22, 1983

Mr. Bill Krispin
Tennessee Department of Health & Environment
Division of Solid Waste Management
701 Broadway, B-30
Nashville, Tennessee 37203

Dear Bill:

This responds to your request for flood hazard information on property located on the right overbank of the Tennessee River between river miles 461.0 and 462.0. Listed below are the 100-year flood and Tennessee Valley Authority (TVA) Structure Profile elevation at the subject miles.

	Elevations	
Miles	100-Year Flood	Structure Profile
461.0	655.5	668.0
462.0	656.0	668.0

The TVA Structure Profile is a contour established by TVA which marks the elevation below which structures or any other forms of development that are subject to significant damage are prohibited on all lands which TVA either owns or has certain landrights. The profile was developed to avoid increasing the flood damage potential in areas affected by reservoir operations. According to our Office of Natural Resources (ONR), TVA has flood easement rights on some properties located on the east overbank. I would suggest that you contact Greg McKibben of ONR to ascertain information on the specific site with which you are concerned. Mr. McKibben can be reached by telephone at (615)745-1783.

Enclosed is a reproduced portion of the Floodway Flood Boundary Map (panel 20) prepared for Chattanooga, Tennessee. Shown thereon are the limits of the 100-year floodplain floodway, and floodway fringe. No development involving fill material is permitted within the floodway. Development requiring the use of fill material and structures are permitted within the floodway fringe. We would recommend that you contact Don Young of the Chattanooga Building Inspector's office to ascertain specific local building requirements. Mr. Young can be reached by telephone at (615)757-5105. Also enclosed for your information is a reproduced portion of the TVA Quadrangle Map (number 105-SE).

MWPS007507

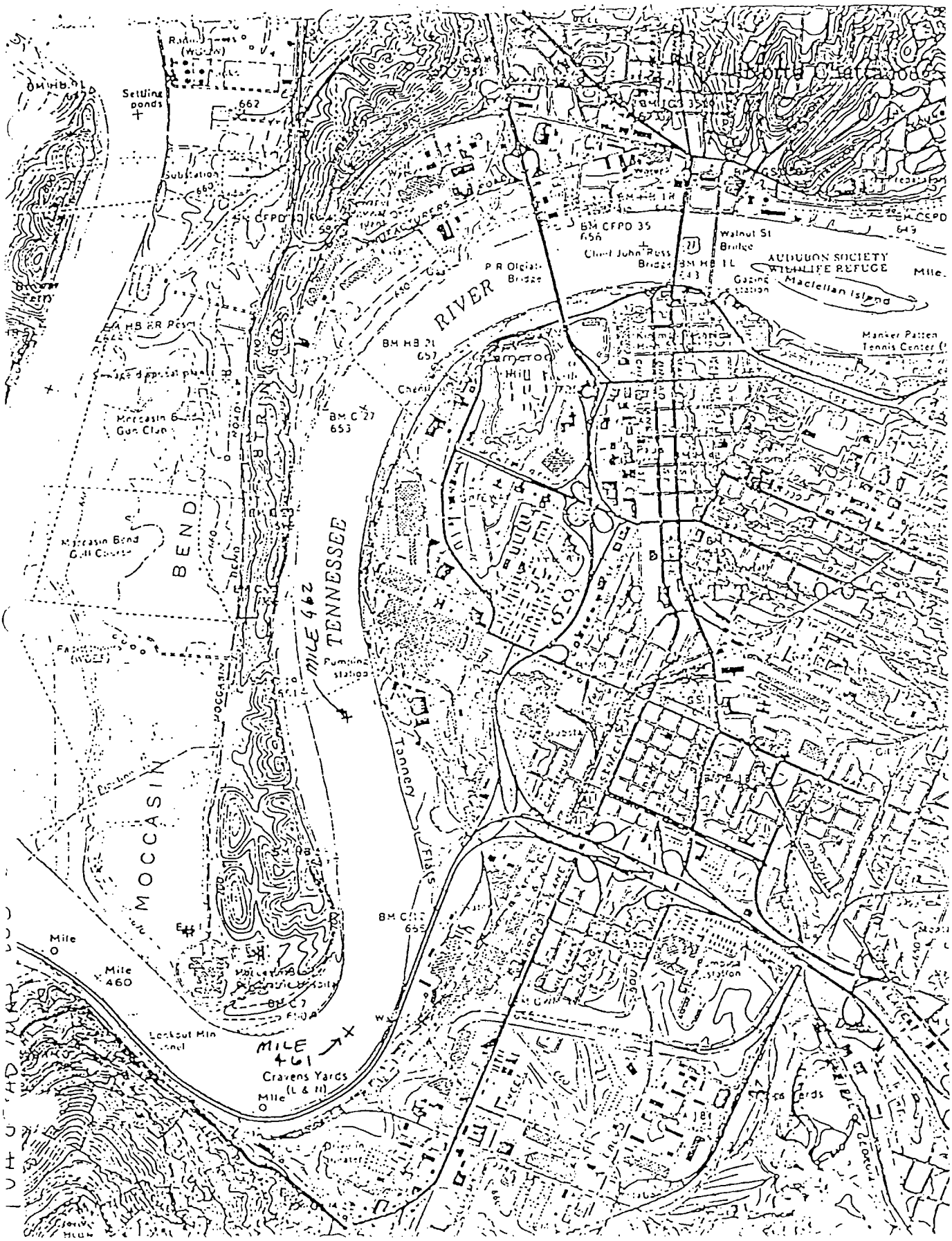
If I can be of further assistance feel free to call on me.

Sincerely,

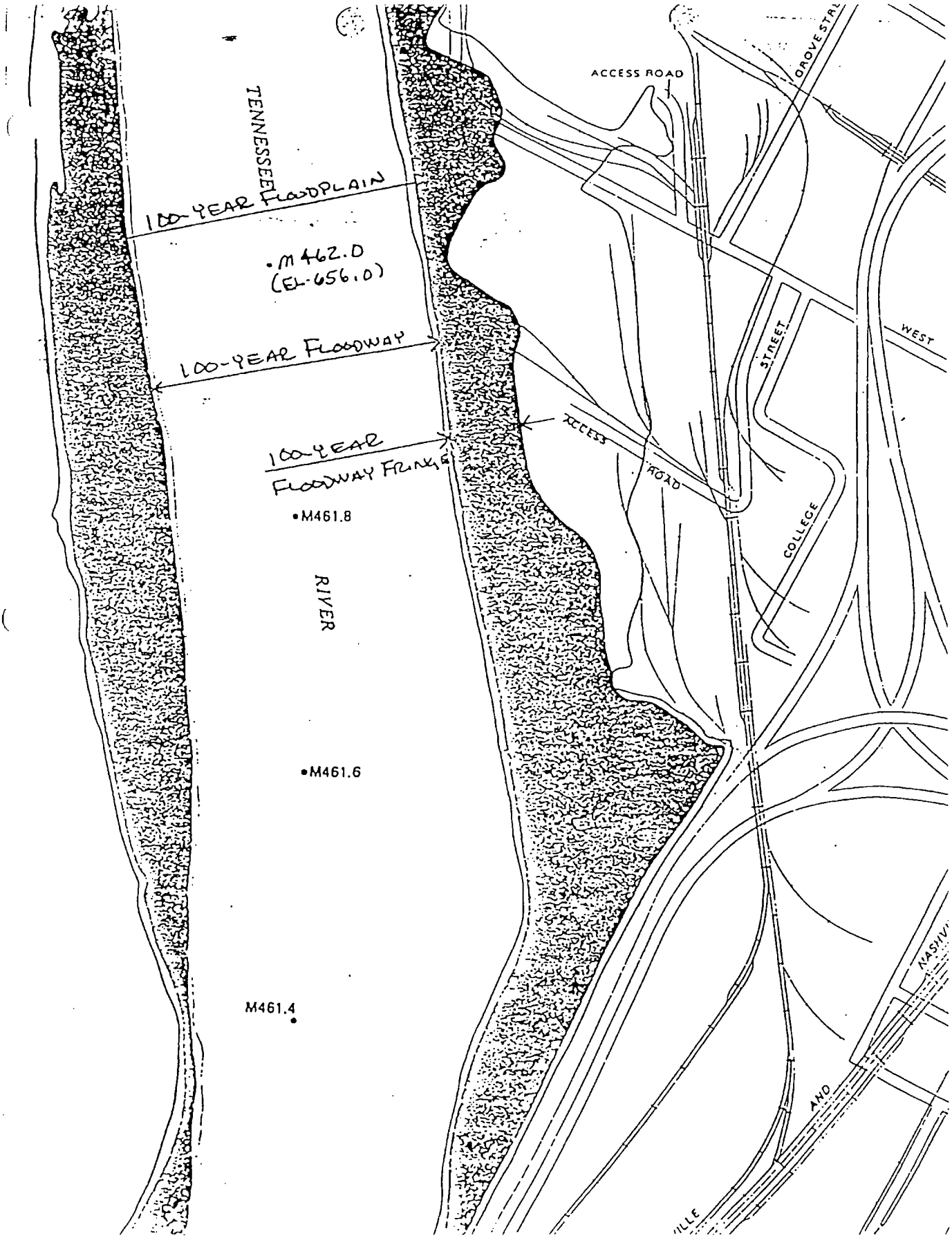
Treasure

Treasure H. Rogers, Jr.
Floodplain Specialist
Floodplain Management Branch

Enclosures
cc (Enclosures):
Mr. Don Young
Chattanooga Building Inspection Office
Room 44, City Hall
Chattanooga, TN 37402


Settling ponds
662
Substation
BM CFPD 35
656
Chief John Ross Bridge
Walnut St Bridge
AUDUBON SOCIETY WILDLIFE REFUGE
Maclellan Island
P R Olgiati Bridge
RIVER
BM HB 21
657
Moccasin Gun Club
BM C 27
653
Moccasin Bend Golf Course
BEND
TENNESSEE
MILE 462
Pumping station
Tannery
MOCCASIN
BM C
650
Mile 0
Mile 460
Lookout Mtn Tunnel
MILE 461
Cravens Yards (L & H)
Mile 0
Pumping station
Yards

MWPS007509


TENNESSEE
RIVER
100-YEAR FLOODPLAIN
M462.0
(EL-656.0)
100-YEAR FLOODWAY
100-YEAR
FLOODWAY FRINGE
M461.8
M461.6
M461.4
ACCESS ROAD
ACCESS
ROAD
COLLEGE
STREET
WEST
GROVE STR
AND

MWPS007510

APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY

FLOOD BOUNDARY AND FLOODWAY MAP

CITY OF

CHATTANOOGA, TENNESSEE

HAMILTON COUNTY

PANEL 20 OF 30

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
470072 0020 A

EFFECTIVE DATE:
SEPTEMBER 3, 1980

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

500-Year Flood Boundary

100-Year Flood Boundary

FLOODWAY FRINGE

FLOODWAY

100-Year Flood Boundary

500-Year Flood Boundary

Approximate 100-Year Flood Boundary

Cross Section Line

Elevation Reference Mark RM7

River Mile M1.5

NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Insurance Administration.

This map was prepared to support minimum flood plain management regulations; it may not show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

MWPS007511

McGill Associates, P.A. P.O. Box 4187 Sevierville, TN 37864-4187

FAX

Faxed successfully 3/8/96 at 10:35 am (RM)

Date: 3/8/96

Number of pages including cover sheet: 10

To:
Rick Lance
TVA

Phone:
Fax phone: 423-954 3814
CC: File

From:
Robert Mason

Phone: 423-908-0575
Fax phone: 423-908-0110

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment

Hard copy mailed today
Thanks - Robert Mason

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
CHATTANOOGA ENVIRONMENTAL FIELD OFFICE
540 McCALLIE AVENUE, SUITE 550
CHATTANOOGA, TENNESSEE 37402-2013
(615) 634-5745 FAX (615) 634-6389

April 26, 1995

James Smallwood, Plant Engineer
U.S. Pipe and Foundry Corporation
P.O. Box 311
Chattanooga, Tennessee 37401

Re: Completeness/Technical Review
Hydrogeology/Geotechnical Report
U.S. Pipe and Foundry Proposed
Class II Landfill (File #33-138)

Dear Mr. Smallwood:

The Division of Solid Waste Management (DSWM) has reviewed the submitted Hydro-Geo report for completeness pursuant to Rule 1200-1-7-.07(6)(a)1. Our review has determined the report/study complete as per the aforementioned rule.

Please note that a technical review was also performed, and has determined it suitable with the following contingencies:

1) If a permit is required from T.V.A. to fill in the 100 year floodway, one must be obtained and submitted to the CFO no later than when submitting engineering plans.

2) If approval from the Corps of Engineers, or Water Pollution Control (DWPC) is required this must be obtained and submitted no later than when submitting engineering plans.

3) Variances must be obtained for Items #1 and 2 along with a variance for buffer standards for waste placed below the required distance above the seasonal high water table.

If questions arise, please feel free to contact David Smith at (615) 634-5776.

Sincerely,

Guy M. Moose
Field Office Manager
Division of Solid Waste Management

GMM/34025116

cc: James Book, Project Engineer, U.S. Pipe and Foundry
Frank Victory, DSWM, Nashville Central Office
DSWM, Central Files, Nashville

UNITED STATES PIPE AND FOUNDRY COMPANY

GENERAL OFFICE
3300 FIRST AVENUE NORTH • BIRMINGHAM, ALABAMA 35202

April 21, 1986

Mr. Steve Baxter, Environmental Specialist
Tennessee Department of Health and Environment
Division of Solid Waste Management
2501 Milne Street
Chattanooga, Tennessee 37406

Re: Chattanooga Plants Landfill
Waste Characterization

Dear Steve:

In accordance with your letter of January 24, 1986, we are hereby submitting the following additional data and comments as a follow-up to the physical/chemical waste characterization which was submitted on December 3, 1985. The following items are listed and numbered in the same order as outlined in your January 24 letter:

1. Desulfurizing ladle slag:

   The results of the Reactivity characteristic tests are shown on the attached data sheet and marked CVF#1. It is our opinion that the results indicate that this waste is not hazardous and would have minimal effects on human health and the environment. The acetylene gas generated (22ppm) is well below the lower explosive limit (lel) of 2.5% (25,000ppm) and should not present a problem on the landfill.

2. Waste core sand:

   The analytical data attached on three types of waste core sand are representative of all waste core sands generated at both CSP and CVF. These data sheets are marked CVF#2, 3, and 4. As you requested, these sand samples were tested directly for the items of concern rather than testing leachate samples from them. Please bear in mind that the concentrations found are not indicative of how much would be leached out by groundwater in a landfill situation. In fact, we are still of the opinion that waste core sand is relatively inert.

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.
CHATTANOOGA, TENNESSEE 37405

MARTIN H. DAVIS
President

615/265-4533

ACCOUNT NO.	1182-001	**DATE**	APRIL 14, 1986
RECEIVED FROM	U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401 MR. JIM SMALLWOOD		
RECEIVED DATE	04/01/86		
MATERIAL	DESULFURIZING LADLE SLAG		
MARKED	U.S. PIPE, CVF NO. 1		
LABORATORY NO.	240,361		

Acetylene Gas Formation

22 ppm Acetylene was liberated when the sample was mixed with water.

Heat

No heat was detected when the sample was mixed with water.

Corrosivity

0.028 mm/year

TECHNICAL LABORATORIES, INC.

Martin H. Davis

MARTIN H. DAVIS
President

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.
CHATTANOOGA, TENNESSEE 37405

MARTIN H. DAVIS
President

615/265-4533

ACCOUNT NO. 1182-001 **DATE** APRIL 14, 1986

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL WASTE SHELL CORE SAND

MARKED U.S. PIPE, CVF NO. 2

LABORATORY NO. 240,362

ENVIRONMENTAL SERVICE
APR 17 1986

Phenols ppm	2.9 ✓
Formaldehyde ppm	0.2 ✓
Cyanide ppm	0.7
Ammonia Nitrogen ppm	16

TECHNICAL LABORATORIES, INC.

Martin H. Davis

MARTIN H. DAVIS
President

ibc

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.
CHATTANOOGA, TENNESSEE 37405

MARTIN H. DAVIS
President

615/265-4533

ACCOUNT NO. 1182-001 **DATE** APRIL 14, 1986

RECEIVED FROM U. S. PIPE & FOUNDRY COMPANY, P. O. BOX 311, CHATTANOOGA, TENNESSEE 37401
MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL WASTE AIR SET SAND

MARKED U.S. PIPE, CVF NO. 3

LABORATORY NO. 240,363

Phenols ppm	1.1
Formaldehyde ppm	0.2
Cyanide ppm	0.2
Ammonia Nitrogen ppm	24

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MR. JIM SMALLWOOD

RECEIVED DATE 04/01/86

MATERIAL WASTE ISOCURE SAND

MARKED U.S. PIPE, CVF NO. 4

LABORATORY NO. 240,364

Phenols ppm	16
Formaldehyde ppm	0.1
Cyanide ppm	0.1
Ammonia Nitrogen ppm	9.8

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MR. JIM BOOK

RECEIVED DATE 03/26/85

MATERIAL BAG HOUSE DUST - CVF source K(b)
V. P.

MARKED GRINDING - Brass Fdy

LABORATORY NO. 226,663

ENVIRONMENTAL SERVICE
APR 24 1985

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

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Barium mg/l	0.068 ✓
Cadmium mg/l	0.14 ✓
Chromium mg/l	0.034 ✓
Lead mg/l	3.1 ✓
Mercury mg/l	0.006 ✓
Selenium mg/l	0.12 ✓
Silver mg/l	0.040 ✓

TECHNICAL LABORATORIES, INC.

Lewis E Cain for

MARTIN H. DAVIS
President

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MR. JIM BOOK

RECEIVED DATE 03/26/85

MATERIAL BAG HOUSE DUST - CVF source K(c)
V. P.

MARKED MELTING - Brass Fdy.

LABORATORY NO. 226,664

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

Arsenic mg/l	0.069 ✓
Barium mg/l	0.079 ✓
Cadmium mg/l	0.064 ✓
Chromium mg/l	0.042 ✓
Lead mg/l	2.5 ✓
Mercury mg/l	0.001 ✓
Selenium mg/l	0.17 ✓
Silver mg/l	0.077 ✓

TECHNICAL LABORATORIES, INC.

Lewis E Cain for

MARTIN H. DAVIS
President

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U. S. Pipe and Foundry Co. - Chattanooga Plants

Physical/Chemical Characterization of Foundry Solid Wastes

(Note: Following numbers "keyed" to attached "Classification of Foundry Wastes.")

1. Used refractories (cupola and ladle linings):

The materials are used in the form of bricks, castables, plastic mortar mixes, and gunning mixes for lining of the cupolas, holding ladles, transfer ladles, etc. Wastes landfilled would likely have the consistency of demolition debris from the destruction of a building of masonry construction. These materials are by their very nature (refractories) highly inert and should present no problems in a landfill. A review of the MSDS on the various products used indicate the following compounds are present in the approximate ranges given:

Aluminum oxide	-	17 to 95%
Silicon dioxide	-	25 to 54%
Calcium oxide	-	0 to 6%
Zirconium oxide	-	0 to 35%
Carbon	-	0 to 55%
Iron oxide	-	trace
Magnesium oxide	-	trace

2. Excess System Sand:

The Green Sand Systems contain (dry basis) over 99% sand (silicon dioxide) with the remainder composed of seacoal, bentonite, and wood flour.

This Process No Longer Exists

Seacoal	-	mixture of bituminous coal and styrene butadiene
Bentonite	-	colloidal clay (hydrous aluminum silicates)
Wood Flour	-	"Charbo," a pulverized cellulose and lignin compound

~~At Chattanooga Soil Pipe (CSP), dust from the Green Sand handling system is collected in the DCE Vokes baghouse and dust from the Disamatic metal pouring and shakeout is collected in the Griffin baghouse.~~

At Chattanooga Valve & Fittings (CVF), dust from the Green Sand handling system (#9 Unit) is collected in the apron conveyor baghouse,

and melting and pouring fumes from this unit are collected by a wet collector as a sludge. In addition, melting and pouring fumes from the valve plant brass foundry are collected in a baghouse located in that area. EP toxicity test data on this waste stream [CVF source K(c)] is attached.

We do not anticipate any environmental problems from the above wastes other than the possibility of their contributing to Total Organic Carbon (TOC) in the landfill groundwater due to the organic nature of seacoal and wood flour.

3. Core Sand:

A small portion of the core sand degrades and ends up in the system sand during shakeout and sand reconditioning, on those systems where sand reclaim is practiced. The core butts screened out during reclaim and the core sweepings, along with unused broken cores, becomes waste for landfilling.

Shell Cores ~~(Used at both CSP & CVF)~~

Shell core sand is primarily sand (91% sand, silicon dioxide) with the remainder consisting of the following:

Phenol - formaldehyde resin	-	3%
Hexamethylene - tetramine (HEXA)	-	0.85%
Iron Oxide	-	0.2%
Calcium Stearate (Calcium soap of stearic acid)	-	0.1%
Water	-	Remainder

Some of these shell cores will be coated with a "blacking" mix containing graphite and clay. At CSP, dust from the Shell Sand Coating System is collected in the Sly 79 baghouse.

Airset (and Pepset) Cores and Molds (CVF only)

The Airset sand cores and molds are primarily sand (98%) with the remainder consisting of the following:

Phenol - formaldehyde no-bake resin	-	1.5%
Benzene Sulfonic Acid	-	0.5%

Isocure Cores (CVF only)

The Isocure cores are primarily sand (98%) with the remaining 2% consisting of the following binders;

Part 1 - Phenolic resin	-	55% of binder
Part 2 - Polymeric isocyanate	-	45% of binder
Catalyst Gas - Triethylamine (TEA)		

Core sand being landfilled is relatively inert and stable since practically all of the organics are emitted either during core making operations or at the time of metal pouring and shakeout. Phenol and ammonia are emitted during core making, with phenol, ammonia, and formaldehyde emitted during metal pouring and shakeout.

4. Cleaning room waste:

No Longer Exists

~~At CSP, these wastes are collected as a fine dust in the Zurn baghouse. It is expected that the dust is composed primarily of sand, fine particles of cast iron, and abrasives from the grinding wheels. The spent steel shot (consistency of birdshot) is not collected by the baghouse, but is landfilled along with the other wastes. We do not anticipate any problems with organics or heavy metals from these waste streams.~~

These same type wastes are collected in the baghouses and rotoclones at the #1, 2, and 3 cleaning sheds at CVF. The grinder booth baghouse dust at the CVF brass foundry is a slightly different waste stream [CVF source K(b)] since it contains metal particles of brass rather than cast iron. EP toxicity test data on this waste stream is also attached.

5. Slag:

~~Both CSP &~~ CVF produce cupola and pouring ladle slag. This slag is a granular material and is considered to be inert. The following slag analysis is from our Bessemer, Alabama plant; however, we would expect both CSP and CVF slags to have similar constituents:

Silicon dioxide	-	48.5%
Iron Oxide	-	3.2%
Aluminum Oxide	-	16%
Calcium Oxide	-	24.4%
Magnesium Oxide	-	2.4%
Manganese Oxide	-	2.5%
Sulfur	-	0.2%

CVF also produces desulfurizing ladle slag, a byproduct of ductile iron operations. In this phase of the operation, the molten iron is treated with calcium carbide for the removal of sulfur. The resultant slag from the reaction of carbide with the molten metal is raked off the treating ladles and subsequently landfilled. A previous analysis of this slag indicated the presence of the following constituents:

Calcium sulfide	-	7%
Calcium oxide	-	19%
Calcium carbide	-	4%
Cast iron	-	70%

6. Cupola baghouse dust:

Data on this waste stream has been provided previously.

7. Coke:

Coke fines as well as unburned coke from the cupola bottom drops may be landfilled as necessary. This waste is also considered to be inert with the following typical analysis:

Fixed carbon	-	93%
Ash	-	6.5%
Volatiles	-	0.5%

8. Ductile treating baghouse dust:

This waste stream is present only at CVF. The molten iron (after desulfurization) is inoculated with a magnesium alloy which causes the graphite in the iron to form spheroidal particles thereby producing ductile iron. The fumes from this turbulent reaction are captured in the subject baghouse. Emission rates are estimated to be approximately 3.3 pounds of dust per ton of metal treated. The dust collected is very fine with the major constituent being magnesium oxide.

The remainder is composed of the following compounds:

Iron oxide
Silicon dioxide
Manganese oxide
Calcium oxide

9. Cement lining wastes:

This waste is present only at CVF. No data is being provided since this waste is simply a mixture of Portland cement, sand and water.

~~10. Paint wastes:~~

Hauled Away For Disposal

~~No data is being provided since the dry paint wastes at CSP are being disposed of by a contract hauler at the local municipal landfill. At CVF, these type wastes will be disposed of in a similar manner in the future.~~

~~11. Process wastewater treatment sludge:~~

No Longer Exists

~~This waste stream is present only at CSP. It is the result of solids removal from process wastewater prior to its recycle back into the plant with some of the clarified wastewater being discharged to the sanitary sewer. The sludge is composed primarily of a slurry mix used as a mold coating compound at the pipe casting machines [93% silica flour (silicon dioxide) and 7% bentonite (clay)] with some fines included from the cupola slagging system (see item 5 above). EP toxicity analytical data on this waste sludge is attached [CSP source H].~~

No Longer Exists

CHATTANOOGA VALVE & FITTINGS PLANT

Sources and Types of Waste For Disposal in "Permitted" Landfill

Source	Code*		Waste Type
A. Cupola Area	6	(a)	Cupola baghouse dust
	5a	(b)	Cupola slag
	7	(d)	Bottom drop coke
	1	(e)	Used refractories
B. Electric Furnaces (3) (Holding only-not melting)	8	(a)	Ductile treating baghouse dust
	5b	(b)	Desulfurizing ladle slag
	5a	(c)	Slag from treating, pouring ladles
	1	(d)	Used refractories (from furnaces & ladles)
C. #9 Unit (Green sand system)	2&3a	(b)	Recycling spillover sand
	2	(c)	Apron conveyor baghouse dust
	2	(d)	Waste binder additives (seacoal, bentonite, woodflour)
	-	(e)	Spilled iron
D. #3 Cleaning Shed	4c	(a)	Blast Cleaner baghouse dust
	4a	(b)	Grinding booths rotoclone dust
	4b	(c)	Steel shot (spent)
E. #1 Cleaning Shed	4c	(a)	Cabinet cleaner baghouse dust
	4a	(b)	Swing grinder rotoclone dust
	4b	(c)	Steel shot (spent)
F. #2 Cleaning Shed	4c	(a)	Blast cleaner baghouse dust
	4a	(b)	Grinding booths rotoclone dust
	4b	(c)	Spent steel shot
G. Coreroom	3b	(a)	Airset, Shell & Isocure scrap cores & sand
	3b	(b)	Airset cores - waste sand and scrap cores
H. #10 Unit (Air set system)	2&3a		Waste mold & core sand
I. #4 Unit (green sand system)	2&3a		Waste mold & core sand
J. Cement Lining	9	(a)	Waste cement mortar
K. Valve Plant, Brass (Foundry Area)	4c	(a)	Shot blast baghouse dust
	4a	(b)	Grinder booth baghouse dust
	2	(c)	Melting & pouring loop baghouse dust
	2&3a	(d)	Waste molding & core sand

Classification of Foundry Wastes

1. Used refractories (cupola and ladle linings).

2. System Sand (molding and including core sand dilution).
   (This includes binder additives and dust collected during handling.)

3. Core Sand:
   a. Core butts - that which doesn't enter system sand.
   b. Core sweepings and broken cores.

4. Cleaning room waste:
   a. Grinding dust (abrasives and metal).
   b. Spent steel shot.
   c. Blast cleaner dust (dust from system and core sand).

5. Slag:
   a. Cupola plus holding and pouring ladle slag.
   b. Desulfurizing ladle slag (spent calcium carbide slag).
   c. Melting of non-ferrous metals.

6. Cupola baghouse dust (collected particulates including coke ash).

7. Coke (fines and cupola bottom drop).

8. Ductile treating baghouse dust.

9. Cement lining wastes (waste cement mortar).
   (Portland cement plus sand.)

After pre-mixing and Stabilization

~~10. Paint wastes.~~ Hauled Away For Disposal

~~11. Process wastewater treatment sludge.~~

No Longer Exists

"Attch. A"

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CHATTANOOGA, TENNESSEE 37405
615/265-4533

MARTIN H. DAVIS
President

ACCOUNT NO. 1182-001 **DATE** APRIL 18, 1985

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MR. JIM BOOK

RECEIVED DATE 03/26/85

MATERIAL BAG HOUSE DUST - CVF source K(b)

MARKED GRINDING - Brass Fdy

LABORATORY NO. 226,663

ENVIRONMENTAL SERVICE
APR 23 1985

ACETIC ACID EXTRACTION per FEDERAL REGISTER
VOL. 45, NO. 98, May 19, 1980

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Silver mg/l	0.040

TECHNICAL LABORATORIES, INC.

Lewis E Cain for

MARTIN H. DAVIS
President

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PR 19 1985

Plant Engineering

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BLVD.
CHATTANOOGA, TENNESSEE 37405
615/265-4533

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Selenium mg/l	0.17 ✓
Silver mg/l	0.077 ✓

TECHNICAL LABORATORIES, INC.

Lewis E Cain for

MARTIN H. DAVIS
President

ibc

GEOTECHNICAL STUDY
U.S. PIPE INDUSTRIAL LANDFILL
CHATTANOOGA, TENNESSEE
GA FILE 87-0662

EDGe

MWPS007531

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LABORATORY TEST RESULTS.....Section II

CALCULATIONS AND DRAWINGS.....Section III

EDGe

Geologic Associates Division

January 11, 1988

THE EDGe

MCI/Consulting Engineers, Inc.
P.O. BOX 20301
Knoxville, Tennessee 37933

Attn: Mr. Chuck Priddy

RE: Geotechnical Study
U.S. Pipe Industrial Landfill
Chattanooga, Tennessee
GA File 87-0662

Gentlemen:

With reference to the above project, we have completed a modest geotechnical study and presented herewith are the data, our comments and recommendations. The purpose of this study is to assess the factors of safety against instability of the waste fill as it presently exists, and to propose a stable final configuration. Important information regarding the limitations of geotechnical studies is included as Section I.

INTRODUCTION

In 1984, we presented our initial study of the subject site which included the existing site conditions, drilling and testing information and subsurface conditions. This information is presented again in the following section herein for clarity. In that study, we recommended that a 25 foot bench be created along an existing 1.5 horizontal to 1 vertical slope adjacent to the river bank at approximately elevation 660. That provided a factor of safety of approximately 1.6 for static conditions and 1.2 during rapid drawdown. Since that initial study, we understand that U.S. Pipe does not wish to disturb this existing slope on the riverside of the land fill, and the Tennessee Division of Solid waste Management (DSWM) is agreeable to not disturbing this existing slope. Accordingly, you have redesigned the fill configuration with a 50 foot terrace above this slope at approximately elevation 680 to 695. Additionally, the State rejected the proposed 1.5 to 1 slope along the

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remaining sides of the fill, although they met the required factor of safety of 1.5. Therefore, the remaining slopes were redesigned at a 2 to 1 slope. Because these remaining slopes will be flatter than originally proposed, we do not feel that further analyses are necessary.

SITE CONDITIONS

As shown by the Plan (Section III), the site being used by U.S. Pipe for their landfilling operations consists of more than 22 acres within the southermost parcel of U.S. Pipe property. The site is located within the corporate limits of Chattanooga, Tennessee and is bounded on the east by Interstate Highway 24 and on the west by the Tennessee River. The location map included on the Plan shows the site's location with regard to nearby topographic and cultural features.

Presently, waste has been disposed within the northern three-fourths of the site. As shown on the appended Profiles, the crest of the waste fill ranged at the time of our field investigation from about elevation 695 feet at the southern end of the waste pile to approximately elevation 655 feet at the northern end. The outslope of the west end of the site has an inclination of about 1.5 horizontal to 1 vertical, where it rests on the bank of the Tennessee River (normal pool elevation is about 656 feet). Surface drainage in the area of the waste fill is fair to poor with the majority of the surface runoff flowing toward the river.

The southern one-fourth of the site is covered by dense vegetation and has a surface elevation ranging from 640 to 645 feet. Surface drainage in this undisturbed and unfilled area is good and toward the river.

EXPLORATION AND TESTING

Seven holes were drilled in conformance with ASTM D 1586 (Standard Penetration Test and Split-Barrel Sampling of Soils). In conjunction with this drilling, relatively undisturbed Shelby tube samples (ASTM D

1587) were recovered from selected borings. The locations of these borings and depths at which the samples were obtained are shown on the Plan and Profiles (Section III).

The soil and waste samples were visually classified by members of our professional staff. Representative samples were tested for grain size distribution, Atterberg limits, unit weight determinations and triaxial compressive strength. Results of the laboratory testing are included in Section II.

SUBSURFACE CONDITIONS

The fill, which consists of sand castings (i.e., sandstone-like fragments ranging in size from gravel to boulders), glass, sand, clay, bentonite, and debris, ranges in thickness from approximately 20 feet to 60 feet and is primarily medium dense to dense. Overall, the waste has a relatively high shear strength and a moderately high coefficient of permeability. Beneath the fill, at an average elevation of 635 feet, the borings encountered alluvial soil consisting of brown, silty, sandy, clay. The alluvail soil has a consistency which ranges from soft to stiff and extends to at least the bottom of our borings. Beneath the waste fill where the alluvium has consolidated to a stiff consistency, it possesses a relatively high shear strength.

Ground water was generally found to coincide with the level of the Tennessee River. Considering the permeability of the fill, we expect that the ground water will respond rapidly to fluctuations in the river level.

DESIGN CONSIDERATIONS

We have reviewed the drawings showing the existing site configuration and the preliminary drawings showing the proposed fill configuration as it will exist upon abandonment. Accordingly, the existing fill and the proposed final fill were analyzed for potential slope instability

during three conditions: (1) steady state seepage; (2) rapid drawdown; and (3) dynamic (earthquake) loading. Moreover, two slopes were analyzed as follows: 1) Section Y-Y, representative of the highest slopes in the new fill and, 2) Section X-X, representative of the steepest slope in the existing fill. Phreatic levels within the fill, as measured in 1984, are used in our assessment of stability during steady state seepage conditions. In our analysis of the rapid drawdown condition, we have used the 100-year flood elevation of 656 feet (as estimated by the Tennessee Valley Authority) for the Tennessee River and presumed that the fill becomes saturated to that level and then the lake drops to its normal pool level. Our estimation of the phreatic level within the pile during that condition is shown on the attached drawing. Finally, the site is situated in earthquake zone 2 (moderate risk) and an earthquake acceleration factor of 0.1 was used in our pseudo-static analysis.

The following analyses and recommendations are based on the preceding design considerations. Any changes in the slope configuration or waste composition and consistency will require our review of the recommendations.

STABILITY OF EXISTING WASTE FILL

A stability analysis was performed for the critical section of the existing fill as shown on the attached drawings using effective strength parameters as determined during the triaxial testing of undisturbed samples of waste and alluvial soil. Results of the laboratory testing of the waste indicate that it has an effective cohesion of 900 PSF and an effective angle of internal friction of 35°. However, in the stability analyses, we conservatively used an effective cohesion of 100 PSF and an effective angle of internal friction of 35° for the existing fill. For the alluvial soil, the measured effective cohesion of 0 PSF and effective angle of internal friction of 33° were used in the analyses.

The stability analysis was performed with the aid of a digital computer using the Janbu circular arc analysis and/or hand calculations using the simple method of slices. The computer program used is entitled STABL and was developed during the Joint Highway Research Project HRP-7906 by Purdue University and the Indiana State Highway Commission.

As previously described, the outslope of the waste fill near the river exists at an inclination of about 1.5 horizontal to 1 vertical. Table 1 contains a summary of the factors of safety against instability as calculated for the critical slope of the western face of the existing waste fill.

TABLE 1

Results of Stability Analysis for Existing Slope Configuration

Condition	Minimum Factor of Safety
Steady State Seepage	1.2
Rapid Drawdown	1.0
Dynamic (Earthquake) Loading	1.0

We previously recommended that a bench be excavated into the existing slope of the fill near the river. This bench would be 25 feet wide and would be excavated to an elevation of about 660 feet. Above the bench, the slope should be cut at an inclination of 2 horizontal to 1 vertical. However, as an alternative to disturbing this existing vegetated slope, you have redesigned the slope above the existing fill using a 50 foot wide bench and inclinations of 2 horizontal to 1 vertical on the west side near the river, and 2.0 horizontal to 1 vertical on the east side of the fill away from the river.

loading conditions were analyzed, and are shown on the Stability Analysis Sheets.

COMMENTS AND RECOMMENDATIONS

As shown by the analyses presented herein, failure arcs passing through the new fill material will have calculated factors of safety which are in accordance with current, prudent, engineering practice.

As more waste material is placed, U.S. Pipe should continue to use the disposal practices outlined in our original report and discussed below. Essentially, in placing the additional waste fill, we recommend that debris be placed toward the center of the fill and that only the foundary sand waste be placed near the outslopes. Moreover, the waste should be placed in maximum 18 inch thick lifts and it should be compacted with the hauling and spreading equipment. The ditches and the crest of the pile should be sloped to drain to reduce the possibility of ponded water on the fill.

Before the waste fill is extended to the southern part of the site, the area should be cleared and grubbed. Afterwards, the area to receive fill should be proofrolled using the loaded waste hauling equipment. Soft or otherwise deleterious material (organic, etc.) so delineated should be excavated to stable ground. As an alternative, filter fabric can be placed above soft areas and the waste can be placed on the filter fabric for stabilization purposes. Further, if seeps are found to be issuing from areas to receive fill, rockfill drains wrapped in filter fabric (see Sheet 4) should be installed to collect the water and to discharge it beyond the toe of the proposed fill. Fill placement procedures should follow those as described in the previous section.

Scour Protection

Scour of waste at the toe of the existing fill and at the toe of the proposed extension by the Tennessee River could have a detrimental

effect on the stability of the fill. Therefore, the outslopes should be routinely inspected at periodic intervals and following high river stages. Scour of the waste encountered during these inspections should be repaired immediately.

Geologic Associates appreciates this opportunity to be of service to you on this project. If you have any questions, please feel free to contact the writer.

Respectfully submitted,

GEOLOGIC ASSOCIATES

Luke C. Williams

Luke C. Williams, P.E.
Project Manager

LCW/mn16

SECTION I

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, thanks to the Association of Soil and Foundation Engineers (ASFE).

When ASFE was founded in 1969, subsurface problems were frequently being resolved through lawsuits. In fact, the situation had grown to such alarming proportions that consulting geotechnical engineers had the worst professional liability record of all design professionals. By 1980, ASFE-*member consulting soil and foundation engineers had the best professional liability record.* This dramatic turn-about can be attributed directly to client acceptance of problem-solving programs and materials developed by ASFE for its members' application. *This acceptance was gained because clients perceived the* ASFE *approach to be in their own best interests.* Disputes benefit only those who earn their living from others' disagreements.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of his report may affect his recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

A geotechnical engineer cannot accept responsibility for problems which may develop if he is not consulted after factors considered in his report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by the geotechnical engineer who then renders an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those opined to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. For example, the actual interface between materials may be far more gradual or abrupt than the report indicates, and actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultant through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy

of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by the geotechnical engineer based upon his interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpretating the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report.* Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgement and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist the geotechnical engineer's liabilities onto someone else. Rather, they are definitive clauses which identify where the geotechnical engineer's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, the Association of Soil and Foundation Engineers has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

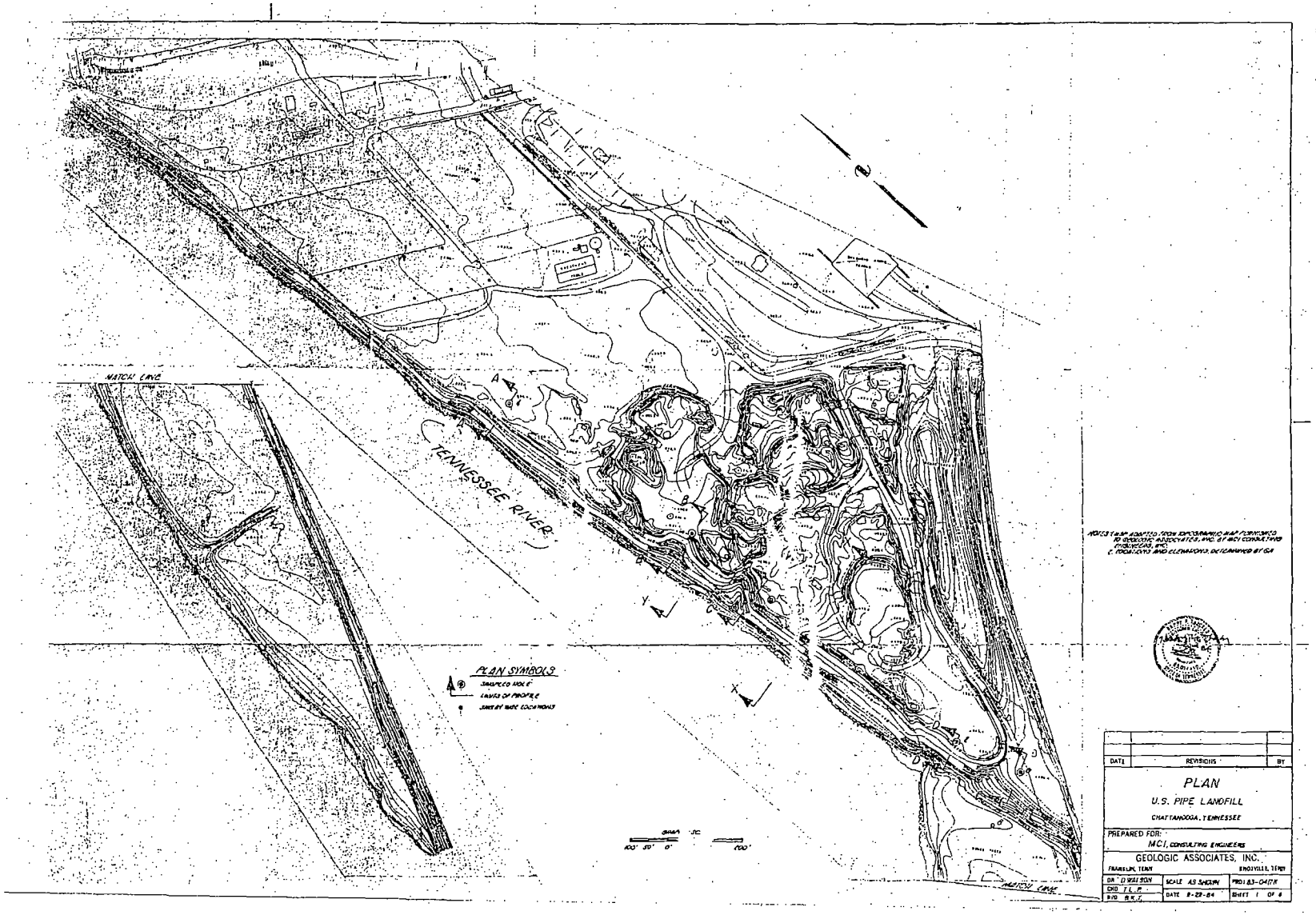
Published by

ASFE

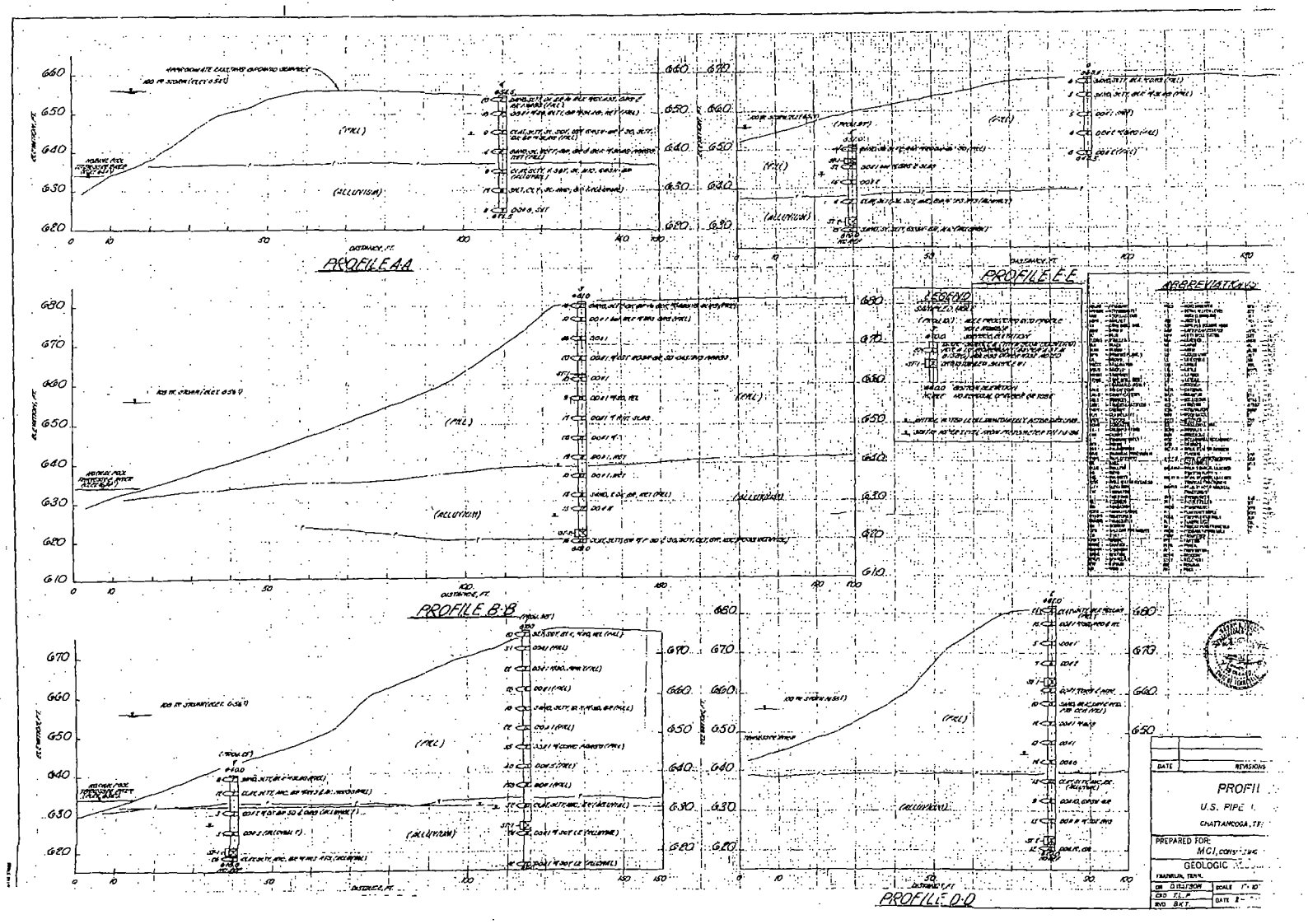
ASSOCIATION OF SOIL AND FOUNDATION ENGINEERS

8811 Colesville Road/Suite 225
Silver Spring, Maryland 20910
301/565-2733

SECTION II


WATCH CREEK
TENNESSEE RIVER
PLAN SYMBOLS
SAMPLED HOLE
LAYOUT OF PROFILE
SITES BY MCI LOCATIONS
SCALE 1"=
100' 50' 0' 100'
WATCH CREEK
DATE
REVISIONS
BY
PLAN
U.S. PIPE LANDFILL
CHATTANOOGA, TENNESSEE
PREPARED FOR:
MCI, CONSULTING ENGINEERS
GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN
KNOXVILLE, TENN
DR D WALSON
SCALE AS SHOWN
PROJ 83-0417R
CKD J.L.P.
DATE 8-23-84
SHEET 1 OF 6
APPD R.K.L.

MWPS007544


PROFILE A-A
PROFILE B-B
PROFILE C-C
PROFILE D-D
PROFILE E-E
LEGEND
ABBREVIATIONS
(FILL)
(ALLUVIUM)
DISTANCE, FT.
ELEVATION, FT.
PROFII
U.S. PIPE I.
CHATTANOOGA, TE
PREPARED FOR:
MCI, CONSTRUC
GEOLOGIC
DATE
REVISIONS

MWPS007545

SECTION III

SUMMARY OF LABORATORY TEST RESULTS

Project U.S. Pipe Landfill
Project No. 83-0417 K
Date March 1, 1984

Hole No.	Sample No.	SAMPLE TYPE*	Depth (ft)	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, φ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS**	Soil Description
1	1	ST	48.5-50.5	31.1	117.2	89.4				**	**		SILT,sandy,micaceous,brown
2	1	ST	18.5-20.0	15.6	120.1	104.1	40	17	CL	**	**		CLAY,silty,black,with slag
2	10	SS	43.5-45.0	26.1									SAND,silty,black,with slag
4	5	SS	18.5-20.0	30.9			40	12	ML				SILT,clayey,very sandy,slightly micaceous, greyish-brown
5	4	SS	13.5-15.0	32.0			30	7	CL/ML			*** S	CLAY,silty,slightly sandy,micaceous grey
5	5	SS	20.5-22.0	32.3					SP/SM			S	SAND,slightly silty,micaceous,greyish brown
7	1	ST	18.5-20.5	31.5	121.1	92.4	44	16	CL/ML	**	**		CLAY,silty,micaceous,brown

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE

** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

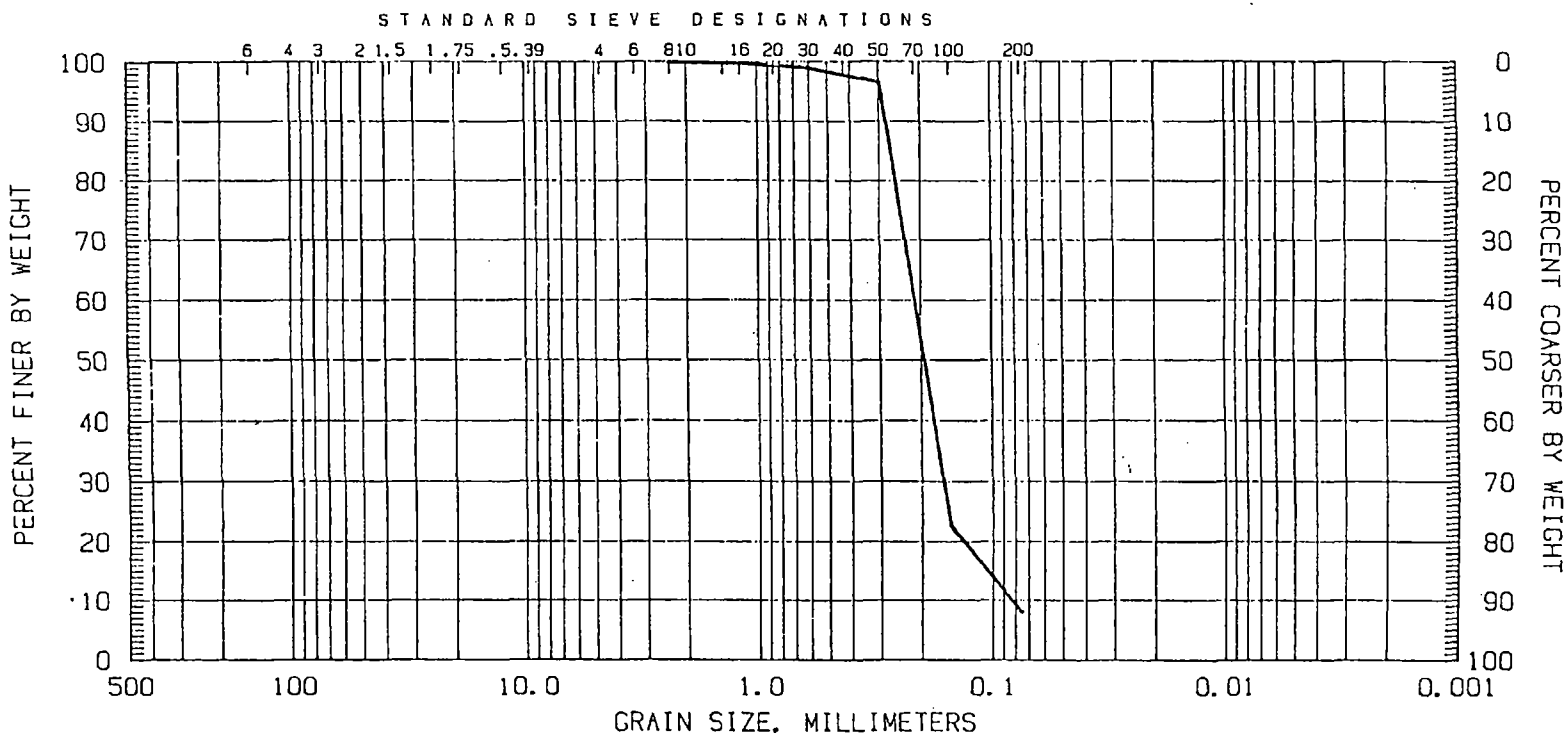
*** Sieve analysis indicates 66.7% passing #200 sieve

DATA CHECKED BY: HOp

GEOLOGIC ASSOCIATES, INC.

MWPS007547

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

PROJECT NO.: 83-0417
U.S. PIPE
MCI CONSULTING ENGINEERS
JANUARY 12, 1984
BORING: 5 SAMPLE: 5
DEPTH: 20.5-22.0 FT

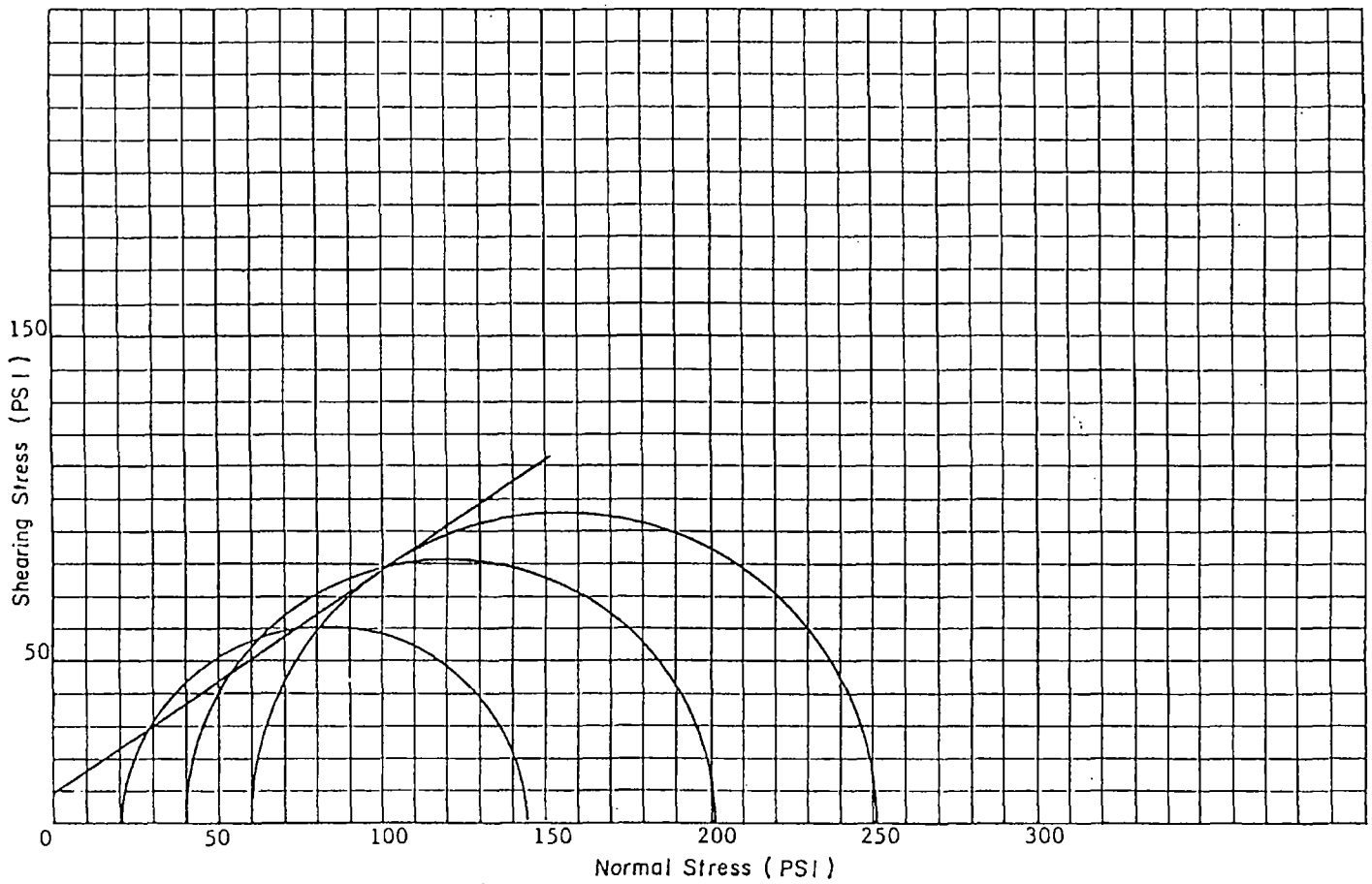
SAND, slightly silty, micaceous, grayish-brown
NATURAL MOISTURE CONTENT= 32.3 %
REMARKS: USC=SP/SM

GEOLOGIC ASSOCIATES, INC.

MWPS007548

MOHR DIAGRAMS — ϕ

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)



COHESION (c) 9 PSI

ANGLE OF INTERNAL FRICTION (ϕ) 35°

PROJECT U.S. Pipe Stability Analysis

HOLE 2 SAMPLE WASTE

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)

Client Mining Consultants, Inc.

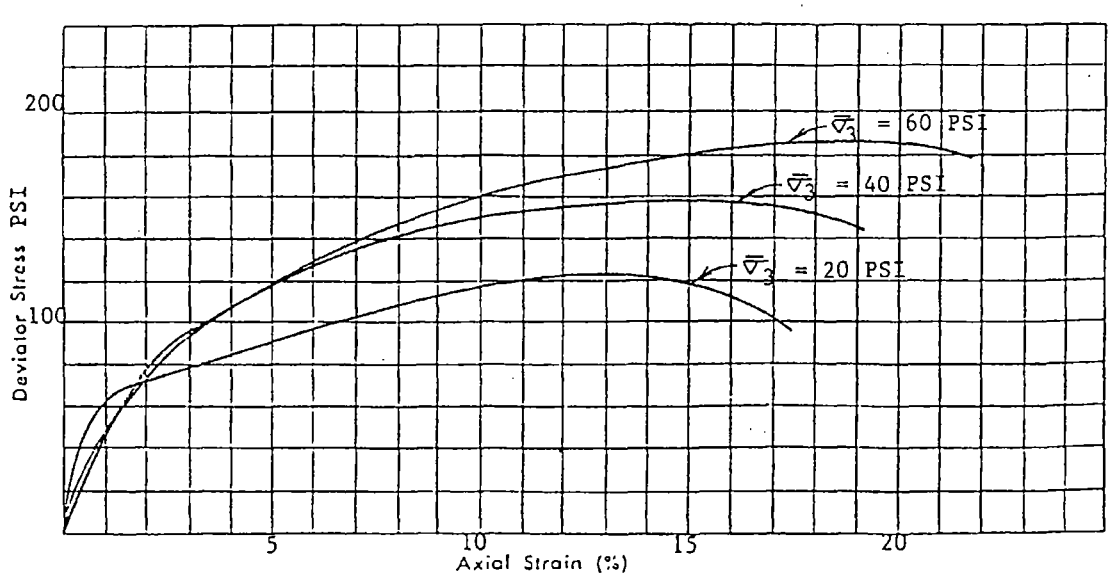
Project U.S. Pipe Landfill

Project No. 83-0417 DATE February, 1984

Sample Description Waste Material

INITIAL SAMPLE PROPERTIES

Property	Test 1	Test 2	Test 3
Boring No./Sample No.	2/St-1	2/St-1	Remolded Sample
Depth	18.0'-20.0'	18.0'-20.0'	
Consolidation Pressure PSI	20	40	60
Dry Unit Weight, PCF	97.9	110.3	105.1
Moisture Content, %	18.4	12.7	14.1
Volume, cu. ft.	.0223	.0214	.0199
Void Ratio	0.696	0.505	0.579
Saturation, %	70.4	67.0	64.8
Specific Gravity	2.66	2.66	2.66

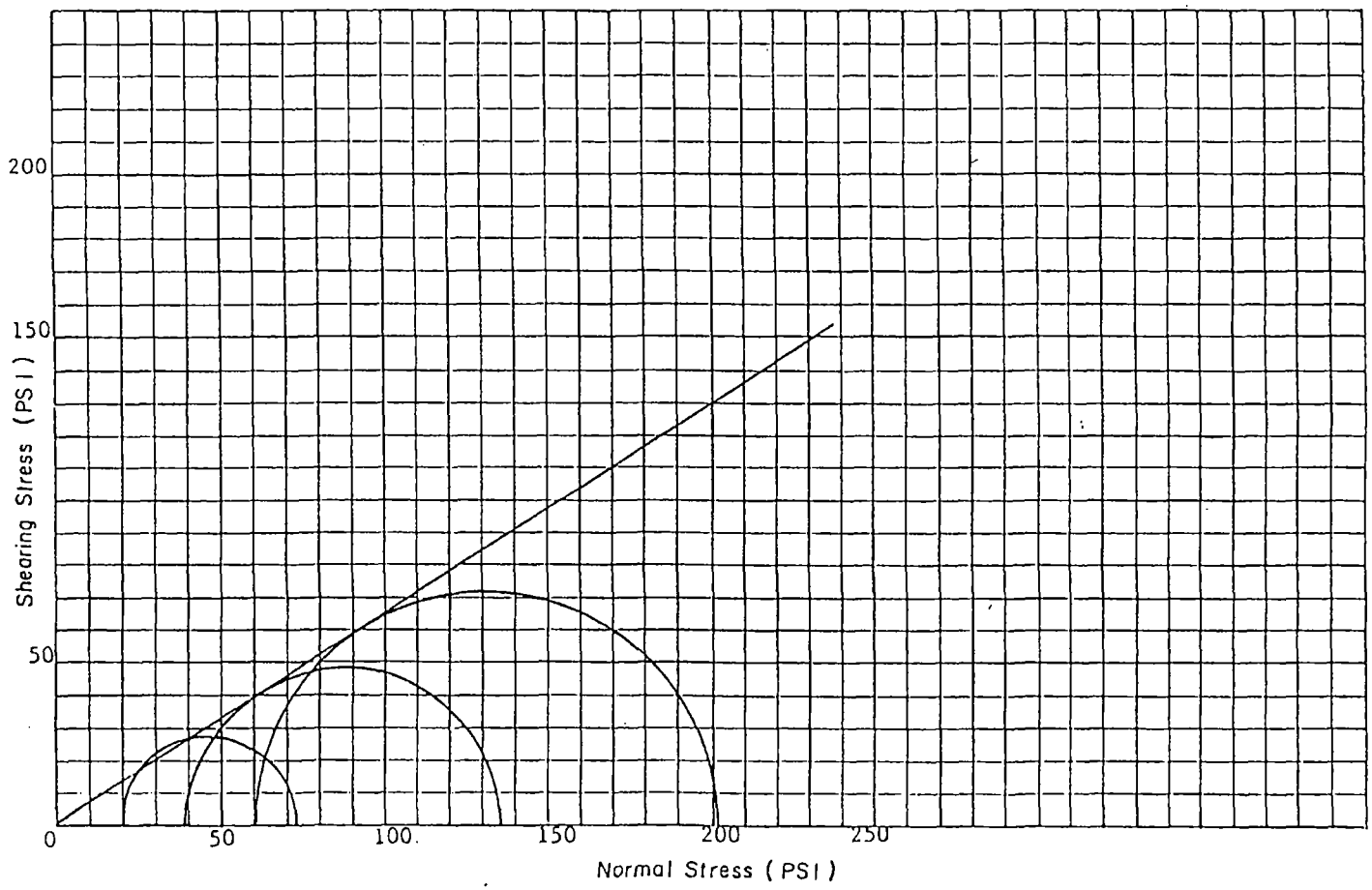


STRESS — STRAIN CURVES

MWPS007550

MOHR DIAGRAMS — Φ

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)



COHESION (c) 0 P.S.I.

ANGLE OF INTERNAL FRICTION (ϕ) 33°

PROJECT U.S. Pipe Stability Analysis

HOLE 1 & 7 SAMPLE Alluvium

MWPS007551

CONSOLIDATED-DRAINED TRIAXIAL COMPRESSION TEST (CD)

Client Mining Consultants, Inc.

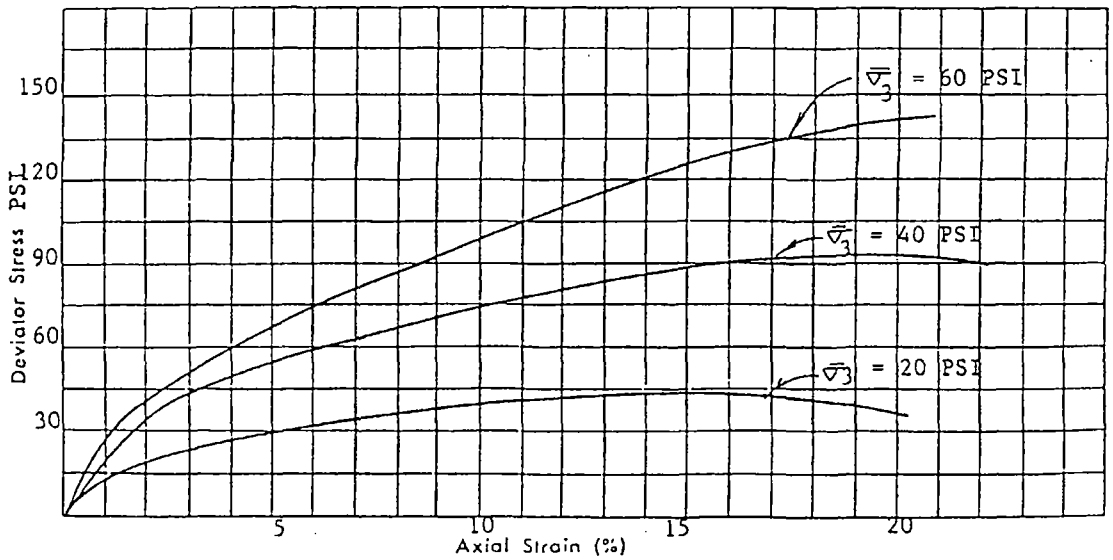
Project U.S. Pipe Landfill

Project No. 83-0417 DATE February, 1984

Sample Description Alluvial Soil

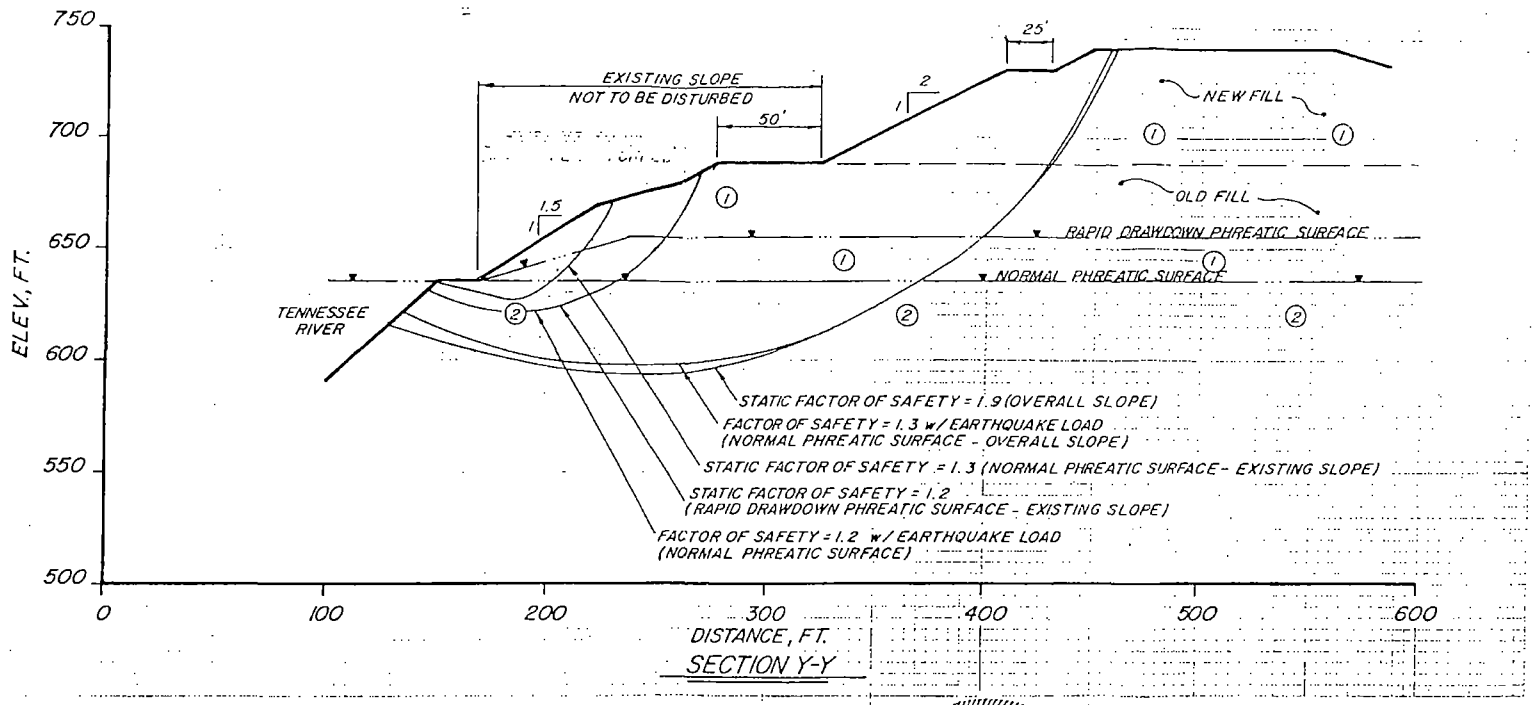
INITIAL SAMPLE PROPERTIES

Property	Test 1	Test 2	Test 3
Boring No./Sample No.	7/St-1	7/St-1	1/St-1
Depth	18.5'-20.5'	18.5'-20.5'	48.5'-50.5'
Consolidation Pressure PSI	20	40	60
Dry Unit Weight, PCF	100.1	84.8	89.4
Moisture Content, %	25.5	37.6	31.1
Volume, cu. ft.	.01998	.0203	.0201
Void Ratio	.696	1.00	.871
Saturation, %	99.7	1.00	95.8
Specific Gravity	2.72	2.72	2.68



STRESS — STRAIN CURVES

MWPS007552



SECTION Y-Y

REFUSE / SOIL PARAMETERS

MATERIAL	NO.	MOIST UNIT WEIGHT (pcf) γ_m	SATURATED UNIT WEIGHT (pcf) γ_s	EFFECTIVE COHESION (psf) c	EFFECTIVE ANGLE OF INTERNAL FRICTION (°)
WASTE FILL	1	120	125	100	35
ALLUVIAL	2	120	125	0	33

LUKE C. WILLIAMS
REGISTERED ENGINEER
AGRICULTURE
No. 17690
STATE OF TENNESSEE
1/12/88

DATE	REVISIONS	BY

STABILITY ANALYSIS

U.S. PIPE LANDFILL

CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS, INC.

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN

DR P. TROXEL	SCALE AS SHOWN	PROJ. 83-0417
CKD L.C.W.	DATE 12/22/87	SHEET 3 OF 6
RVD B.K.T.		

BRUNING 44-132 54194-10

MWPS007553

** PCSTABL4 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu Method of Slices
or Simplified Bishop Method

Run Date:
Time of Run:
Run By:
Input Data Filename: USPIP.IN
Output Filename: USPIP.OUT

PROBLEM DESCRIPTION FINAL SLOPE CONFIGURATION U.S. PIPE FO
UNDRY

BOUNDARY COORDINATES

10 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	100.00	135.00	167.00	135.00	3
2	167.00	135.00	220.00	169.00	1
3	220.00	169.00	260.00	180.00	1
4	260.00	180.00	275.00	188.00	1
5	275.00	188.00	325.00	188.00	1
6	325.00	188.00	410.00	230.00	1
7	410.00	230.00	430.00	230.00	1
8	430.00	230.00	450.00	240.00	1
9	450.00	240.00	560.00	240.00	1
10	560.00	240.00	600.00	225.00	1
11	100.00	90.00	150.00	132.00	2
12	150.00	132.00	167.00	135.00	2
13	167.00	135.00	600.00	135.00	2

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	35.0	.00	.0	1
2	120.0	125.0	.0	33.0	.00	.0	1
3	62.4	62.4	.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	135.00
2	600.00	135.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 140.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 220.00 ft.
and X = 325.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

20.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Placed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And [illegible] Deg.

Following Are Displayed The Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	146.67	133.00
2	166.15	130.49
3	186.05	132.48
4	204.25	140.78
5	218.81	154.49
6	227.61	171.09

*** 1.353 ***

```
                                                                  =-
          Y                A      X      I      S              F      T

                .00      75.00  150.00  225.00  300.00  375.00

X        .00  +-------------------------------------------------------+
              -
              .
              .
              .
       75.00  -
              -
              -            3      4
              -
              .
              -                  2
A     150.00  +                 . 3
              -                 61*
              -                .234.
              -               ..631 .
              -               ...241 .
              -              .....24.
X     225.00  +               .....521 *
              -              ......95422
              -               ........5.5
              -               ..........*.
              -                ..........*
              -                 .........
I     300.00  +                   ........
              -                   . ......
              -                        ..*
              -
              -
              -
S     375.00  +
              -
              -
              -                                  *
              -                                  *
              -
      450.00  +                                   *
              -
              -
              -
              -
              -
F     525.00  +
              -
              -
              -                                   *
              -
              -
T     600.00  +                    *             *
```

MWPS007557

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	133.00
2	187.00	135.00
3	275.00	156.00
4	600.00	156.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 140.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 220.00 ft.
and X = 325.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

20.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And .0 deg.

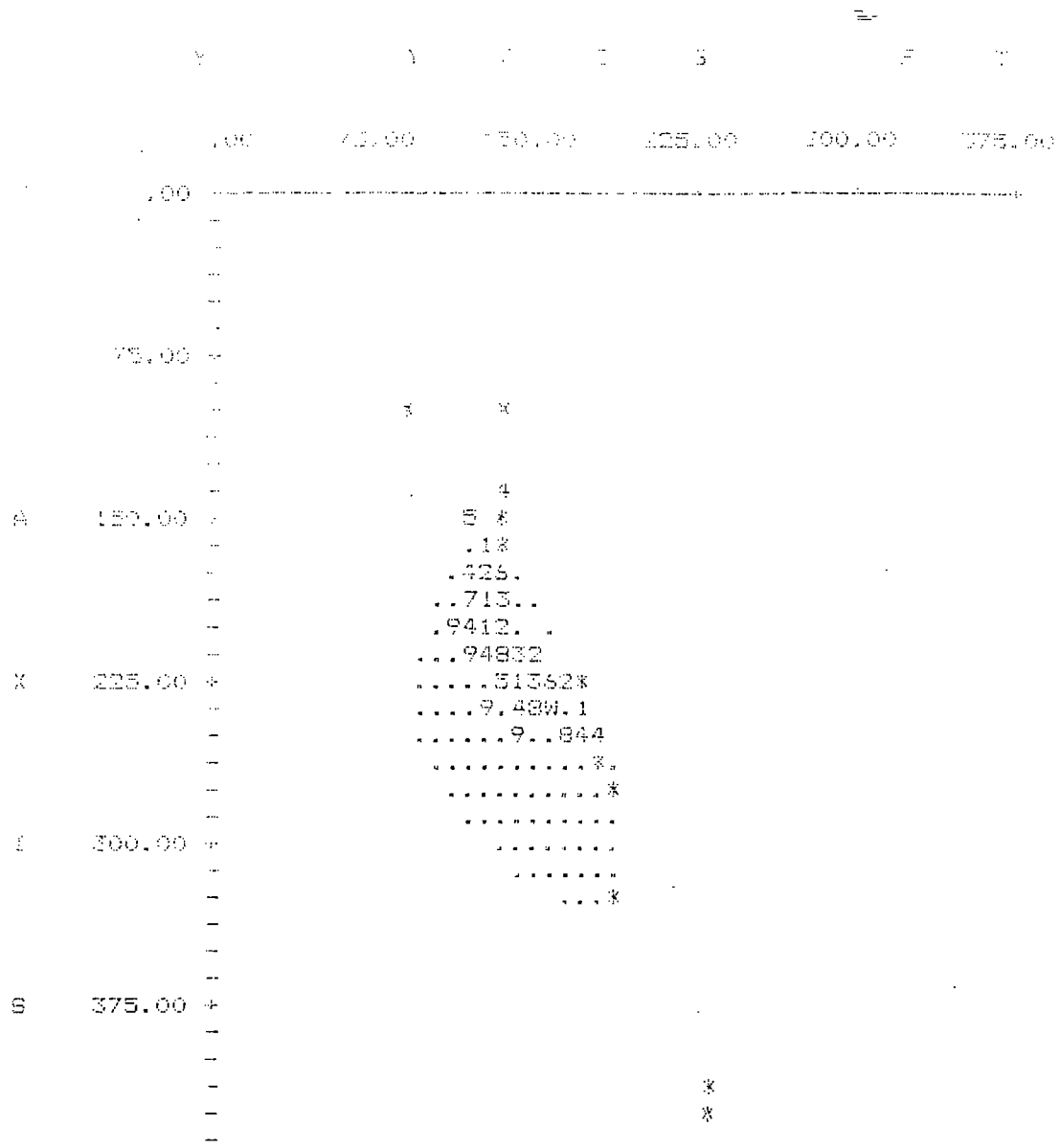
Following Are [illegible] The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

[illegible] Safety [illegible] Calculated by the Modified Janbu Method [illegible]

The [illegible] Surface Defined By 7 Coordinate Points

Point No.	X-Coord (ft)	Y-Coord (ft)
1	146.67	135.00
2	164.71	126.50
3	174.85	125.23
4	194.14	139.48
5	220.54	141.93
6	232.12	158.24
7	236.39	173.51

FOS = 1.196 [illegible]


.00
75.00
150.00
225.00
300.00
375.00
A
X
S

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Constructed.

10 Surfaces Have Been Made From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 200.00 ft.

Such Trial Surfaces Between X = 450.00 ft.
and X = 560.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

77.50 ft Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And .0 deg.

Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

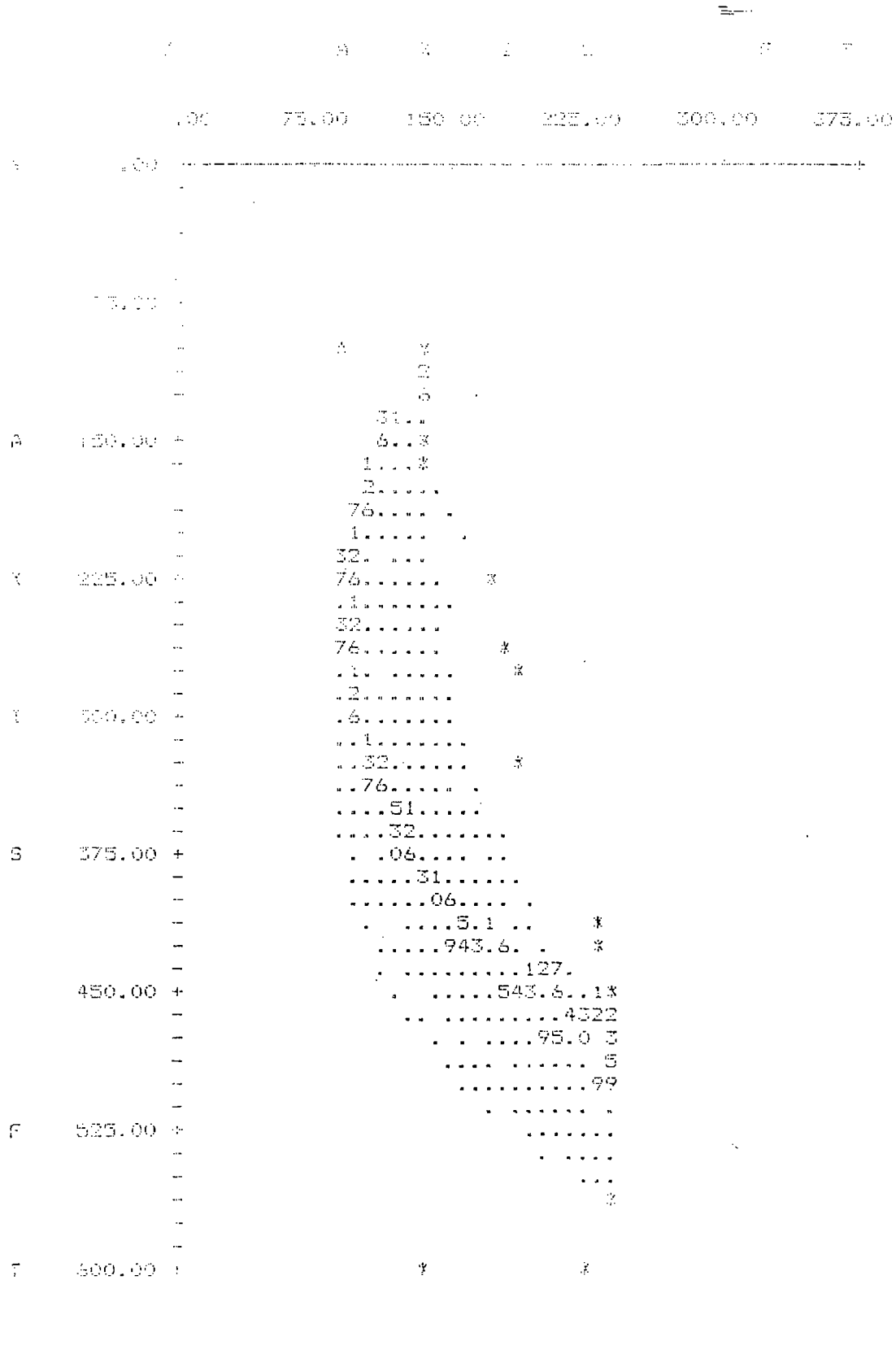
* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	135.00
2	132.75	116.72
3	167.92	103.71
4	204.67	96.28
5	242.13	94.60
6	279.41	98.72
7	315.60	108.55
8	349.85	123.90
9	381.24	144.17
10	409.31	169.15
11	433.09	198.14
12	452.12	230.06
13	455.91	240.00

*** 1.910 ***

MWPS007561


.00
75.00
150.00
225.00
300.00
375.00
450.00
525.00
600.00

[illegible] GEOMETRIC LIMITATIONS HAVE BEEN SPECIFIED

[illegible] Height of Water = 82.00

[illegible] Modified by 2 Coordinate Points

[illegible]	X-value (ft)	Y-value (ft)
[illegible]	[illegible]	130.00
[illegible]	600.00	135.00

[illegible] Horizontal Earthquake Loading Coefficient
[illegible] .100 Has Been Assigned

[illegible] Vertical Earthquake Loading Coefficient
[illegible] .100 Has Been Assigned

[illegible] Pressure = 1700.0 psf

[illegible] Trial Failure Surface Searching Method, Using A Random [illegible] Technique For Generating Circular Surfaces, Has Been Specified.

[illegible] Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 140.00 ft.
and X = 177.00 ft.

Each Surface Terminates Between X = 260.00 ft.
and X = 325.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

10.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of [illegible]3.0 And [illegible]0.0 deg.

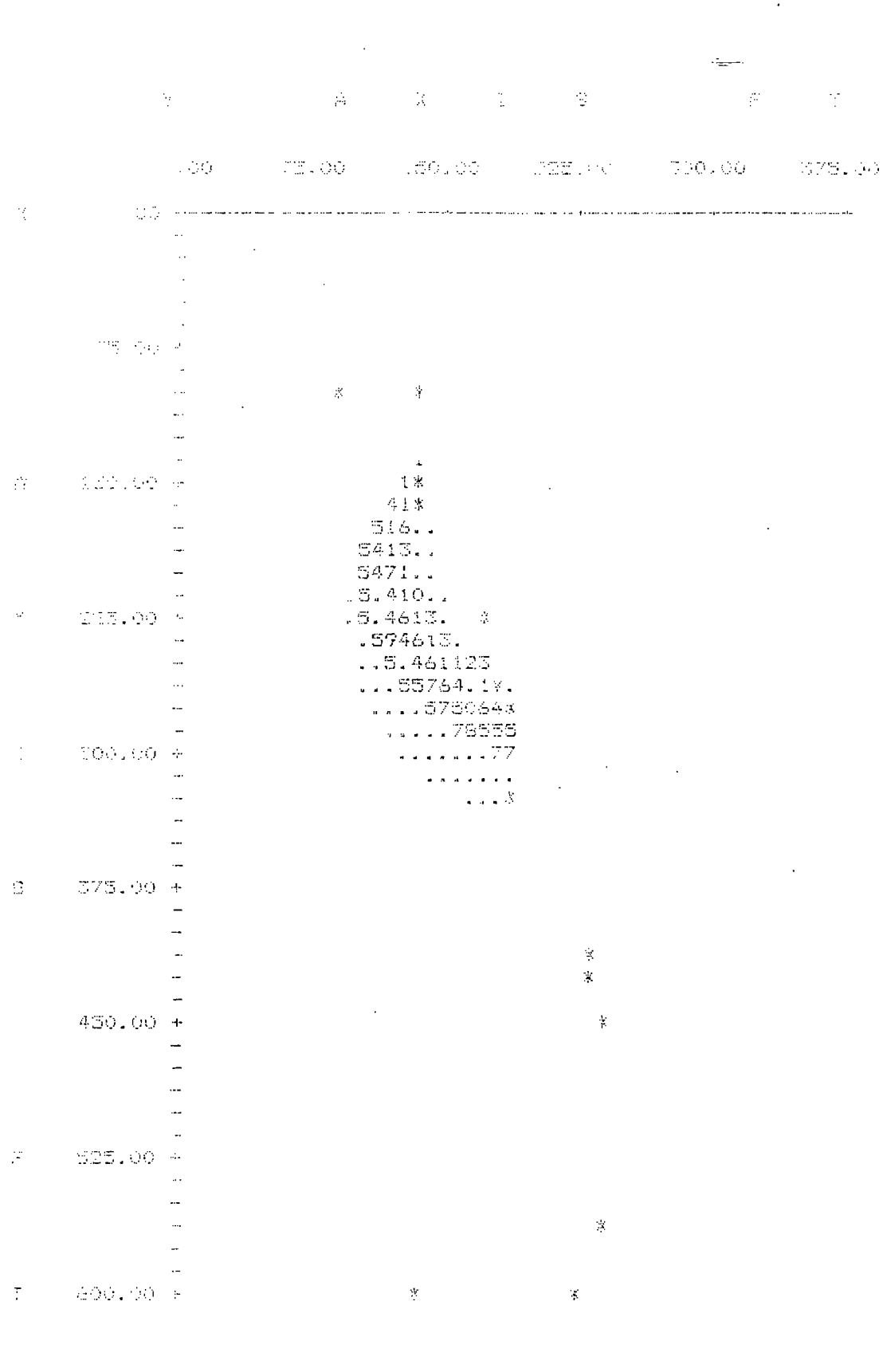
Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

% X Safety Factors Are Calculated By The Modified Janbu Method # 1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.00	133.00
2	151.61	129.15
3	163.97	125.12
4	176.79	122.99
5	189.79	122.83
6	202.67	124.62
7	215.12	128.34
8	226.88	133.90
9	237.66	141.16
10	247.22	149.97
11	255.34	160.12
12	261.84	171.38
13	266.57	183.49
14	268.58	193.51

*** 1.153 ***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X 00
75.00
A 100.00
Y 225.00
I 300.00
S 375.00
450.00
F 525.00
T 600.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 450.00 ft.
and X = 560.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

37.50 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And .0 deg.

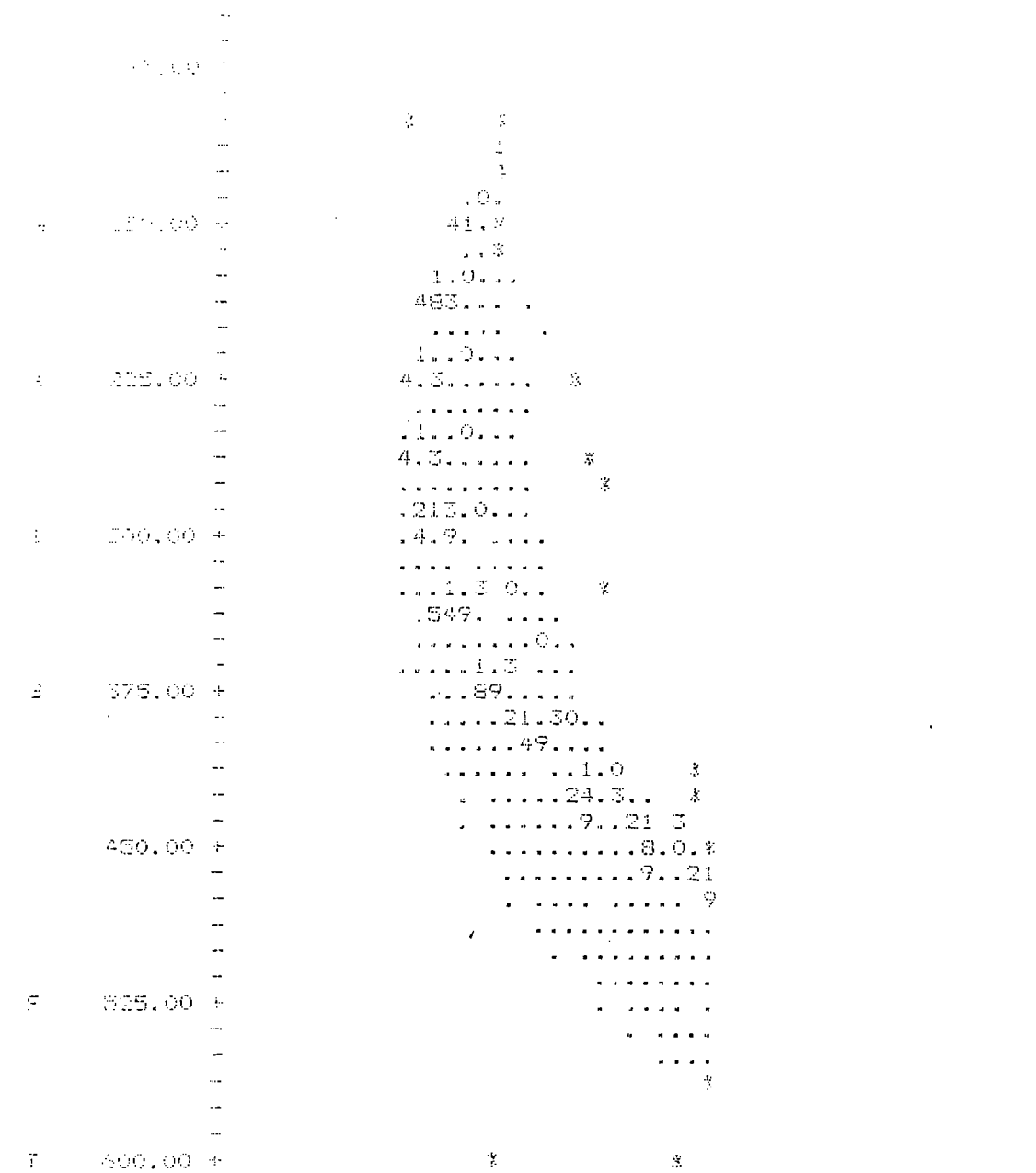
Following Are Displayed The Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	135.00
2	144.15	117.26
3	179.56	104.91
4	216.47	98.28
5	253.96	97.51
6	291.11	102.63
7	326.99	113.51
8	360.73	129.89
9	391.48	151.35
10	418.48	177.37
11	441.07	207.31
12	458.47	240.00

*** 1.361 ***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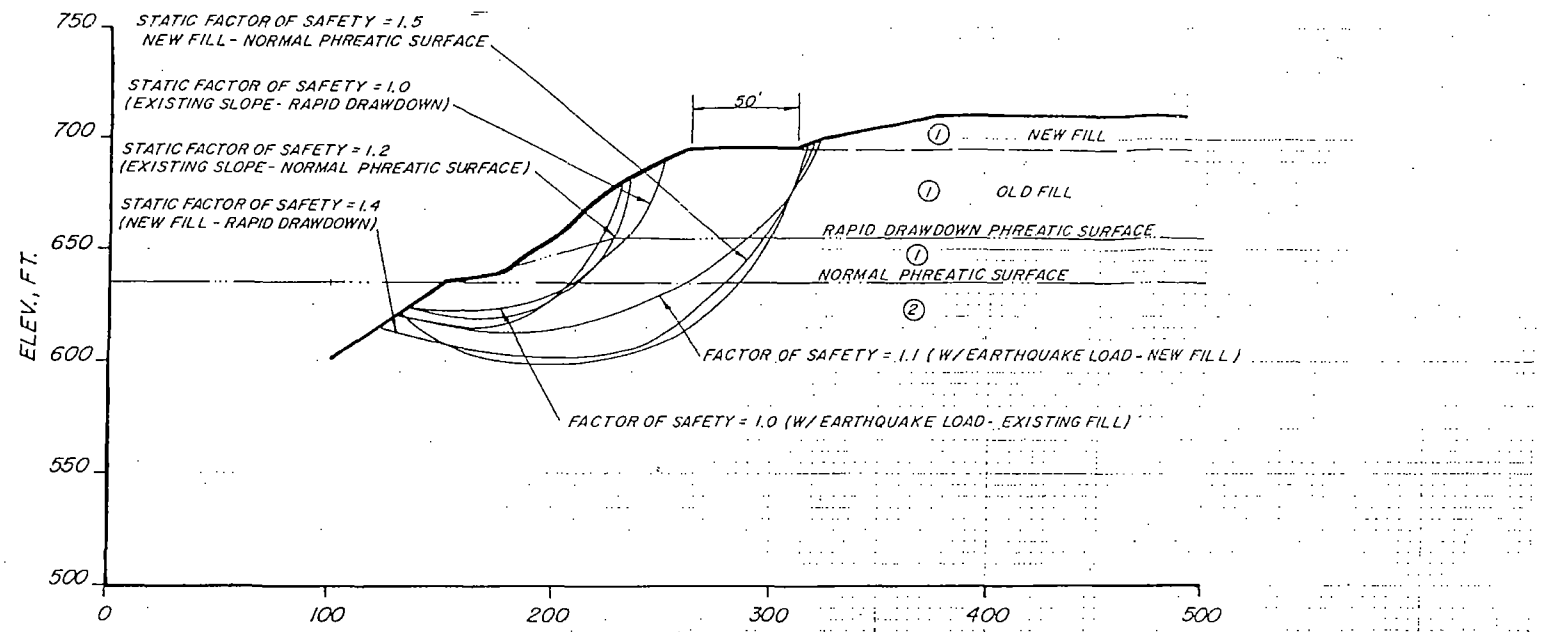
225.00
300.00
375.00
225.00
300.00
375.00
450.00
525.00
600.00



SECTION X-X

REFUSE / SOIL PARAMETERS

MATERIAL	NO.	MOIST UNIT WEIGHT (pcf) γ_m	SATURATED UNIT WEIGHT (pcf) γ_s	EFFECTIVE COHESION (psf) c	EFFECTIVE ANGLE OF INTERNAL FRICTION (°)
WASTE FILL	1	120	125	100	35
ALLUVIAL	2	120	125	0	33

LUKE C. WILLIAMS
REGISTERED ENGINEER
No. 17690
STATE OF TENNESSEE
1/12/88

DATE	REVISIONS	BY

STABILITY ANALYSIS

U.S. PIPE LANDFILL

CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS, INC.

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR P.TROXEL	SCALE AS SHOWN	PROJ. 83-0417
CKD L.C.W.	DATE 1/11/88	SHEET 4 OF 6
RVD B.K.T.		

BRUNING 44-132 54194-10

MWPS007568

** PCSTABL4 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu Method of Slices
or Simplified Bishop Method

Run Date:
Time of Run:
Run By:
Input Data Filename: USPIP2.IN
Output Filename: USPIP2.OUT

PROBLEM DESCRIPTION FINAL SLOPE CONFIGURATION U.S. PIPE FO
UNDRY

BOUNDARY COORDINATES

11 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	100.00	136.00	157.00	136.00	3
2	157.00	136.00	175.00	140.00	1
3	175.00	140.00	188.00	150.00	1
4	188.00	150.00	205.00	160.00	1
5	205.00	160.00	215.00	170.00	1
6	215.00	170.00	230.00	180.00	1
7	230.00	180.00	250.00	190.00	1
8	250.00	190.00	262.00	196.00	1
9	262.00	196.00	312.00	196.00	1
10	312.00	196.00	370.00	210.00	1
11	370.00	210.00	485.00	210.00	1
12	100.00	100.00	150.00	134.00	2
13	150.00	134.00	157.00	136.00	2
14	157.00	136.00	485.00	136.00	2

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	120.0	125.0	100.0	35.0	.00	.0	1
2	120.0	125.0	.0	33.0	.00	.0	1
3	62.4	62.4	.0	.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	136.00
2	600.00	136.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 205.00 ft.
and X = 312.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	113.33	136.00
2	125.59	127.36
3	139.37	121.42
4	154.07	118.45
5	169.07	118.56
6	183.73	121.75
7	197.41	127.89
8	209.55	136.71
9	219.60	147.84
10	227.16	160.80
11	231.89	175.04
12	232.60	181.30

*** 1.224 ***

```
                Y            A     X     I     S           F     T

                .00     75.00    150.00    225.00    300.00    375.00
X          .00 +---------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
        75.00 +
               -
               -            *    *
               -                01
               -               013
               -              .136
A     150.00 +              .013*
               -            ..023*
               -            ..0136*
               -            ..0123.*
               -            ..0.126.*
               -            ...0.132..*
X     225.00 +             ...0.7112.*
               -            .....0.47116
               -             .....0..74*7
               -             .......0.0.*
               -              ...........
               -                .........
I     300.00 +                   .......
               -                      ..*
               -
               -
               -
               -
S     375.00 +                          *
               -
               -
               -
               -
               -
        450.00 +
               -
               -
               -                  *          *
               -
               -
F     525.00 +
               -
               -
               -
               -
               -
T     600.00 +                  W
```

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 312.00 ft.
and X = 412.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	136.00
2	111.77	126.70
3	124.50	118.77
4	138.03	112.30
5	152.20	107.38
6	166.83	104.06
7	181.74	102.39
8	196.74	102.39
9	211.65	104.06
10	226.27	107.38
11	240.44	112.30
12	253.98	118.77
13	266.71	126.70
14	278.48	136.00
15	289.14	146.55
16	298.56	158.22
17	306.62	170.87
18	313.23	184.34
19	317.93	197.43

*** 1.574 ***

```
                Y            A     X     I     S           F     T

                .00      75.00    150.00    225.00    300.00    375.00
X          .00 +---------+---------+---------+---------+---------+
                -
                -
                -
                -
                -
         75.00 +
                -
                -              *    *
                -                 17
                -               2104
                -              2104.
A     150.00 +                 104.*
                -             2148.*
                -            324....*
                -            2718... *
                -            .518.... *
                -            2518....   *
X     225.00 +               .2198...    *
                -            .2418....
                -            ..2418...    *
                -            ...241....    *
                -            ...7241....
                -             ....2041...
I     300.00 +               ....72414..
                -             .....7272141*
                -              .......562722
                -               .........655
                -                .............
                -                  ...........
S     375.00 +                      .........*
                -                     .......
                -                       .....
                -                          ..
                -
                -
      450.00 +
                -
                -
                -                  *          *
                -
                -
F     525.00 +
                -
                -
                -
                -
                -
T     600.00 +                   W
```

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	136.00
2	167.00	136.00
3	225.00	156.00
4	485.00	156.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 205.00 ft.
and X = 312.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	106.67	136.00
2	119.90	128.93
3	134.07	124.01
4	148.83	121.36
5	163.83	121.03
6	178.69	123.05
7	193.06	127.36
8	206.58	133.85
9	218.93	142.37
10	229.79	152.71
11	238.92	164.61
12	246.08	177.79
13	250.50	190.25

*** .998 ***

```
                Y            A     X     I     S            F     T

                .00      60.63    121.25    181.88    242.50    303.13

X          .00 +----------+---------+---------+---------+---------+
               -
               -
               --
               -
               -
        60.63 +
               --
               -
               -
               -                 *     *
               -                     21
A     121.25 +                     6215
               -                  ..1.4
               -                  62...
               -                 .6214*
               -                 6..14*.
               -                ...234W*
X     181.88 +                  ..6.13..
               -                ..6..18..*
               -                .....718..*.
               -                ....6:2.38..*
               -                .....6712.W833
               -                 ......671..28*
I     242.50 +                   .......671.1..
               -                  ..........756*7
               -                   ............5*
               -                    ............
               -                     ...........
               -                      ..........
S     303.13 +                          .......
               -                           ...*
               -
               -
               -
               -
        363.75 +
               -                                  *
               -
               -
               -
               -
F     424.38 +
               -
               -
               -
               -
               -
T     485.00 +                     *   W         *
```

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 312.00 ft.
and X = 412.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -45.0 And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	113.33	136.00
2	124.18	125.64
3	136.27	116.75
4	149.38	109.47
5	163.31	103.92
6	177.84	100.18
7	192.73	98.33
8	207.73	98.39
9	222.60	100.35
10	237.10	104.19
11	250.99	109.85
12	264.05	117.23
13	276.06	126.21
14	286.84	136.65
15	296.19	148.37
16	303.98	161.19
17	310.07	174.90
18	314.37	189.27
19	315.62	196.87

*** 1.430 ***

```
                Y            A     X     I     S           F     T

                .00     60.63   121.25   181.88   242.50   303.13

X          .00 +---------+---------+---------+---------+---------+
                -
                -
                -
                -
                -
          60.63 +
                -
                -
                -
                -                *     *
                -                     41
A     121.25 +                     4.15
                -                  41.58
                -                  3.58.
                -                 41.6.*
                -                41.56.*.
                -                .358..W*
X     181.88 +                 .21.86..
                -                015..6... *
                -                .25.8....  *
                -                019.86...    *
                -                .21.86.... W
                -                ..15.....     *
I     242.50 +                 .743586 ...
                -                ..41..86...     *
                -                ...715..6..      *
                -                .....218... .
                -                ....04.216.. .
                -                 .....743186. .
S     303.13 +                  .......4.321.. .
                -                  .......04.321.1*.
                -                   ........07.73633
                -                    ............7.4
                -                    ................
                -                     ...............
          363.75 +                       ...............
                -                         .. ........*
                -                            ..........
                -                              ........
                -                                ......
                -                                    ..
F     424.38 +
                -
                -
                -
                -
                -
T     485.00 +                      *   W         *
```

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	100.00	136.00
2	600.00	136.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = 1700.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 205.00 ft.
and X = 312.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	106.67	136.00
2	118.49	126.77
3	131.94	120.13
4	146.46	116.38
5	161.45	115.66
6	176.26	118.01
7	190.29	123.32
8	202.94	131.38
9	213.69	141.84
10	222.08	154.28
11	227.76	168.16
12	229.95	179.97

*** .860 ***

1

```
                Y.            A     X     I     S           F     T

                .00      75.00    150.00    225.00    300.00    375.00

X          .00 +---------+---------+---------+---------+---------+
               -
               -
               -
               -
               -
         75.00 +
               -
               -              *    *
               -                 11
               -                245
               -               .14.
A     150.00 +               .219*
               -             ..154*
               -             ..214.*
               -             ..8194.*
               -             ...321..*
               -             ...635142.*
X     225.00 +              ....6305112*
               -              ....6375....
               -               .....6375.*.
               -               .......3636*
               -                 ........83
               -                  .........
I     300.00 +                    .......
               -                       ...*
               -
               -
               -
               -
S     375.00 +                            *
               -
               -
               -
               -
               -
      450.00 +
               -
               -
               -                  *         *
               -
               -
F     525.00 +
               -
               -
               -
               -
               -
T     600.00 +                  W
```

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = 1700.0 psf

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 160.00 ft.

Each Surface Terminates Between X = 312.00 ft.
and X = 412.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 90.00 ft.

15.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -45.0
And 20.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.00	136.00
2	113.24	128.95
3	127.09	123.19
4	141.42	118.75
5	156.10	115.69
6	171.01	114.03
7	186.01	113.77
8	200.96	114.94
9	215.74	117.51
10	230.21	121.46
11	244.25	126.75
12	257.72	133.35
13	270.51	141.19
14	282.50	150.20
15	293.59	160.30
16	303.68	171.40
17	312.67	183.40
18	320.50	196.20
19	321.52	198.30

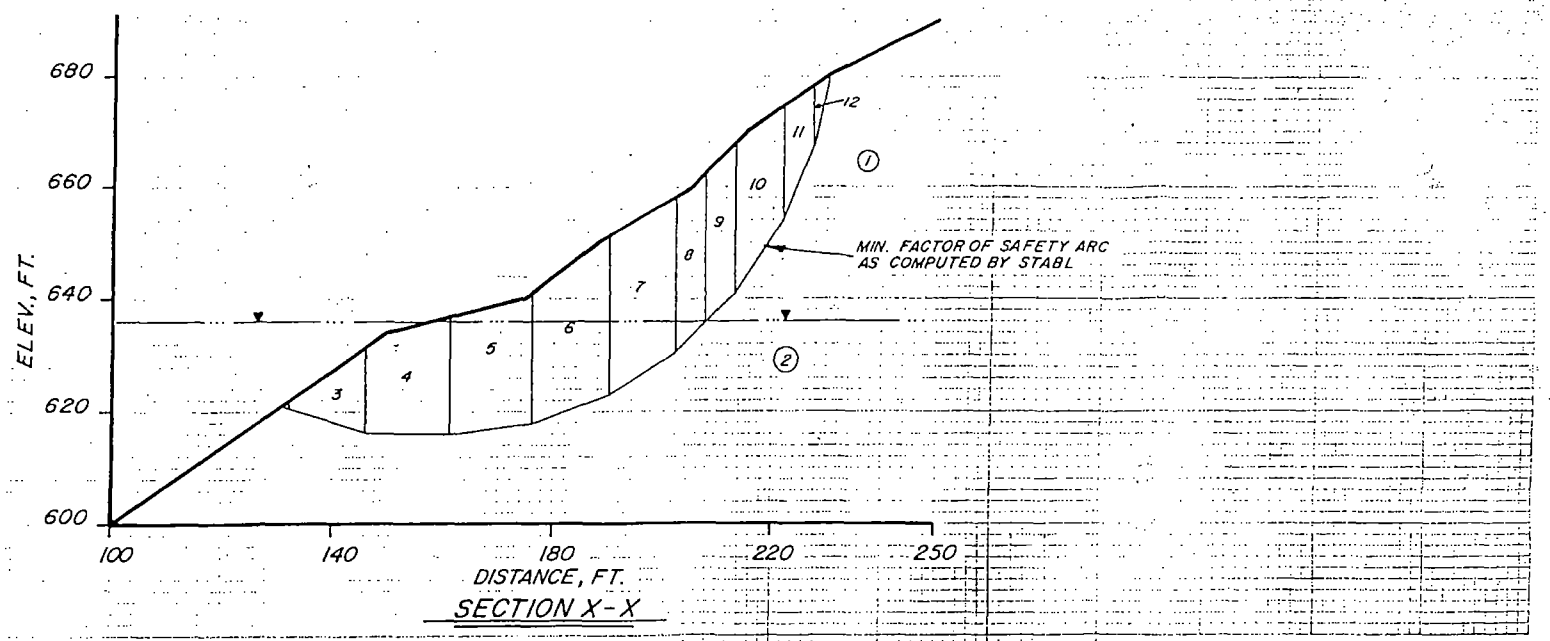
*** 1.144 ***

1

```
                Y            A     X     I     S           F     T

                .00     75.00    150.00    225.00    300.00    375.00

X        .00 +----------+---------+---------+---------+---------+
             -
             -
             -
             -
             -
      75.00 +
             -
             -            *    *
             -                12
             -              3127
             -             391.8
A    150.00 +             31.8*
             -            942.8*
             -            3218..*
             -           93218...*
             -           37218... *
             -           63..1....  *
X    225.00 +           93.21...    *
             -          .642.8...
             -          .34.218...   *
             -          ..34.218...   *
             -          ...34.218. .
             -           ...354211..
I    300.00 +           ....6332.818
             -           .....953221.*
             -           ......9.633212
             -            .......99..66
             -             .........9.9.
             -               ..........
S    375.00 +                .........*
             -                 ........
             -                  . .....
             -                      ...
             -
             -
      450.00 +
             -
             -
             -                 *         *
             -
             -
F    525.00 +
             -
```



SECTION X-X

REFUSE / SOIL PARAMETERS

MATERIAL	NO.	MOIST UNIT WEIGHT (pcf) γ_m	SATURATED UNIT WEIGHT (pcf) γ_s	EFFECTIVE COHESION (psf) c	EFFECTIVE ANGLE OF INTERNAL FRICTION (φ°)
WASTE FILL	1	120	125	100	35
ALLUVIAL	2	120	125	0	33

LUKE C. WILLIAMS
REGISTERED ENGINEER
No. 17690
STATE OF TENNESSEE
1/12/88

DATE	REVISIONS	BY

STABILITY ANALYSIS

U.S. PIPE LANDFILL

CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS, INC.

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR P.TROXEL	SCALE AS SHOWN	PROJ. 83-0417
CKD L.C.W.		
RVD B.K.T	DATE 1/11/88	SHEET 5 OF 6

BRUNING 44-132 54194-10

MWPS007587

Job Name: U.S. PIPE STABILITY STUDY

Job Number: 87

Title: HAND CALCULATED DYNAMIC STABILITY ANALYSIS

Computed by: LCW Checked by: BKT

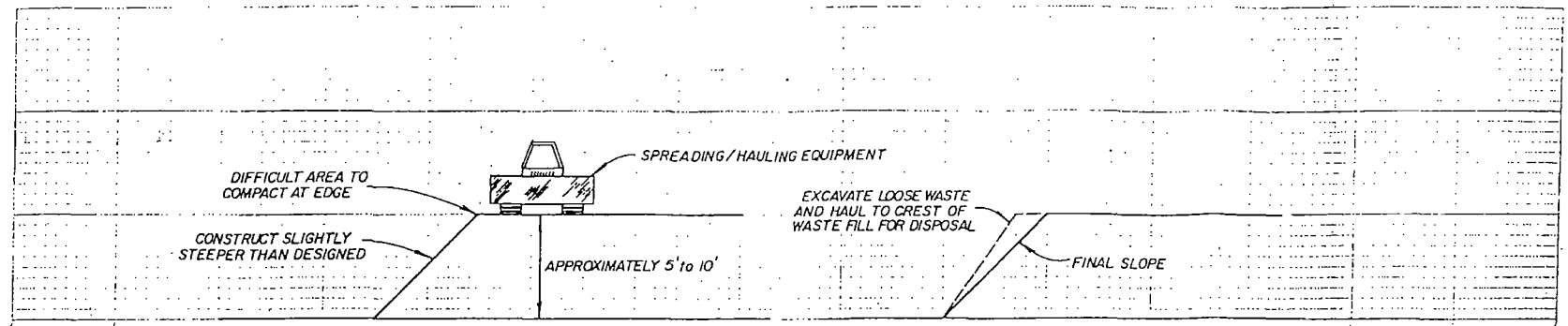
Date: 1/8/88 Sheet: Of:

(1) SLICE	(2) WT OF SLICE (SUBMURGED WT)	(3) ANGLE AT BOTTOM OF SLICE	(4) DRIVING FORCE (2) x Sin (3)	(5) TAN Φ ANGLE AT BOTTOM OF SLICE	(6) RESISTING FORCE 2 x Cos (3) x (6)
1					
2					
3	14,343 (7,183)	-14.481	-1,796	0.649	4516
4	34,687 (17,371)	- 2.75	- 833	0.649	11,268
5	50,025 (32,241)	9.016	5052	0.649	20,678
6	44,765 (31,229)	20.73	11,052	0.649	18,964
7	40,500 (33,761)	32.503	18,141	0.649	18,490
8	17,890 (17,031)	44.212	11,876	0.7	8545
9	17,820	44.212	12,426	0.7	8941
10	25,380	56.003	21,042	0.7	9,934
11	10,230	67.745	9,468	0.7	2,712
12	1,560	79.495	1,534	0.7	199
	257,199		87,962		104,258

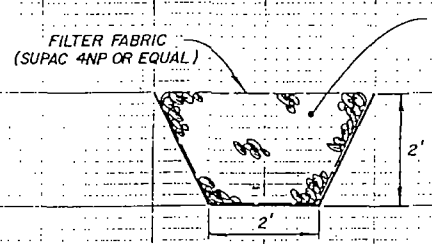
$$F.S.\ (EQUAKE) = \frac{\text{RESISTING FORCE}}{\text{DRIVING FORCE + ACCEL.}} = \frac{AF + COHESION}{DF + 0.1(WT)}$$

$$= \frac{104,258 + (150' \times 100 psf)}{87,962 + (0.1 \times 257,199)} = \frac{119258}{113,682} = 1.05$$

MWPS007588



SLOPE PREPARATION DETAIL



DRAIN DETAIL

BARRY K. THACKER REGISTERED ENGINEER AGRICULTURE COMMERCE NO. 014419 STATE OF TENNESSEE

DATE	REVISIONS	BY

DETAILS
U.S. PIPE LANDFILL
CHATTANOOGA, TENNESSEE

PREPARED FOR:
MCI, CONSULTING ENGINEERS

GEOLOGIC ASSOCIATES, INC.
FRANKLIN, TENN. KNOXVILLE, TENN.

DR D. WATSON	SCALE NO SCALE	PROJ. 83-0417K
CKD T.L.P.		
RVD B.K.T.	DATE 2-22-84	SHEET 6 OF 6

MWPS007589

RECEIVED
FEB 1987
M. C. I.

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
SOUTHEAST REGIONAL OFFICE
2501 MILNE STREET
CHATTANOOGA, TENNESSEE 37406-3399

February 2, 1987

Mr. John H. Watson
U.S. Pipe and Foundry Company
3300 First Avenue, North
Birmingham, Alabama 35202

Dear Mr. Watson:

Enclosed are the soil test results and recommendations as determined by the University of Tennessee Agricultural Extension Service for U.S. Pipe's solid waste disposal site. We will be referring to this report in our review and evaluation of this site.

If you have any questions, please feel free to call me at 624-9921.

Sincerely,

Janet Dutto
Environmental Engineer
Division of Solid Waste Management

JD:pph
Enclosure

cc: Jim Smallwood, U.S. Pipe and Foundry Co.
Chuck Priddy, MCI
Wayne McCoy, EDGE
Division of Solid Waste Management, Nashville
Bob Jerardi, Hamilton County Health Department

Agricultural Extension Service
University of Tennessee Institute of Agriculture

P. O. Box 1071
Knoxville, Tennessee 37901-1071

January 19, 1987

Mr. J.T. Haralson
Asst. Ext. Agent
110 Dayton Blvd.
Chattanooga, TN 37405

Dear Tim:

The establishment and maintenance of a permanent, erosion resistant ground cover at the U.S. Pipe Foundry location will be a challenging project. Enclosed, please find two publications which may be of value.

Based on the soil test report, the two samples you submitted contain high levels of phosphorus and medium to high levels of potassium (levels adequate for ground cover growth). Due to the high pH (01=pH 8.4, 02=pH 7.9), no limestone application was recommended. As you know, the availability of mineral elements in soil is greatly influenced by pH. Between a soil pH of 6.0 and 6.5, the essential soil elements are adequately available for optimal turfgrass growth. A sulfur application prior to planting may be required to reduce alkalinity and the potential for severe imbalances in nutrient availability.

Additional factors to consider regarding the dump site material include 1) heavy metal and 2) sodium content, and 3) salinity. Heavy metals (i.e. copper, nickel, lead,...) may interfere with normal, internal plant processes when toxic levels exist in soils.

Generally, sodium is considered as it relates to soil physical and chemical properties. Adverse physical and chemical conditions may exist in soils high in exchangeable sodium. Sodic soils may be reclaimed by replacing exchangeable sodium with calcium or magnesium and removing sodium by leaching. Gypsum ($CaSO_4$-$2H_2O$) may be used to remove exchangeable sodium from soil and replace it with calcium. The resultant soil is more friable and water infiltration and percolation rates increase.

The Agricultural Extension Service offers its programs to all eligible persons regardless of race, color, national origin, sex, or handicap and is an Equal Opportunity Employer.

THE UNIVERSITY OF TENNESSEE, THE U.S. DEPARTMENT OF AGRICULTURE, AND COUNTY GOVERNMENTS COOPERATING

One effect of a high soil salt concentration is to produce water stress which may cause the plant to wilt and/or die. If the salinity level is less than 1.0 mmhos/cm (determined by soluble salts test) the effect of soluble salts is negligible. A soluble salts level greater than 2.0 mmhos/cm may limit the selection of adapted plant species. Bermudagrasses are moderately tolerant of soluble salts. Soluble salts testing is now available at the University of Tennessee Diagnostic Laboratory, Nashville.

Several plant species may be adapted to the U.S. Pipe Foundry site (refer to pg. 4 in Revegetation and beautification of roadsides in Tennessee). Typically, species selection is influenced by planting date. A common bermudagrass plus annual lespedeza seed mixture may be seeded from April 15 to June 15, a tall fescue plus white clover mixture, February 15 to April 15 and August 15 to October 15.

Bermudagrass, a warm season, perennial sod-forming grass deserves consideration. Common bermudagrass spreads by both above ground (stolons) and below ground (rhizomes) runners and provides excellent erosion control when properly managed. Common bermudagrass can be seeded, sprigged (sprigs are individual plants or pieces of plants from which new plants develop which may be placed 4 to 6 inches apart in furrows 2 to 3 inches deep spaced on 6 to 12 inch centers), stolonized (sprigs uniformly broadcast over the soil surface - a disk is used to partially incorporate sprigs following stolonizing), plugged or sodded. Sodding is recommended on areas prone to erosion including extreme slopes, waterways and critical areas which may experience water moving at a high velocity.

Hydromulching (hydraulic broadcasting of seed and mulch over the soil surface) has been used effectively for ground cover establishment on steep slopes where seedbed preparation and use of conventional equipment is not possible. A seed mixture containing 67 percent (by weight) hulled bermudagrass and 33 percent annual lespedeza planted from

of light, daily applications of water can be discontinued. More water should be applied less frequently to increase rooting depth.

Due to the limited information available regarding response of several plant species to the material generated at the U.S. Pipe Foundry, I agree with John Jared and suggest that a small area be established for observation and evaluation before a major capital expenditure for the establishment of a vegetative canopy over the entire site.

Please don't hesitate to call if I may be of further assistance.

Sincerely,

Tom Samples

Tom Samples
Assistant Professor
Ornamental Horticulture and
Landscape Design

Enclosures

gi

A cultural Extension Se...
Univ y of Tennessee Institute of Agriculture

HARALSON, JOHN TIMOTHY
TO: ASST. EXTENSION AGENT
1110 DAYTON BLVD.
CHATTANOOGA, TENNESSEE 37405

DATE: 11/07/8
COUNTY: HAMILTON
LAB NO: 65661

Nashville, T 3/2

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMM DATIONS		
				Pounds Per Acre And Ratings										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K Pot
01	Grass Pasture est-renov.	8.4		68 H	190 H								0	30	30	3
	Grass Pasture maintenance	8.4		68 H	190 H								0	30-60	0	
02	Crown Vetch	7.9		36 H	160 M								0	0-15	30	
	Crown Vetch maintenance	7.9		36 H	160 M								0	0	0	

Grass pasture est.-renov. notes:

Each pasture sample has two recommendations. The first should be used for new crops or to renovate an existing c The second should be used for maintenance of an existing crop. For future maintenance of the new or renovated cr use the second recommendation and omit the lime.

If renovation involves the addition of legumes to grass pastures, the nitrogen should be omitted.

Grass pasture maintenance notes:

Apply recommended amounts of phosphate and potash in one application anytime during the year. For extra growth stockpiling in the fall, apply nitrogen August 15 to September 15 and from March 1 to March 30, if additional is needed in the spring. If additional growth is only needed during one season, apply nitrogen for that season

If urea is the nitrogen source, especially for fall topdressing, some loss of nitrogen may occur if applied to soils followed by three or more days of rapidly drying conditions without rainfall.

Crown Vetch establishment notes:

Each crown vetch sample has two recommendations. The first should be used for new crops or to renovate an e crop. The second should be used for maintenance of an existing crop. For future maintenance of the new or crop, use the second recommendation and omit the lime.

*Ratings indicates relative availability of nutrients to plants: (L) = Low; (M) = Medium; (H) = High; (V) = Very High; (D) = Deficient; (S) = Suff
**PPM = Parts Per Million If you have questions about these recommendations, contact your Extension office.

MWPS007594

Agricultural Extension Service
University of Tennessee Institute of Agriculture

SOIL TEST REPORT

TO: HARALSON, JOHN TIMOTHY
(page 2, cont'd)

DATE:
COUNTY:
LAB NO:

FROM: John R. Jared
John R. Jared
Professor
Plant & Soil Science
P. O. Box 110019
Nashville, TN 37222-0019

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMMENDATIONS		
				Pounds Per Acre And Ratings										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash
	Crown Vetch maintenance notes:															
	Apply recommended amounts of phosphate and potash in one application anytime during the year.															

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MWPS007595

A. :ultural Extension Service
University of Tennessee Institute of Agriculture

SOIL TE:T REPORT

TO: HARALSON, JOHN TIMOTHY
ASST. EXTENSION AGENT
1110 DAYTON BLVD.
CHATTANOOGA, TENNESSEE 37405

DATE: 11/07/86
COUNTY: HAMILTON
LAB NO: 65661

FROM: John R. Jared
John R. Jared
Professor
Plant & Soil Science
P. O. Box 110019
Nashville, TN 37222-0019

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMMENDATIONS		
				Pounds Per Acre And Ratings*										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash
01	Grass Pasture est-renov.	8.4		68 H	190 H								0	30	30	30
	Grass Pasture maintenance	8.4		68 H	190 H								0	30-60	0	0
02	Crown Vetch	7.9		36 H	160 M								0	0-15	30	60
	Crown Vetch maintenance	7.9		36 H	160 M								0	0	0	30

The two samples you submitted to the Soil Testing Laboratory contain medium to high levels of potassium and high levels of phosphorus. Such levels would certainly be sufficient for grass or ground cover growth. However, water pH readings are higher than necessary and could perhaps cause problems. This is especially true for sample 01. Such high pH values could cause severe nutrient imbalances.

I would suggest that only a small area be established for observation before too many dollars are invested.

Sincerely,

/S/ John R. Jared
John R. Jared
Professor
Plant and Soil Science

JRJ:Mjw

cc: Debbie Brakefield

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**PPM = Parts Per Million

MWPS007596

RECEIVED
FEB 1987
M. C. I.

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
SOUTHEAST REGIONAL OFFICE
2501 MILNE STREET
CHATTANOOGA, TENNESSEE 37406-3399

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Environmental Engineer
Division of Solid Waste Management

JD:pph
Enclosure

cc: Jim Smallwood, U.S. Pipe and Foundry Co.
Chuck Priddy, MCI
Wayne McCoy, EDGE
Division of Solid Waste Management, Nashville
Bob Jerardi, Hamilton County Health Department

Agricultural Extension Service
University of Tennessee Institute of Agriculture

P. O. Box 1071
Knoxville, Tennessee 37901-1071

January 19, 1987

Mr. J.T. Haralson
Asst. Ext. Agent
110 Dayton Blvd.
Chattanooga, TN 37405

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Additional factors to consider regarding the dump site material include 1) heavy metal and 2) sodium content, and 3) salinity. Heavy metals (i.e. copper, nickel, lead,...) may interfere with normal, internal plant processes when toxic levels exist in soils.

Generally, sodium is considered as it relates to soil physical and chemical properties. Adverse physical and chemical conditions may exist in soils high in exchangeable sodium. Sodic soils may be reclaimed by replacing exchangeable sodium with calcium or magnesium and removing sodium by leaching. Gypsum ($CaSO_4$-$2H_2O$) may be used to remove exchangeable sodium from soil and replace it with calcium. The resultant soil is more friable and water infiltration and percolation rates increase.

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Bermudagrass, a warm season, perennial sod-forming grass deserves consideration. Common bermudagrass spreads by both above ground (stolons) and below ground (rhizomes) runners and provides excellent erosion control when properly managed. Common bermudagrass can be seeded, sprigged (sprigs are individual plants or pieces of plants from which new plants develop which may be placed 4 to 6 inches apart in furrows 2 to 3 inches deep spaced on 6 to 12 inch centers), stolonized (sprigs uniformly broadcast over the soil surface - a disk is used to partially incorporate sprigs following stolonizing), plugged or sodded. Sodding is recommended on areas prone to erosion including extreme slopes, waterways and critical areas which may experience water moving at a high velocity.

Hydromulching (hydraulic broadcasting of seed and mulch over the soil surface) has been used effectively for ground cover establishment on steep slopes where seedbed preparation and use of conventional equipment is not possible. A seed mixture containing 67 percent (by weight) hulled bermudagrass and 33 percent annual lespedeza planted from

April 15 to June 15 at a rate of 21 pounds per acre may provide adequate erosion control. Annual lespedeza in combination with bermudagrass will provide temporary cover until bermudagrass becomes well established. Use of a mulch is recommended to absorb and retain moisture, reduce soil erosion and hold seed in place.

Tall fescue, a cool season, perennial bunch grass may be established in spring, late summer or early fall. Periodic fertilization and mowing are required to maintain adequate cover (tall fescue does not spread by rhizomes or stolons). A seed mixture containing 90 percent (by weight) tall fescue and 10 percent white clover has been recommended for revegetation of roadsides in Tennessee. Serecia lespedeza and crownvetch have also been used effectively (pg. 8 - Revegetation and beautification of roadsides in Tennessee).

Reducing steepness and length of slopes will make plant establishment and maintenance easier and prevent land slides. Thirty pounds of nitrogen, phosphate and potash per acre (200 lbs. 15-15-15 fertilizer/acre) should be broadcast and incorporated prior to planting bermudagrass or tall fescue. If bermudagrass is established prior to July 1, 44 lbs. nitrogen per acre (approximately 100 lbs. urea/acre or 125 lbs. ammonium nitrate/acre) should be applied six weeks after planting. Two-hundred-fifty pounds of 15-15-15 fertilizer (or equivalent) should be applied to bermudagrass each spring (May 1 to May 15). Spring plantings of tall fescue should be refertilized in the early fall (500 lbs. 6-12-12/acre or its equivalent). Refertilize fall plantings of tall fescue in the early spring (April 1-15). Tall fescue should be fertilized each spring (April 1-15) with 250 lbs. of 15-15-15 per acre to maintain cover.

Immediately after planting, the area should be irrigated frequently to maintain adequate moisture in the upper 1 to 2 inches of soil (630 gallons/1000 ft^2 is equivalent to a 1 inch rainfall). If possible, water should be applied slowly to prevent seed movement and reduce runoff. After developing plants have become well established, the practice

of light, daily applications of water can be discontinued. More water should be applied less frequently to increase rooting depth.

Due to the limited information available regarding response of several plant species to the material generated at the U.S. Pipe Foundry, I agree with John Jared and suggest that a small area be established for observation and evaluation before a major capital expenditure for the establishment of a vegetative canopy over the entire site.

Please don't hesitate to call if I may be of further assistance.

Sincerely,

Tom Samples

Tom Samples
Assistant Professor
Ornamental Horticulture and
Landscape Design

Enclosures

gi

A cultural Extension Service
University of Tennessee Institute of Agriculture

TO: HARALSON, JOHN TIMOTHY
ASST. EXTENSION AGENT
1110 DAYTON BLVD.
CHATTANOOGA, TENNESSEE 37405

DATE: 11/07/80
COUNTY: HAMILTON
LAB NO: 65661

Nashville, TN 37212

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMMENDATIONS		
				Pounds Per Acre And Ratings*										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash
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Grass pasture est.-renov. notes:

Each pasture sample has two recommendations. The first should be used for new crops or to renovate an existing c The second should be used for maintenance of an existing crop. For future maintenance of the new or renovated cr use the second recommendation and omit the lime.

If renovation involves the addition of legumes to grass pastures, the nitrogen should be omitted.

Grass pasture maintenance notes:

Apply recommended amounts of phosphate and potash in one application anytime during the year. For extra growth stockpiling in the fall, apply nitrogen August 15 to September 15 and from March 1 to March 30, if additional is needed in the spring. If additional growth is only needed during one season, apply nitrogen for that season

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Crown Vetch establishment notes:

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**PPM = Parts Per Million If you have questions about these recommendations, contact your Extension office.

MWPS007602

Agricultural Extension Service
University of Tennessee Institute of Agriculture

SOIL TEST REPORT

TO: HARALSON, JOHN TIMOTHY
(page 2, cont'd)

DATE:
COUNTY:
LAB NO:

FROM: John R. Jared
John R. Jared
Professor
Plant & Soil Science
P. O. Box 110019
Nashville, TN 37222-0019

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMMENDATIONS		
				Pounds Per Acre And Ratings										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Lime-stone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash
	Crown Vetch maintenance notes:															
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**PPM = Parts Per Million [illegible] If you have questions [illegible]

MWPS007603

SOIL TEST REPORT

Agricultural Extension Service
University of Tennessee Institute of Agriculture

TO: HARALSON, JOHN TIMOTHY
ASST. EXTENSION AGENT
1110 DAYTON BLVD.
CHATTANOOGA, TENNESSEE 37405

DATE: 11/07/86
COUNTY: HAMILTON
LAB NO: 65661

FROM: John R. Jared
John R. Jared
Professor
Plant & Soil Science
P. O. Box 110019
Nashville, TN 37222-0019

SAMPLE INFORMATION				SOIL TEST RESULTS										RECOMMENDATIONS		
				Pounds Per Acre And Ratings*										Pounds Per Acre		
Sample Number	CROP	Water pH	Buffer pH	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	Zn Zinc	Fe Iron	Mn Manganese	Organic Matter %	Soluble Salts PPM**	Limestone Tons/Acre	N Nitrogen	P_2O_5 Phosphate	K_2O Potash
01	Grass Pasture est-renov.	8.4		68 H	190 H								0	30	30	30
	Grass Pasture maintenance	8.4		68 H	190 H								0	30-60	0	0
02	Crown Vetch	7.9		36 H	160 M								0	0-15	30	60
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I would suggest that only a small area be established for observation before too many dollars are invested.

Sincerely,

/S/ John R. Jared
John R. Jared
Professor
Plant and Soil Science

JRJ:Mjw

cc: Debbie Brakefield

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**PPM = Parts Per Million

MWPS007604

MONITORING WELL INSTALLATION PROGRAM
U.S. PIPE & FOUNDRY COMPANY
CHATTANOOGA, TENNESSEE

Prepared for:

U.S. Pipe & Foundry Company
Birmingham, Alabama

Prepared by:

MCI Consulting Engineers, Inc.
Knoxville, Tennessee

May 6, 1985

1.0 INTRODUCTION

This report presents the details of U.S. Pipe & Foundry's monitoring well installation program at their Chattanooga, Tennessee landfill site. The well locations are shown on page 2 on a copy of a 1983 aerial photograph. Pursuant to approval of the well locations by the Tennessee Division of Solid Waste Management (TDSWM) in a letter dated March 22, 1985, U.S. Pipe & Foundry contracted with MCI Consulting Engineers, Inc. (MCI) for the installation, development, sampling, and analyses for two monitoring wells.

These activities are summarized as follows:

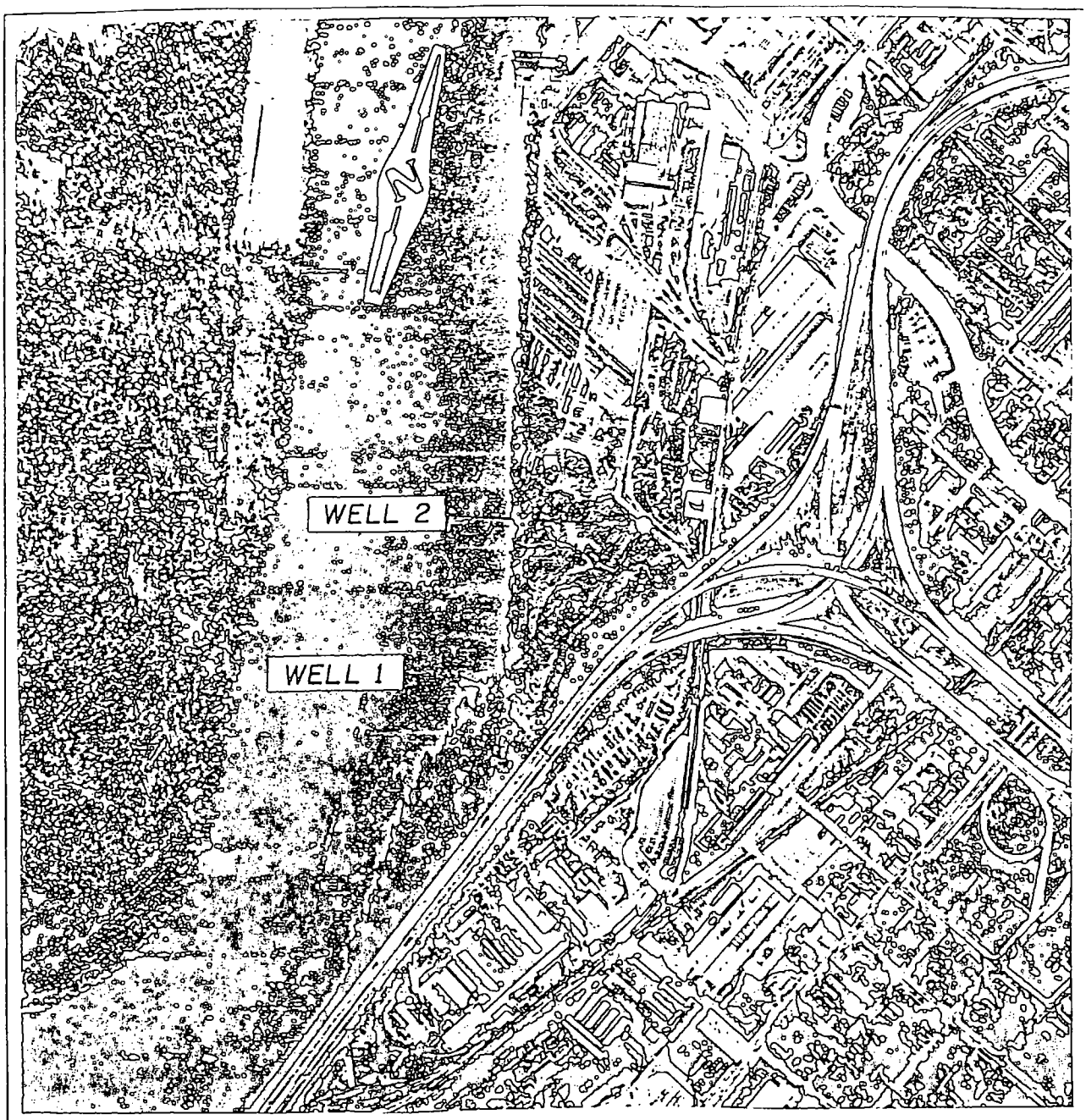
- Installation of wells: April 11, 12 and 16, 1985
- Development of wells: April 11, 12, 16 and 17, 1985
- Sampling of wells: April 24, 1985
- Analyses of samples: April 25, 26 and 29, 1985

Subsequent sections of this report provide specific information associated with each of the above referenced activities.

2.0 MONITORING WELLS

2.1 Drilling

Drilling was conducted with a CME-550 all terrain vehicle rig. Hollow stem augers with an internal diameter (ID) of 4 inches were utilized for Well 1. Because Well 2 had to be installed



Photograph was flown in October, 1983 by Continental Aerial Surveys for MCI Consulting Engineers, Inc. as part of the permit development for U.S. Pipe and Foundry's landfill.

DATE	REVISION	BY

LOCATION MAP FOR MONITORING WELLS

SCALE NO SCALE

PREPARED FOR U.S. Pipe & Foundry
Chattanooga, Tennessee

MCI/CONSULTING ENGINEERS, INC
NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

ENG: 2282220

MWPS007607

approximately 45 feet below the water table, 6-inch ID augers were necessary for this installation. MCI's hydrogeologist logged all phases of the drilling and installation of the monitoring wells.

The drilling logs can be found on pages 4 and 5. As expected, Well 1, which is near the Tennessee River, penetrated alluvial sandy clays and fine-grained sands at shallow depths of 0.5 and 3.5 feet, respectively, below ground surface. In contrast, Well 2, which is along the landfill's eastern border, was drilled through 49 feet of foundry wastes overlying alluvial coarse-grained sands and gravels. A perched water table was encountered at a depth of approximately 14 feet below ground surface, and saturated conditions persisted throughout the drilling. However, it should be noted that observations made during the drilling and subsequent well development operations indicate that the perched water zone within the wastes is not hydraulically connected with the deeper, underlying ground water in the alluvium. This conclusion is based on the differences in the water levels of each zone. The perched zone exhibited a water level approximating 14 feet from ground surface, whereas the water level in the alluvium subsequent to well installation was about 28 feet below ground surface, or nearly at the river elevation. These two ground water zones may be hydraulically connected at other locations, however.

GEOLOGIST's LOG

Facility:	U.S. Pipe & Foundry Landfill
Location:	Chattanooga, TN
Date:	April 11, 1985
Hole:	1-downgradient
Logged by:	SBD
Drilling Method:	4-inch hollow stem augers

0-.5:	Veneer of foundry fill from pad construction.
.5-3.5:	Clay, silty, sandy, micaceous, brown. Very moist to wet.
3.5-4.0:	Sand, fine- to medium-grained, dark gray, with silt and clay laminae. Possible phenolic odor. Wet with soft returns.
4.0-14.5:	Sand, fine- to medium-grained, light gray, with less silt and clay below 10', micaceous. Wet with soft returns.
14.5-17.0:	Sand, fine- to medium-grained, light gray and brown, micaceous, with less silt and clay. Wet, flowing returns.
Total Depth:	17.0

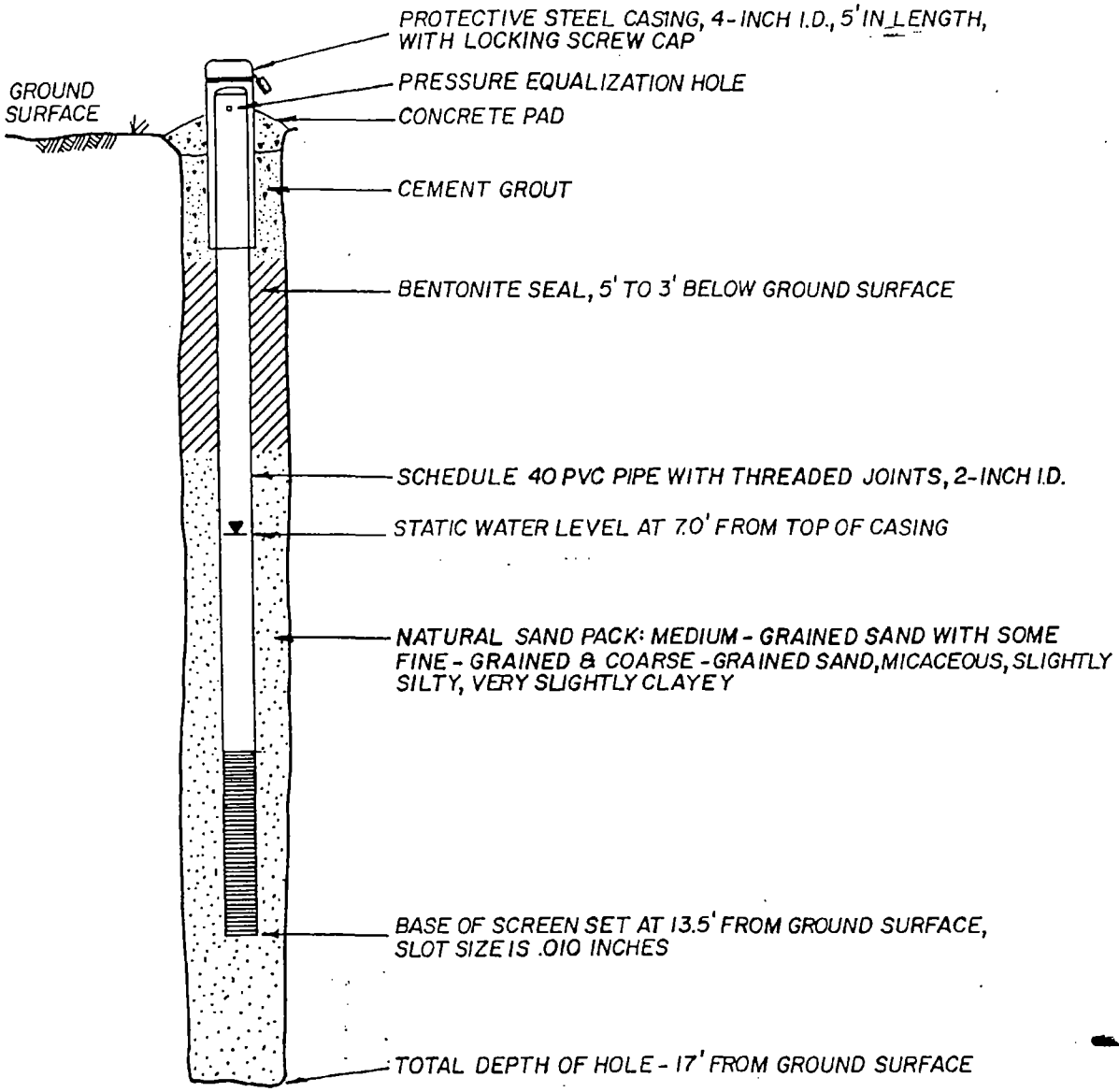
MCI
Consulting Engineers, Inc.

GEOLOGIST's LOG

Facility:	U.S. Pipe & Foundry Landfill
Location:	Chattanooga, TN
Date:	April 12 and 16, 1985
Hole:	2-upgradient
Logged by:	SBD
Drilling Method:	4-inch and 6-inch hollow stem augers

0-.3:	Soil with grass and roots.
.3-13.9:	Silt, sandy, black, dry, firm.
13.9-25.0:	Silt, sandy, black, wet, soft.
25.0-40.0:	Silt, sandy, black with yellow sand and scattered rubber and metal trash. Less saturated.
40.0-49.0:	No return. At 49.0 slightly rough drilling, believed to be contact between waste and alluvium.
49.0-55.0:	No return.
	Used rods and split-spoon sampler to clear plug within hollow stem augers. After plug was cleared, split-spoon sampler was driven to obtain in-situ sample. Sampler contained 8 inches of yellowish-brown sand, coarse- to very coarse-grained, with chert pebbles. Above the sand were 1 inch of orange and yellow clay laminae.
	Hole was deepened to 58.0 on April 16, 1985 with 6-inch hollow stem augers.
Total Depth:	58.0'

MCI
Consulting Engineers, Inc.



DATE	REVISION	BY

WELL No. 1
DETAILS OF MONITORING WELL CONSTRUCTION

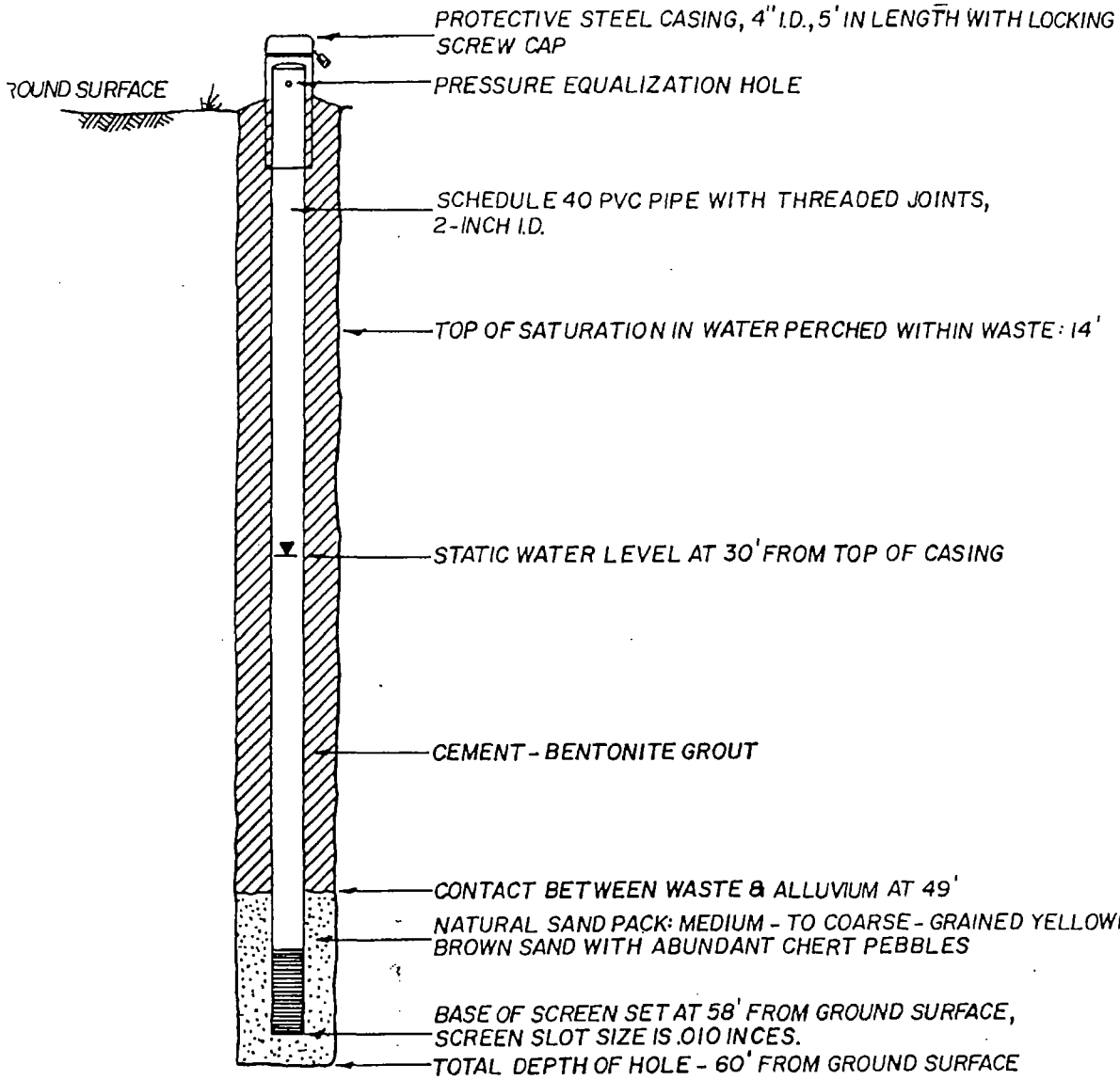
SCALE: NOT TO SCALE

PREPARED FOR U.S. PIPE and FOUNDRY
CHATTANOOGA, TENNESSEE

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

DATE 4/22/85 SHEET 6 OF 12

MWPS007611



DATE	REVISIONS	BY

WELL No. 2
DETAILS OF MONITORING WELL CONSTRUCTION

SCALE: NOT TO SCALE

PREPARED FOR U.S. PIPE and FOUNDRY
CHATTANOOGA, TENNESSEE

MCI/CONSULTING ENGINEERS, INC.
NASHVILLE KNOXVILLE HUNTSVILLE LOUISVILLE

DATE 4/22/85 SHEET 7 OF 12

2.2 Installation

As shown on the figures on pages 6 and 7, these wells are constructed of 2-inch ID Schedule 40 polyvinyl chloride (PVC), with threaded joints. The PVC Schedule 40 screens are 5-feet in length and have a slot size of .010 inches. The end of the screen is capped, as is the top of the PVC pipe, where a pressure equalization hole was drilled. Protective steel casing 5-feet in length extends approximately 2.5 feet above ground surface, and has a locking cap. The protective casings are painted fluorescent orange for maximum visibility.

The alluvial sands form a natural sand pack around and slightly above the screens. Well 1 is sealed with a layer of bentonite 2 feet in thickness, above which is neat cement grout. Well 2 is sealed with a cement-bentonite grout mixture from the top of the sand pack to the ground surface.

In Well 2, a drilling mud was used to provide greater hole stability and to prevent the foundry wastes from circulating and/or collapsing into the screened interval. The screen and pipe were installed within the 6-inch ID hollow stem augers. The tools were raised 5 feet to allow collapse of the alluvial sands and gravels for a natural sand pack. Subsequently, the cement-bentonite grout

was immediately pumped after the tools were raised in increments of 5 feet.

2.3 Development

Development of a monitoring well is a very important process for the following reasons:

- removes drilling products from the area around the well screen
- removes fine-grained materials from the sand pack and the adjacent areas around the well screen
- promotes flow of ground water to the well
- provides that ground water representative of the aquifer is sampled

The development of these wells was accomplished by using a bottom-discharging PVC bailer 3-feet in length, 1.25 inches ID, and with threaded joints. Each well had its own dedicated bailer and polyethylene rope. A large plastic sheet was laid by the well so that the rope would not contact the ground surface.

Typically a well is evacuated several times the well volume during development. A well volume is defined as the volume of water contained within the screen, casing, and also within the sand pack. During the evacuation process surge bailing is also used to agitate

the water and cause it to move in and out of the screen and sand pack. This action helps remove fines from the sand pack so they can be bailed out. In Well 2 fines were not a problem because of the coarse nature of the sands and the minor amount of silt and clay present. However, Well 1 was installed within fine-grained sands, some of which entered the well via the screen slots.

During development, field measurements for pH, specific conductance, and temperature were taken. Appendix I provides these measurements and visual observations during both development and also the pre-sampling purge. Persistent trends noted include a high specific conductance and a sulfur odor in Well 1, and a relatively low specific conductance in Well 2.

3.0 SAMPLING AND ANALYTIC RESULTS

Each dedicated bailer and rope was washed and triple rinsed with distilled water prior to the pre-sampling purge. The field measurements indicated when the ground water had reached stability, which was after approximately 1.5 well volumes for both wells. Samples were collected from within the screened interval and were carefully poured into bottles supplied by IT Analytical Services of Knoxville. Each bottle was tagged with the necessary information, and the bottles were stored on ice in a cooler. The samples were transported to the laboratory on the same day. Written instructions to the laboratory included that samples be filtered

so that the metals reported would be dissolved metals and not total metals. A copy of the laboratory's analytic sheet can be found in Appendix I.

Parameter (mg/l)	MCI-1	MCI-2
Phenols	0.05	0.01
pH (standard units)	7.60	7.79
Total Organic Carbon	278	15
Cadmium	<0.001	0.001
Iron	2.4	4.4
Lead	<0.01	<0.01

Iron exceeds the standard of 0.3 mg/l (National Secondary Drinking Water Standards). However, ground water within alluvium quite often exhibits high concentrations of iron, these concentrations are not believed to be significant. Both the lead and cadmium are well below their respective standards of 0.05 mg/l and 0.010 mg/l (National Interim Primary Drinking Water Standards). Although there is no standard for phenols, the Environmental Protection Agency (EPA) has developed criteria for the protection of human health for certain inorganic and organic contaminants (Federal Register, November 28, 1980). Based on available toxicity data, EPA's derived level for the protection of human health is 3.5 mg/l. However, to control the undesirable taste and odor quality of ambient water, EPA's estimated level is 0.3 mg/l. Samples from both wells are well below even the more restrictive phenol criterion.

The Total Organic Carbon (TOC) value exhibited by Well 1 is 278 mg/l, and is excessive, although there is no standard for comparison. This TOC concentration could be a one-time anomalous elevation, or it could be attributable to the leaching of organic resins and binders from old wastes. A series of samplings and analyses should determine the actual TOC concentration and establish if this initial concentration is an anomalous value.

U.S. PIPE & FOUNDRY
CHATTANOOGA, TN
WELL DEVELOPMENT RECORD
WELL NO. 1: DOWNGRADIENT

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
4-11-85/ Development	7.5	17.0	89	1	-	-	-	-	Very dark gray water with abundant brown and black (minor) sand. No film or odor.
				49	9.5	-	-	-	Water improved to medium grayish-tan. No film or odor.
4-12-85	7.8	15.4	86	1	-	12.3	6.68	2530	Clear water, except for gray, sandy water from base of screen. No film or odor.
				35	6.8	12.9	6.87	2420	Grayish water with sand. No film or odor.
				35	6.7	13.1	6.90	2150	Light gray, slightly turbid water with less sand. No film or odor.
				51	9.7	13.1	6.60	2100	Less turbid water. No odor or film.
4-16-85/ Development	8.1	16.4	86	1	-	13.3	6.76	2330	Slightly turbid with a faint greenish-yellow tint. No film or odor.

WELL NO. 1: DOWNGRADIENT (continued)

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
				39	7.6	13.6	6.15	2310	Turbid with grayish color due to fine-grained sediment. Possible slight sulfur odor. No film.
				50	9.5	13.5	6.20	2460	Turbid with grayish color. Possible slight sulfur odor. No film.
				45	8.6	13.5	6.20	2510	Turbid with slight grayish color. Definite sulfur odor. No film.
				45	8.6	13.6	6.20	2490	Turbid with slight grayish color. Definite sulfur odor. No film.
4-24-85/ Pre-Sampling Purge	7.0	17.0	89	1	-	13.4	6.80	2200	Clear, strong sulfur odor, no film.
				39	7.6	13.6	6.08	2420	Turbid, grayish from clay and silt. Contains fine-grained brown sand. Slight sulfur odor, no film.
				48	9.1	13.9	6.27	2310	Turbid, grayish from clay and silt. Some fine-grained brown sand. Slight sulfur odor, no film.
				44	8.4	13.9	6.25	2300	Turbid, grayish. Some fine-grained brown sand. Slight sulfur odor, no film.

U.S. PIPE & FOUNDRY
CHATTANOOGA, TN
WELL DEVELOPMENT RECORD
WELL NO. 2: UPGRADIENT

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
4-17-85/ Development	30.0	32.2	169	200	28.5	-	-	-	Bailed to remove drilling mud fluid from well column and sand pack. (Bailer held approximately 75% of its volume.)
				1	-	16.9	7.29	654	Slightly turbid water with small amount of very fine-grained sand. No film or odor.
									Added 3/4 quart of bleach and 3 gallons of distilled water after bailing down to top of screen. Agitated water column with bailer and continued bailing to remove water with floccules.
				75	14.4	17.2	7.16	719	Slightly turbid with brownish-black floating floccules. No odor, slight film.
				80	15.2	18.2	7.14	696	Slightly turbid with much less floccules. No odor, slight film.

WELL NO. 2: UPGRADIENT (continued)

Date/Activity	Depth to Water (ft.)	Well Volume (gal.)	Bails Per Volume	Bails Removed	Volume Evacuated (gal.)	Temp. °C	pH	Cond. umhos/cm	Comments
				80	15.2	17.3	7.03	694	Slightly turbid with only a very small amount of floccules. No odor and no film.
4-24-85/ Pre-Sampling Purge	30.3	32.2	169	1	-	16.7	7.76	685	Turbid with some suspended matter. No odor, no film.
				84	16.2	16.3	7.13	636	Clear with a small amount of suspended matter. No odor, no film.
				85	16.2	16.2	7.10	674	Clear with a small amount of suspended matter. No odor, no film.
				85	16.2	16.2	7.10	669	Clear with a small amount of suspended matter. No odor, no film.

HYDROLOGIC CALCULATIONS
DITCH DESIGN

		DITCH CHARACTERISTICS				DESIGN		ANALYSIS	
Ditch	Peak Flow (cfs)	Length (feet)	Elevation Difference (feet)	Slope (feet/feet)	Mannings Coefficient	Flow Depth (feet)	Velocity (feet/sec.)	Ditch Depth (feet)	Ditch Capacity (CFS)
1	3	590	30.00	0.051	0.04	0.6	3.6	1.5	28.9
2	4	630	4.00	0.006	0.04	1.1	1.8	1.5	10.2
3	8	320	25.00	0.078	0.04	0.9	5.5	1.5	35.8
4	7	790	4.00	0.005	0.04	1.4	1.9	1.5	9.1
5	12	1445	8.00	0.006	0.04	1.6	2.2	2.0	20.5
6	8	950	30.00	0.032	0.04	1.0	3.9	1.5	22.8
7	6	670	15.00	0.022	0.04	1.0	3.2	1.5	19.2
8	14	150	41.00	0.273	0.04	0.8	10.1	1.5	67.0
9	5	450	2.25	0.005	0.04	1.2	1.7	1.5	9.1
10	4	560	17.00	0.030	0.04	0.8	3.2	1.5	22.3
11	5	740	45.00	0.061	0.04	0.8	4.4	1.5	31.6
12	9	200	18.00	0.090	0.04	0.9	5.9	1.5	38.4
13	4	950	49.00	0.052	0.04	0.7	3.9	1.5	29.1
14	14	600	44.00	0.073	0.04	1.1	6.1	1.5	34.7
15	3	515	16.00	0.031	0.04	0.7	3.0	1.5	22.6
16	3	285	20.00	0.070	0.04	0.6	4.1	1.5	33.9
17	5	760	14.00	0.018	0.04	0.9	2.8	1.5	17.4

Notes:

a. Calculations based on Manning's Formula
b. $Q_3 = Q_{15} + Q_{17}$
c. $Q_8 = Q_6 + Q_7$
d. Peak flow in Ditch 12 includes the flows from ditches 11 & 16
e. Peak flow in Ditch 14 includes the flows from ditches 10 & 13

HYDROLOGIC CALCULATIONS
CULVERT DESIGN

Culvert	Ditch	Flow (cfs)	Mannings Coefficient	Pipe Length (feet)	Slope (%)	Calculated Diameter (inches)	Actual Diameter (inches)
A	1 & 2	7	0.024	40	0.5%	22.1	24
B	9 & 12	14	0.024	50	0.5%	28.7	30
C	4, 5 & 8	33	0.024	40	0.5%	39.6	42
D	13	4	0.024	50	0.5%	17.9	18
E	3	8	0.024	40	0.5%	23.3	24

NOTE: Calculations based on Mannings Formula

HYDROLOGIC CALCULATIONS

SEDIMENT TRAPS

Sediment Trap	Drainage Area (acres)	Runoff Depth (inches)	25 year/24 hour Storm Volume (cubic feet)	Required Size (square feet)
A	2.23	2.0	16271	2712
B	2.95	2.0	21524	3587
C	15.46	2.0	112801	18800
D	3.82	2.0	27872	4645
E	2.95	2.0	21524	3587

SPILLWAYS FOR SEDIMENT TRAPS A - E

Difference Between 25 and 100 Year Flows (cfs)	Length (feet)	Slope (feet/feet)	Mannings Coefficient	Width (feet)	Depth (feet)	Flow Capacity (CFS)	Comments
2	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
6	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
13	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
2	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement
5	10	0.1	0.030	5	1	62.6	Standard detail meets design requirement

Notes:

1. Sediment traps are typically 6 feet deep
2. Sediment traps are shown on drawings at approximate scale.
3. Spillways are typically 1 foot deep and 5 feet wide

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #1

Data: Drainage Area : .93 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.697
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #2

Data: Drainage Area : 1.3 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.377
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #4

Data: Drainage Area : 3.43 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.24 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.071
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	7

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #5

Data: Drainage Area : 7.89 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.48 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	0.763
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	12

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #6

Data: Drainage Area : 2.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.628
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #7

Data: Drainage Area : 1.74 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.628
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #9

Data: Drainage Area : 1.71 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.377
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #10

Data: Drainage Area : 1.32 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.697
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #11

Data: Drainage Area : 1.36 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.775
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #12

Data: Drainage Area : .26 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.973
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #13

Data: Drainage Area : 1.1 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.973
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #14

Data: Drainage Area : 1.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.02 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	2.263
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #15

Data: Drainage Area : 1.01 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.697
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #16

Data: Drainage Area : .95 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.775
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	3

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 25 YEAR, 24 HOUR STORM - DITCH #17

Data: Drainage Area : 1.94 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	6.00
Ia/P Ratio	0.21
Runoff (in)	2.01
Unit Peak Discharge (cfs/acre/in)	1.377
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100 YEAR, 24 HOUR STORM - DITCH #1

Data: Drainage Area : .93 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.707
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #2

Data: Drainage Area : 1.3 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.400
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
unty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #4

Data: Drainage Area : 3.43 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.24 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.097
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	10

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Title: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #5

Data: Drainage Area : 7.89 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.48 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	0.787
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	17

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #6

Data: Drainage Area : 2.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.642
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	11

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #7

Data: Drainage Area : 1.74 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.08 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.642
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

ject : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
nty : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #9

Data: Drainage Area : 1.71 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.400
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	7

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #10

Data: Drainage Area : 1.32 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.707
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #11

Data: Drainage Area : 1.36 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.781
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	7

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #12

Data: Drainage Area : .26 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.961
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	1

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #13

Data: Drainage Area : 1.1 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.04 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.961
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	6

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #14

Data: Drainage Area : 1.4 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.02 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	2.210
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	9

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #15

Data: Drainage Area : 1.01 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.07 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.707
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Subtitle: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #16

Data: Drainage Area : .95 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.06 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.781
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	5

* - Value(s) provided from TR-55 system routines

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : US PIPE FOUNDRY WASTE LANDFILL User: RBM Date: 05-27-96
County : HAMILTON State: TN Checked: ____ Date: _____
Title: HYDROLOGIC CALCULATIONS FOR 100YEAR, 24 HOUR STORM - DITCH #17

Data: Drainage Area : 1.94 * Acres
Runoff Curve Number : 61 *
Time of Concentration: 0.13 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	100
24-Hr Rainfall (in)	7.10
Ia/P Ratio	0.18
Runoff (in)	2.77
Unit Peak Discharge (cfs/acre/in)	1.400
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

* - Value(s) provided from TR-55 system routines

stability requirement, use retardance for newly mowed condition (generally C or D). To determine channel capacity, use at least one retardance class higher.

b. Determine *n* from Figure 8.05c.

Step 7. Calculate the actual channel velocity, V, using Manning's equation (Figure 8.05a), and calculate channel capacity, Q, using the continuity equation.

Step 8. Check results against permissible velocity and required design capacity to determine if design is acceptable.

Step 9. If design is not acceptable, alter channel dimensions as appropriate. For trapezoidal channels, this adjustment is usually made by changing the bottom width.

Table 8.05b
Manning's *n* for Structural Channel Linings

Channel Lining	Recommended *n* values
Asphaltic concrete, machine placed	0.014
Asphalt, exposed prefabricated	0.015
Concrete	0.015
Metal, corrugated	0.024
Plastic	0.013
Shotcrete	0.017
Gabion	0.030
Earth	0.020

Source: American Society of Civil Engineers (modified)

Exhibit 8

Abbreviated Table of Values of Manning Roughness Coefficients.

Description of Lining	n
Reinforced concrete pipe	0.013
Corrugated metal pipe	0.024
Concrete, trowelled finish	0.013
Concrete, float finish	0.015
Street gutter or paved channel	0.015
Earth, straight and uniform	0.022
Grass-lined swales	0.030
Unmaintained brushy channel	0.080
Stone-lined channel (4-inch)	0.028
Stone-lined channel (6-in)	0.030
Stone-lined channel (9-in)	0.032
Stone-lined channel (12-in)	0.034
Stone-lined channel (15-in)	0.035
Stone-lined channel (18-in)	0.036

TABLE 21-11 Values of the Roughness Coefficient n for Use in the Manning Equation

	Min	Avg	Max
A. Open-channel flow in closed conduits			
1. Corrugated-metal storm drain	0.021	0.024	0.030
2. Cement-mortar surface	0.011	0.013	0.015
3. Concrete (unfinished)			
a. Steel form	0.012	0.013	0.014
b. Smooth wood form	0.012	0.014	0.016
c. Rough wood form	0.015	0.017	0.020
B. Lined channels			
1. Metal			
a. Smooth steel (unpainted)	0.011	0.012	0.014
b. Corrugated	0.021	0.025	0.030
2. Wood			
a. Planed, untreated	0.010	0.012	0.014
3. Concrete			
a. Float finish	0.013	0.015	0.016
b. Gunite, good section	0.016	0.019	0.023
c. Gunite, wavy section	0.018	0.022	0.025
4. Masonry			
a. Cemented rubble	0.017	0.025	0.030
b. Dry rubble	0.023	0.032	0.035
5. Asphalt			
a. Smooth	0.013	0.013	
b. Rough	0.016	0.016	
C. Unlined channels			
1. Excavated earth, straight and uniform			
a. Clean, after weathering	0.018	0.022	0.025
b. With short grass, few weeds	0.022	0.027	0.033
c. Dense weeds, high as flow depth	0.050	0.080	0.120
d. Dense brush, high stage	0.080	0.100	0.140
2. Dredged earth			
a. No vegetation	0.025	0.028	0.033
b. Light brush on banks	0.035	0.050	0.060
3. Rock cuts			
a. Smooth and uniform	0.025	0.035	0.040
b. Jagged and irregular	0.035	0.040	0.050

use 0.04 for ditches

critical-depth line C.D.L. The N.D.L. and C.D.L. are identical for a channel of critical slope and the N.D.L. is replaced by a horizontal line, at an arbitrary elevation, for the channel of horizontal or adverse slope.

There are three types of surface-profile curves possible in channels of mild or steep slope and two types for channels of critical, horizontal, and adverse slope.

The M1 curve is the familiar surface profile from which all backwater curves derive their name and is the most important from a practical point of view. It forms above the normal-depth line and occurs when water is backed up a stream by high water in the downstream channel. It is shown in Fig. 21-46*a* and *b*.

The M2 curve forms between the normal- and critical-depth lines. It occurs under conditions shown in Fig. 21-46*c* and *d*, corresponding to an increase in channel width or slope.

The M3 curve forms between the channel bottom and critical-depth line. It terminates in a hydraulic jump, except where a drop-off in the channel occurs before a jump can form. Examples of the M3 curve are in Fig. 21-46*e* and *f* (a partly opened sluice gate and a decrease in channel slope, respectively).

The S1 curve begins at a hydraulic jump and extends downstream, becoming tangent to a horizontal line (Fig. 21-46*g* and *h*) under channel conditions corresponding to those for Fig. 21-46*a* and *b*.

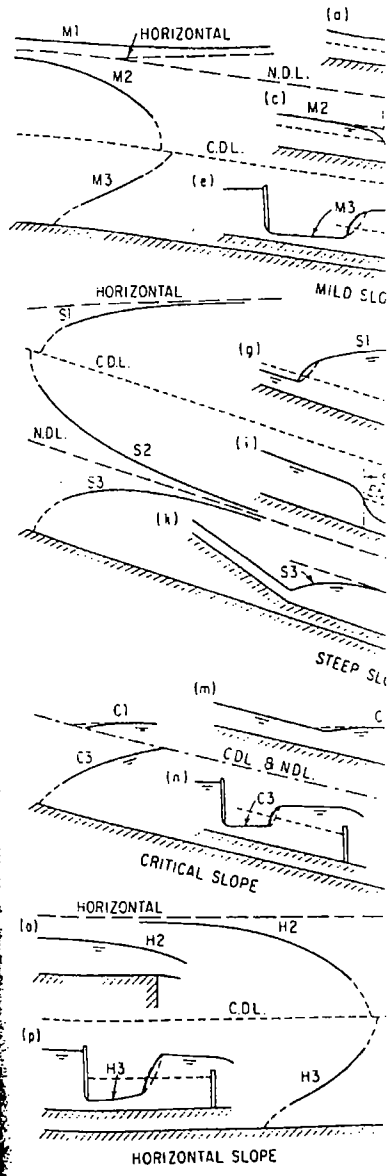
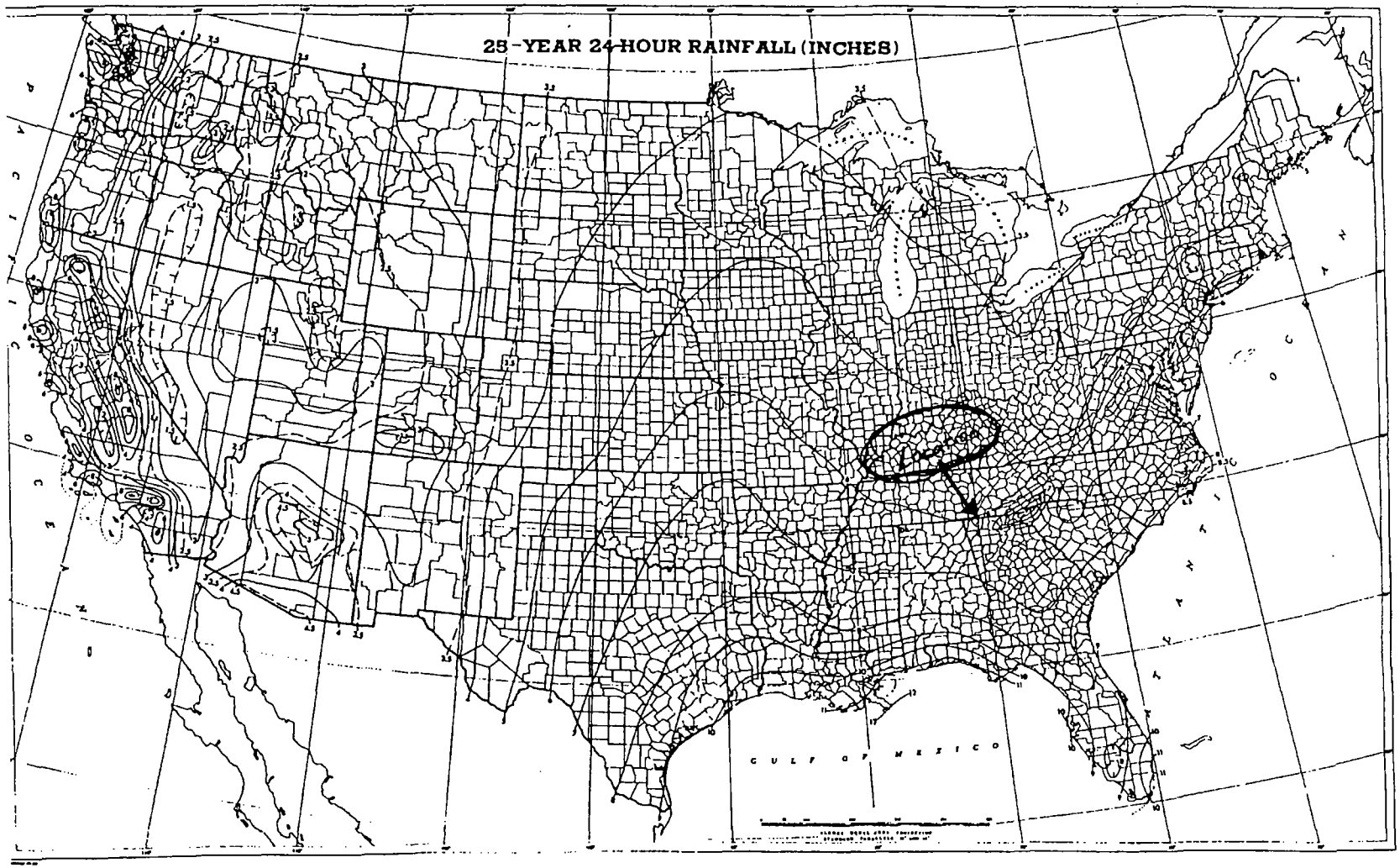


Fig. 21-46. Typical flow profiles for channel depth line; C.D.L., critical-depth line.



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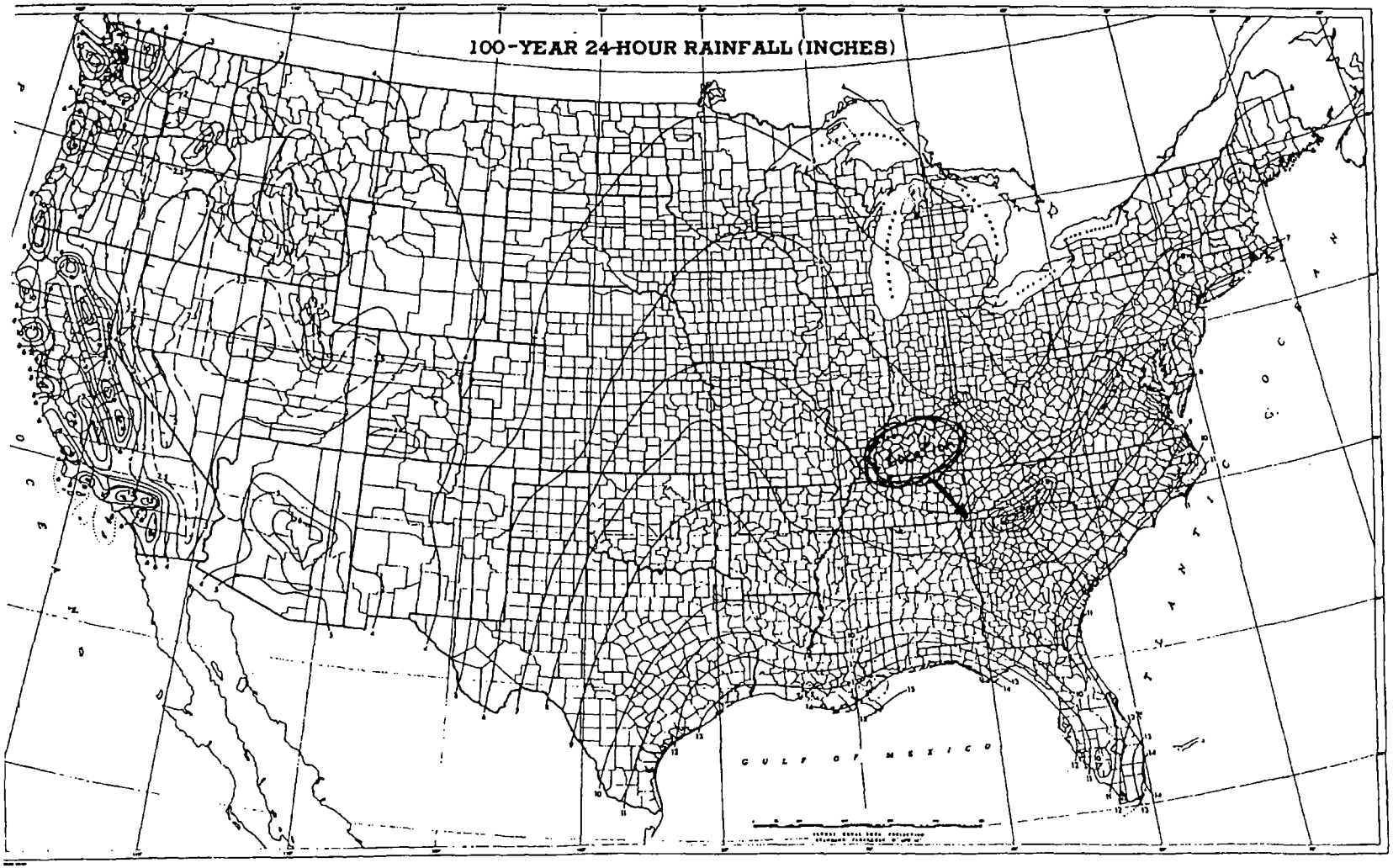

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U. S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No. 1

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
10/27/87			0.009	0.01	0.1	15	0.14		0.020	210	<0.0001
3/8/88	22	1220	0.015	<0.01	<1	16	0.001	7.1	0.025	290	0.0001
5/4/88	303	1260	0.004	<0.01	<1	19	0.071	6.8	0.021	290	0.0001
7/19/88	199	1230	0.001	<0.01	<1	14	0.015	7.1	0.008	15	0.0002
9/27/88	12	164	0.020	<0.01	<1	31	0.1	6.1	<0.001	44	<0.0005
1/4/89	151	173	<0.001	<0.01	<1	0.31	0.015	6.5	0.001	11	<0.0005
4/6/89	41	172	0.022	0.01	<1	21	0.03	7.0	0.001	29	0.0010
8/9/89	14	895	<0.001	<0.01	<1	6.6	0.004	7.1	0.016	70	1.8
10/5/89	123	736	0.003	0.01	<1	32	0.04	7.1	0.008	40	2.1
1/4/90	146	172	0.016	<0.01	<1	0.69	0.027	6.7	0.06	130	0.0035
4/10/90	199	1380	0.015	<0.01	<1	4.6	0.006	7.1	0.022	180	<0.0005
8/16/90	157	1130	0.003	<0.01	<1	5.9	0.024	7.2	0.004	100	0.0048
10/25/90	116	1220	0.002	0.01	<1	1.5	0.006	7.4	0.006	52	<0.0005
10/17/91	20	190	<0.004	<0.02	<1	11.53	<0.042	6.4	0.726	21.4	<0.002
4/8/92	72.5	741	<0.004	<0.02	<1	14.6	<0.042	7.0	0.027	228	<0.002
9/3/92	74	716	<0.004	<0.02	<1	2.72	<0.042	6.9	<0.005	27.3	<0.002
2/5/93	228	639	<0.004	<0.02	<1	3.91	<0.042	6.8	0.007	39.8	<0.002
5/7/93	170	976	<0.004	<0.02	<1	4.74	<0.042	6.75	0.012	38.1	<0.002
7/8/93	154	577	<0.004	<0.02	<1	6.29	<0.042	6.5	0.020	80.3	<0.002
10/1/93	140	177	<0.004	<0.02	<1	6.16	<0.042	6.5	<0.005	51.6	<0.002
1/6/94	20.2	196	<0.004	<0.02	<1	6.83	<0.042	6.8	<0.005	33.2	<0.002
6/1/94	200	687	<0.004	<0.02	<1	8.15	<0.042	6.9	<0.005	8.5	<0.002
9/26/94	5.93	4.07	<0.004	<0.02	<1	8.58	<0.042	7.1	<0.005	6.2	<0.002
12/30/94	180	440	<0.004	<0.02	<1	9.74	<0.042	6.9	<0.005	9.4	<0.002
3/27/95	907	230	<0.004	<0.02	<1	10.7	<0.042		<0.005	55	<0.002
6/30/95	95	932	<0.004	<0.02	<1	8.80	<0.042		<0.005	57	<0.002
9/29/95	100	591	<0.004	<0.02	<1	13.0	<0.042		<0.005	33.1	<0.002

U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No. 2 - Background

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
10/27/87			0.007	0.03	0.1	34	0.22		0.007	35	<0.0001
3/8/88	70	264	0.001	<0.01	<1	18	0.001	6.8	0.001	54	0.0001
5/4/88	112	249	0.007	<0.01	<1	72	0.099	6.6	0.001	35	0.0001
7/19/88	102	209	0.005	0.01	<1	33	0.063	6.6	0.002	12	0.0002
9/27/88	34	1170	0.011	<0.01	<1	21	0.079	6.8	0.040	26	<0.0005
1/4/89	303	1174	<0.001	<0.01	<1	0.31	0.006	6.9	0.009	8	0.0012
4/6/89	204	1070	0.10	<0.01	<1	8.2	0.032	7.2	0.007	550	0.0007
8/9/89	5	169	<0.001	<0.01	<1	23	0.038	6.8	<0.001	10	0.25
10/5/89	104	180	0.011	<0.01	<1	14	0.005	6.7	0.005	16	0.84
1/4/90	344	1180	0.004	0.01	<1	5.7	0.018	7.2	0.003	<1	<0.0005
4/10/90	83	190	0.011	<0.01	<1	33	0.012	6.7	0.001	60	<0.0005
8/16/90	96	166	0.006	<0.01	<1	13	0.034	6.7	<0.001	4	<0.0005
10/25/90	59	187	0.003	<0.01	<1	3.4	0.016	6.9	<0.001	260	<0.0005
10/17/91	203	959.5	<0.004	0.02	2	16.2	<0.042	6.6	0.0347	123	<0.002
4/8/92	23.7	114	<0.004	<0.02	<1	1.70	<0.042	6.6	<0.005	35.1	<0.002
9/3/92	49.3	111	<0.004	<0.02	<1	11.4	<0.042	6.5	<0.005	5.2	<0.002
2/5/93	45.6	91.3	<0.004	<0.02	<1	8.74	<0.042	6.3	<0.005	4.7	<0.002
5/7/93	85	244	<0.004	<0.02	<1	8.99	<0.042	6.0	0.007	4.80	<0.002
7/8/93	51.2	81.6	<0.004	<0.02	<1	13.1	0.073	5.8	<0.005	16.1	<0.002
10/1/93	100	98	<0.004	<0.02	<1	13.5	<0.042	5.7	<0.005	7.8	<0.002
1/6/94	110	8.96	<0.004	<0.02	<1	15.4	<0.042	5.8	<0.005	3.7	<0.002
6/1/94	150	540	<0.004	<0.02	<1	17.0	<0.042	6.5	<0.005	7.7	<0.002
9/26/94	5.97	4.16	<0.004	<0.02	<1	34.9	0.428	6.2	<0.005	2.4	<0.002
12/30/94	210	120	<0.004	<0.02	<1	15.1	<0.042	6.8	<0.005	6.7	<0.002
3/27/95	100	200	<0.004	<0.02	<1	14.4	<0.042		<0.005	218	<0.002
6/30/95	50	110	<0.004	<0.02	<1	17.9	<0.042		<0.005	36	<0.002
9/29/95	30	85	<0.004	<0.02	<1	5.39	<0.042		<0.005	3.5	<0.002

U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Outfall Pipe

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
10/27/87			0.001	0.01	<0.1	2.1	0.061		0.007	44	0.0010
3/8/88	40	257	<0.001	<0.01	<1	2.4	0.001	7.1	0.074	35	0.0002
5/4/88	55	266	0.003	<0.01	<1	1.8	0.048	7.0	0.002	8	0.0001
7/19/88	38	239	0.001	0.01	<1	4.1	0.014	7.1	0.01	10	0.013
1/4/89	44	173	<0.001	<0.01	<1	0.28	0.003	7.1	0.001	12	<0.0005
4/10/90	20	314	0.011	<0.01	<1	2.7	0.004	7.6	0.004	60	<0.0005
8/16/90	44	270	0.003	<0.01	<1	2.3	0.011	7.2	0.002	25	0.0007
10/25/90	36	284	0.006	0.01	<1	2.4	0.012	7.4	<0.001	8	<0.0005
10/17/91	30	190	<0.004	<0.02	5	0.402	<0.042	6.6	0.0218	31.9	<0.002
4/8/92	47.4	204	<0.004	<0.02	<1	2.31	<0.042	6.9	0.008	64.8	<0.002
9/3/92	49.3	199	<0.004	<0.02	<1	3.75	<0.042	6.6	<0.005	11.3	<0.002
2/5/93	91.3	319	<0.004	<0.02	<1	3.66	<0.042	6.9	0.009	28.9	<0.002
5/7/93	34	195	<0.004	<0.02	<1	3.79	<0.042	6.7	<0.005	24.6	0.005
7/8/93	68	249	<0.004	<0.02	<1	2.93	<0.042	6.6	0.027	30.3	<0.002
10/1/93	120	118	<0.004	<0.02	<1	4.52	<0.042	6.6	<0.005	26.6	<0.002
1/6/94	16.9	98	<0.004	<0.02	<1	2.08	<0.042	6.6	<0.005	10.5	<0.002
6/1/94	120	392	<0.004	<0.02	<1	2.60	<0.042	7.0	<0.005	11.8	0.067
9/26/94	4.27	3.79	<0.004	<0.02	<1	2.58	<0.042	7.1	<0.005	2.1	0.004
12/30/94	100	340	<0.004	<0.02	<1	3.58	<0.042	7.4	<0.005	14	0.003
3/27/95	160	30	<0.004	<0.02	<1	2.69	<0.042		<0.005	127	0.005
6/30/95	80	261	<0.004	<0.02	<1	5.21	<0.042		<0.005	33	0.003
9/28/95	30	130	<0.004	<0.02	<1	219	0.561		<0.005	42.9	<0.002
9/29/95	60	220	<0.004	<0 .02	<1	1.73	<0.042		<0.005	23.8	0.024

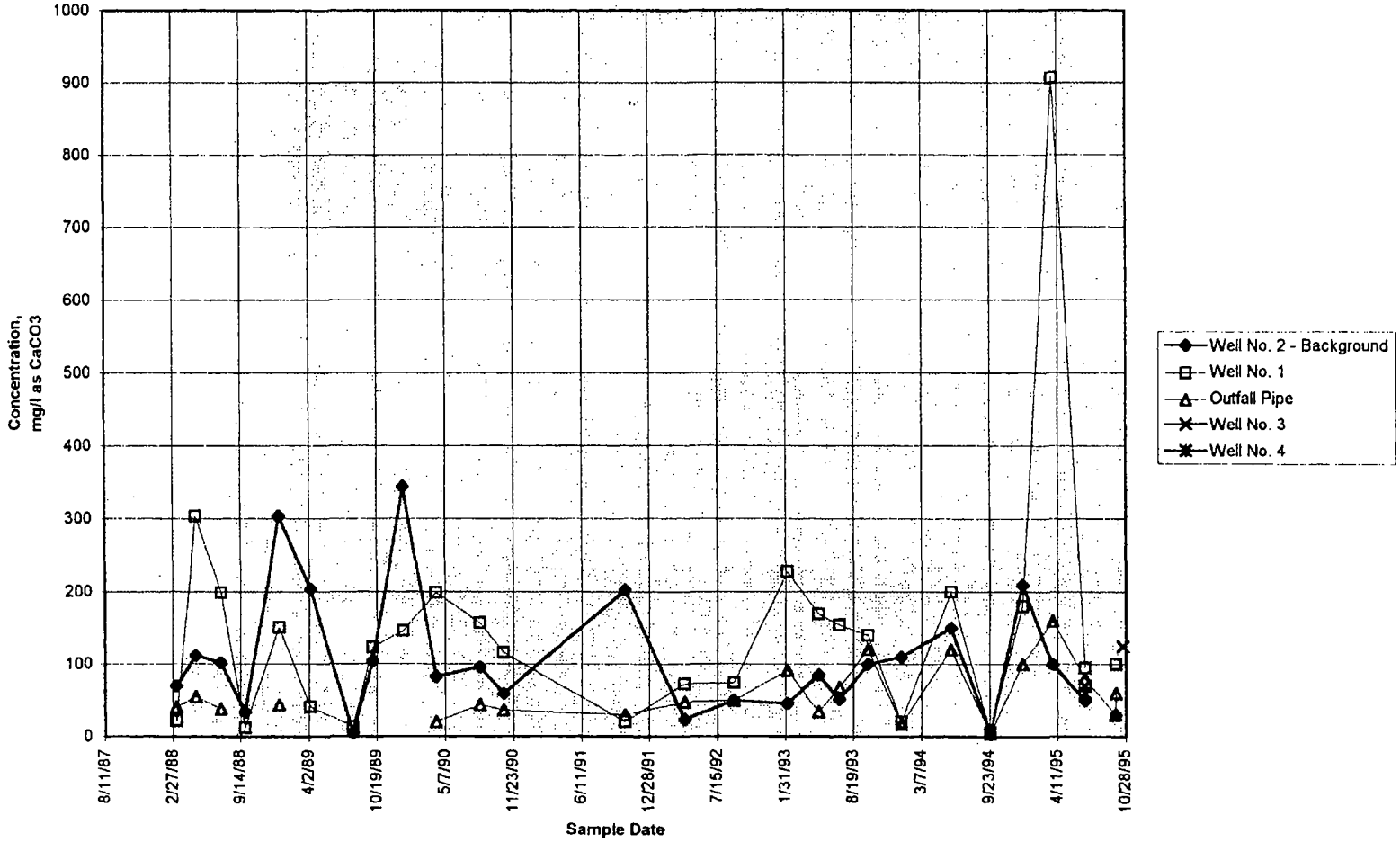
U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No.3

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
6/30/95	70	180	<0.004	<0.02	<1	49.0	0.081		<0.005	50	<0.002
10/19/95	125	396	<0.004	<0.02	<1	15.5	<0.042		<0.005	17.6	<0.002

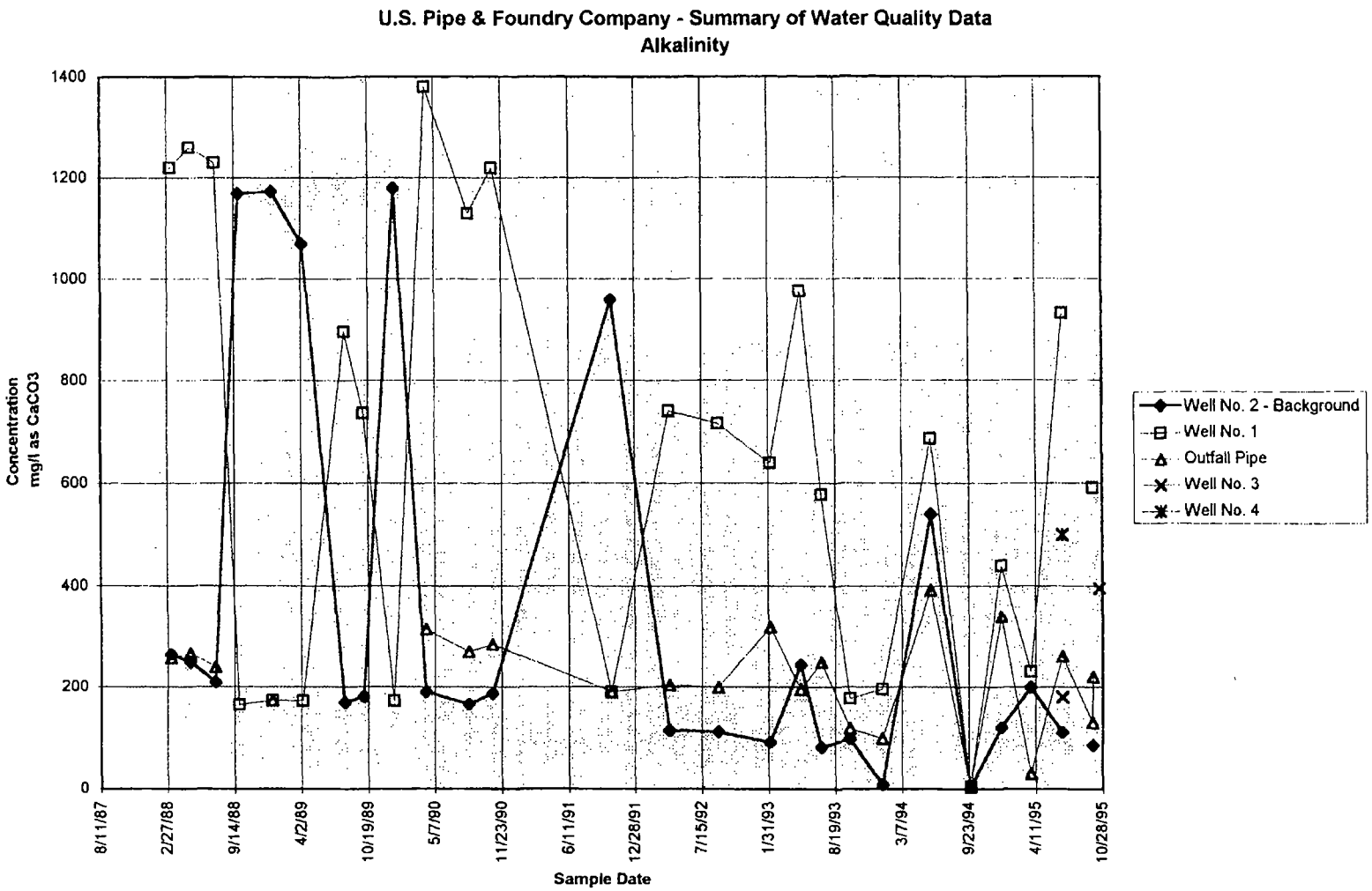
U.S. Pipe & Foundry Co.
Summary of Water Quality Data
Groundwater Monitoring Well No.4

Sample Date	Acidity mg/l	Alkalinity mg/l	Cadmium mg/l	Cyanide mg/l	Formaldehyde mg/l	Iron mg/l	Lead mg/l	pH	Phenols mg/l	TOC mg/l	Toluene mg/l
6/30/95	60	501	<0.004	<0.02	<1	41.4	0.342		<0.005	36	<0.002

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Acidity

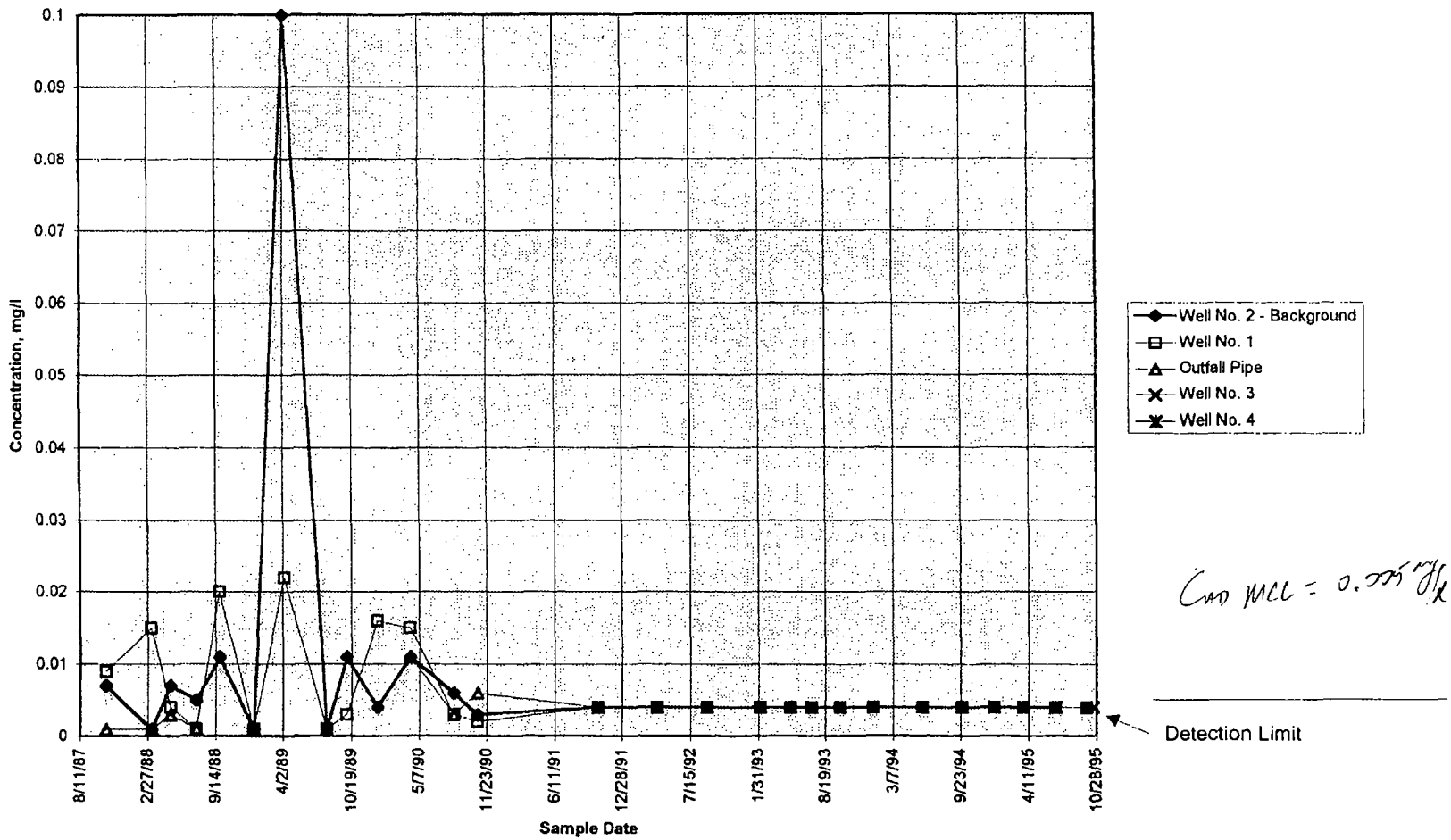


MWPS007664


U.S. Pipe & Foundry Company - Summary of Water Quality Data
Alkalinity
Concentration
mg/l as CaCO3
1400
1200
1000
800
600
400
200
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

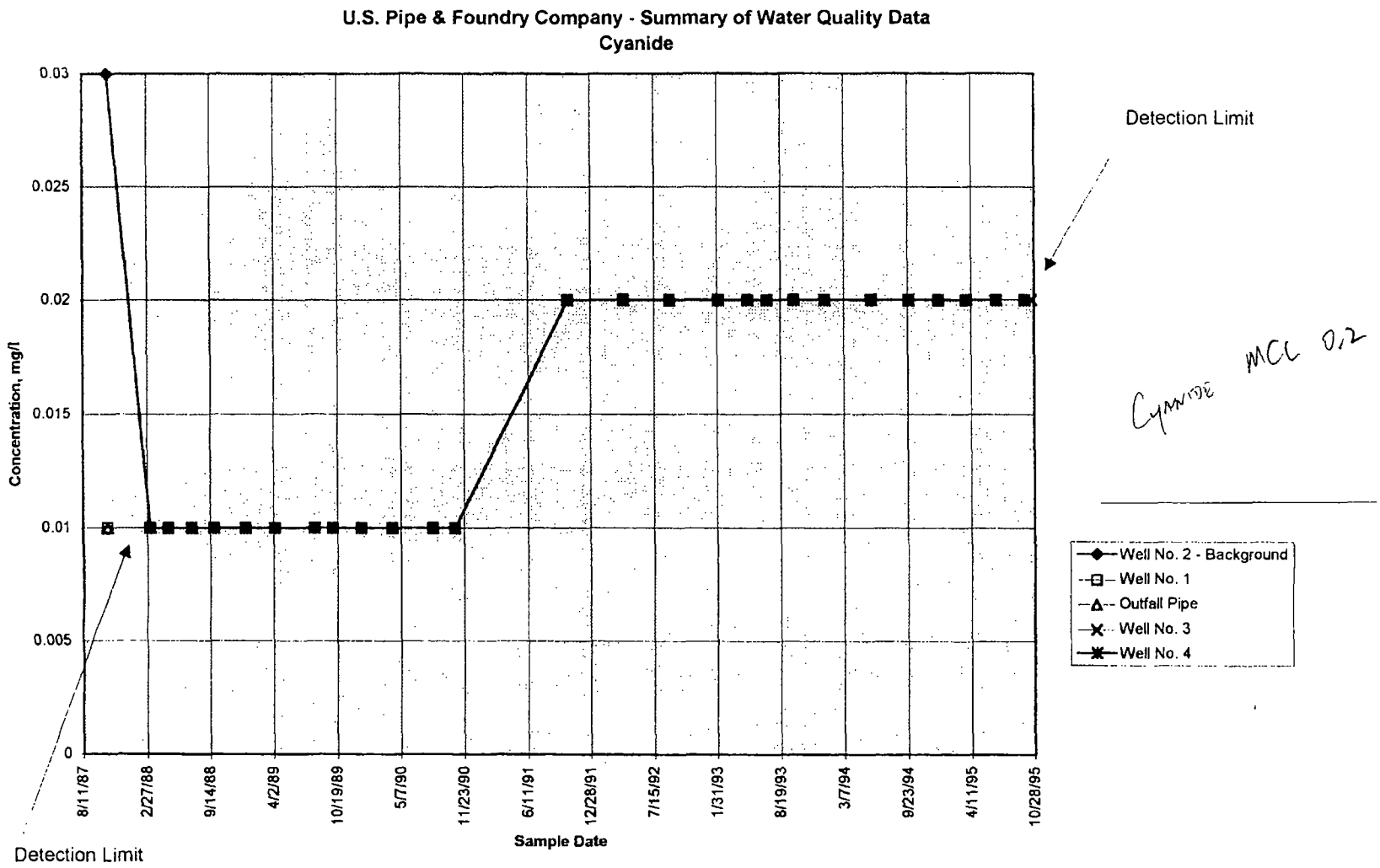
MWPS007665

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Cadmium



Cd MCL = 0.005 mg/l

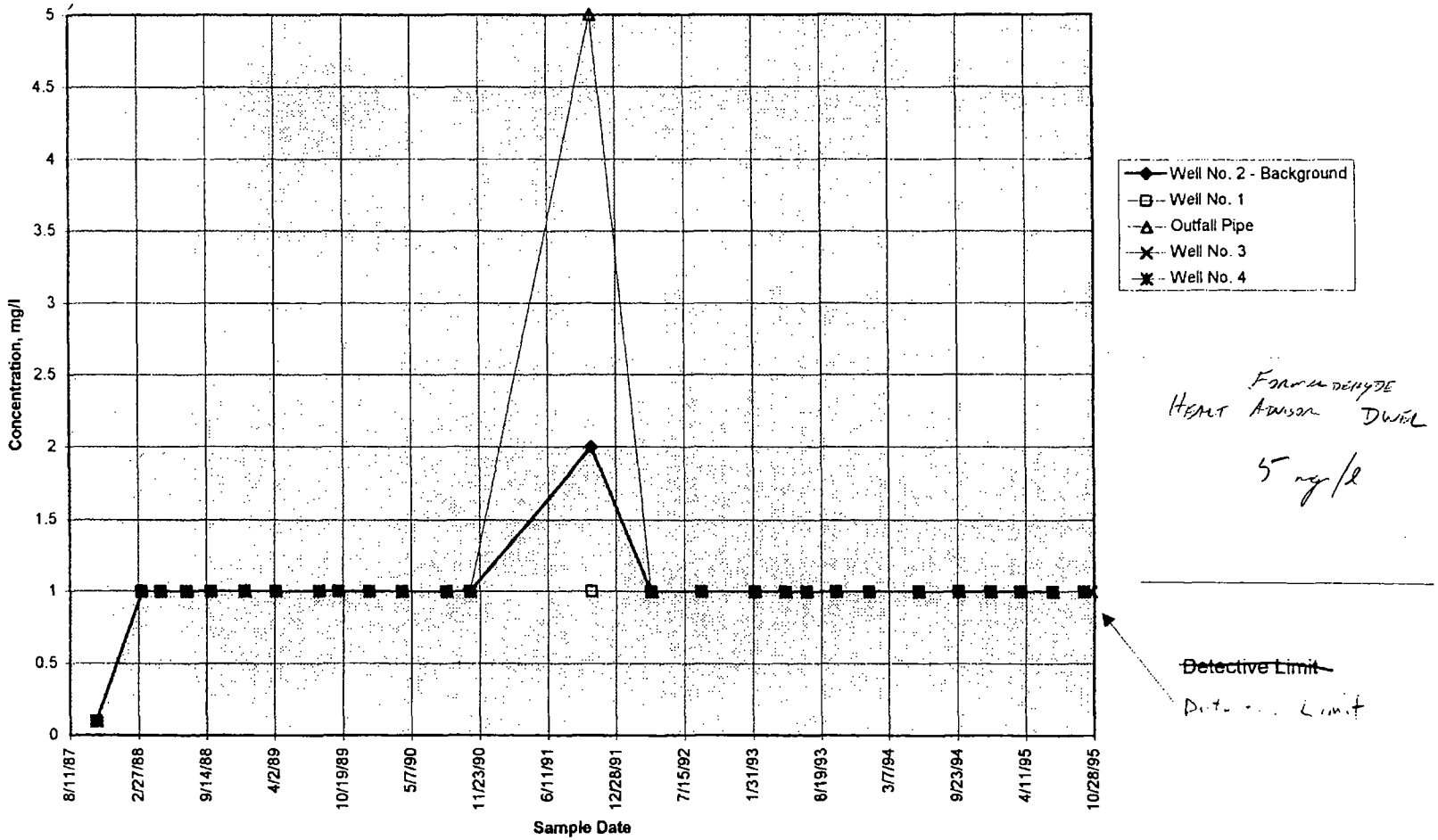
MWPS007666



Cyanide MCL 0.2

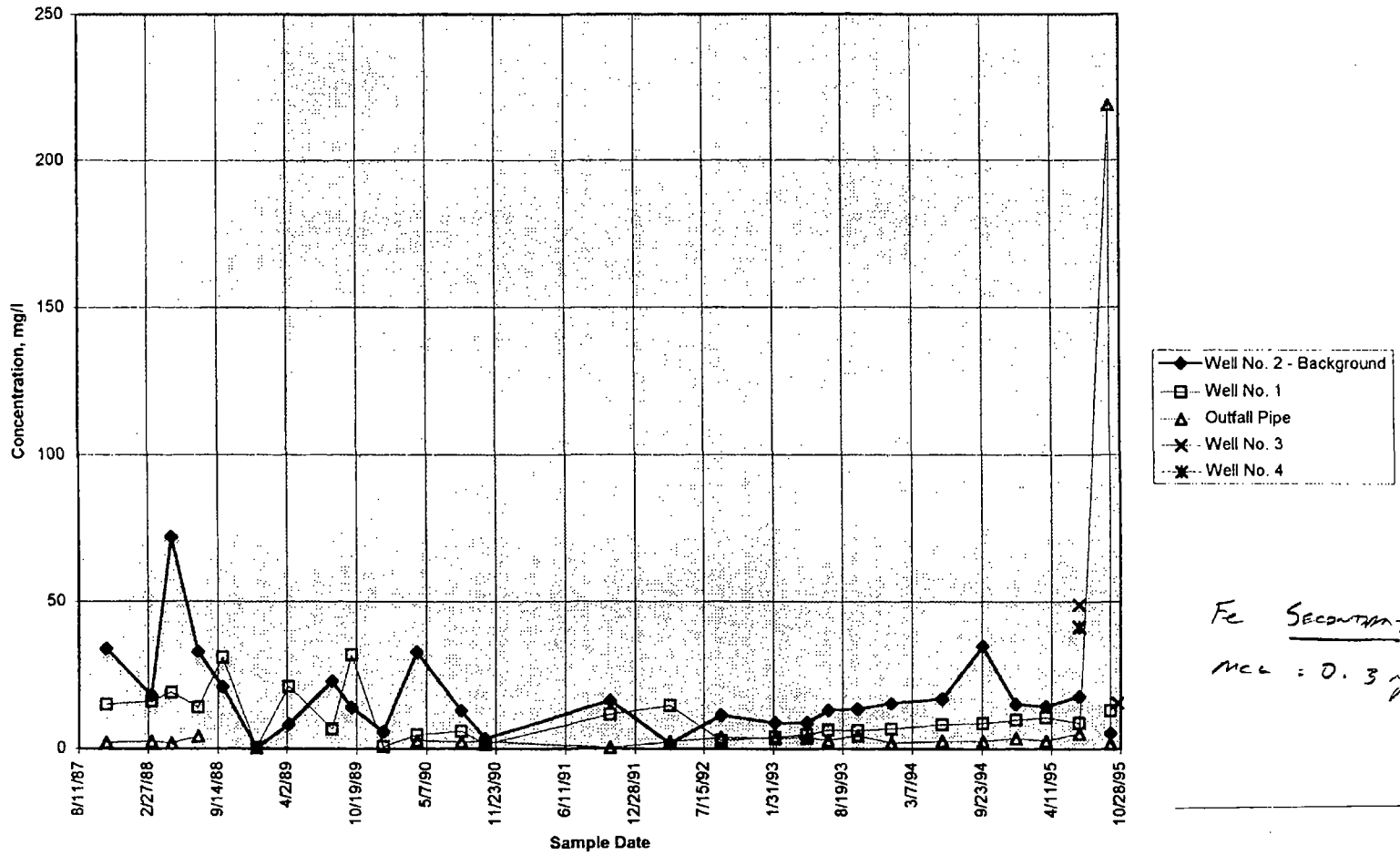
MWPS007667

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Formaldehyde



MWPS007698

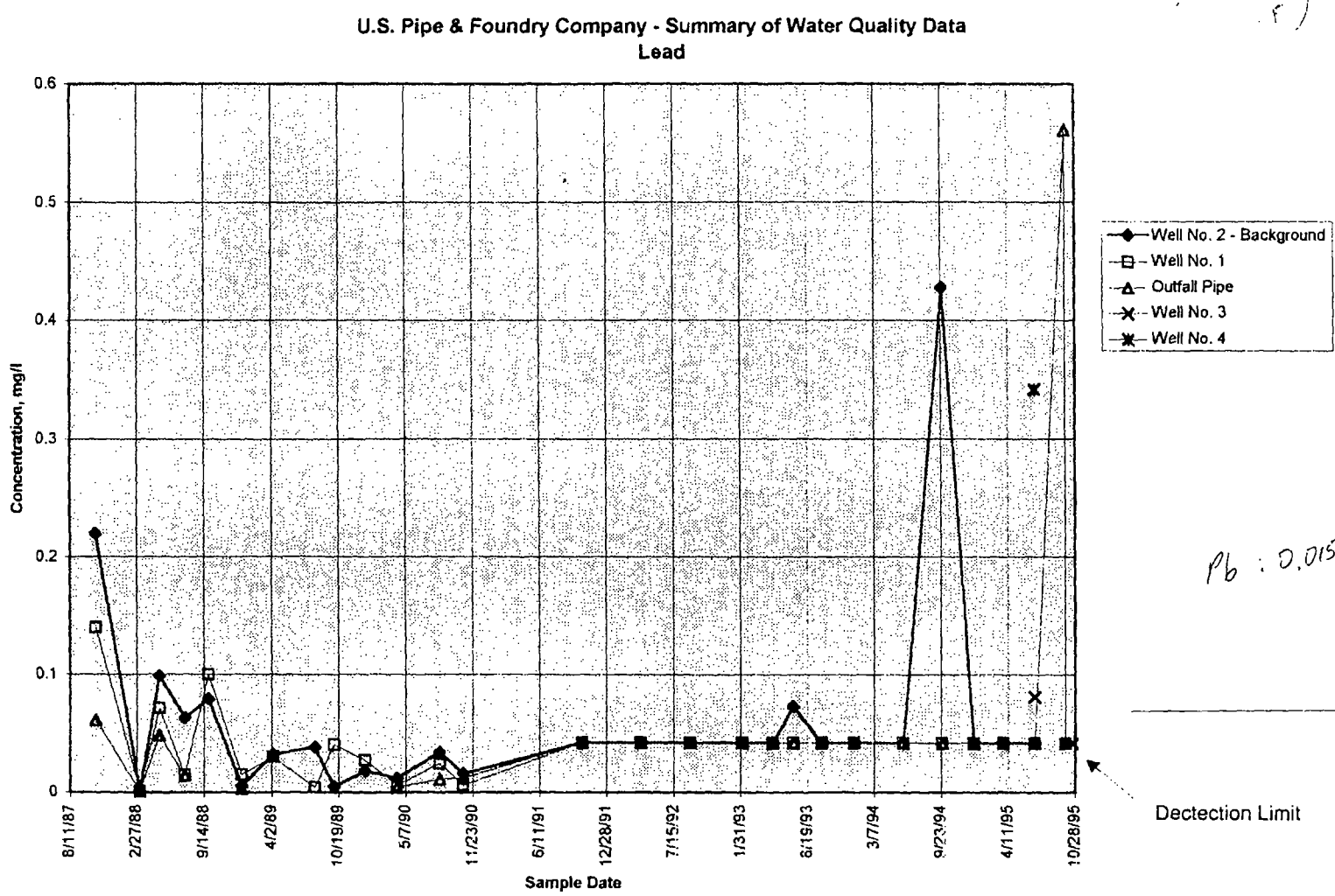
U.S. Pipe & Foundry Company - Summary of Water Quality Data
Iron



Fe Secondary

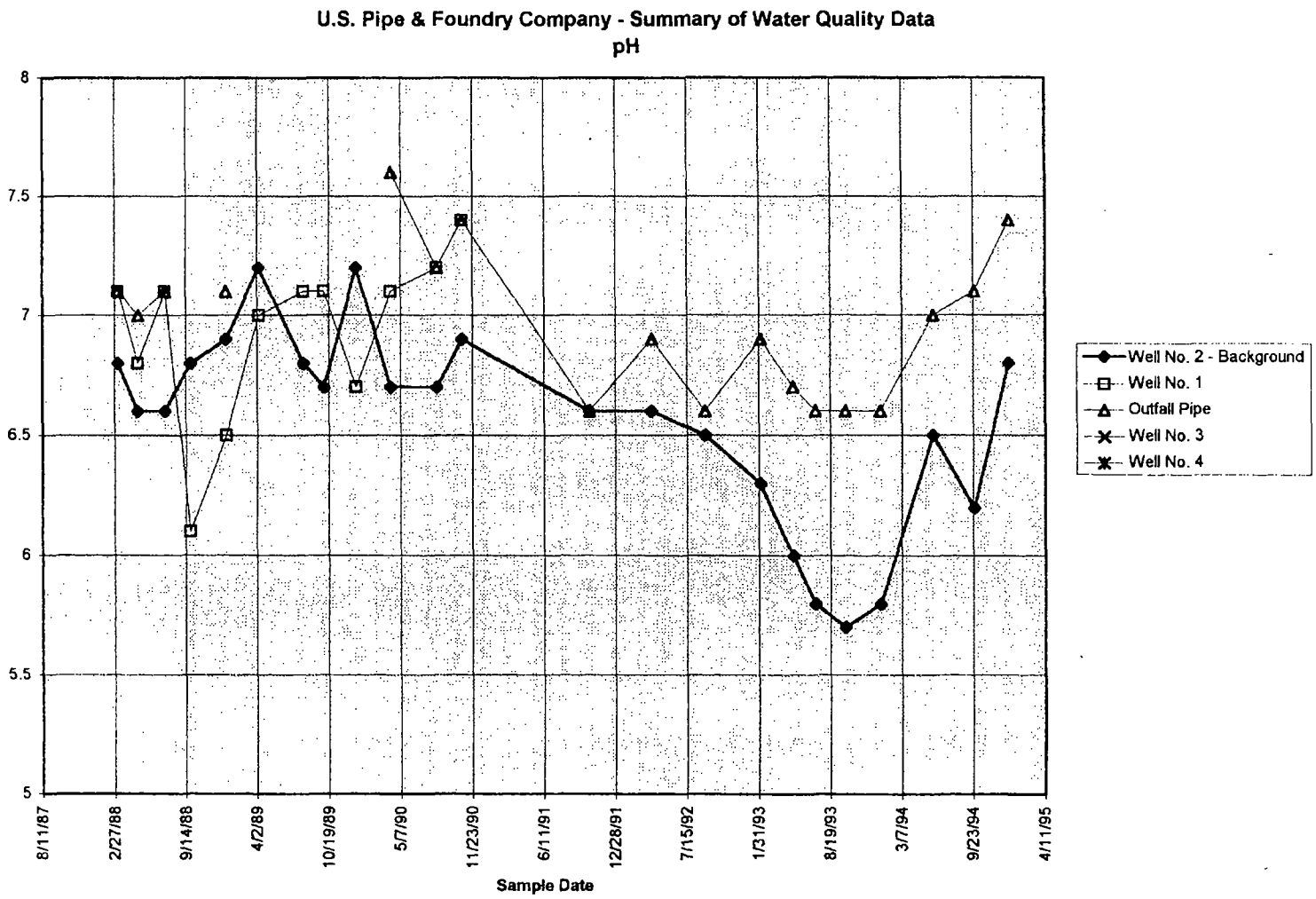
MCL : 0.3 mg/l

MWPS007669



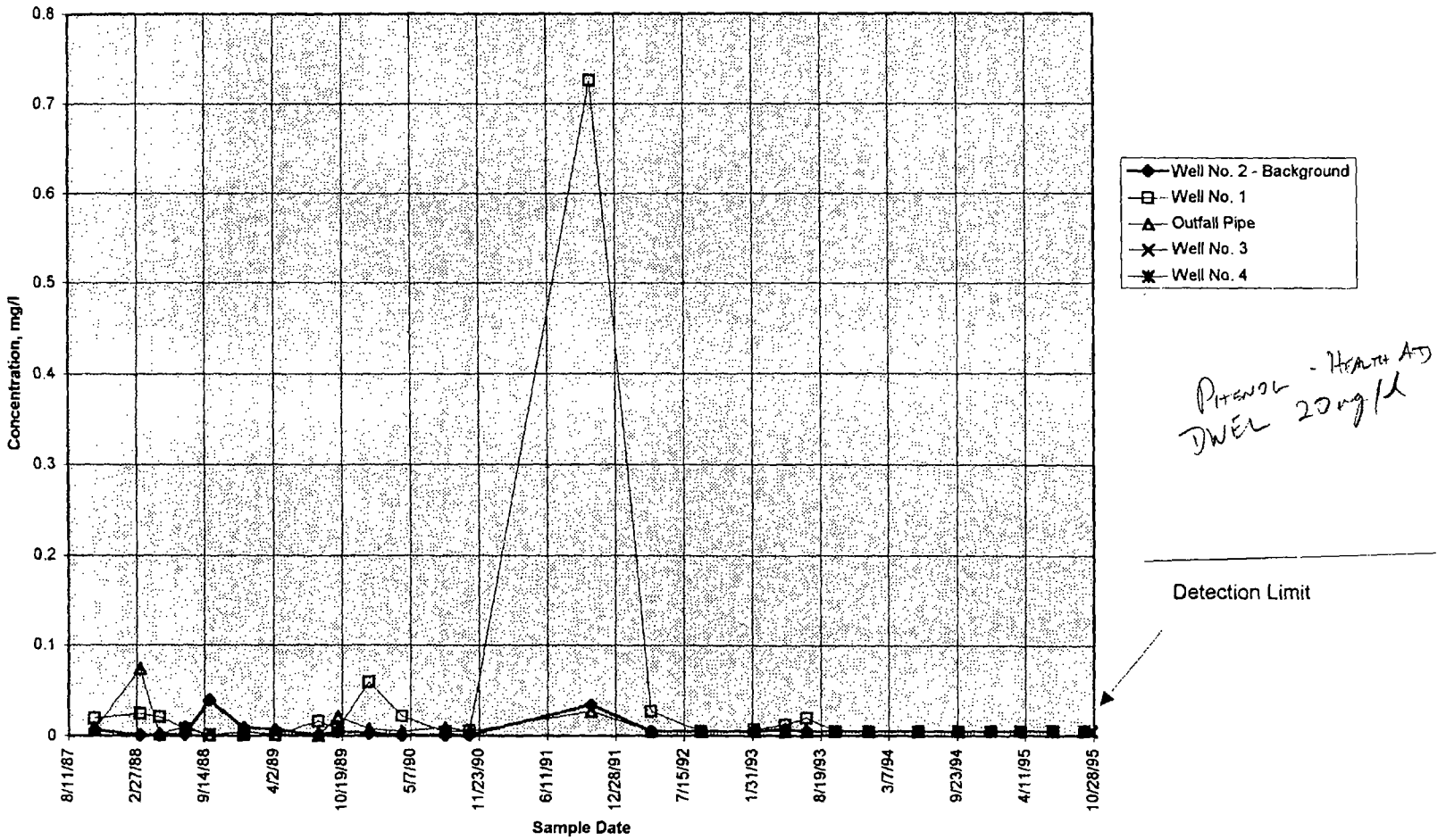
Pb : 0.015 ppm

MWPS007670


U.S. Pipe & Foundry Company - Summary of Water Quality Data
pH
8
7.5
7
6.5
6
5.5
5
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

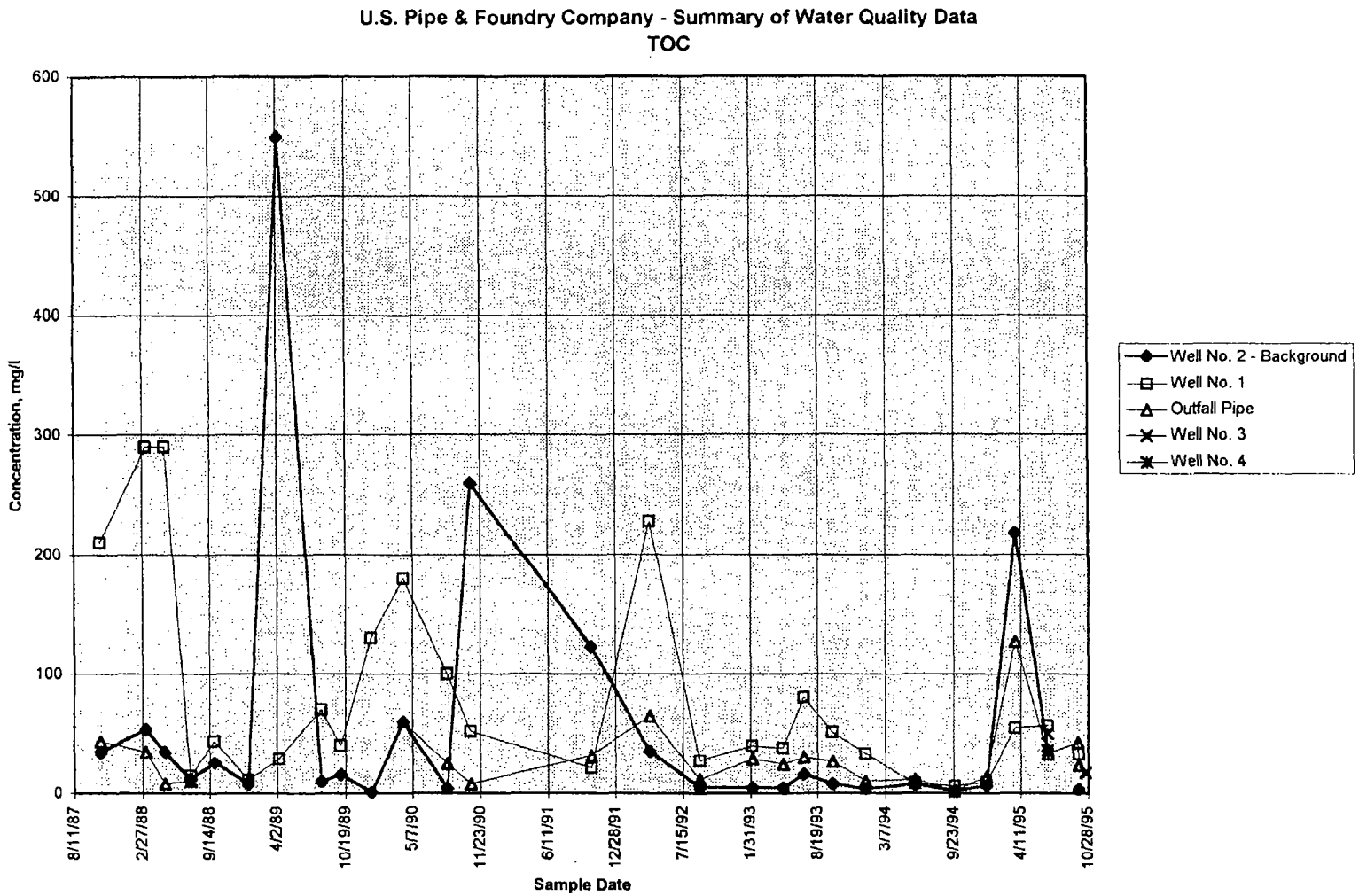
MWPS007671

U.S. Pipe & Foundry Company - Summary of Water Quality Data
Phenols

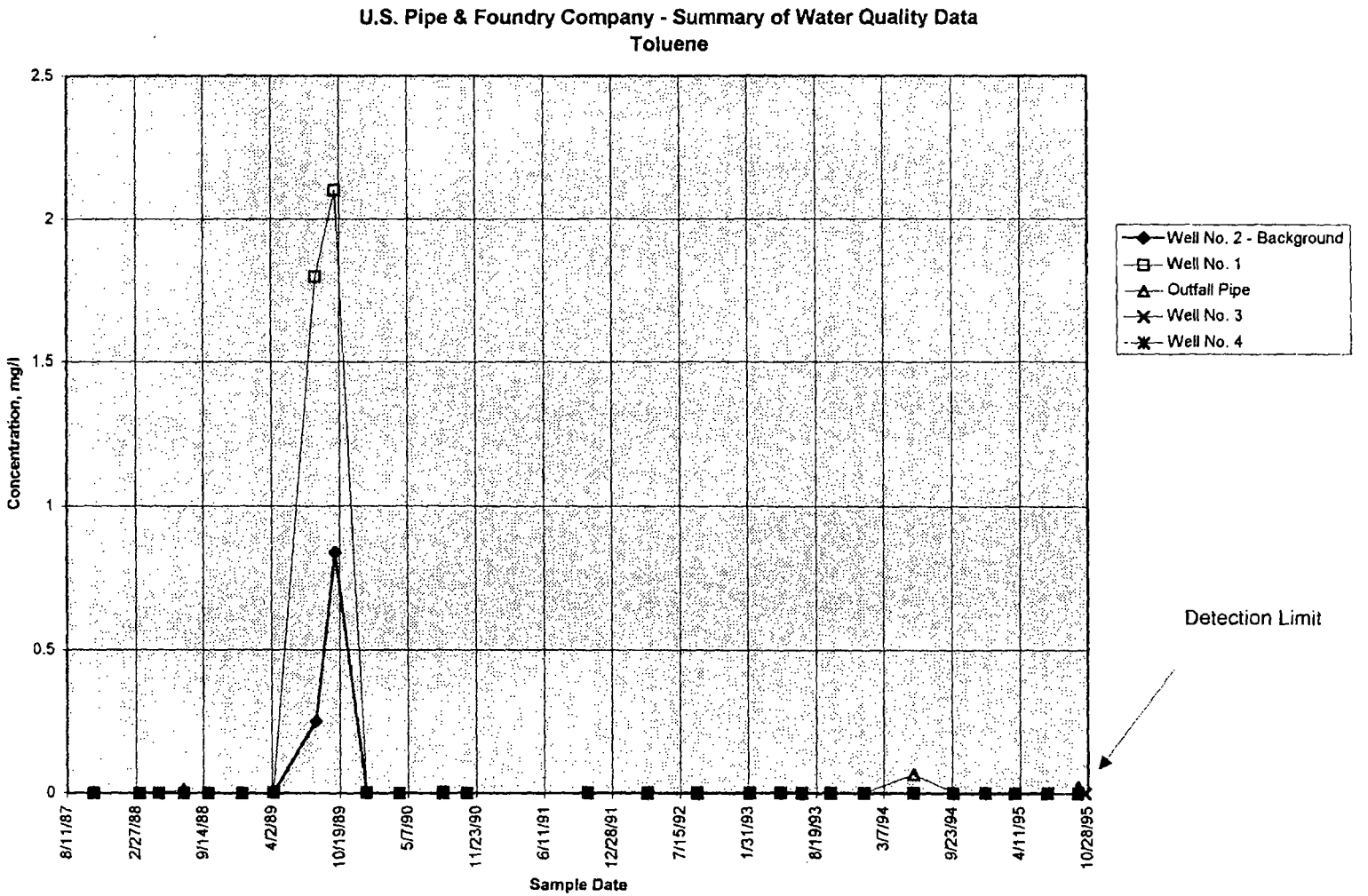


PHENOL - HEALTH ADVISORY DWEL 20 mg/L

MWPS007672


U.S. Pipe & Foundry Company - Summary of Water Quality Data
TOC
Concentration, mg/l
600
500
400
300
200
100
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4

MWPS007673


U.S. Pipe & Foundry Company - Summary of Water Quality Data
Toluene
Concentration, mg/l
2.5
2
1.5
1
0.5
0
8/11/87
2/27/88
9/14/88
4/2/89
10/19/89
5/7/90
11/23/90
6/11/91
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
Sample Date
Well No. 2 - Background
Well No. 1
Outfall Pipe
Well No. 3
Well No. 4
Detection Limit

MWPS007674

CLOSURE/POST CLOSURE PLAN

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

PREPARED BY:

MCGILL ASSOCIATES, P.A.
870 Winfield Dunn Parkway, Suite 6
Sevierville, Tennessee 37876

PROJECT NUMBER 95315.01

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1.0 INTRODUCTION

The following text details closure and post-closure activities to be conducted at the U.S. Pipe and Foundry Company (U.S. Pipe) Class II Foundry Waste Landfill. This plan has been prepared in accordance with Rule 1200-1-7, Solid Waste Processing and Disposal, promulgated under the authority of the Tennessee Department of Environment and Conservation (TDEC) Division of Solid Waste Management (DSWM), with an effective date of September 2, 1993.

1.1 FACILITY DESCRIPTION

This landfill is located along the east bank of the Tennessee River at mile 461.5, at Latitude N35° 01' 53" and Longitude W85° 19' 24". The landfill is located adjacent to the U.S. Pipe valve and fittings facility at 2701 Chestnut Street, Chattanooga, Tennessee. It will be on property owned by U.S. Pipe, and will serve only U.S. Pipe. The landfill comprises approximately 33 acres consisting of the existing 21 acre landfill area, 8 acres of storage yard north of the existing landfill and 4 acres of presently undeveloped area located south of the existing landfill and is accessible only by roads within the U.S. pipe facility. A site location map is provided in Appendix I.

The completed fill area will essentially be two mounds with sides sloped at two horizontal to one vertical and an approximately rectangular, slightly sloping top. These mounds will be constructed in three phases, as described in the Operations and Maintenance Manual, and will contain terraces as shown on the construction drawings for added stability.

1.2 EXPECTED LANDFILL LIFE

This landfill, in which only U.S. Pipe foundry waste will have been deposited, has a projected life of 41 years under the expected operating parameters. Therefore, with the facility currently being operational, the year of closure is expected to be 2037.

1.3 FACILITY CONTACT

Supervisor of Stores and Yard
U.S. Pipe and Foundry Company
2701 Chestnut Street
Chattanooga, Tennessee 37408
Phone (423)752-3800

2.0 FACILITY CLOSURE

In general, facility closure will consist of grading the site to the final contours shown on the construction drawings, the establishment of vegetation, and the modification of drainage systems as necessary to control run-on, run-off, and sedimentation in off-site water courses. These activities will be implemented to achieve the following closure performance standards as specified in TN Rule 1200-1-7-.04 (8):

1. Minimize the need for further maintenance.

2. Protect public health and the environment by controlling, minimizing, or eliminating the post-closure escape of solid waste or solid waste constituents,

including leachate, contaminated run-off, or waste decomposition products, to surface waters, groundwater or the atmosphere.

3. Provide for the post-closure care of the facility as necessary to ensure the above performance standards are attained.

Specific closure procedures pertaining to partial and complete facility closure are provided in Sections 2.1 and 2.2.

2.1 PARTIAL CLOSURE

Closure of the U.S. Pipe Class II Foundry Waste Landfill prior to exhausting all permitted disposal capacity is not intended. In the event that closure of the existing fill area is required prior to reaching permitted capacity, the following activities will be implemented to ensure that a complete closure of the facility is achieved:

1. DSWM will be notified at least 60 days before the date of facility closure.

2. The approved closure plan will be revised to address any final grading or drainage modifications necessary to ensure complete closure in accordance with existing regulations.

3. Drainage facilities will be inspected at the time of closure and stabilized, if necessary, in accordance with Section 2.2.2.

4. A groundwater monitoring system is in place and operational. Inspection and maintenance will be conducted during closure activities.

5. DSWM will be provided with certification that all closure activities have been completed in accordance with the approved plans.

2.2 COMPLETE CLOSURE

2.2.1 FINAL COVER

As described earlier in section 4.2, final soil cover will not be required. Recommendations by the University of Tennessee Agricultural Extension Service for seeding, fertilization and establishment of vegetative cover (Appendix IV) have been successful implemented in the past at this site and it is recommended that they be followed in the future for the establishment of cover vegetation. A survey performed by a surveyor licensed in Tennessee will be conducted to verify that the final contours are established as shown on the plans. Survey reports will be included in the final closure report.

2.2.2 DRAINAGE SYSTEM

The existing drainage facilities at the U.S. Pipe Foundry Waste Class II Landfill will be enhanced as needed to ensure compliance with the drainage system requirements identified in TN Rule 1200-1-7-.04 (8) (c) 4. These requirements specify that the final surface of the disposal facility shall be graded and/or provided with drainage facilities in a manner that:

- Minimizes precipitation run-on from adjacent areas onto the disposal facility;

- Minimizes erosion
- Optimizes drainage of precipitation falling on the disposal facility; and
- Provides a surface drainage system which is consistent with the surrounding area and does not adversely affect proper drainage from the adjacent land.

2.2.3 LEACHATE COLLECTION

As described earlier in Section 7.0 of the Operations and Maintenance Manual, a leachate collection system will not be necessary at this site.

2.2.4 GAS MONITORING

As described earlier in Section 9.11 of the Operations and Maintenance Manual, no significant amount of gas will be generated by the foundry waste; therefore, no gas monitoring will be necessary at this site.

2.2.5 NOTIFICATION AND CERTIFICATION

In accordance with TN Rule 1200-1-7-.04 (8) (c) 9, written notification will be provided by U.S. Pipe to the DSWM upon completion of closure of the U.S. Pipe Class II Foundry Waste Landfill. This notification will include a certification that the disposal facility has been closed in accordance with the approved closure/post-closure plan. Within 21 days after TDEC receives this notification, the DSWM is required to inspect the facility to verify that closure has been completed in accordance with the approved plan. If proper closure is verified, the DSWM will notify U.S. Pipe within 10 days that closure has been approved. This final

notification will constitute final approval, and acknowledgment by the state that closure of the U.S. Pipe Class II Foundry Waste Landfill has been completed.

2.2.6 CLOSURE SCHEDULE

The anticipated closure schedule for the U.S. Pipe Class II Foundry Waste Landfill is provided in Table 1. It is anticipated that the landfill will be closed within 120 days from start of closure, if unfavorable weather is not encountered that would impact construction activities.

TABLE 1. U.S. PIPE CLASS II LANDFILL CLOSURE SCHEDULE

ACTIVITY	SCHEDULE
Notification of intent to close	-60
Begin final grading	0
Revegetation	90
Complete closure activities	120

3.0 POST-CLOSURE ACTIVITIES

The post-closure activities planned for the U.S. Pipe Class II Foundry Waste Landfill include post-closure maintenance and inspection, and recording of a notification on the property deed that the site has been used as a disposal facility.

3.1 POST-CLOSURE CARE

Subparagraph (d) of TN Rule 1200-1-7-.04 (8) states that post-closure care activities at disposal facilities such as the U.S. Pipe Class II Landfill will be conducted for 30 years. The primary requirements for this post-closure care are to maintain the approved final contours (with prevention of ponding on the surface), drainage system, and healthy vegetative cover (once it is established). The objective of these requirements is to ensure the integrity of the final cover and thereby minimize the potential for future releases of waste or waste constituents from the facility.

3.1.1 INSPECTIONS

A program of quarterly inspections will be conducted to check for settlement, erosion, insufficient vegetative cover, and other defects. Any observed defects will be corrected. Normal maintenance activities, such as grass mowing and drainage ditch maintenance, will also be performed on a regular basis. Post-closure care will be provided on an as-needed basis throughout the post-closure period to ensure the long-term integrity of the final contours.

3.1.2 WATER MONITORING ACTIVITIES

3.1.2.1 SURFACE WATER

Surface water monitoring will be accomplished in compliance with U.S. Pipe's Stormwater Discharge Permit system.

3.1.2.2 GROUNDWATER

Groundwater monitoring will continue using the same wells and the same sampling procedures and schedule used during the active life of the landfill. These wells, procedures, and schedule are described in the Operating and Maintenance Manual. The compliance monitoring boundary is also shown on the construction drawings.

3.1.3 GAS MONITORING ACTIVITIES

This landfill should not generate significant amounts of gas. No gas probes are proposed for this facility.

3.1.4 POST CLOSURE LAND USE

There is no planned future use of the site.

3.2 DEED NOTIFICATION

Within 60 days of completing final closure at the U.S. Pipe Class II Foundry Waste Landfill, U.S. Pipe will record a notation on the deed to the property (or other instrument which is normally examined during a title search). This notation will in perpetuity notify any person conducting a title search that the area associated with the U.S. Pipe Class II Foundry Waste Landfill has been used as a disposal facility.

3.3 BENEFICIAL REUSE OF FOUNDRY SAND

U.S. Pipe may, at any time during the post closure period, excavate and process the foundry sand for reuse as described in the TDEC Policy on the Beneficial Use of Nontoxic Spent Foundry Sand currently being developed. The surface will be regraded, seeded and mulched after any such activity as necessary to maintain good surface drainage as specified in TN Rule 1200-1-7-.04 (8).

4.0 COST ESTIMATE AND FINANCIAL ASSURANCE

4.1 CLOSURE

The cost of hiring a third party to perform the closure activities, including the effects of inflation over the projected life of the landfill, is shown in Table 2. The cost of operating the facility for 30 days prior to closure is not included due to the characteristics of the waste stream to the landfill. The landfill serves only U.S. Pipe, and in the event that U.S. Pipe is unable to perform the closure activities, the landfill will stop receiving new waste. Based on the changes in the Consumer Price Index from 1982 to 1988, an average annual inflation rate of 4% was selected for the calculations in Table 2.

Table 2
Costs Associated With Closure

YEAR	CLOSURE COST	YEAR	CLOSURE COST
1996	$15,721	2017	$35,825
1997	$16,350	2018	$37,257
1998	$17,004	2019	$38,748
1999	$17,684	2020	$40,298
2000	$18,391	2021	$41,910
2001	$19,127	2022	$43,586
2002	$19,892	2023	$45,329
2003	$20,688	2024	$47,143
2004	$21,515	2025	$49,028
2005	$22,376	2026	$50,989
2006	$23,271	2027	$53,029
2007	$24,202	2028	$55,150
2008	$25,170	2029	$57,356
2009	$26,177	2030	$59,650
2010	$27,224	2031	$62,036
2011	$28,313	2032	$64,518
2012	$29,445	2033	$67,099
2013	$30,623	2034	$69,783
2014	$31,848	2035	$72,574
2015	$33,122	2036	$75,477
2016	$34,447	2037	$78,496

4.2 POST CLOSURE

It is estimated that the quarterly inspections and associated maintenance activity should cost approximately $1000 per year. This figure includes the cost of maintaining the vegetative cover as well as periodic cleaning of the erosion control facilities.

The cost of the semi-annual groundwater monitoring program is currently $2,400 per year.

The cost of hiring a third party to perform the post closure activities listed above, including the effects of inflation throughout the 30 year post closure period, is listed in Table 3.

Table 3
Costs Associated With Post Closure

YEAR	COST	YEAR	COST
1996	$ 3,500	2032	$14,364
1997	$ 3,640	2033	$14,938
1998	$ 3,786	2034	$15,536
1999	$ 3,937	2035	$16,157
2000	$ 4,095	2036	$16,804
2001	$ 4,258	2037	$17,476
2002	$ 4,429	2038	$18,175
2003	$ 4,606	2039	$18,902
2004	$ 4,790	2040	$19,658
2005	$ 4,982	2041	$20,444
2006	$ 5,181	2042	$21,262
2007	$ 5,388	2043	$22,112
2008	$ 5,604	2044	$22,997
2009	$ 5,828	2045	$23,917
2010	$ 6,061	2046	$24,873
2011	$ 6,303	2047	$25,868
2012	$ 6,555	2048	$26,903
2013	$ 6,818	2049	$27,979
2014	$ 7,090	2050	$29,098
2015	$ 7,374	2051	$30,262
2016	$ 7,669	2052	$31,473
2017	$ 7,976	2053	$32,732
2018	$ 8,295	2054	$34,041
2019	$ 8,627	2055	$35,403
2020	$ 8,972	2056	$36,819
2021	$ 9,330	2057	$38,291
2022	$ 9,704	2058	$39,823
2023	$10,092	2059	$41,416
2024	$10,495	2060	$43,073
2025	$10,915	2061	$44,796
2026	$11,352	2062	$46,587
2027	$11,806	2063	$48,451
2028	$12,278	2064	$50,389
2029	$12,769	2065	$52,404
2030	$13,280	2066	$54,501
2031	$13,811	2067	$56,681

MWPS007688

4.3 FINANCIAL ASSURANCE

As stated in TN Rule 1200-1-7-.03 (3) (c), "Within 10 days after his final decision to issue a permit for a new facility, the Commissioner shall notify the operator in writing of the amount of financial assurance required (as established by subparagraph (b) of this paragraph). The operator must, before the permit can be effective, file with the commissioner financial assurance meeting the requirements of this paragraph...".

Note: Calculations for the preceding tables are included following this page.

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JOB U.S. Pipe Class II Foundry Waste Landfill
SHEET NO. 1 OF 1
CALCULATED BY RBM DATE 4-23-96
DESCRIPTION Cost Estimate of Closure Activity
SCALE N/A PROJECT NO. 95315.01

1. Final Grading

	(U.S. Average Rate / 1000 SF)	x	(City Factor for Knoxville Tennessee)	x	(Payroll Tax & Insurances, Fringe Benefits)	=	Local Rate / 1000 SF
Bulldozer	$ 27.37	x	0.637	x	1.0	=	17.43
Labor	$ 22.00	x	0.637	x	1.3	=	18.22
Bulldozer Operator	$ 25.96	x	0.637	x	1.3	=	21.50
Subtotal							57.15
Add Subcontractor Overhead and Profit at 25 %							14.29
Total Cost Per 1000 SF							71.44

Total Cost Per SF $ 0.07/SF

* Crew production is 6500 SF/8 Hour Day

Landscaping

Hydroseeding with mulch $ 0.035/SF
* Based on current subcontractor Price Quotes

Total Cost Per SF $ 0.105/SF

3. Drainage System Maintenance

Clean Culverts and Check Dams $ 1000 Lump Sum

NOTES

1. Grading calculations based on Walker's Building Estimator's Reference Book, 25th Ed.

2. It is assumed that 3 acres are disturbed at time closure activity begins

$$3 \text{ ac.} \times \frac{43560 \text{ SF}}{1 \text{ ac.}} \times (0.105) + 1000 = \$ 14,721$$ (To Complete Closure)

* Add $1000 to the total cost for an engineer's certification that the [illegible]

GROUNDWATER MONITORING PROGRAM

FOR

U. S. PIPE AND FOUNDRY COMPANY

CLASS II FOUNDRY WASTE LANDFILL

PREPARED FOR:

U.S. PIPE AND FOUNDRY COMPANY
2701 Chestnut Street
Chattanooga, Tennessee 37408

PREPARED BY:

MCGILL ASSOCIATES, P.A.
870 Winfield Dunn Parkway, Suite 6
Sevierville, Tennessee 37876

PROJECT NUMBER 95315.01

INTRODUCTION

The Groundwater Monitoring Program (GMP) presented herein, is provided as part of the plan for the U.S. Pipe and Foundry Company Class II Foundry Waste Landfill, located in Chattanooga, Tennessee. The facility is owned and operated by U.S. Pipe and Foundry Company (U.S. Pipe). The GMP has been prepared in accordance with the criteria established by the State of Tennessee Department of Environment and Conservation (TDEC), Solid Waste Management Regulations (TN Rule Chapter 1200-1-7, Solid Waste Management) and in accordance with the related guidance document issued by the Offices of Solid and Hazardous Waste of the TDEC.

The Groundwater Monitoring Program presented herein includes: definition of the compliance groundwater monitoring boundary, description of the groundwater monitoring system, description of the detection monitoring program (i.e., groundwater sampling and analysis procedures), and record keeping and reporting procedures. The following issues have been addressed in detail with respect to the groundwater sampling and analysis procedures described in the GMP:

(a) Sample Collection

- Order of Sampling
- Measurement of Static Water Level and Well Depth
- Well Evacuation
- Sample Withdrawal

(b) Sample Preservation and Handling

- Sample Container and Preservation
- Sample Handling Considerations

(c) Chain-of-Custody

- Sample Labels
- Sample Seals
- Field Logbook
- Chain-of-Custody Record

(d) Analytical Procedures

- Analytical Parameters and Methods
- Quality Assurance/Quality Control Samples

MWPS007693

1.0 SITE LOCATION AND HYDROGEOLOGIC CONDITIONS

U. S. Pipe and Foundry Company, Inc. (U.S. Pipe) operates a valve and fittings foundry in Chattanooga, Tennessee. Foundry sand, cupola slag, cupola baghouse dust, dried sludge, non-isocure core sand and demolition wastes generated at the plant and a previously operated soil pipe plant have been disposed on plant property along the Tennessee River, (Nickajack Lake) for over forty years. The U.S. Pipe foundry waste landfill has been the subject of negotiation between U.S. Pipe and the Tennessee Department of Environment and Conservation (TDEC) as well as between U.S. Pipe and the U.S. Environmental Protection Agency (EPA). As a result of separate agreements with the TDEC and EPA, U.S. Pipe has reactivated efforts to permit the foundry landfill as a Class II Industrial Waste Disposal Facility in accordance with TDEC Solid Waste Regulations.

The landfill is located in Chattanooga along the east bank of the Tennessee River at mile 461.5, at Latitude N35° 01' 53" and Longitude W85° 19' 24". The landfill is located adjacent to the U.S. Pipe Valve and Fittings operation at 2701 Chestnut Street, Chattanooga, Tennessee, 37408. A site location map is provided in Appendix I. Access to the site is by roads within the U.S. Pipe and Foundry plant.

Site topography has been altered due to the many years of landfilling, grading, revegetation, and other improvements. Outslope relief toward the river ranges from flat or gently sloping in the northern and southern extremities to steep in the central area of the site.

A hydrogeologic study was previously performed by Ogden Environmental and Energy Services Company for U.S. Pipe in March, 1995, and submitted to the TDEC. The study

indicates that site groundwater recharges by way of precipitation infiltration, passing through the landfill, and discharges into the Tennessee River. The landfill material is generally dark in color and should absorb a significant amount of sunlight and a substantial amount of water will be released back into the atmosphere reducing the total amount of infiltration to the water table.

Extensive site improvements have removed any surficial features that may have indicated natural recharge and/or discharge points. This applies not only to the landfill site but also the remainder of the adjacent area known as Tannery Flats. Much of the area has been subjected to river channelization and road improvements stemming from Interstate Highway I-24. These have significantly altered the original topography.

Generally for the region, groundwater recharges by way of precipitation and/or stream flow infiltration from the east near Missionary Ridge (most likely the eastern groundwater drainage divide), flows westward, and discharges into the Tennessee River. See the above mentioned Hydrogeologic Report for further information.

2.0 GROUNDWATER MONITORING SYSTEM

The proposed groundwater monitoring system will consist of four monitoring well locations. Groundwater monitoring will be conducted for the one existing upgradient monitoring well and the three downgradient monitoring wells. The monitoring well locations are shown on Sheets 1, 2 and 3 of the drawings. Monitoring well details and construction data for the four wells are provided in Appendix V and in the Hydrgeologic Report.

3.0 GROUNDWATER SAMPLING AND ANALYSIS PROCEDURES

3.1 SAMPLING STRATEGY

Class II facilities are required to establish reliable background concentrations of values against which future comparisons can be made. All Monitoring Wells (MWs) will have water samples taken semi-annually and analyzed for the following parameters:

Acidity
Alkalinity
Cadmium
Cyanide
Formaldehyde
Iron
Lead
pH
Phenols
Total Organic Carbon (TOC)
Toluene

Groundwater monitoring will be conducted throughout the active life and post-closure care period of the facility. The regulations place the burden of establishing background values and evaluating statistical increases on the regulatory authority, the TDEC.

3.2 QUALITY ASSURANCE PLAN

The laboratory performing the groundwater analyses should supply most of the necessary sample collection equipment and documentation forms. Other equipment may be dedicated to the facility or supplied by the sampler.

Prior to sampling, the sampling project leader should identify the following information requirements.

A. Sample point identification (i.e., well number, well diameter, depth of well, well casing stick-up, details of sampling equipment, etc.).

B. Sampling point accessibility

C. Recommended constituent storage and holding time, preservative and analytical method.

D. Analyte collection order.

E. Quality control samples, as necessary.

F. Required documentation of field activities, including field measurements and calibration of field equipment, chain of custody, sample labels, and instructions to the laboratory (if necessary).

3.3 LOGGING OF FIELD ACTIVITIES

A Field Logbook will be used to record field events, observations, and other pertinent information (e.g., well evacuation and sampling). The Logbook consisting of a bound notebook with consecutively numbered pages is desirable. A separate Field Log for each well may be maintained. Entries will be legibly printed or written in waterproof ink, dated and signed. The Field Logbook shall contain the following minimum information:

- Project number and facility name;
- Site location (city, state);
- Date and time work initiated/completed
- Personnel involved and roles (e.g., collector's name);
- Weather and other field conditions;
- Location of sampling point (e.g., well/spring number, code or name);
- Field measurements made (e.g., well depth, static water level depth, pH, temperature), including results and a general description of the methods used (including instrument make and model), and type and date of calibrations made;
- Well condition (e.g., no cap, broken casing, grout deterioration);
- Description of well purging and sample collection activities, including results and a general description of the methods used;
- Description of how samples were handled;
- Description of and justification for any deviations from planned activities and procedures;
- Pertinent field observations, including extraordinary factors that may affect the analytical results; and

- Incidents and observations concerning personnel health and safety.

The completed Field Logbook(s) (or, alternatively, the Field Logs) will be retained in the project files.

3.4 SAMPLE COLLECTION

3.4.1 ORDER OF SAMPLING

Each well (and spring if applicable) in the system will be sampled during each sampling event, but all procedures will be initiated with the upgradient locations to minimize potential cross-contamination.

3.4.2 MEASUREMENTS OF STATIC WATER LEVEL AND WELL DEPTH

Prior to purging or sampling any well, the static water levels in and the depth of all wells will be measured and recorded. The static water level will be measured using a pre-cleaned and calibrated electronic water level indicator, and well depth will be measured using a weighted measuring tape.

It is recommended that these activities will be performed as follows:

A. Obtain keys from office to unlock and open well; observe condition of well and don clean gloves.

B. Record well number, date, time, weather conditions, condition of the well, and any other pertinent well-specific information.

C. Locate reference mark at top of well casing. If reference mark is not present, make one on side of casing and alert management. [Note that the mark should have been surveyed to determine elevation by a licensed surveyor.]

D. Obtain water level measurement(s) as follows:

1) Check battery on electronic water level indicator and on alarm.

2) Lower electronic water level indicator probe into well making sure the cord on the probe does not scrape the sides of the well casing. When the alarm sounds and/or the red light illuminates, stop lowering the probe. Pull up on the probe until alarm no longer sounds.

3) Lower probe again slowly. Stop at the instant the alarm sounds and/or the light comes on and stays on. Hold cord to side of casing where reference mark is etched, and mark cord with thumb where it touches the reference mark.

4) Use measuring device to determine distance from last marked increment to marked point on cord. Depth to water is the distance from top of casing to the water level.

5) Record measurement to the nearest 0.01 foot as depth to water in Field Logbook.

6) Repeat steps (2) - (5) three times for consistency.

7) Subtract distance from mark on casing to water level from the elevation of the mark on casing to get the elevation of the groundwater level: elevation of water level = (elevation of well) - (depth to water level).

8) After each measurement, rinse the probe with distilled water to avoid possible cross-contamination.

E. Obtain well depth measurement as follows:

1) Lower a weighted measuring tape until refusal.

2) Measure and record the distance from the well bottom to the top of the well casing.

3) Take all measurements to the nearest 0.01 foot.

4) After each measurement rinse tape with distilled water to avoid possible cross-contamination.

After rinsing, the water level indicator probe and the measuring tape will be wrapped in clean aluminum foil or polyethylene to keep it clean between uses. At each well, clean, new plastic will be used to provide a clean surface on which to lay decontaminated equipment.

3.4.3 WELL EVACUATION

No immiscible layers are expected. Therefore, each monitoring well will be purged prior to sampling in order to remove stagnant water from the casing and draw a representative sample from the aquifer. The pH and temperature will be measured during the purging process. Each well will be purged either to dryness or until at least three (3) well volumes of water have been removed.

Purging may be performed using one of the following: dedicated PVC bailers (or other TDEC approved material), dedicated electrically powered Teflon/stainless steel submersible pumps; or dedicated gas operated positive displacement (bladder or piston) Teflon/stainless steel pumps. If a pump system is used, the discharge tube and fittings will be of Teflon or high density polyethylene. The exact purging device selected will depend on the expected yield of the wells, water levels, and other site-specific factors, and upon device availability at the time of purging. Regardless of the device used, the rate of purging will be regulated to minimize agitation of the groundwater.

It is recommended that purging be performed as follows:

A. Ensure that purging equipment has been properly decontaminated, and ensure that measuring instruments are properly calibrated.

B. Record well number, date, time, weather conditions, condition of the well, and other pertinent well-specific information.

C. In the Field Logbook, use the depth to water and well depth measurements to calculate the water column length (h), in feet, and well volume (v), in gallons, as follows:

h = length of water column (in feet) = (depth of well) - (distance to water level).
V = well volume (in gallons) = 0.16 (gal/ft) x h (ft).

D. Unlock and open well, don clean gloves.

E. Begin purging, measuring and recording times and gallons removed. Measure initial pH and record. If applicable, measure initial temperature, and record, and measure pH, and temperature after one well volume has been removed. Repeat until at least three volumes have been removed, or until the well is dry if sufficient water is not present to yield required purge volumes. Measure water level and record time after purging.

F. Unless well yield is sufficient to allow sampling to be performed promptly, close and lock the well cap.

Purged water will be discharged onto the ground at a distance away from the well to prevent infiltration back into the well.

3.4.4 SAMPLE WITHDRAWAL

Groundwater samples obtained from wells will be collected after purging as soon as possible, but within 24 hours. For rapidly recovering wells, it is recommended that the time interval between well evacuation and sampling is considerably less than 24 hours. Samples may be collected using dedicated, PVC (or other approved material) bottom-loading bailers constructed with non-adhesive joints (bailers constructed from the same material as the well casing), or positive displacement (bladder or piston) Teflon/stainless steel pumps. Bailers used to purge the wells may be used for collecting the sample. The bailer will not be decontaminated between purging and sampling unless fouled. The pH will be measured before the sample collection.

Any groundwater samples obtained from springs will be collected directly into the sampling bottle by holding the bottle just below the water surface with the bottle opening pointing upstream. In a case where the water is too shallow to submerge the bottle, water samples will be collected using a clean glass baker or stainless steel bucket from which they will be transferred to the sample bottle.

All samples will be preserved in accordance with the procedures described in Section 3.5. Samples may also be collected for dissolved metals analysis. Any samples collected for dissolved metals analysis may be immediately filtered through a 0.45 micron glass filter or membrane filter prior to transfer to the sample container and preservation. Samples that will be transported to the laboratory within 2-3 hours after collection, may be filtered in the laboratory. The preservative will be added after the sample is filtered in the laboratory. It is recommended that sample collection be performed as follows:

A. Record well number, date, time weather conditions, condition of well, and any other pertinent well-specific information.

B. Place clean, plastic sheeting around well and work area, unlock and open well, and don clean gloves.

C. Obtain water level measurements as described in Section 3.4.2.

D. The following procedures are to be followed, as applicable, when bailers or pumps are used:

1) If a bailer is used, lower bailer slowly to the water level and allow to submerge slowly to the approximate bottom of the well. Allow bailer to fill with a minimum of surface disturbance in order to prevent aeration of the water sample. Raise bailer to surface, taking care that neither the cord or bailer contact the ground.

2) If the gas driven piston pump is used, lower the pump into the well to the desired level, if the pump is not dedicated. Connect air lines from regulated compressed air source to pump. Start air flow. Adjust flow rate with throttle knob found on pump regulator.

3) If a bladder pump is used, attach air lines, sample lines and lifting lines to pump. Lifting lines should bear the weight of the pump with air and sample lines should be attached to lifting lines approximately every 10 feet with appropriate inert devices. Lower pump in well to desired level, if pump is not dedicated. Connect battery, if required. Start air flow. Adjust flow rate with throttle knob found on control box. To control discharge and refill cycle rate of the bladder, use the discharge and refill control knobs located on the control box. Equal length discharge and refill cycles are generally desirable, but individual well conditions may dictate otherwise.

E. Release samples directly (from the bailer or pump system) into the sample container as follows:

1) Remove the cap from the sample container, and hold the container slightly tilted.

2) Release the sample slowly down the inside of the sample container, avoiding splashing of the sample and ensuring that any suspended matter in the sample is also transferred (in approximate proportions) to the sample containers. [Note: Typically, sample is released from the bailer by carefully depressing the bottom ball valve slightly with a gloved finger. However, exact technique may depend upon bailer design.]

3) Fill the container completely.

4) Place the cap on the filled container and screw on tightly. Handle closed container as described in Sections 3.5 and 3.6.

F. Record sampling results in the Field Logbook. Repeat steps D and E until all sample containers are filled. Take final water level reading and record time.

G. Close and lock well.

H. Clean work area.

3.4.5 FIELD MEASUREMENT PROCEDURES

Measurements of the pH and temperature will be obtained in the field. These measurements may serve two purposes. First, both parameters may be used to determine when purging of a well is complete by indicating consistent water quality. Second, the parameter pH is a required groundwater monitoring parameter, and it is most easily and accurately measured in the field. Both parameters may be measured using portable, direct-reading, electronic instruments equipped with remote probes. To obtain a reading (measurement), the probe will be immersed in a container holding sample groundwater that has been freshly removed from the well. The following procedures describe how these measurements may be obtained. However, any other approved procedures may also be followed.

A. pH (Hydrogen Ion Concentration) may be measured using a pH meter that also reads sample temperature and provides automatic temperature compensation.

1) Prior to field activity, ensure that meter is in proper operating condition--check for mechanical and electrical failures, weak batteries, and cracked or fouled electrodes and correct such problems.

2) Prior to using, ensure that meter is properly calibrated in accordance with manufacturer's instructions by testing against standard buffer solutions. While in the field, the meter will be periodically (e.g., daily) checked against

standard buffer solutions and recalibrated as necessary, also in accordance with manufacturer's instructions. These field checks will be recorded in the Field Logbook.

3) Allow the meter to equilibrate to ambient temperature when it is removed from a field vehicle.

4) Rinse the electrode (probe) with distilled water and allow excess water to drain. [Note: this rinsing will be performed prior to and after immersion in each buffer solution and sample.] Collect a fresh sample of groundwater in the container. Immerse the electrode in the sample and swirl it in the sample (or swirl the sample around the electrode) at a slow constant rate until the meter reading reaches equilibrium. Note and record pH reading to nearest 0.1 pH unit in Field Logbook. Discard sample.

5) Repeat step (4) four times. Rinse electrode with distilled water and store in appropriate storage solution in accordance with manufacturer's instructions. Repack instrument. [Note: Poorly buffered solutions with low specific conductance values (less than 200 μmhos) may cause fluctuations in the pH readings. In such case, the electrode may be equilibrated by immersing in three or four portions of sample before taking pH measurements on fresh portions.]

B. Temperature may be measured using the pH meter each time a pH measurement is made and recorded in the Field Logbook.

3.5 SAMPLE PRESERVATION AND HANDLING

Refer to *Methods for Chemical Analysis of Water and Wastes*, USEPA 600/4-79-020, revised March 1983 for sample container, preservative, storage time, and analysis requirements. The containers for the samples will be obtained from the analytical laboratory in "clean" condition or will be newly-purchased "clean" containers.

Samples shall be kept cool (4° C) prior to analysis. This will be achieved through the use of cooled portable ice chests in the field and during transport, and by refrigeration in the laboratory.

3.6 CHAIN-OF-CUSTODY

3.6.1 SAMPLE DESIGNATION AND STORAGE

Each sample will have an identification code which will be used throughout the sampling/analysis/reporting process associated with a sampling event. All containers of groundwater samples collected from a well during a sampling event will be designated with the well or spring number (e.g., "W-1"). Trip blanks will be designated with the label "equipment blank". The recommended frequency of trip blanks is one per sampling/shipment event. Equipment blanks "rinsate samples" shall be

taken for each well sampled. Only one randomly selected sample should be shipped for testing. Should any well produce a distinguishable contaminant odor, the equipment blank for this event shall be selected for testing.

As soon as practicable after filling, sample containers will be wiped clean with disposable rags or paper towels (preceded by a distilled water rinse as necessary); labeled as described in Section 3.6.2; secondarily contained in clean, new, leak-proof plastic bags; and, as appropriate, placed in a cooled ice chest for storage and delivery to the laboratory (with cushioning material as necessary).

3.6.2 CONTAINER LABELS AND SEALS

Each sample container, either before or shortly after filling, will be labeled with the following minimum information:

- Sample identification number
- Project number
- Site name
- Date and time of collection
- Sampler's name
- Parameter(s) requested (if space permits)
- Preservation information

Labels will be obtained from the analytical laboratory (or container vendor) along with the sample containers. Labels will be completed

legibly using waterproof ink. Container seals may not be utilized, if shipment of the samples to the laboratory is not necessary. However, if shipment of the samples to the laboratory is necessary and container seals are used, they will be completed legibly using waterproof ink.

3.6.3 CHAIN-OF-CUSTODY RECORD

At the conclusion of each day's sampling activities, all collected samples will be transported or shipped to the analytical laboratory along with a completed Chain-of-Custody Record(s). The completed record will include the following minimum information:

- Sample identification number(s)
- Signature of sampler
- Date and time of collection
- Sample type (e.g., groundwater)
- Number of containers
- Dated signature of persons involved in the chain of possession (showing transfer of custody).

This form may also serve as the analysis request form, showing the analyses to be performed on each sample. After obtaining the dated signature of the receiving laboratory official, the sampler(s) will obtain a copy of the completed Chain-of-Custody Record(s) for retention in the project files.

3.7 EQUIPMENT DECONTAMINATION

In order to preclude cross contamination between wells and/or sampling points, all sampling equipment (i.e., bailer, pump, tubing, etc.) which comes into direct contact with the groundwater will be decontaminated prior to reuse. Decontamination may be performed by cleaning equipment with a solution of tap water and non-metallic or non-phosphatic detergent and rinsing with tap water and subsequently with distilled (or deionized) water. The equipment may subsequently be rinsed with an organic solvent such as isopropanol and allowed to air dry prior to use. Distilled (or deionized) water may always be substituted for tap water.

3.8 ANALYTICAL PROCEDURES

3.8.1 ANALYTICAL PARAMETERS AND METHODS

Groundwater samples will be analyzed for the parameters listed in Section 3.1 in accordance with EPA 600/4-79-020 and in accordance with the strategy described in Section 3.8. Upon receipt from the laboratory, the analytical results will be made a part of the permanent project file.

3.8.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

In addition to actual groundwater samples, one set of trip blanks and one set of equipment blanks will also be collected and analyzed for each sampling event (or for each day that groundwater monitoring wells are sampled - for equipment blanks) to provide Quality Assurance/Quality

Control (QA/QC) information relative to the sample collection and handling process. Trip blanks will account for any contamination that may occur as a result of the containers, the sample cooler, the cleaning operations or the chemical preservatives. Equipment blanks are primarily used to check the effectiveness of the equipment decontamination process, but the equipment blank analytical results will also reflect contamination that may have resulted from onsite contamination or the use of contaminated distilled (or deionized) water or inadequately cleaned sample containers.

The trip blank samples will be prepared in the laboratory by filling the appropriate clean sample bottles with Type II reagent grade water. These bottles will then be labeled "trip blank", the analyses to be performed will be indicated on each, and they will be placed in the appropriate sample shuttle cooler(s) to be utilized for sample transport to the field and back to the laboratory.

Equipment blank samples will be prepared in the field immediately following decontamination cleaning procedures and before new or non-dedicated equipment is used for evacuation, sampling, or sample preparation. Non-dedicated sampling devices may be considered possible sources of cross contamination. Following decontamination, the sampling device will be filled with Type II reagent grade water, or Type II reagent grade water will be pumped through the device. Then the Type II reagent grade water will be transferred to the sample container(s) (i.e., bottles) and returned to the laboratory for analysis.

4.0 RECORD KEEPING AND REPORTING PROCEDURES

U.S. Pipe will maintain records of all groundwater sampling activities conducted, the sample analysis results, and the associated groundwater surface elevations throughout the active life of the facility and post-closure period. All records will be maintained at the U.S. Pipe Plant Office of the Supervisor of Stores and Yard.

U.S. Pipe will submit to the regulatory authority all groundwater sample analysis results and associated recordings of groundwater surface elevations, within thirty days after receiving the results of analysis.

DRAFT

Tennessee Department of Environment and Conservation

BENEFICIAL USE OF NONTOXIC SPENT FOUNDRY SAND

POLICY

I. PURPOSE

This policy was developed by the Tennessee Division of Solid Waste Management (the Division) to facilitate the beneficial use of nontoxic spent foundry sand and to assure that such uses do not cause environmental harm.

Generators of spent foundry sand are encouraged to actively explore and implement economically feasible alternatives to reduce the volume and toxicity of foundry sand produced, as well as on-site recycling, or recovery, before evaluating potential beneficial uses.

II. SCOPE

This policy sets forth beneficial uses of nontoxic spent foundry sand from iron and aluminum foundries. It describes notification requirements, lists uses which do not require Division review or approval, lists examples of uses which require project specific Division review, and outlines record keeping requirements.

III. APPLICABILITY

This policy applies to nontoxic spent sand from iron and aluminum foundries used or proposed to be used for a particular beneficial purpose in lieu of a competing raw material or finished product. This policy does not apply to waste disposal or indiscriminate dumping/filling.

IV. INITIAL DOCUMENTATION REQUIRED

For a beneficial reuse of foundry sand to be covered by this policy, the foundry which generates the sand must provide documentation to the Division that the sand is "nontoxic" and has been "processed for reuse". For the purposes of this policy, "nontoxic" means that the foundry sand is non-hazardous and contains chemical constituents in concentrations equal to or less than those outlined in Table I. Also, for the purposes of this policy, "processed for reuse" means that the sand has been subjected to a process by which metal and trash are removed. Metal or trash removal is not required provided the foundry can demonstrate that these materials are not present in their sand in significant quantities.

For uses outlined in Part V, items A through E of this policy, initial documentation is not required. However, if the foundry wishes to be covered by this policy, documentation may be submitted.

V. USES NOT REQUIRING DIVISION REVIEW

The following uses do not require prior Division review or approval:

A. *Manufacturing another product:* The use as a raw material in manufacturing another final product, including, but not limited to, grout, cement, flowable fill, lightweight aggregate, concrete block, bricks, asphalt, roofing materials, plastics, paint, glass, fiberglass, ornamental ceramics and other non-land applications, or as a substitute for a product (e.g. blasting grit), excluding soil products.

B. *Stabilization/solidification of other waste (for disposal):* The use as a stabilization/solidification agent, singly or in combination with other additives or agents, for other wastes which will be disposed of at an approved disposal facility.

C. *Use in a composting process:* The use in a composting process when the process is performed in accordance with applicable composting regulations. This term does not include the use as a post-composting additive, or land application.

D. *Daily cover/final cover at landfill:* Uses as daily cover/final cover at a solid waste landfill, meeting all technical requirements for daily cover/final cover and approved by a permit. The amount of daily cover/final cover shall not exceed the amount under an approved permit.

Landfill Liner protective layer: Use as a protective layer for landfill liners as part of an approved permit for the landfill.

E. ~~Soil Blending~~ . . .

F. *Small Construction Projects:* Uses outlined in Part VI of this policy when the amount used for any single project does not exceed 200 tons and is stabilized. The project must not impact streams, wetlands, or other waters of the State. For small construction projects to be covered under this policy, the generator must provide the "initial documentation" to the Division.

VI. USES REQUIRING DIVISION REVIEW TO PARTICIPATE UNDER THIS POLICY

The following uses require prior Division project review for concurrence. Notification shall be by the attached form.

A. *Structural fill:* An engineered use of nontoxic spent foundry sand structural fills for the following: building or equipment supportive base or foundation, foundation backfill, construction material for road bases and subbase, overpasses, embankments, parking lots, dams, retaining walls, dikes, levees; as a construction fill material for planned commercial and residential projects including office parks, commercial plazas, malls, industrial parks, institutions, subdivisions, apartments, duplexes, condominiums; as bedding and backfill material for sanitary sewer lines and other utility lines; or as a construction fill material for planned recreational type uses which include tennis courts and other public park applications below surface grade. Note that all above applications will be below surface grade when completed.

B. *Mines/Strip Mine Reclamation:* Beneficial uses to fill abandoned or closed mines or strip mine areas. The intent is to fill the areas to the original topography, cover with one foot of soil and vegetate, thus restoring the land to its original contours and adding to it's value.

C. *Other uses:* The Director may approve other uses on an individual basis if they are consistent with this policy and protective of human health and the environment.

J. RECORD KEEPING REQUIREMENTS

Each foundry subject to this policy must maintain the following records:

1. The amount of sand used;

2. The nature, purpose, and location of the projects;

3. Chemical analysis documenting the "nontoxic" nature of their sand; ~~and~~ (Such analysis must be completed every two years or whenever process change occur which may affect composition of the sand, whichever is more frequent);
4. Any written approval/concurrence by DSWM where required for participation under this policy.

Tom Tiesler, Director
Tennessee Division of Solid Waste Management

(date)

DRAFT

BENEFUSE.POL

DRAFT

ATTACHMENT 1

Foundry Sand Beneficial Use Notification Form

GENERAL INFORMATION:

1.) Name of Project: _____

2.) Entity Requesting Review: _____

3.) Proposed Generator: _____

4.) Proposed Use As: _____

5.) Proposed Use Location (Enclose topographical map showing material placement boundaries. Include lowest elevation of material placement): _____

6.) Name and address of property owner: _____

7.) Amount of Nontoxic Spent Foundry Sand to be Used: _____

ENVIRONMENTAL CONSIDERATIONS:

1.) Is the proposed use location subject to flooding? YES NO
(Attach map indicating 100-year flood plains.)

2.) Distance from proposed location to nearest surface water: _____
(On the map, show any nearby perennial (blue line) streams, ponds, wetlands, etc.)

3.) Describe runoff/silt control: _____

4.) Indicate on the map approximate location of monitoring and/or potable water supply wells in the area.

5.) What are the adjacent land uses? _____

_____

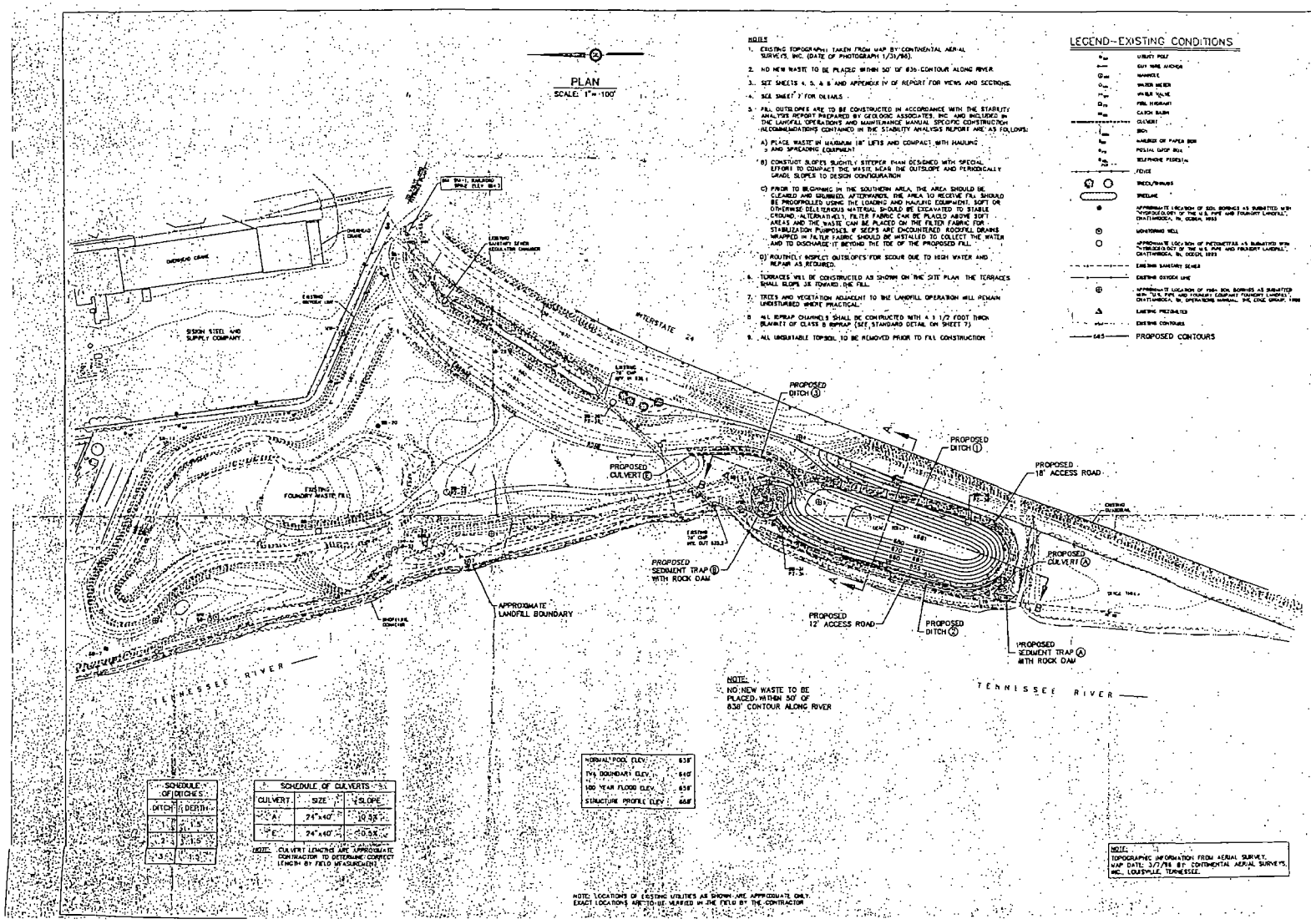
6.) Are you aware of any potential (attributable to this project) or existing public water supply or groundwater quality degradation in the area? YES NO
Explain: _____

_____

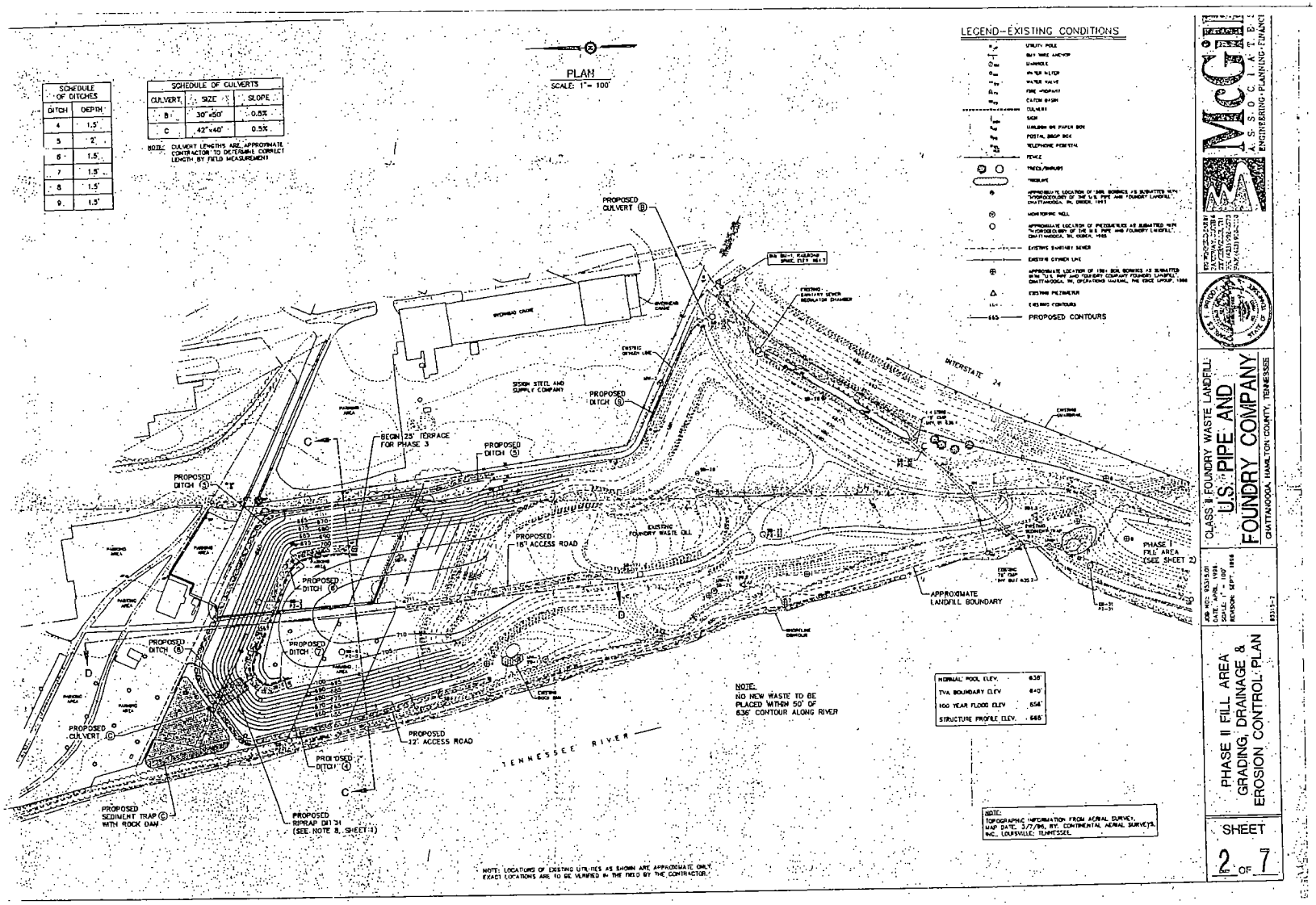
7.) Indicate the area USGS soil type classification: _____

This signature shall constitute personal affirmation that all statements or assertions of fact made in this proposal are true and complete and shall be subject to applicable state laws for false or misleading statements.

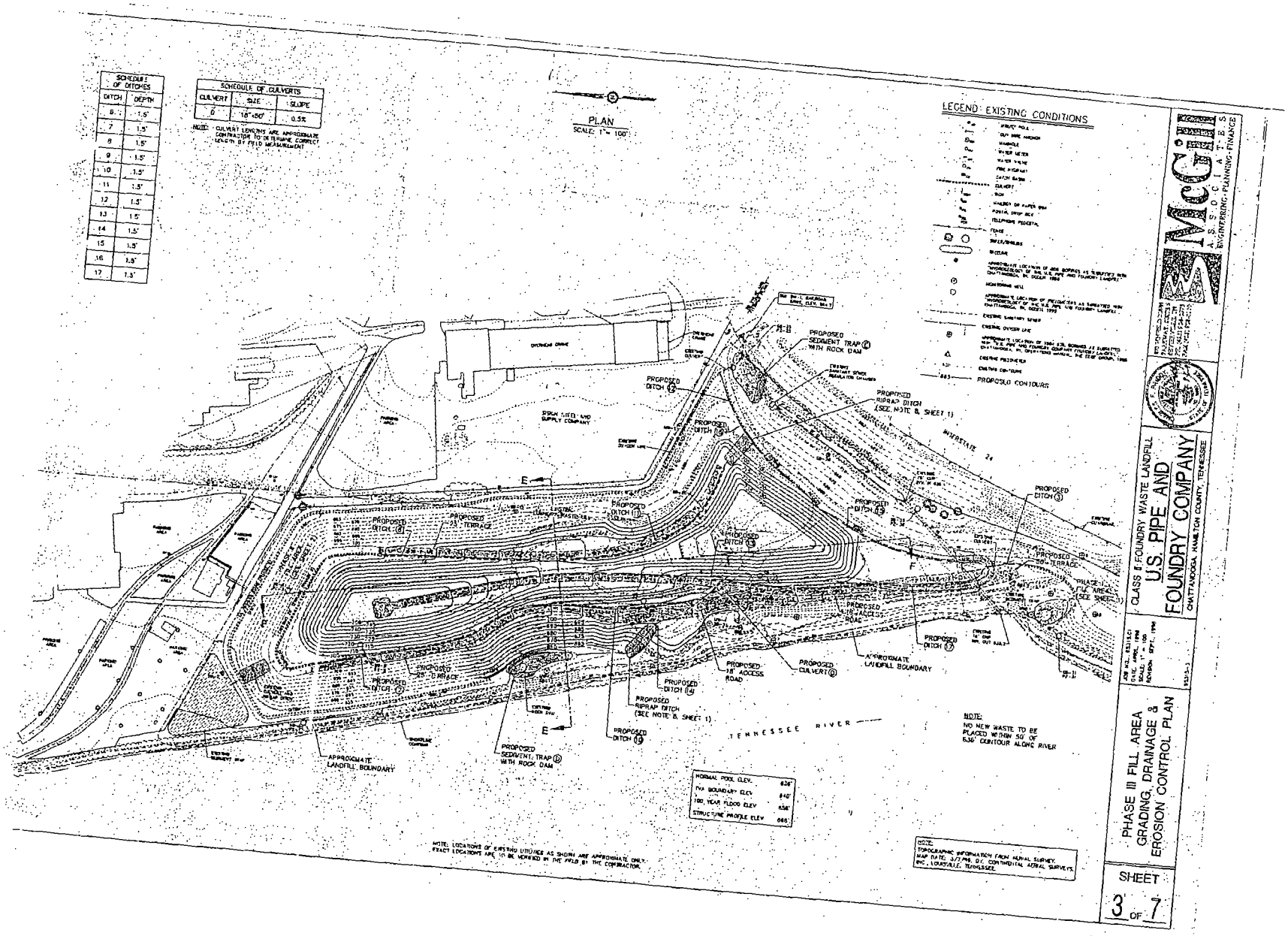
_____	_____
Signature of Project Manager	Name of Property Owner
_____	_____
Company	Signature
_____	_____
Title	Date
_____	
Date	


PLAN
SCALE: 1"=100'
NOTES
1. EXISTING TOPOGRAPHY TAKEN FROM MAP BY CONTINENTAL AERIAL SURVEYS, INC. (DATE OF PHOTOGRAPH 1/31/86).
2. NO NEW WASTE TO BE PLACED WITHIN 50' OF 838-CONTOUR ALONG RIVER
3. SEE SHEETS 4, 5, & 6 AND APPENDIX IV OF REPORT FOR VIEWS AND SECTIONS.
4. SEE SHEET 7 FOR DETAILS
5. FILL OUTSLOPES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STABILITY ANALYSIS REPORT PREPARED BY GEOLOGIC ASSOCIATES, INC. AND INCLUDED IN THE LANDFILL OPERATIONS AND MAINTENANCE MANUAL. SPECIFIC CONSTRUCTION RECOMMENDATIONS CONTAINED IN THE STABILITY ANALYSIS REPORT ARE AS FOLLOWS:
A) PLACE WASTE IN MAXIMUM 18" LIFTS AND COMPACT WITH HAULING AND SPREADING EQUIPMENT
B) CONSTRUCT SLOPES SLIGHTLY STEEPER THAN DESIGNED WITH SPECIAL EFFORT TO COMPACT THE WASTE NEAR THE OUTSLOPE AND PERIODICALLY GRADE SLOPES TO DESIGN CONFIGURATION
C) PRIOR TO BEGINNING IN THE SOUTHERN AREA, THE AREA SHOULD BE CLEARED AND GRUBBED. AFTERWARDS, THE AREA TO RECEIVE FILL SHOULD BE PROOFROLLED USING THE LOADING AND HAULING EQUIPMENT. SOFT OR OTHERWISE DELETERIOUS MATERIAL SHOULD BE EXCAVATED TO STABLE GROUND. ALTERNATIVELY, FILTER FABRIC CAN BE PLACED ABOVE SOFT AREAS AND THE WASTE CAN BE PLACED ON THE FILTER FABRIC FOR STABILIZATION PURPOSES. IF SEEPS ARE ENCOUNTERED ROCKFILL DRAINS WRAPPED IN FILTER FABRIC SHOULD BE INSTALLED TO COLLECT THE WATER AND TO DISCHARGE IT BEYOND THE TOE OF THE PROPOSED FILL.
D) ROUTINELY INSPECT OUTSLOPES FOR SCOUR DUE TO HIGH WATER AND REPAIR AS REQUIRED.
6. TERRACES WILL BE CONSTRUCTED AS SHOWN ON THE SITE PLAN. THE TERRACES SHALL SLOPE 3% TOWARD THE FILL.
7. TREES AND VEGETATION ADJACENT TO THE LANDFILL OPERATION WILL REMAIN UNDISTURBED WHERE PRACTICAL.
8. ALL RIPRAP CHANNELS SHALL BE CONSTRUCTED WITH A 1 1/2 FOOT THICK BLANKET OF CLASS B RIPRAP (SEE STANDARD DETAIL ON SHEET 7)
9. ALL UNSUITABLE TOPSOIL TO BE REMOVED PRIOR TO FILL CONSTRUCTION
LEGEND--EXISTING CONDITIONS
UTILITY POLE
GUY WIRE ANCHOR
MANHOLE
WATER METER
WATER VALVE
FIRE HYDRANT
CATCH BASIN
CULVERT
BOX
MAILBOX OF PAPER BOX
POSTAL DROP BOX
TELEPHONE PEDESTAL
FENCE
TREES/BRUSH
SHRUBS
MONITORING WELL
EXISTING SANITARY SEWER
EXISTING DITCH LINE
EXISTING CONTOURS
PROPOSED CONTOURS
PROPOSED DITCH 3
PROPOSED DITCH 1
PROPOSED 18' ACCESS ROAD
PROPOSED CULVERT E
PROPOSED CULVERT A
PROPOSED SEDIMENT TRAP B WITH ROCK DAM
PROPOSED SEDIMENT TRAP A WITH ROCK DAM
PROPOSED 12' ACCESS ROAD
PROPOSED DITCH 2
APPROXIMATE LANDFILL BOUNDARY
EXISTING FOUNDRY WASTE FILL
EXISTING SANITARY SEWER REGULATOR CHAMBER
EXISTING SEWER STEEL AND SUPPLY COMPANY
INTERSTATE 24
TENNESSEE RIVER
NOTE: NO NEW WASTE TO BE PLACED WITHIN 50' OF 838' CONTOUR ALONG RIVER
NORMAL POOL ELEV. 838'
1% BOUNDARY ELEV. 840'
100 YEAR FLOOD ELEV. 838'
STRUCTURE PROFILE ELEV. 838'
SCHEDULE OF DITCHES
SCHEDULE OF CULVERTS
NOTE: CULVERT LENGTHS ARE APPROXIMATE. CONTRACTOR TO DETERMINE CORRECT LENGTH BY FIELD MEASUREMENT.
NOTE: TOPOGRAPHIC INFORMATION FROM AERIAL SURVEY. MAP DATE: 3/7/86 BY CONTINENTAL AERIAL SURVEYS, INC. LOUISVILLE, TENNESSEE.
NOTE: LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR
CLASS II FOUNDRY WASTE LANDFILL
Sheet 1 of 7

MWPS007721


PLAN
SCALE: 1" = 100'
LEGEND—EXISTING CONDITIONS
PROPOSED CONTOURS
SCHEDULE OF DITCHES
DITCH | DEPTH
4 | 1.5'
5 | 2'
6 | 1.5'
7 | 1.5'
8 | 1.5'
9 | 1.5'
SCHEDULE OF CULVERTS
CULVERT | SIZE | SLOPE
B | 30"x50' | 0.5%
C | 42"x40' | 0.5%
NOTE: CULVERT LENGTHS ARE APPROXIMATE. CONTRACTOR TO DETERMINE CORRECT LENGTH BY FIELD MEASUREMENT
PROPOSED CULVERT B
PROPOSED DITCH 9
PROPOSED DITCH 5
BEGIN 25' TERRACE FOR PHASE 3
PROPOSED DITCH 3
PROPOSED 16' ACCESS ROAD
EXISTING FOUNDRY WASTE OIL
PROPOSED DITCH 6
PROPOSED DITCH 7
PROPOSED DITCH 8
PROPOSED CULVERT D
PROPOSED 12' ACCESS ROAD
PROPOSED DITCH 4
PROPOSED SEDIMENT TRAP C WITH ROCK DAM
PROPOSED RIPRAP DITCH (SEE NOTE 8, SHEET 4)
TENNESSEE RIVER
INTERSTATE 24
APPROXIMATE LANDFILL BOUNDARY
PHASE I FILL AREA (SEE SHEET 2)
NOTE: NO NEW WASTE TO BE PLACED WITHIN 50' OF 636' CONTOUR ALONG RIVER
NORMAL POOL ELEV. 638'
TVA BOUNDARY ELEV 640'
100 YEAR FLOOD ELEV 654'
STRUCTURE PROFILE ELEV. 648'
NOTE: TOPOGRAPHIC INFORMATION FROM AERIAL SURVEY, MAP DATE 3/7/96, BY CONTINENTAL AERIAL SURVEYS, INC., LOUISVILLE, TENNESSEE.
NOTE: LOCATIONS OF EXISTING UTILITIES AS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE
PHASE II FILL AREA GRADING, DRAINAGE & EROSION CONTROL PLAN
SHEET 2 OF 7

MWPS007722

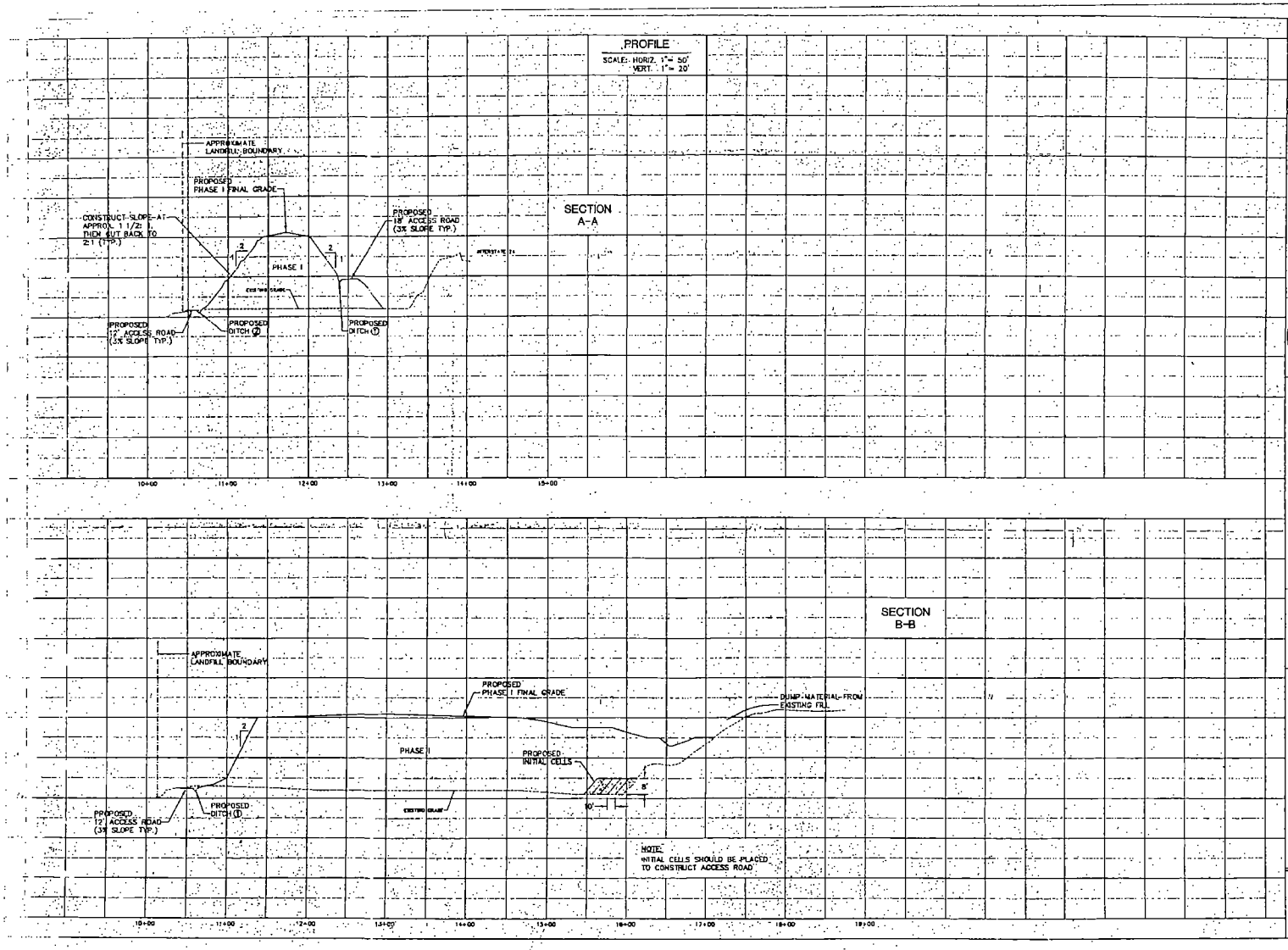


SCHEDULE OF DITCHES	
DITCH	DEPTH
6	1.5'
7	1.5'
8	1.5'
9	1.5'
10	1.5'
11	1.5'
12	1.5'
13	1.5'
14	1.5'
15	1.5'
16	1.5'
17	1.5'

SCHEDULE OF CULVERTS		
CULVERT	SIZE	SLOPE
6	18"x50'	0.5%

NOTE: CULVERT LENGTHS ARE APPROXIMATE. CONTRACTOR TO DETERMINE CORRECT LENGTH BY FIELD MEASUREMENT

MWPS007723



MACC ASSOCIATES
ENGINEERING • PLANNING • FINANCE

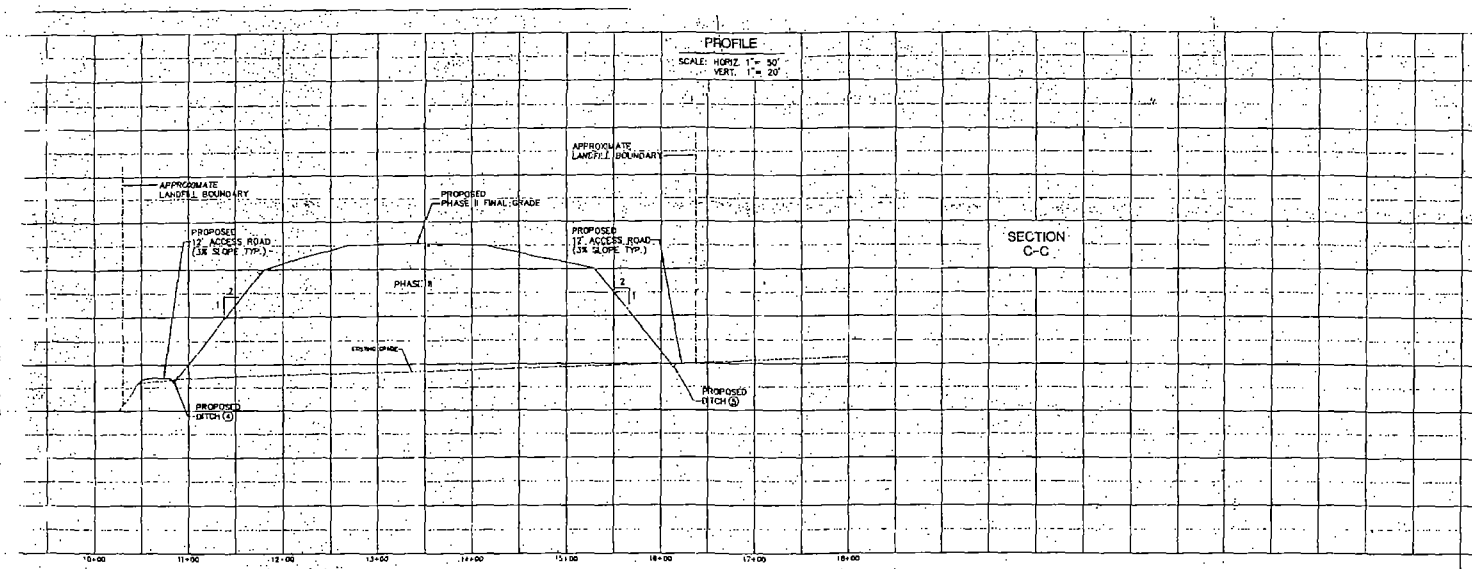
CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

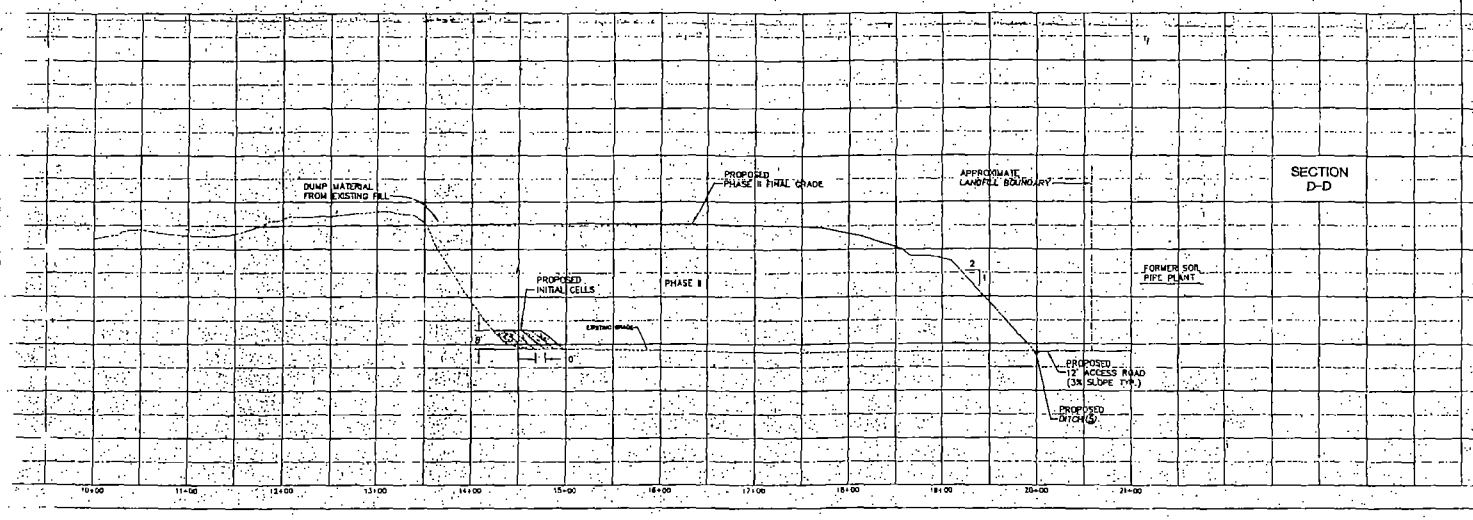
JOB NO. 5333.00
DATE: APRIL, 1998
SCALE: AS NOTED
REVISION: SEPT., 1998
5333-4

SECTIONS A-A & B-B

SHEET 4 OF 7

MWPS007724





McGINTY ASSOCIATE
ENGINEERING · PLANNING · FINANCE

CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

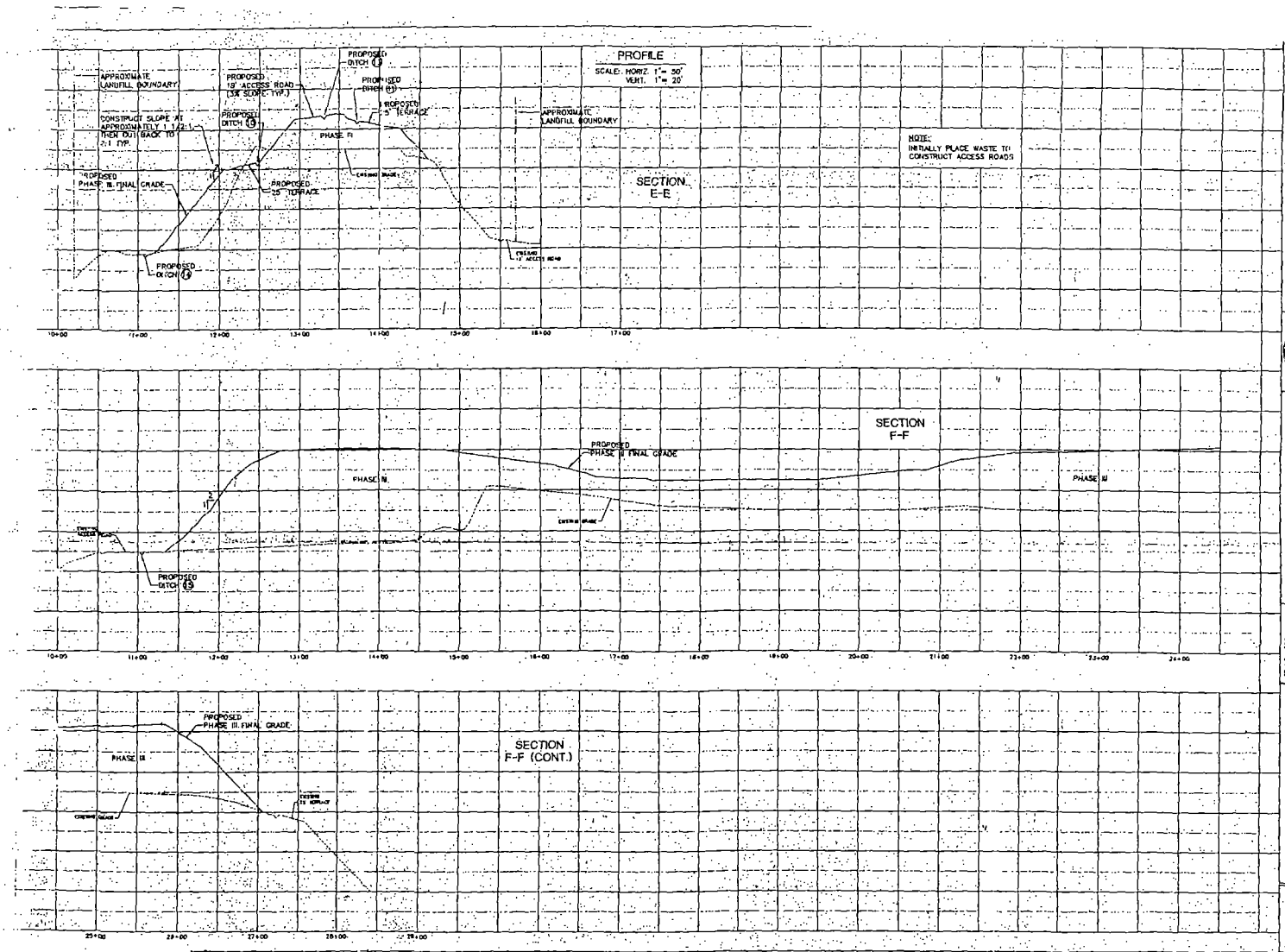
JOB NO.: 93319.01
DATE: NOV. 1994
SCALE: AS NOTED
REVISION: SEPT. 1998

93319-3

SECTIONS C-C & D-D

SHEET 5 OF 7

MWPS007725

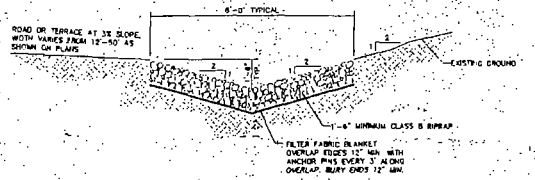


CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

SECTIONS E-E & F-F

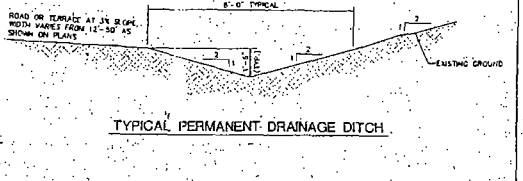
SHEET 6 OF 7

MWPS007726

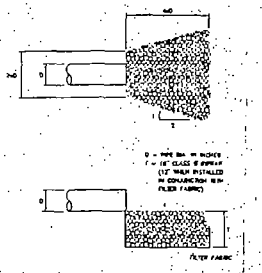


TYPICAL RIPRAP LINED DITCH

NOTE:
CLASS B (5"-15"), NO SPECIFIC GRADATION IS REQUIRED, HOWEVER, THE VARIOUS SIZES OF STONE SHALL BE EQUALLY DISTRIBUTED WITHIN THE REQUIRED SIZE RANGE.

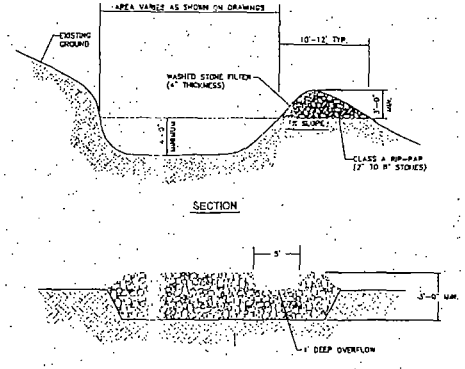


TYPICAL PERMANENT DRAINAGE DITCH



RIPRAP AT PIPE OUTLET

NOTE:
CLASS B (5"-15"), NO SPECIFIC GRADATION IS REQUIRED, HOWEVER, THE VARIOUS SIZES OF STONE SHALL BE EQUALLY DISTRIBUTED WITHIN THE REQUIRED SIZE RANGE.



SECTION

FRONT VIEW

TEMPORARY SEDIMENT TRAP WITH GRAVEL FILTER OUTLET

NOTES:

1. FILTER BARRIERS SHALL BE INSPECTED AFTER EACH RAINFALL AND DAILY DURING PROLONGED RAINFALL. REPAIR SHALL BE MADE AS NECESSARY.
2. SEDIMENT DEPOSITS SHALL BE REMOVED AFTER EACH STORM EVENT AND WHEN DEPOSITS REACH APPROXIMATELY 1/3 HEIGHT OF BARRIER.
3. CLASS A RIPRAP (2"-8") NO SPECIFIC GRADATION IS REQUIRED, HOWEVER THE VARIOUS SIZES OF STONE SHALL BE EQUALLY DISTRIBUTED WITHIN THE REQUIRED SIZE RANGE.

McGILL ASSOCIATES
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CHATTANOOGA, TENNESSEE
PHONE (423) 892-0011
FAX (423) 892-0015

CLASS II FOUNDRY WASTE LANDFILL
U.S. PIPE AND FOUNDRY COMPANY
CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

JOB NO. 9315.01
DATE: APRIL 1998
SCALE: 1" = 1/02'
REVISION: SEPT., 1998

9315-7

MISCELLANEOUS DETAILS

SHEET 7 OF 7

MWPS007727