Environmental Consultants

SCS ENGINEERS

PERMANENT PUMP STATION B
CONSTRUCTION PERMIT APPLICATION AND
DESIGN ENGINEERING REPORT

Presented to:

Hillsborough County
Solid Waste Management Department
P. O. Box 1110
Tampa, Florida 33601

Presented by:

SCS Engineers
3012 U.S. Highway 301 North
Suite 700
Tampa, Florida 33619

File No. 0995029.13
October 15, 1997

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Attachments

Section I

DEP Form # 62.701.900(1)
Form Title Solid Waste Management Facility Permit
Effective Date May 19, 1994

DEP Application No. _____
(Filled by DEP)

Florida Department of Environmental Protection

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, FL 32399-2400

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SOLID WASTE MANAGEMENT FACILITY PERMIT

APPLICATION INSTRUCTIONS AND FORMS

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

APPLICATION FOR PERMIT TO CONSTRUCT, OPERATE, MODIFY OR CLOSE
A SOLID WASTE MANAGEMENT FACILITY

Please Type or Print

A. GENERAL INFORMATION

1. Type of facility:

Disposal [X]

Class I Landfill	[X]	Ash Monofill	[ ]
Class II Landfill	[ ]	Asbestos Monofill	[ ]
Class III Landfill	[ ]	Industrial Solid Waste	[ ]
Other	[ ]		

Volume Reduction [ ]

Incinerator	[ ]	Pulverizer/Shredder	[ ]
Composting	[ ]	Compactor/Baling Plant	[ ]
Materials Recovery	[ ]	Energy Recovery	[ ]
Other	[ ]		

2. Type of application:

Construction	[X]	Construction/Operation	[ ]
Operation	[ ]	Closure	[ ]

3. Classification of application:

New	[ ]	Substantial Modification	[ ]
Renewal	[ ]	Minor Modification	[X]

4. Facility name: Southeast County Landfill

5. DER ID number: SO29-256427 County: Hillsborough

6. Facility location (main entrance): 8.8 miles east of U.S. 301 on County Road 672

7. Location coordinates:

Section: 13,14,15,18,19,22,23,24 Township: 31 & 32 S Range: 21 E

UTMs: Zone N/A _____ km E N/A km N

Latitude: 27 ° 46 ' 25 " Longitude: 82 ° 11 ' 15 "

8. Applicant name (operating authority): Hillsborough County Department of Solid Waste

Mailing address: P.O. Box 1110 Tampa FL 33601
Street or P.O. Box City State Zip

Contact person: Daryl H. Smith Telephone: (813) 272-5680

Title: Director, Solid Waste Management Department

9. Authorized agent/Consultant: SCS Engineers

Mailing address: 3012 U.S. Highway 301 North, Suite 700 Tampa Florida 33619
Street or P.O. Box City State Zip

Contact person: Mr. Robert B. Gardner Telephone: (813) 621-0080

Title: Vice President

10. Landowner (if different than applicant): Same

Mailing address: _____
Street or P.O. Box City State Zip

Contact person: _____ Telephone: ( )

11. Cities, towns and areas to be served: Tampa, Temple Terrace, Plant City, Hillsborough County

12. Population to be served:

Current: 573,013 Five-Year Projection: 634,884 (see SCS 1996 Exhibit 2-5)

13. Volume of solid waste to be received: 2,200 ~~yds^3/day~~ tons/day ~~gallons/day~~

14. Date site will be ready to be inspected for completion: Existing landfill

15. Estimated life of facility: 29 years

16. Estimated costs:

Total Construction: $ Existing landfill (N/A) Closing Costs: $ 13,600,000

17. Anticipated construction starting and completion dates:

From: Existing landfill To: Existing landfill

B. DISPOSAL FACILITY GENERAL INFORMATION

1. Provide brief description of disposal facility design and operations planned by this application:

   See attached report

2. Facility site supervisor: Meredith Matthews

   Title: Senior Engineering Technician, HCDSW Telephone: (813) 671-7707

3. Disposal area: Total 162.4(±) acres; Used 120.4(±) acres; Available 162.4(±) acres

4. Weighing scales used: Yes [X] No [ ]

5. Security to prevent unauthorized use: Yes [X] No [ ]

6. Charge for waste received: _____ $/yds^3 _____ $/ton **(See SCS 1996 Exhibit 8-3)** 7.

   Surrounding land use, zoning:

Residential	[ ]	Industrial	[ ]
Agricultural	[X]	None	[ ]
Commercial	[ ]	Other	[ ] _____

8. Types of waste received:

Residential	[X]	C & D debris	[X]
Commercial	[X]	Shredded/cut tires	[X]
Incinerator/WTE ash	[X]	Yard trash	[ ]
Treated biohazardous	[ ]	Septic tank	[ ]
Water treatment sludge	[X]	Industrial	[X]
Air treatment sludge	[X]	Industrial sludge	[X]
Agricultural	[X]	Domestic sludge	[ ]
Asbestos	[X]		
Other	[ ] _____		

9. Salvaging permitted: Yes [ ] No [X]

10. Attendant: Yes [X] No [ ] Trained operator: Yes [X] No [ ]

11. Spotters: Yes [X] No [ ] Number of spotters used: 1 minimum

12. Site located in: Floodplain [ ] Wetlands [ ] Other [X] upland, closed phosphate mine site

13. Property recorded as a Disposal Site in County Land Records: Yes [ ] No [X]

14. Days of operation: 6/week

15. Hours of operation: 7:30 a.m. to 5:30 p.m., Monday - Saturday

16. Days Working Face covered: 6/week

17. Elevation of water table: varies - see SCS 1996 Section 6, Figures 6-1 to 6-4 Ft. NGVD

T. CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

A. Applicant

The undersigned applicant or authorized representative of Hillsborough County is aware that statements made in this form and attached information are an application for a Construction Permit from the Florida Department of Environmental Protection and certifies that the information in this application is true, correct and complete to the best of his knowledge and belief. Further, the undersigned agrees to comply with the provisions of Chapter 403, Florida Statutes, and all rules and regulations of the Department. It is understood that the Permit is not transferable, and the Department will be notified prior to the sale or legal transfer of the permitted facility.

Signature of Applicant or Agent

Daryl H. Smith, Director
Name and Title

Date: 10/28/97

Attach a letter of authorization if agent is not a governmental official, owner, or corporate officer.

B. Professional Engineer Registered in Florida or Public Officer as required in Section 403.707 and 403.707(5), Florida Statutes.

This is to certify that the engineering features of this solid waste management facility have been designed/examined by me and found to conform to engineering principals applicable to such facilities. In my professional judgement, this facility, when properly maintained and operated, will comply with all applicable statutes of the State of Florida and rules of the Department. It is agreed that the undersigned will provide the applicant with a set of instructions of proper maintenance and operation of the facility.

Signature

Robert B. Gardner
Name and Title (please type)

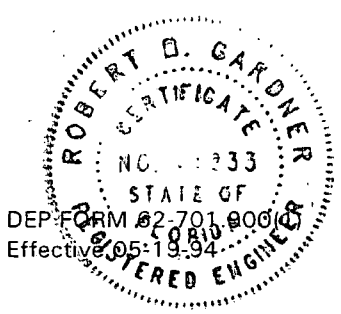
39233
Florida Registration Number
(please affix seal)

SCS Engineers, 3012 U.S. Highway 301 North, Suite 700
Mailing Address

Tampa, Florida 33619
City, State, Zip Code

(813) 621-0080
Telephone Number

Date: October 15, 1997



Section II

SECTION 2
DESIGN ENGINEERING REPORT

2.1 PURPOSE

The purpose of this report is to present the design of the leachate collection sump designated as Permanent Pump Station B (PPS-B) at the Southeast County Landfill (SCLF), including general design criteria, site layout, equipment layout, and operation. This report was prepared pursuant to Specific Condition No. 3 of the SCLF operation Permit No. S029-256427 (Permit).

2.2 SITE BACKGROUND

The Southeast County Facility, Hillsborough County (County), Florida is located 8.8 miles east of U.S. Highway 301 off County Road 672. The County owns the Southeast County Facility, which currently includes the Class I SCLF, a waste tire processing facility, stormwater management facilities, an equipment maintenance facility, and a leachate treatment and reclamation facility (LTRF).

The SCLF was permitted by the Florida Department of Environmental Protection (FDEP) to accept incinerated municipal solid waste, ash residues, non-processibles, and bypass waste. The SCLF has a permitted area of approximately 162.4 acres, and is operated by Waste Management, Inc. of Florida (WMI) under contract with the County. On August 22, 1994, SCS submitted to the FDEP the "Operation Permit Renewal Southeast County Landfill, Hillsborough County, Florida, Permit Application Engineering Report" (SCS, 1994). On October 30, 1996, the FDEP issued the Permit, which includes the SCLF and the LTRF.

The SCLF utilizes on-site phosphatic clays as a component of the bottom liner system (i.e., with permeabilities on the order of 1×10^{-7} cm/sec or less before consolidation), which range in thickness from 4 to 18 feet. As estimated by the geotechnical

engineering consultant, Ardaman and Associates, Inc. (Ardaman) in their 1983 and 1994 geotechnical reports, as the landfill induced stresses consolidate the phosphatic clay deposits, the relatively flat surface of the SCLF footprint will settle to create a low point. Upon consolidation, the leachate will flow into the low point where PPS-B will be located. The design of the leachate collection and removal system, and the phased development of the SCLF, was based upon the calculated settlement of the phosphatic clay liner.

2.3 LEACHATE GENERATION

The leachate collected in PPS-B will include leachate from the entire SCLF (Phases I through VI). Leachate generation estimates are addressed in the approved Leachate Management Plan (LMP) for the SCLF (SCS, 1995). Based on recorded data, the current leachate generation rate averages 59,000 gallons per day (gpd). As stated in the LMP, leachate generation at the SCLF will vary as new phases are opened or closed. The worst case scenario was estimated to occur when Phase VI - Lift 7B begins operation, resulting in a temporary maximum leachate generation of approximately 93,800 gpd.

2.4 PUMP STATION DESIGN

Ardaman estimated that the low point in the SCLF will occur in Phase VI, where the phosphatic clays are the thickest and landfill loads are the greatest (Ardaman, 1993). PPS-B will be located in the area estimated to become the low point of the SCLF. In April 1997, Ardaman advanced two Standard Penetration Test (SPT) borings in the area where PPS-B will be located. The phosphatic clay depths ranged from 13 to 18 feet, which is consistent with Ardaman's previous findings.

2.4.1 Vault

The PPS-B vault will be constructed of reinforced concrete (5,500 psi) and coated with an epoxy resin. The structural calculations for the sump design are presented in Attachment C.

The vault will be surrounded by granite rock (Number 4 gradation) to allow for drainage of leachate to the low point and to the vault via perforated pipes. As a future contingency, the granite rock is of sufficient quantity to allow for a well-point system to be incorporated into the leachate collection and removal system (LCRS) if necessary.

The vault is sized to have sufficient leachate storage (479 gallons) to provide for a minimum pump cycle time of approximately 13 minutes, and to maximize the LCRS performance by providing free flow into the vault.

2.4.2 Horizontal Access Pipes

Two horizontal access pipes will be provided. The main access pipe leading to the existing Permanent Pump Station A (PPS-A) will serve as the primary access to the vault (Attachment A, Drawing No. 3). The alternate access pipe leading to the SCLF western perimeter, will serve as the backup access into the vault. The horizontal access pipes will be comprised of 18-inch diameter high density polyethylene (HDPE) pipes SDR 13.5, in a fabric wrapped gravel (river-rock) trench.

The HDPE access pipes have sufficient strength to withstand the forces expected to be developed when the SCLF reaches its final capacity (see Attachment D) and HDPE is compatible with leachate. In addition, the 18-inch diameter is an adequate size to allow for rolling of the pump into the vault. The pipes also could be easily slip-lined, if necessary, in the future. The gravel trench provides for a stable pipe support and relatively low friction resistance to allow the access pipes to move as the SCLF settles.

2.4.3 Pumps

Two EPG Companies Type WSD27-1 submersible pumps (one active and one backup), comprised of stainless steel components will be used to remove the leachate from PPS-B. The pump will be mounted on wheels and inserted through the 18-inch diameter HDPE access pipe into the concrete vault. The mounting device will include wheels which allows the pump to be removed for maintenance. Attachment E presents the manufacturer specifications and a landfill project list of similar applications. The submersible pump will cycle at a minimum time of 13 minutes (depending on the leachate generation rate), at a design flow rate range of 75 gallons per minute (gpm) at a maximum total dynamic head of 45 feet. The pump level sensor will be set for pump off at elevation 118 feet, and pump on at elevation 119 feet.

To remove the leachate from the existing PPS-A, the pump in the existing temporary Pump Station No. 3 will be relocated to the PPS-A. The pump level sensors for existing PPS-A will be set for pump off at elevation 122 feet, pump on at elevation 124 feet, and high level alarm at elevation 125 feet.

2.4.5 Maximum Leachate Depth Over Liner

The LCRS in Phases V and VI consists of 8-inch diameter HDPE pipes with an average spacing of 400 feet on center. The main headers in Phase VI will be connected to the concrete vault, as presented in Attachment A, Drawing No. 4. The HDPE header will include a grouted connection to the vault. The grouted connection will allow the HDPE pipes to move as the SCLF settles.

PPS-B is designed to maximize the performance of the LCRS. At this time, the County is evaluating the performance of the LCRS in Phases V and VI to assess if additional laterals will be needed to obtain the goals outlined in the LMP. The County has begun continuous pumping and monitoring the levels of the stormwater in Phases V and VI to

assess the performance of the LCRS. Any future lateral additions into the LCRS of Phases V and VI will not have an adverse impact on the performance of PPS-B.

2.4.6 Geotechnical Design

The calculations for slope stability during construction and bearing capacity of the phosphatic clay are presented in Attachment F. The calculations were used to verify the following design and construction criteria:

- The maximum excavation depth into the phosphatic clays is 3.5 feet.
- The excavation slope is not to exceed 3H:1V.
- The excavation is to proceed in a step manner which incorporates a 30 foot wide bench 2 feet above the phosphatic clay.
- The maximum ground pressure for construction equipment is restricted to 5 pounds per square inch.
- A geogrid system will be placed immediately beneath the concrete vault to reduce the effective pressure exerted on the phosphatic clay.
- 12-inch square galvanized steel plates with 1-inch diameter threaded fitting welded at the center will be attached at the four top-corners of the vault. The plates will be fastened by 1/2-inch galvanized steel anchor bolts and will have 1-inch diameter galvanized steel pipes. The steel pipes will be removed in the future before the beginning of Lift 12.

2.4.7 Specifications

The construction specifications for PPS-B are presented in Attachment G.

2.5 CONSTRUCTION SEQUENCE

Phase VI is scheduled to receive waste in 1999. Figure 1 presents the proposed construction schedule, which demonstrates that the construction of PPS-B will be completed prior to Phase VI receiving waste. The following steps will be necessary to incorporate PPS-B into the SCLF's LCRS system:

- Excavate the existing drainage sand layer and phosphatic clay to reach the design elevation for the concrete vault.

- Install the concrete vault in Phase VI as presented in Attachment A, Drawing No. 4 and 6, including the connections to the 8-inch leachate collection lines and 18-inch access pipes. At this stage the PPS-B will be used to remove stormwater from Phases V and VI.

- If required, complete modifications to the LCRS (i.e., add more leachate collection piping), depending on the results of the LCRS assessment in Phases V and VI.

- Prior to the placement of waste in Phase VI, extend the 18-inch access pipes to the SCLF perimeter berm.

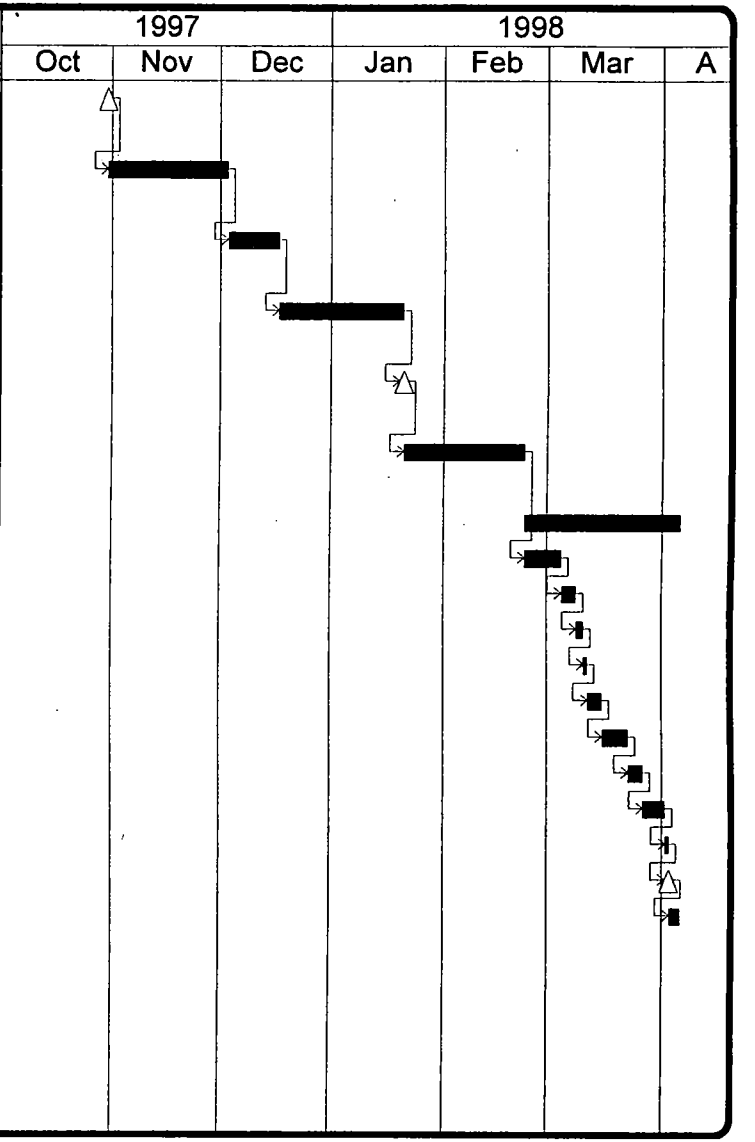
- When the previous steps are completed, activate the LCRS in Phases V and VI as described in SCS 1994, Section 5.3.2.

2.6 OPERATIONS

The wheel mounted submersible pump will be the primary method of removing the leachate from PPS-B. Leachate will be removed from PPS-B through the main access pipe leading to PPS-A (Attachment A, Drawing No. 3). Leachate will be conveyed from

Figure 1. Estimated Schedule for Permanent Pumpt Station B
Southeast County Landfill, Hillsborough County

Item	Task Name	Duration	Start	End
1	Submit Permit Application	0.00 d	Oct/31/97	Oct/31/97
2	FDEP Review	1.00 m	Oct/31/97	Dec/03/97
3	SCS Responds to FDEP Comments	2.00 w	Dec/03/97	Dec/17/97
4	FDEP's Final Review	1.00 m	Dec/17/97	Jan/21/98
5	Permit Issued	0.00 d	Jan/21/98	Jan/21/98
6	WMI Preparation Time	1.00 m	Jan/21/98	Feb/23/98
7	**CONSTRUCTION PHASE:**	**30.00 d**	**Feb/23/98**	**Apr/06/98**
	Excavation	8.00 d	Feb/23/98	Mar/05/98
	Place Geogrid	2.00 d	Mar/05/98	Mar/09/98
	Place Gravel Bedding	2.00 d	Mar/09/98	Mar/11/98
	Place Geotextile	1.00 d	Mar/11/98	Mar/12/98
	Place Vault	2.00 d	Mar/12/98	Mar/16/98
	Connect Pipes	5.00 d	Mar/16/98	Mar/23/98
	Complete Gravel Backfill	4.00 d	Mar/23/98	Mar/27/98
	Complete Sand Backfill	4.00 d	Mar/27/98	Apr/02/98
	Test Pumps and Lines	1.00 d	Apr/02/98	Apr/03/98
	Final Completion	0.00 d	Apr/03/98	Apr/03/98
	FDEP Inspection	1.00 d	Apr/03/98	Apr/06/98



October 14, 1997 (hills\0995029.12\schedulz\pumpb_4)

the PPS-A to the existing Main Leachate Pump Station via the existing 6-inch diameter force main.

The alternate access pipe leading to the western perimeter of the SCLF will be a secondary backup access point. The County will have a second submersible pump for use when the primary pump is being repaired or is receiving scheduled maintenance. In addition, the County may use a vacuum assisted pump as a secondary system or to remove sediment from the PPS-B vault when needed.

The leachate removed from PPS-B will be disposed of as described in the LMP. The current disposal methods include treatment at the LTRF, irrigation/evaporation of the treated effluent, and hauling to the two County public waste-water treatment plants.

WMI will be responsible for all operations and maintenance of the PPS-B under the existing contract with the County. The visible components of the PPS-B will be inspected daily. Maintenance of the entire LCRS will be conducted per the Permit Specific Condition No. 17, or on as needed basis. Currently the LCRS is performing satisfactorily and no repairs have been necessary.

2.7 REFERENCES

1. Ardaman & Associates, Inc., 1983, *"Hydrogeological Investigation, Southeast Landfill".*

2. Ardaman & Associates, Inc., 1994, *"Geotechnical Investigation, Southeast Landfill".*

3. SCS Engineers, August 1994, *"Operation Permit Renewal Application, Southeast County Landfill, Hillsborough County, Florida".*

4. SCS Engineers, August 1995, *"Leachate Management Plan, Southeast County Landfill, Hillsborough County, Florida".*

ATTACHMENT A

CONSTRUCTION DRAWINGS

(Prepared by SCS Engineers)

ATTACHMENT B

FIELD EXPLORATION REPORT

(Prepared by Ardaman & Associates, Inc.)

REPORT OF GEOTECHNICAL SERVICES

Proposed Sump B Location
Hillsborough County Southeast Landfill
Picnic, Florida

For
Hillsborough County Solid Waste Dept.

Ardaman & Associates, Inc.

OFFICES

Orlando, 8008 S. Orange Avenue, Orlando, Florida 32809, Phone (407) 855-3860
Bartow, 1525 Centennial Drive, Bartow, Florida 33831, Phone (813) 533-0858
Cocoa, 1300 N. Cocoa Blvd., Cocoa, Florida 32922, Phone (407) 632-2503
Fort Lauderdale, 3665 Park Central Boulevard, North, Pompano Beach, Florida 33064, Phone (305) 969-8788
Fort Myers, 9970 Bavaria Road, Fort Myers, Florida 33913, Phone (813) 768-6600
Miami, 2608 W. 84th Street, Hialeah, Florida 33016, Phone (305) 825-2683
Port Charlotte, 740 Tamiami Trail, Unit 3, Port Charlotte, Florida 33954, Phone (813) 624-3393
Port St. Lucie, 1017 S.E. Holbrook Ct., Port St. Lucie, Florida 34952, Phone (407) 337-1200
Sarasota, 2500 Bee Ridge Road, Sarasota, Florida 34239, Phone (813) 922-3526
Tallahassee, 3175 West Tharpe Street, Tallahassee, Florida 32303, Phone (904) 576-6131
Tampa, 1406 Tech Boulevard, Tampa, Florida 33619, Phone (813) 620-3389
West Palm Beach, 2511 Westgate Avenue, Suite 10, West Palm Beach, Florida 33409, Phone (407) 687-8200

MEMBERS:
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American Concrete Institute
American Society for Testing and Materials
American Consulting Engineers Council
Florida Institute of Consulting Engineers
American Council of Independent Laboratories

Ardaman & Associates, Inc.
Geotechnical, Environmental and
Materials Consultants

July 30, 1997
File Number 97-9628

Hillsborough County
Solid Waste Department
P.O. Box 1110
Tampa, Florida 33601

Attention: Mr. John W. Johnson

Subject: Geotechnical Services, Proposed Sump B Location, Hillsborough County Southeast Landfill, Picnic, Florida

Dear Mr. Johnson:

As authorized, Ardaman & Associates, Inc. has completed geotechnical services related to the proposed Sump B location of the Southeast Landfill, Hillsborough County, Florida.

The scope of our services consisted of providing geotechnical field support services for use by the project design consultant, SCS Engineers. More specifically, the services consisted of the following:

- Met with County representatives and consultant representatives to generally scope site access.
- Performed two (2) Standard Penetration Test (SPT) borings at locations selected by SCS Engineers.
- Performed ten (10) Cone Penetration Test Soundings (CPT) at locations selected by SCS Engineers.
- Installed one (1) shallow piezometer at a location selected by SCS Engineers to monitor groundwater fluctuations.
- Performed classification of soils recovered from SPT borings.
- Prepared this report which summarizes the data collected.

SITE LOCATION AND DESCRIPTION

The site is located in an unfilled portion of the landfill. A general site location is presented in the boring

location plan of Figure 1. The site elevations vary from about +127 ft. NGVD to +129.5 ft. NGVD.

FIELD EXPLORATION AND FINDINGS

Standard Penetration Test Borings (SPT)

A total of two (2) SPT borings were advanced at the locations noted on Figure 1. The borings were performed at locations selected by SCS Engineers. Boring depths varied from 30.0 feet to 31.5 feet below existing grade. The soils encountered in the borings are depicted on the boring profiles of Figure 1. The borings generally found 7.5 to 10.0 feet of fill material composed of tailing sands. The tailing sands generally varied from medium dense to very dense. A 13 to 18 foot layer of very loose to loose phosphatic waste clays followed the layer of tailing sands. The underlying native soils were loose to very dense, however, the density of these materials did not increase linearly with depth but was somewhat random. We refer the reader to the boring profiles (Figure 1) for specific descriptions and blow count information as well as groundwater level readings at each boring location. Soil stratigraphy at locations other than these two (2) borings would be expected to differ from that disclosed by the borings.

Cone Penetration Test Soundings (CPT)

A total of ten (10) Cone Penetration Test Soundings (CPT) were performed at locations directed by SCS Engineers. The depths of the CPT borings varied from 27.0 to 30.0 feet below present site grades. The CPT results for CPT's 1-10 are presented in Appendix B.

Piezometer Installation

One (1) piezometer was installed at the location and depth selected by SCS Engineers. The depth of the piezometer was 10.5 feet below land surface. The piezometer is constructed of 4 inch diameter

PVC pipe with no casing or seal. The piezometer well installation records and completion reports are presented in Appendix C.

CLOSURE

The information presented herein is for the exclusive use of Hillsborough County Solid Waste Department and their project consultants for the design and permitting of the proposed Sump B location, Hillsborough County Southeast Landfill. The field data presented is only applicable to the locations where the data was obtained. Any interpretation of the soil stratigraphy or properties between SPT or CPT is at the discretion of the County and their consultants. Ardaman & Associates, Inc. is not responsible for such interpretations.

The recovered soil samples will be retained for a period of 90 days following completion of this report and then discarded unless otherwise directed by Hillsborough County Solid Waste Department.

It has been a pleasure assisting you with this phase of your project. If there are any questions or when we may be of further assistance, please contact the undersigned at (813) 620-3389.

Respectfully,
ARDAMAN & ASSOCIATES, INC.

Lance Grace, EI
Staff Engineer

Wayne Pandorf, P.E.
Branch Manager
Florida Registration No. 30254

Thomas J. Leto, P.E.
Principal
Florida Registration No. 12458

LG/WP:lt
a:\a97-9628\01-sumpb.rpt

FIGURE

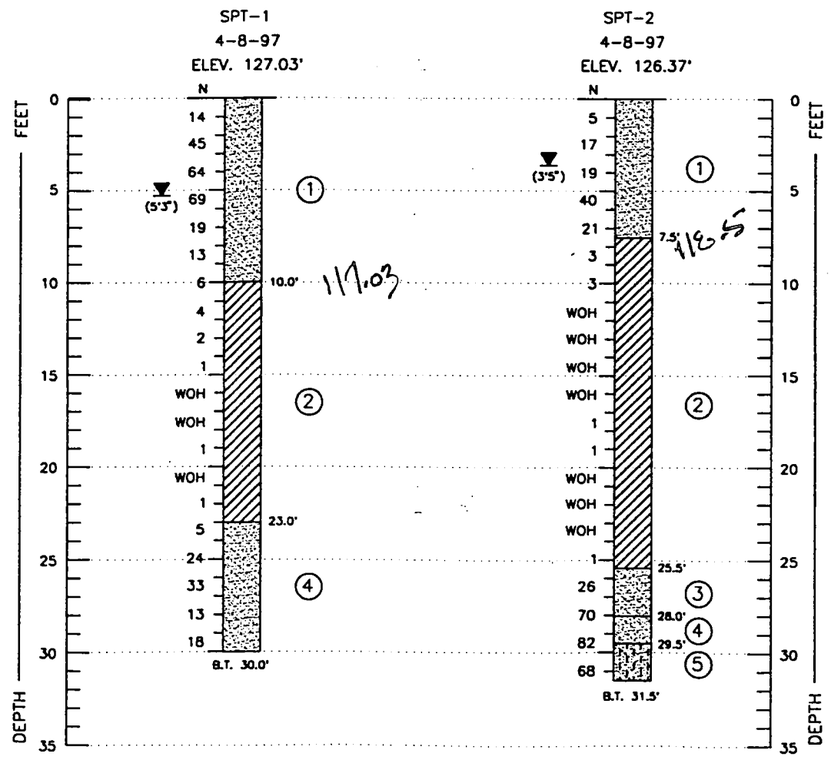
LEGEND

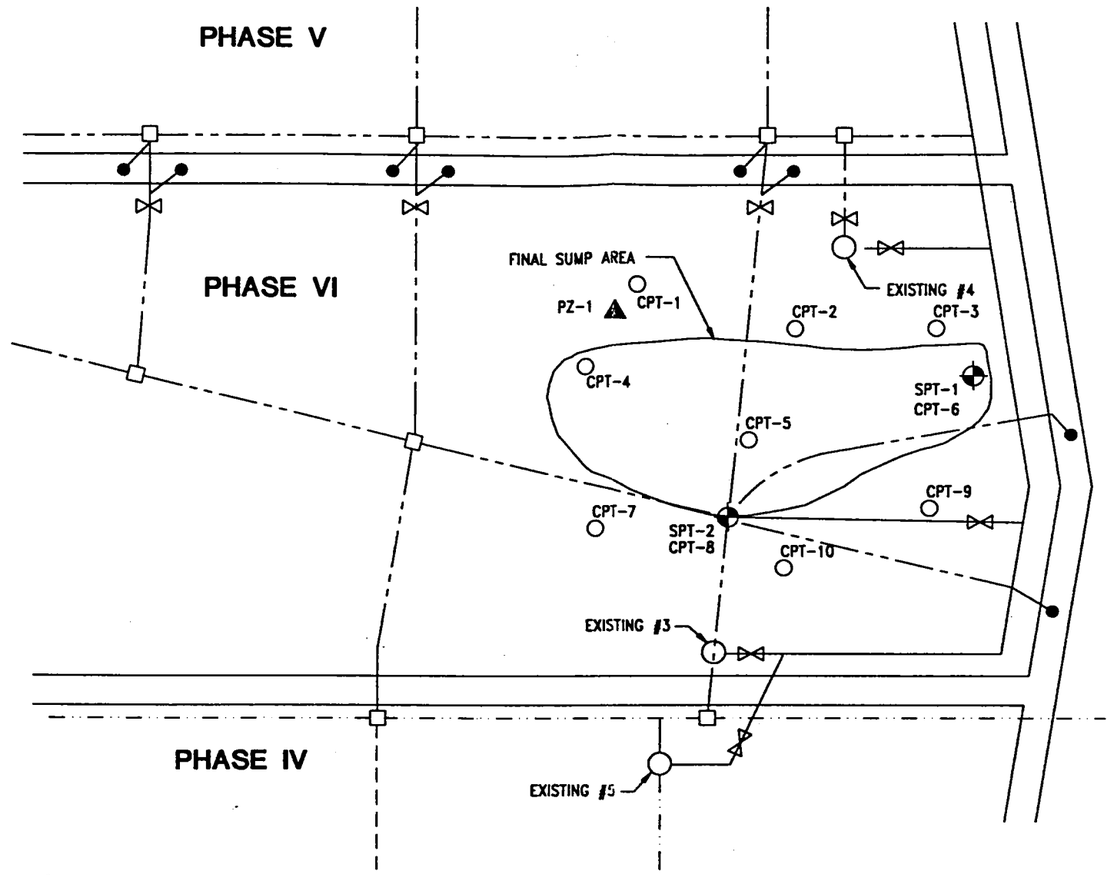
①	BROWN-GRAY SAND WITH PHOSPHATE FINES, TAILINGS (SP)
②	GRAY PHOSPHATIC WASTE CLAY (CH)
③	LIGHT BROWN SAND (SP)
④	DARK BROWN SAND WITH SILT, ORGANICS AND ROOTS (SP-SM)
⑤	GRAY-BROWN SILTY SAND WITH CLAY TO CLAYEY SAND (SM-SC)

TH	STANDARD PENETRATION TEST (SPT) BORING
N	STANDARD PENETRATION RESISTANCE IN BLOWS PER FT
▼ (DEPTH)	GROUNDWATER LEVEL MEASURED ON DATE DRILLED
WOH	WEIGHT OF HAMMER
B.T.	BORING TERMINATION DEPTH

STANDARD PENETRATION TEST DATA:
SPOON I.D.= 1.375" HAMMER DROP= 30"
SPOON O.D.= 2.0" HAMMER WEIGHT= 140 lbs.

DRILL RIG: CME #45 DRILLER: L. PRINCE





NORTH

0 200

LEGEND

- LEACHATE COLLECTION TRENCH
- 8"ø PERFORATED HDPE PIPE
- 8"ø PERFORATED PVC PIPE
- HEADER CONNECTION
- TEMPORARY PUMP STATION
- SPT LOCATION
- CPT LOCATION
- PIEZOMETER WELL LOCATION
- GATE VALVE
- 8"ø SOLID HDPE PIPE CLEANOUT

BORING LOCATION PLAN

FIGURE 1

GENERAL NOTES

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTICS OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES AT THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR. ABSENCE OF WATER SURFACE DATA ON CERTAIN BORINGS IMPLIES THAT NO GROUNDWATER DATA IS AVAILABLE, BUT DOES NOT NECESSARILY MEAN THAT GROUNDWATER WILL NOT BE ENCOUNTERED AT THESE LOCATIONS OR WITHIN THE VERTICAL REACHES OF THESE BORINGS IN THE FUTURE.

ENGINEERING CLASSIFICATION

COHESIONLESS		COHESIVE		
DESCRIPTION	BLOW COUNT "N"	DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, T.S.F.	BLOW COUNT "N"
VERY LOOSE	0 TO 4	VERY SOFT	BELOW .25	0 TO 2
LOOSE	4 TO 10	SOFT	.25 TO .50	2 TO 4
MEDIUM DENSE	10 TO 30	MEDIUM STIFF	.50 TO 1.0	4 TO 8
DENSE	30 TO 50	STIFF	1 TO 2	8 TO 15
VERY DENSE	ABOVE 50	VERY STIFF	2 TO 4	15 TO 30
		HARD	ABOVE 4	ABOVE 30

Ardaman & Associates, Inc.
Consulting Engineers in Soils, Hydrogeology, Foundations, and Materials Testing

BORING PROFILES
SUMP - B
SOUTHEAST LANDFILL
HILLSBOROUGH COUNTY, FLORIDA

DRAWN BY: WAC,PPS | CHECKED BY: | DATE: 5-97

FILE NO. 97-9628 | APPROVED BY:

97-9628\FIG-1

APPENDIX A

FIELD TEST PROCEDURES

STANDARD PENETRATION TEST

The Standard Penetration Test is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2-foot long, 2-inch outside diameter, split-barrel ("spoon") sampler, attached to the end of drilling rods, is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each six inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load.

The tests are usually performed at 5-foot intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. Usually, the circulating fluid, which is a bentonite drilling mud, also serves to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or to prevent the loss of circulating fluid.

Representative split-spoon samples from soils at every 5 feet of drilled depth and from every different stratum are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary. Samples not used in testing are stored for at least sixty (60) days prior to being discarded. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed if necessary, and backfilled.

DUTCH CONE PENETROMETER TESTS

The Dutch Cone Penetrometer is an in-situ deep-testing device utilized to obtain information concerning the strength and compressibility of foundation soils. In the test a shaft with a conical point is pushed into the soil. The resistance to penetration of the point and the friction developed on the circumference of the shaft are measured. The measured values constitute the test result. The cone apparatus does not recover soil samples. Originally developed and extensively used in Europe, the Dutch Cone has recently been accepted in the United States as a valuable geotechnical engineering tool (ASTM Special Technical Publication 479). Similar portable hand-operated penetrometers have been used extensively by our firm for many years as an alternate means for compaction control work and shallow subsurface soil exploration.

The Dutch Cone or Begemann penetrometer employs a 60-degree, hardened-steel cone point with a projected area of 10 square centimeters. The point is located at the end of a smooth cylindrical shaft which is free to move ahead of a second slightly larger cylindrical shaft of friction sleeve. The testing assembly is attached to the end of a string of concentric inner and outer rods which connect it to the surface. The outer rods are used to push the testing assembly and the inner rods to the desired testing depth where they are disengaged and remain stationary while the test is being performed.

During the test, the inner rods are engaged and a hydraulic jack is used to push the cone point ahead of the friction sleeve. After a free travel of 1.5 inches, the friction sleeve engages and together with the cone tip they are pushed an additional 1.7 inches. Penetration speed is one to two centimeters per second. The thrust required to push the cone tip alone, and that required to push it and the friction sleeve are measured by the sensitive pressure gauges. After the completion of the test, the outer rods are reengaged and pushed, collapsing the telescoped testing device and carrying it to the next testing depth which is usually 20 centimeters deeper and the test is repeated. The value of the bearing pressure exerted by the cone point (q_{cone}) has been empirically correlated to various soil properties. The ratio of this value, q_{cone}, to the value of the frictional resistance of the disturbed soils surrounding the friction sleeve gives an indication of type of soil penetrated.

The mantle cone, which we occasionally use, is essentially a Dutch Cone without the friction sleeve. The conical tip which bears directly upon the soil is like that of the Dutch Cone and the procedure of testing is similar to that described above, except that only the cone bearing value, q_{cone}, is obtained.

c:appendix.dcp

APPENDIX B

CONE PENETRATION TEST SOUNDINGS (CPT)

Ardaman & Associates, Inc.

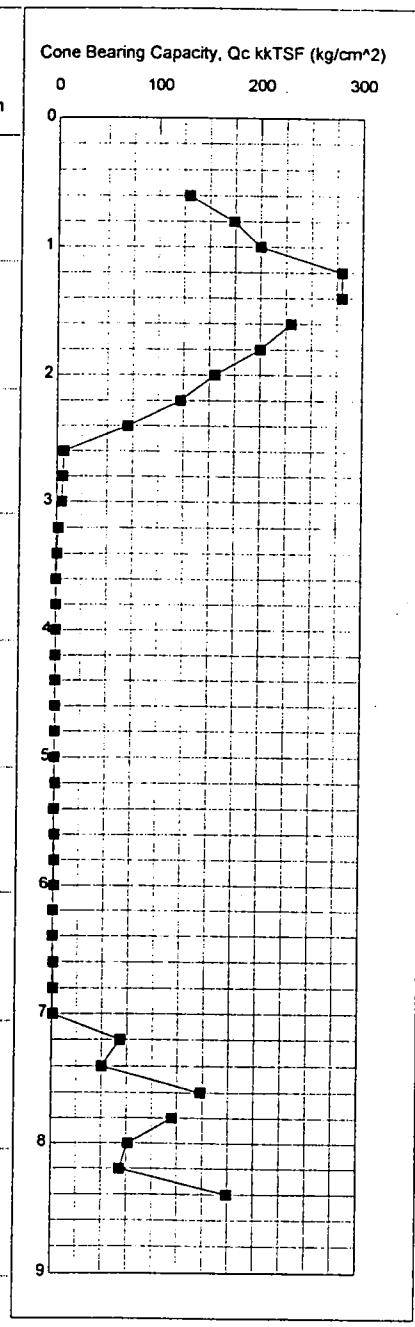
Geotechnical, Environmental and
Materials Consultants

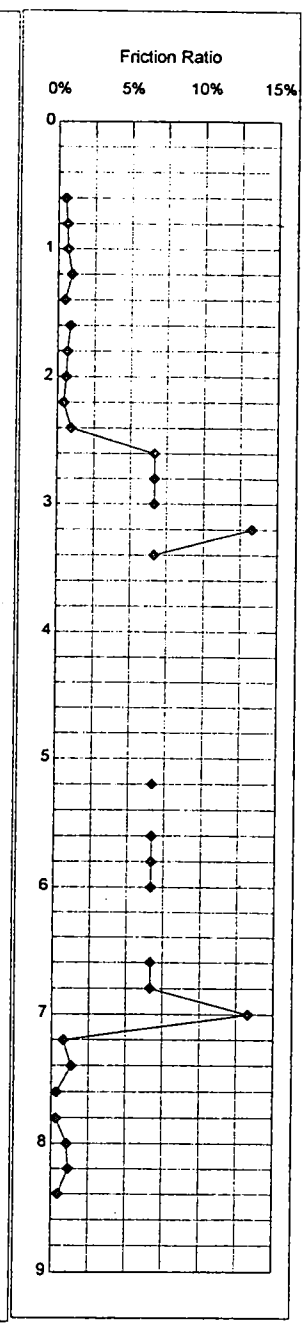
FILE NO.: 97-9628
CPT NO.: 1
DATE: 04/18/97
Tested by: K.P. / D.M.
Total Depth: 27 Ft.
Elevation: 127.27 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth		Field Data					
Feet	Meters	C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2			0		0	NA
	0.4			0		0	NA
	0.6	65	70	5	130	0.665	0.5%
	0.8	87	95	8	174	1.064	0.6%
	1	100	110	10	200	1.33	0.7%
	1.2	140	160	20	280	2.66	1.0%
5	1.4	140	150	10	280	1.33	0.5%
	1.6	115	130	15	230	1.995	0.9%
	1.8	100	110	10	200	1.33	0.7%
	2	78	85	7	156	0.931	0.6%
	2.2	61	65	4	122	0.532	0.4%
	2.4	35	40	5	70	0.665	1.0%
	2.6	3.5	7	3.5	7	0.4655	6.7%
	2.8	3	6	3	6	0.399	6.7%
10	3	2.5	5	2.5	5	0.3325	6.7%
	3.2	1	3	2	2	0.266	13.3%
	3.4	0.5	1	0.5	1	0.0665	6.7%
	3.6	0	0.5	0.5	0	0.0665	NA
	3.8	0	1	1	0	0.133	NA
	4	0	0.5	0.5	0	0.0665	NA
	4.2	0	0.5	0.5	0	0.0665	NA
	4.4	0	0.5	0.5	0	0.0665	NA
15	4.6	0	0.5	0.5	0	0.0665	NA
	4.8	0	0.5	0.5	0	0.0665	NA
	5	0	0.5	0.5	0	0.0665	NA
	5.2	0.5	1	0.5	1	0.0665	6.7%
	5.4	0	0.5	0.5	0	0.0665	NA
	5.6	0.5	1	0.5	1	0.0665	6.7%
	5.8	0.5	1	0.5	1	0.0665	6.7%
20	6	0.5	1	0.5	1	0.0665	6.7%
	6.2	0	0.5	0.5	0	0.0665	NA
	6.4	0	0.5	0.5	0	0.0665	NA
	6.6	0.5	1	0.5	1	0.0665	6.7%
	6.8	0.5	1	0.5	1	0.0665	6.7%
	7	0.5	1.5	1	1	0.133	13.3%
	7.2	34	38	4	68	0.532	0.8%
	7.4	25	30	5	50	0.665	1.3%
25	7.6	74	78	4	148	0.532	0.4%
	7.8	60	63	3	120	0.399	0.3%
	8	38	44	6	76	0.798	1.1%
	8.2	34	40	6	68	0.798	1.2%
	8.4	87	93	6	174	0.798	0.5%
	8.6						
	8.8						
30	9						





Ardaman & Associates, Inc.

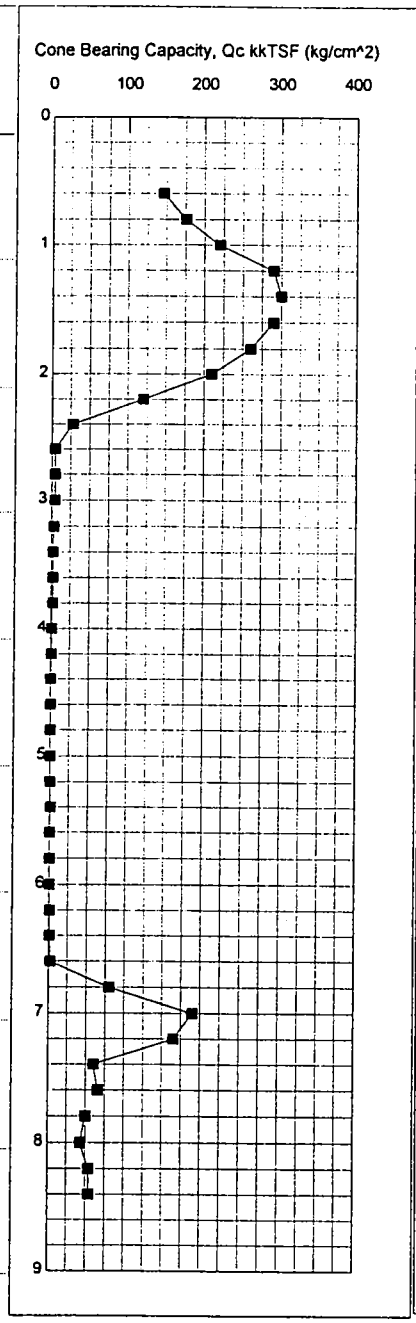
Geotechnical, Environmental and
Materials Consultants

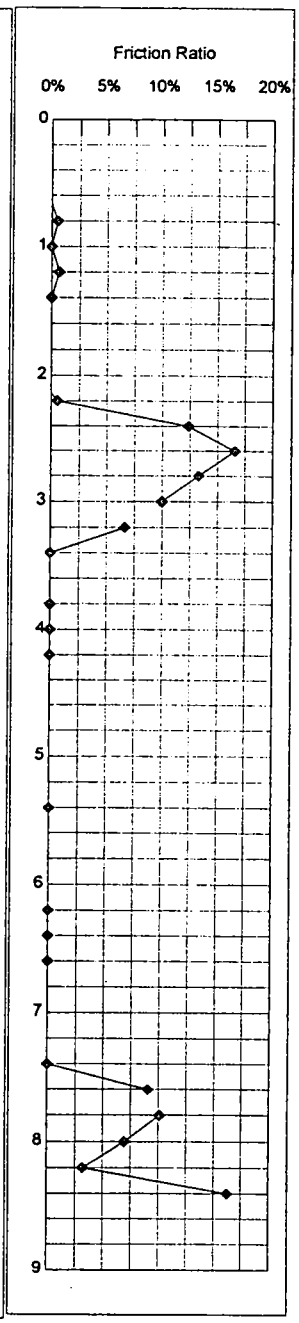
FILE NO.: 97-9628
CPT NO.: 2
DATE: 04/18/97
Tested by: K.P. / D.M.
Total Depth: 27 Ft.
Elevation: 126.77 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2						
	0.4						
	0.6	73	70	-3	146	-0.399	-0.3%
	0.8	88	95	7	176	0.931	0.5%
	1	110	110	0	220	0	0.0%
	1.2	145	160	15	290	1.995	0.7%
5	1.4	150	150	0	300	0	0.0%
	1.6	145	130	-15	290	-1.995	-0.7%
	1.8	130	110	-20	260	-2.66	-1.0%
	2	105	85	-20	210	-2.66	-1.3%
	2.2	60	65	5	120	0.665	0.6%
	2.4	14	40	26	28	3.458	12.4%
	2.6	2	7	5	4	0.665	16.6%
	2.8	2	6	4	4	0.532	13.3%
10	3	2	5	3	4	0.399	10.0%
	3.2	1.5	3	1.5	3	0.1995	6.7%
	3.4	1	1	0	2	0	0.0%
	3.6	1	0.5	-0.5	2	-0.0665	-3.3%
	3.8	1	1	0	2	0	0.0%
	4	0.5	0.5	0	1	0	0.0%
	4.2	0.5	0.5	0	1	0	0.0%
	4.4	0	0.5	0.5	0	0.0665	NA
15	4.6	0	0.5	0.5	0	0.0665	NA
	4.8	0	0.5	0.5	0	0.0665	NA
	5	0	0.5	0.5	0	0.0665	NA
	5.2	0	1	1	0	0.133	NA
	5.4	0.5	0.5	0	1	0	0.0%
	5.6	0	1	1	0	0.133	NA
	5.8	0	1	1	0	0.133	NA
20	6	0	1	1	0	0.133	NA
	6.2	0.5	0.5	0	1	0	0.0%
	6.4	0.5	0.5	0	1	0	0.0%
	6.6	1	1	0	2	0	0.0%
	6.8	40	1	-39	80	-5.187	-6.5%
	7	95	1.5	-93.5	190	-12.436	-6.5%
	7.2	82.5	38	-44.5	165	-5.9185	-3.6%
	7.4	30	30	0	60	0	0.0%
25	7.6	33	78	45	66	5.985	9.1%
	7.8	25	63	38	50	5.054	10.1%
	8	21.5	44	22.5	43	2.9925	7.0%
	8.2	27	40	13	54	1.729	3.2%
	8.4	27	93	66	54	8.778	16.3%
	8.6						
	8.8						
30	9						





Ardaman & Associates, Inc.

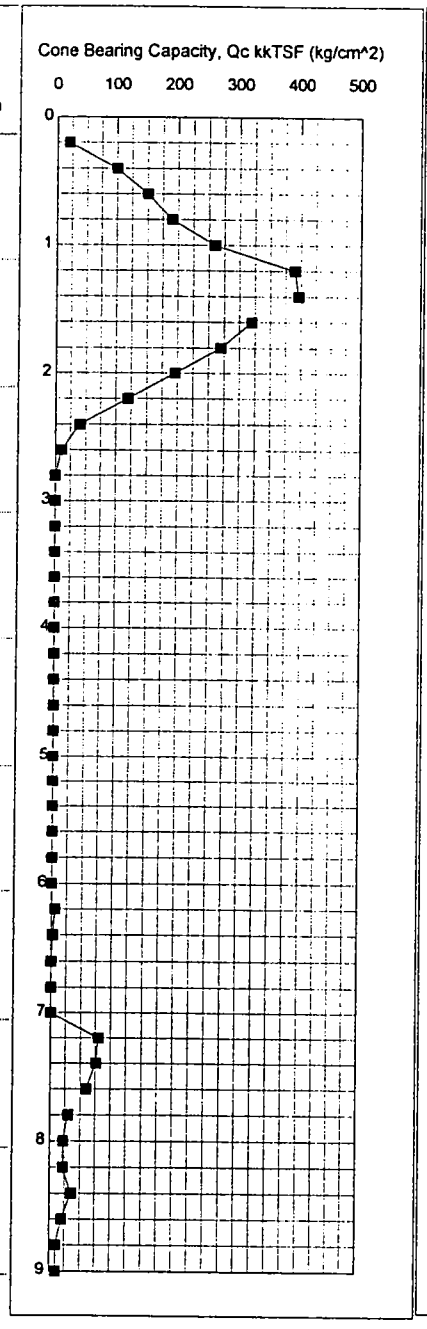
Geotechnical, Environmental and
Materials Consultants

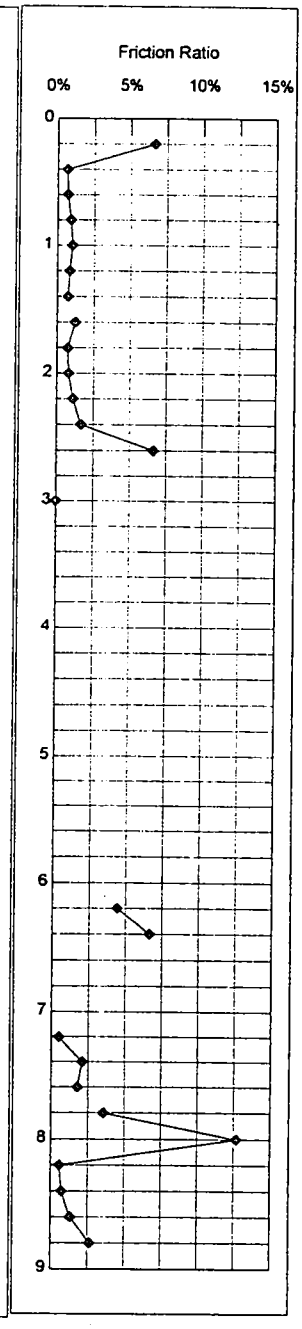
FILE NO.: 97-9628
CPT NO.: 3
DATE: 04/21/97
Tested by: K.P. / D.M.
Total Depth: 30 Ft.
Elevation: 127.75 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2	10	20	10	20	1.33	6.7%
	0.4	50	55	5	100	0.665	0.7%
	0.6	75	83	8	150	1.064	0.7%
	0.8	95	108	13	190	1.729	0.9%
	1	130	150	20	260	2.66	1.0%
	1.2	195	220	25	390	3.325	0.9%
5	1.4	198	220	22	396	2.926	0.7%
	1.6	160	190	30	320	3.99	1.2%
	1.8	135	150	15	270	1.995	0.7%
	2	98	110	12	196	1.596	0.8%
	2.2	60	70	10	120	1.33	1.1%
	2.4	20	25	5	40	0.665	1.7%
	2.6	5	10	5	10	0.665	6.7%
	2.8	0	1	1	0	0.133	NA
10	3	0	0.5	0	0	0	0.0%
	3.2	0	0	0	0	0	NA
	3.4	0	0.5	0.5	0	0.0665	NA
	3.6	0	0.5	0.5	0	0.0665	NA
	3.8	0	0	0	0	0	NA
	4	0	0	0	0	0	NA
	4.2	0	0.5	0.5	0	0.0665	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0	0	0	0	NA
	5	0	0	0	0	0	NA
	5.2	0	0.5	0.5	0	0.0665	NA
	5.4	0	0.5	0.5	0	0.0665	NA
	5.6	0	0.5	0.5	0	0.0665	NA
	5.8	0	0.5	0.5	0	0.0665	NA
20	6	0	0.5	0.5	0	0.0665	NA
	6.2	3	5	2	6	0.266	4.4%
	6.4	1	2	1	2	0.133	6.7%
	6.6	0	0.5	0.5	0	0.0665	NA
	6.8	0	0.5	0.5	0	0.0665	NA
	7	0	0.5	0.5	0	0.0665	NA
	7.2	40	43	3	80	0.399	0.5%
	7.4	38	50	12	76	1.596	2.1%
25	7.6	30	38	8	60	1.064	1.8%
	7.8	15	23	8	30	1.064	3.5%
	8	11	32	21	22	2.793	12.7%
	8.2	11	12	1	22	0.133	0.6%
	8.4	18	20	2	36	0.266	0.7%
	8.6	10	12	2	20	0.266	1.3%
	8.8	5	7	2	10	0.266	2.7%
30	9	5	7	2	10	0.266	2.7%





1406 Tech Boulevard, Tampa, Florida 33619 Phone (813) 620-3389 FAX (813) 628-4008
Offices in: Bartow, Cocoa, Fort Lauderdale, Fort Myers, Miami, Orlando, Port Charlotte, Port St. Lucie, Sarasota, Tallahassee, Tampa, W. Palm Beach

Ardaman & Associates, Inc.

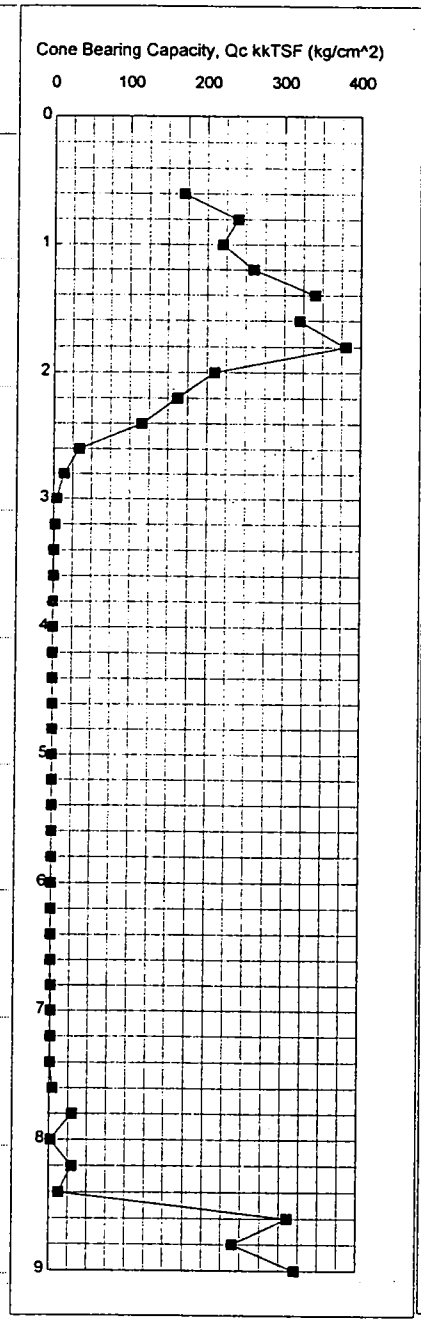
Geotechnical, Environmental and
Materials Consultants

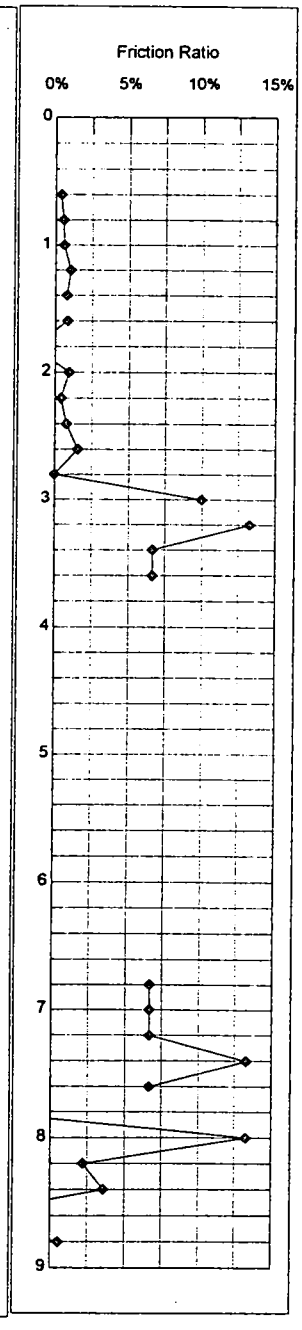
FILE NO.: 97-9628
CPT NO.: 4
DATE: 04/18/97
Tested by: K.P. / D.M.
Total Depth: 30 Ft.
Elevation: 126.43 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2						
	0.4						
	0.6	85	90	5	170	0.665	0.4%
	0.8	120	130	10	240	1.33	0.6%
	1	110	120	10	220	1.33	0.6%
	1.2	130	150	20	260	2.66	1.0%
5	1.4	170	190	20	340	2.66	0.8%
	1.6	160	180	20	320	2.66	0.8%
	1.8	190	150	-40	380	-5.32	-1.4%
	2	105	120	15	210	1.995	1.0%
	2.2	81	86	5	162	0.665	0.4%
	2.4	58	65	7	116	0.931	0.8%
	2.6	17	21	4	34	0.532	1.6%
	2.8	7	7	0	14	0	0.0%
10	3	2	5	3	4	0.399	10.0%
	3.2	1	3	2	2	0.266	13.3%
	3.4	0.5	1	0.5	1	0.0665	6.7%
	3.6	0.5	1	0.5	1	0.0665	6.7%
	3.8	0	0.5	0.5	0	0.0665	NA
	4	0	0.5	0.5	0	0.0665	NA
	4.2	0	0	0	0	0	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0	0	0	0	NA
	5	0	0	0	0	0	NA
	5.2	0	0	0	0	0	NA
	5.4	0	0	0	0	0	NA
	5.6	0	0	0	0	0	NA
	5.8	0	0.5	0.5	0	0.0665	NA
20	6	0	0.5	0.5	0	0.0665	NA
	6.2	0	0.5	0.5	0	0.0665	NA
	6.4	0	0.5	0.5	0	0.0665	NA
	6.6	0	0.5	0.5	0	0.0665	NA
	6.8	0.5	1	0.5	1	0.0665	6.7%
	7	0.5	1	0.5	1	0.0665	6.7%
	7.2	0.5	1	0.5	1	0.0665	6.7%
	7.4	0.5	1.5	1	1	0.133	13.3%
25	7.6	2	4	2	4	0.266	6.7%
	7.8	15	4	-11	30	-1.463	-4.9%
	8	1	3	2	2	0.266	13.3%
	8.2	15	20	5	30	0.665	2.2%
	8.4	6.5	10	3.5	13	0.4655	3.6%
	8.6	155	10	-145	310	-19.285	-6.2%
	8.8	120	130	10	240	1.33	0.6%
30	9	160	170	10	320	1.33	0.4%





Ardaman & Associates, Inc.

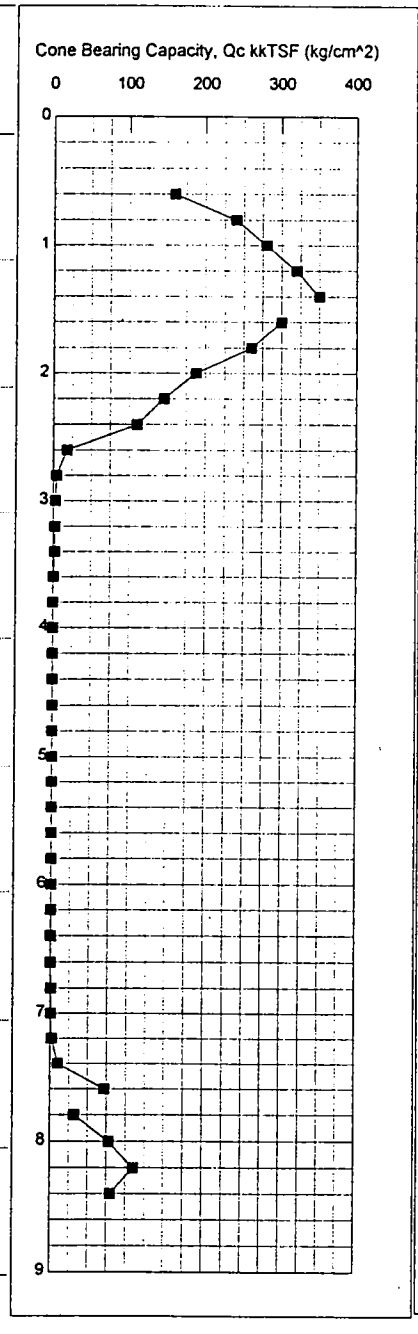
Geotechnical, Environmental and
Materials Consultants

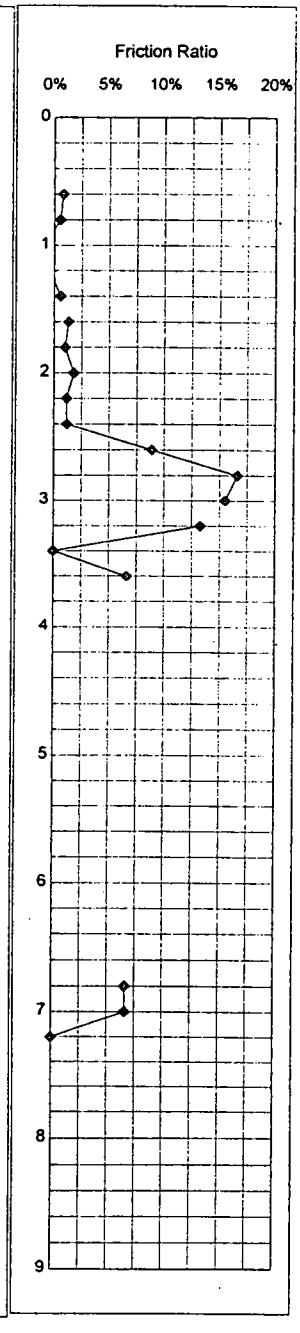
FILE NO.: 97-9628
CPT NO.: 5
DATE: 04/18/97
Tested by: K.P. / D.M.
Total Depth: 27 Ft.
Elevation: 126.12 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2						
	0.4						
	0.6	80	90	10	160	1.33	0.8%
	0.8	120	130	10	240	1.33	0.6%
	1	140	120	-20	280	-2.66	-1.0%
	1.2	160	150	-10	320	-1.33	-0.4%
5	1.4	175	190	15	350	1.995	0.6%
	1.6	150	180	30	300	3.99	1.3%
	1.8	130	150	20	260	2.66	1.0%
	2	94	120	26	188	3.458	1.8%
	2.2	73	86	13	146	1.729	1.2%
	2.4	55	65	10	110	1.33	1.2%
	2.6	9	21	12	18	1.596	8.9%
	2.8	2	7	5	4	0.665	16.6%
10	3	1.5	5	3.5	3	0.4655	15.5%
	3.2	1	3	2	2	0.266	13.3%
	3.4	1	1	0	2	0	0.0%
	3.6	0.5	1	0.5	1	0.0665	6.7%
	3.8	0	0.5	0.5	0	0.0665	NA
	4	0	0.5	0.5	0	0.0665	NA
	4.2	0	0	0	0	0	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0	0	0	0	NA
	5	0	0	0	0	0	NA
	5.2	0	0	0	0	0	NA
	5.4	0	0	0	0	0	NA
	5.6	0	0	0	0	0	NA
	5.8	0	0.5	0.5	0	0.0665	NA
20	6	0	0.5	0.5	0	0.0665	NA
	6.2	0	0.5	0.5	0	0.0665	NA
	6.4	0	0.5	0.5	0	0.0665	NA
	6.6	0	0.5	0.5	0	0.0665	NA
	6.8	0.5	1	0.5	1	0.0665	6.7%
	7	0.5	1	0.5	1	0.0665	6.7%
	7.2	1	1	0	2	0	0.0%
	7.4	5	1.5	-3.5	10	-0.4655	-4.7%
25	7.6	36	4	-32	72	-4.256	-5.9%
	7.8	16	4	-12	32	-1.596	-5.0%
	8	39	3	-36	78	-4.788	-6.1%
	8.2	55	20	-35	110	-4.655	-4.2%
	8.4	40	10	-30	80	-3.99	-5.0%
	8.6						
	8.8						
30	9						





Ardaman & Associates, Inc.

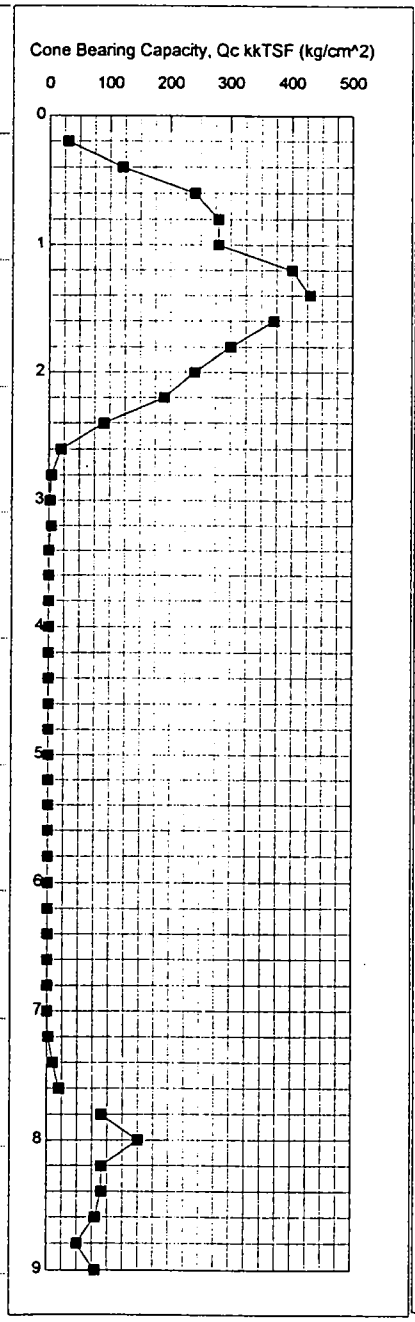
Geotechnical, Environmental and
Materials Consultants

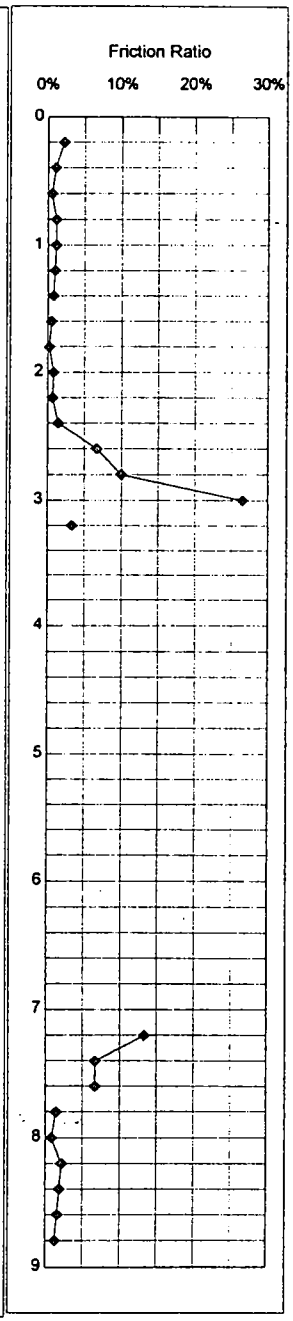
FILE NO.: 97-9628
CPT NO.: 6
DATE: 04/21/97
Tested by: K.P. / D.M.
Total Depth: 30 Ft.
Elevation: 127.03 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth		Field Data					
Feet	Meters	C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2	15	20	5	30	0.665	2.2%
	0.4	60	70	10	120	1.33	1.1%
	0.6	120	130	10	240	1.33	0.6%
	0.8	140	165	25	280	3.325	1.2%
	1	140	165	25	280	3.325	1.2%
	1.2	200	230	30	400	3.99	1.0%
5	1.4	215	240	25	430	3.325	0.8%
	1.6	185	200	15	370	1.995	0.5%
	1.8	150	155	5	300	0.665	0.2%
	2	120	135	15	240	1.995	0.8%
	2.2	95	105	10	190	1.33	0.7%
	2.4	45	55	10	90	1.33	1.5%
	2.6	10	20	10	20	1.33	6.7%
	2.8	2	5	3	4	0.399	10.0%
10	3	1	5	4	2	0.532	26.6%
	3.2	2	3	1	4	0.133	3.3%
	3.4	0	0.5	0.5	0	0.0665	NA
	3.6	0	5	5	0	0.665	NA
	3.8	0	0	0	0	0	NA
	4	0	0.5	0.5	0	0.0665	NA
	4.2	0	0	0	0	0	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0.5	0.5	0	0.0665	NA
	5	0	0	0	0	0	NA
	5.2	0	0	0	0	0	NA
	5.4	0	0.5	0.5	0	0.0665	NA
	5.6	0	0	0	0	0	NA
	5.8	0	0	0	0	0	NA
20	6	0	0.5	0.5	0	0.0665	NA
	6.2	0	0	0	0	0	NA
	6.4	0	0.5	0.5	0	0.0665	NA
	6.6	0	0.5	0.5	0	0.0665	NA
	6.8	0	0.5	0.5	0	0.0665	NA
	7	0	0.5	0.5	0	0.0665	NA
	7.2	1	3	2	2	0.266	13.3%
	7.4	5	10	5	10	0.665	6.7%
25	7.6	10	20	10	20	1.33	6.7%
	7.8	45	55	10	90	1.33	1.5%
	8	75	85	10	150	1.33	0.9%
	8.2	45	60	15	90	1.995	2.2%
	8.4	45	58	13	90	1.729	1.9%
	8.6	40	50	10	80	1.33	1.7%
	8.8	25	30	5	50	0.665	1.3%
30	9	40	48	8	80	1.064	1.3%





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Ardaman & Associates, Inc.

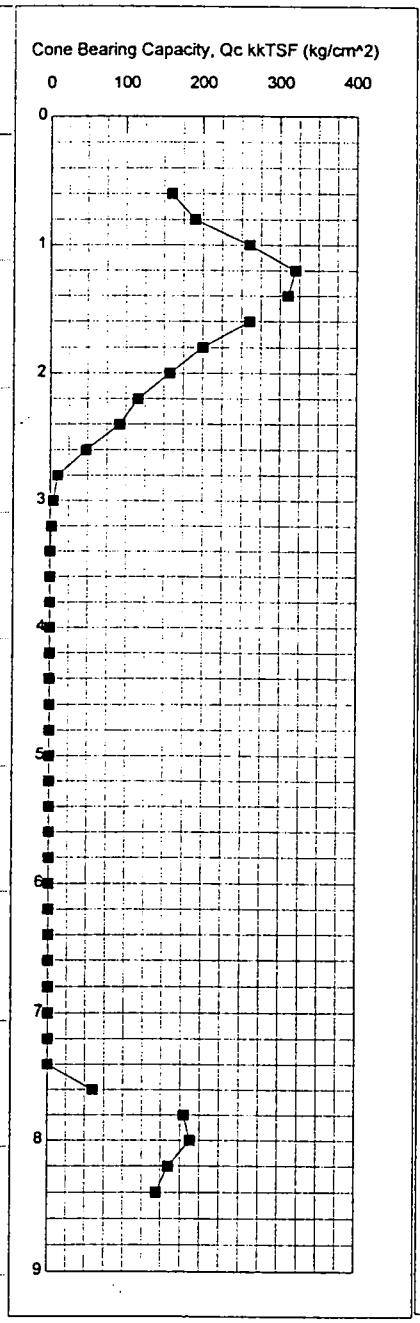
Geotechnical, Environmental and
Materials Consultants

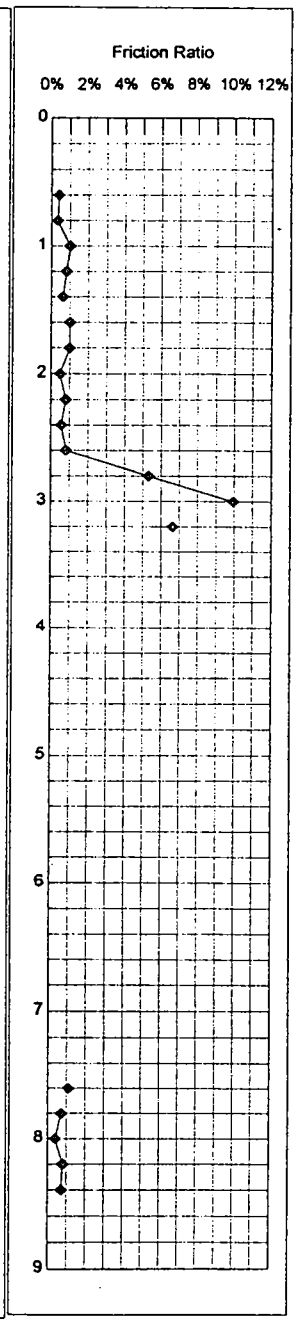
FILE NO.: 97-9628
CPT NO.: 7
DATE: 04/18/97
Tested by: K.P. / D.M.
Total Depth: 27 Ft.
Elevation: 126.02 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2						
	0.4						
	0.6	80	85	5	160	0.665	0.4%
	0.8	95	100	5	190	0.665	0.4%
	1	130	150	20	260	2.66	1.0%
	1.2	160	180	20	320	2.66	0.8%
5	1.4	155	170	15	310	1.995	0.6%
	1.6	130	150	20	260	2.66	1.0%
	1.8	100	115	15	200	1.995	1.0%
	2	79	85	6	158	0.798	0.5%
	2.2	58	65	7	116	0.931	0.8%
	2.4	46	50	4	92	0.532	0.6%
	2.6	24	27	3	48	0.399	0.8%
	2.8	5	9	4	10	0.532	5.3%
10	3	2	5	3	4	0.399	10.0%
	3.2	1	2	1	2	0.133	6.7%
	3.4	0	0.5	0.5	0	0.0665	NA
	3.6	0	0	0	0	0	NA
	3.8	0	0	0	0	0	NA
	4	0	0	0	0	0	NA
	4.2	0	0	0	0	0	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0	0	0	0	NA
	5	0	0	0	0	0	NA
	5.2	0	0	0	0	0	NA
	5.4	0	0	0	0	0	NA
	5.6	0	0	0	0	0	NA
	5.8	0	0	0	0	0	NA
20	6	0	0	0	0	0	NA
	6.2	0	0	0	0	0	NA
	6.4	0	0	0	0	0	NA
	6.6	0	0.5	0.5	0	0.0665	NA
	6.8	0	0	0	0	0	NA
	7	0	0	0	0	0	NA
	7.2	0	0.5	0.5	0	0.0665	NA
	7.4	0	0.5	0.5	0	0.0665	NA
25	7.6	30	35	5	60	0.665	1.1%
	7.8	90	100	10	180	1.33	0.7%
	8	94	100	6	188	0.798	0.4%
	8.2	80	90	10	160	1.33	0.8%
	8.4	72	80	8	144	1.064	0.7%
	8.6						
	8.8						
30	9						





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Ardaman & Associates, Inc.

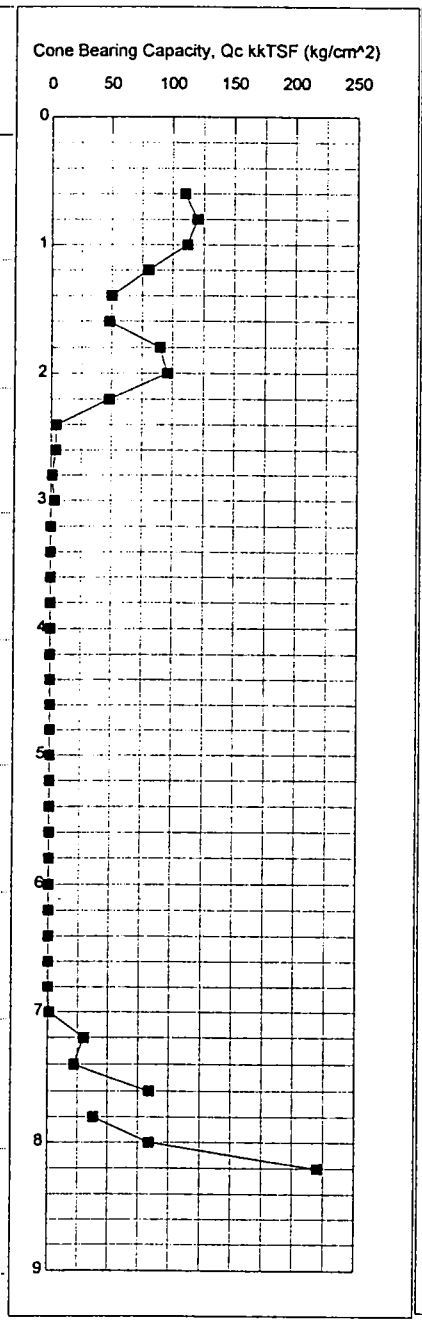
Geotechnical, Environmental and
Materials Consultants

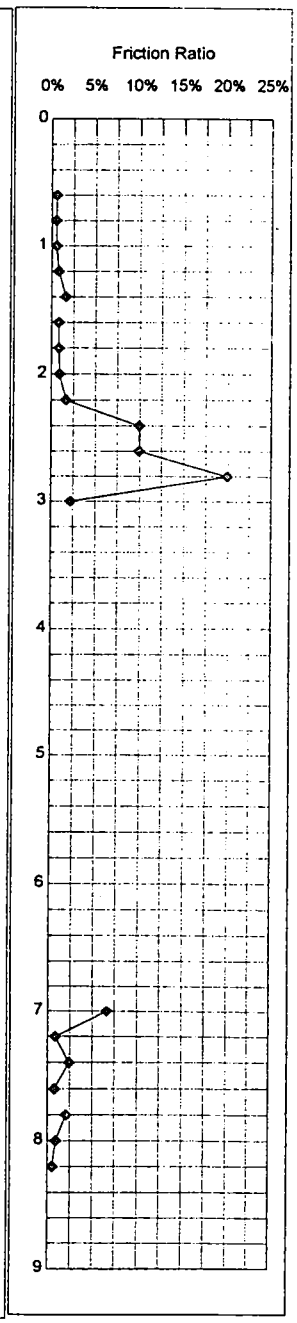
FILE NO.: 97-9628
CPT NO.: 8
DATE: 04/18/97
Tested by: K.P. / D.M.
Total Depth: 27 Ft.
Elevation: 126.37 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2						
	0.4						
	0.6	55	60	5	110	0.665	0.6%
	0.8	60	65	5	120	0.665	0.6%
	1	56	61	5	112	0.665	0.6%
	1.2	40	45	5	80	0.665	0.8%
5	1.4	25	31	6	50	0.798	1.6%
	1.6	24	27	3	48	0.399	0.8%
	1.8	45	51	6	90	0.798	0.9%
	2	48	55	7	96	0.931	1.0%
	2.2	24	30	6	48	0.798	1.7%
	2.4	2	5	3	4	0.399	10.0%
	2.6	2	5	3	4	0.399	10.0%
	2.8	0.5	2	1.5	1	0.1995	20.0%
10	3	1.5	2	0.5	3	0.0665	2.2%
	3.2	0	1	1	0	0.133	NA
	3.4	0	1	1	0	0.133	NA
	3.6	0	0	0	0	0	NA
	3.8	0	0	0	0	0	NA
	4	0	0	0	0	0	NA
	4.2	0	0.5	0.5	0	0.0665	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0	0	0	0	NA
	5	0	0	0	0	0	NA
	5.2	0	0	0	0	0	NA
	5.4	0	0	0	0	0	NA
	5.6	0	0	0	0	0	NA
	5.8	0	0	0	0	0	NA
20	6	0	0.5	0.5	0	0.0665	NA
	6.2	0	0.5	0.5	0	0.0665	NA
	6.4	0	0.5	0.5	0	0.0665	NA
	6.6	0	0	0	0	0	NA
	6.8	0	0.5	0.5	0	0.0665	NA
	7	0.5	1	0.5	1	0.0665	6.7%
	7.2	15	17	2	30	0.266	0.9%
	7.4	11	15	4	22	0.532	2.4%
25	7.6	42	47	5	84	0.665	0.8%
	7.8	19	25	6	38	0.798	2.1%
	8	42	48	6	84	0.798	1.0%
	8.2	110	120	10	220	1.33	0.6%
	8.4						
	8.6						
	8.8						
30	9						





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Ardaman & Associates, Inc.

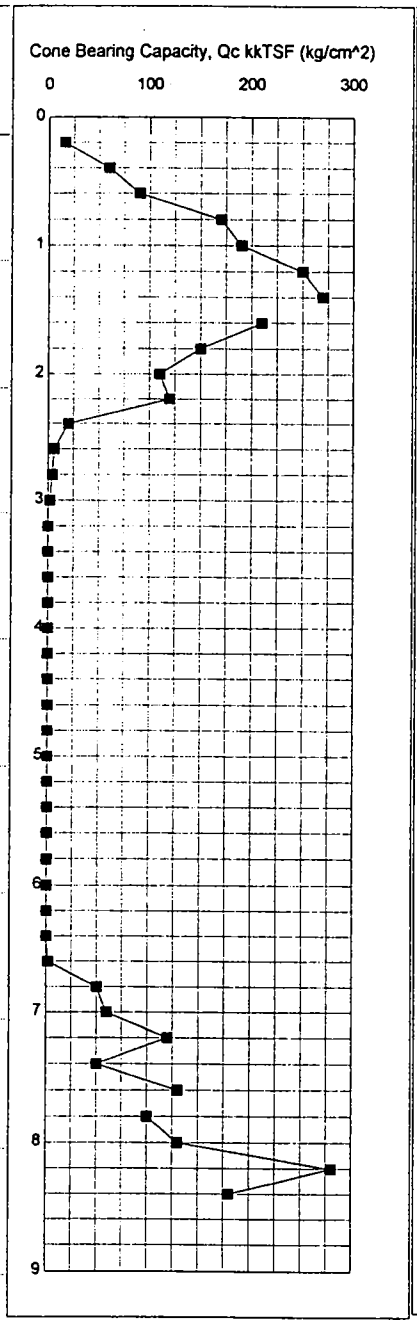
Geotechnical, Environmental and
Materials Consultants

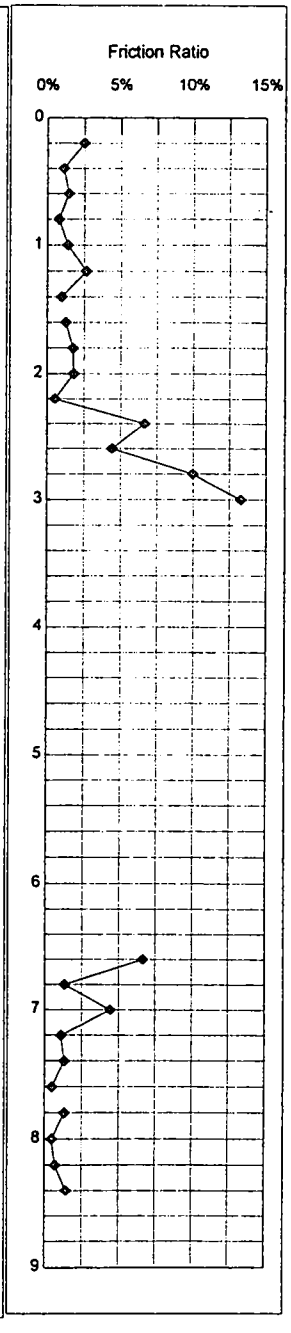
FILE NO.: 97-9628
CPT NO.: 9
DATE: 04/21/97
Tested by: K.P. / D.M.
Total Depth: 27.5 Ft.
Elevation: 126.68 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth		Field Data					
Feet	Meters	C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2	8	11	3	16	0.399	2.5%
	0.4	30	35	5	60	0.665	1.1%
	0.6	45	55	10	90	1.33	1.5%
	0.8	85	95	10	170	1.33	0.8%
	1	95	115	20	190	2.66	1.4%
	1.2	125	175	50	250	6.65	2.7%
5	1.4	135	155	20	270	2.66	1.0%
	1.6	105	125	20	210	2.66	1.3%
	1.8	75	95	20	150	2.66	1.8%
	2	55	70	15	110	1.995	1.8%
	2.2	60	65	5	120	0.665	0.6%
	2.4	10	20	10	20	1.33	6.7%
	2.6	3	5	2	6	0.266	4.4%
	2.8	2	5	3	4	0.399	10.0%
10	3	1	3	2	2	0.266	13.3%
	3.2	0	1	1	0	0.133	NA
	3.4	0	0.5	0.5	0	0.0665	NA
	3.6	0	0.5	0.5	0	0.0665	NA
	3.8	0	0.5	0.5	0	0.0665	NA
	4	0	0.5	0.5	0	0.0665	NA
	4.2	0	0.5	0.5	0	0.0665	NA
	4.4	0	0	0	0	0	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0.5	0.5	0	0.0665	NA
	5	0	0	0	0	0	NA
	5.2	0	0	0	0	0	NA
	5.4	0	0.5	0.5	0	0.0665	NA
	5.6	0	0.5	0.5	0	0.0665	NA
	5.8	0	0.5	0.5	0	0.0665	NA
20	6	0	1	1	0	0.133	NA
	6.2	0	1	1	0	0.133	NA
	6.4	0	1	1	0	0.133	NA
	6.6	1	2	1	2	0.133	6.7%
	6.8	25	30	5	50	0.665	1.3%
	7	30	50	20	60	2.66	4.4%
	7.2	60	70	10	120	1.33	1.1%
	7.4	25	30	5	50	0.665	1.3%
25	7.6	65	70	5	130	0.665	0.5%
	7.8	50	60	10	100	1.33	1.3%
	8	65	70	5	130	0.665	0.5%
	8.2	140	155	15	280	1.995	0.7%
	8.4	90	110	20	180	2.66	1.5%
	8.6						
	8.8						
30	9						





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Ardaman & Associates, Inc.

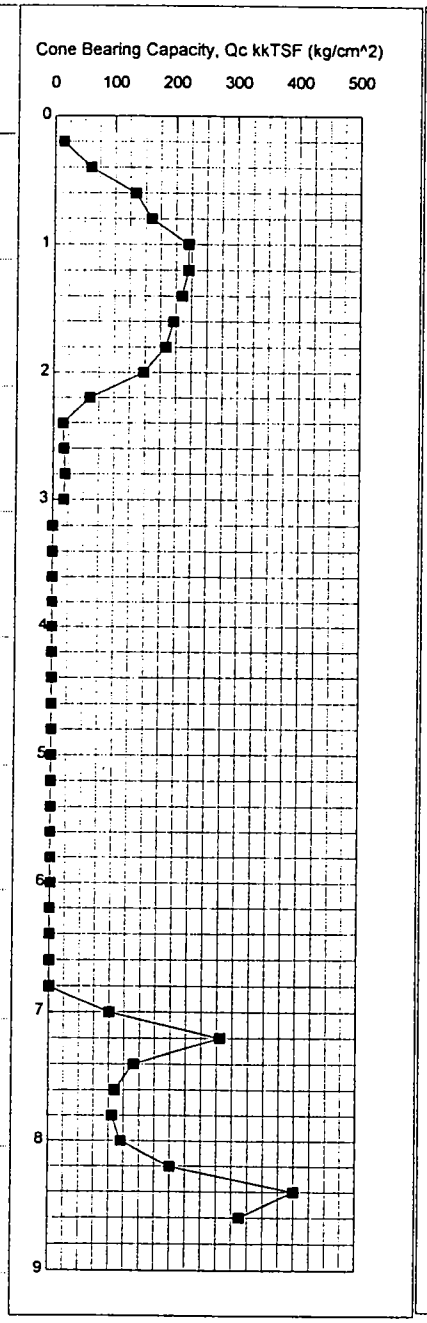
Geotechnical, Environmental and
Materials Consultants

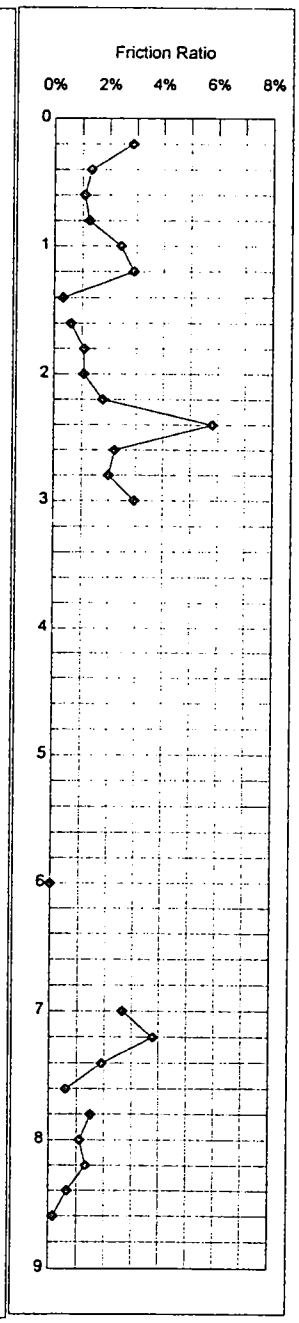
FILE NO.: 97-6628
CPT NO.: 10
DATE: 04/21/97
Tested by: K.P. / D.M.
Total Depth: 28 Ft.
Elevation: 126.10 Ft.

Dutch Cone Penetrometer Log

Project: S.E. Landfill
Location: See Print

Depth Feet	Depth Meters	Field Data C (kg/cm^2)	F+C (kg/cm^2)	Sleve Friction - F - (kg/cm^2)	Cone Resistance - Qc - (kg/cm^2)	Local Friction - LF - (kg/cm^2)	Friction Ratio
	0.2	7	10	3	14	0.399	2.9%
	0.4	30	36	6	60	0.798	1.3%
	0.6	67	78	11	134	1.463	1.1%
	0.8	80	95	15	160	1.995	1.2%
	1	110	150	40	220	5.32	2.4%
	1.2	110	158	48	220	6.384	2.9%
5	1.4	105	110	5	210	0.665	0.3%
	1.6	98	107	9	196	1.197	0.6%
	1.8	92	107	15	184	1.995	1.1%
	2	74	86	12	148	1.596	1.1%
	2.2	30	38	8	60	1.064	1.8%
	2.4	8	15	7	16	0.931	5.8%
	2.6	9	12	3	18	0.399	2.2%
	2.8	10	13	3	20	0.399	2.0%
10	3	9	13	4	18	0.532	3.0%
	3.2	0	1	1	0	0.133	NA
	3.4	0	1	1	0	0.133	NA
	3.6	0	1	1	0	0.133	NA
	3.8	0	1	1	0	0.133	NA
	4	0	1	1	0	0.133	NA
	4.2	0	0.5	0.5	0	0.0665	NA
	4.4	0	0.5	0.5	0	0.0665	NA
15	4.6	0	0	0	0	0	NA
	4.8	0	0	0	0	0	NA
	5	0	0.5	0.5	0	0.0665	NA
	5.2	0	0.5	0.5	0	0.0665	NA
	5.4	0	0	0	0	0	NA
	5.6	0	0	0	0	0	NA
	5.8	0	0	0	0	0	NA
20	6	0.5	0.5	0	1	0	0.0%
	6.2	0	0.5	0.5	0	0.0665	NA
	6.4	0	0.5	0.5	0	0.0665	NA
	6.6	0	0.5	0.5	0	0.0665	NA
	6.8	0	0	0	0	0	NA
	7	50	70	20	100	2.66	2.7%
	7.2	140	220	80	280	10.64	3.8%
	7.4	70	90	20	140	2.66	1.9%
25	7.6	55	60	5	110	0.665	0.6%
	7.8	53	65	12	106	1.596	1.5%
	8	60	70	10	120	1.33	1.1%
	8.2	100	120	20	200	2.66	1.3%
	8.4	200	220	20	400	2.66	0.7%
	8.6	156	160	4	312	0.532	0.2%
	8.8						
30	9						





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APPENDIX C

PIEZOMETER INSTALLATION RECORDS AND COMPLETION REPORTS

STATE OF FLORIDA PERMIT APPLICATION TO CONSTRUCT, REPAIR, MODIFY, OR ABANDON A WELL

☐ Southwest
☐ Northwest
☐ St. Johns River
☐ South Florida
☐ Suwannee River

CHECK BOX FOR APPROPRIATE DISTRICT. ADDRESS ON BACK OF PERMIT FORM.

THIS FORM *MUST* BE FILLED OUT COMPLETELY.

The water well contractor is responsible for completing this form and forwarding the permit to the appropriate delegated county where applicable.

Permit No. 591587-01
Florida Unique I.D. _____
Permit Stipulations Required (See attached)
(-34, -8)
62-524 well ☐
CUP/WUP Application No. _____

ABOVE THIS LINE FOR OFFICIAL USE ONLY

1. Hillsborough County Solid Waste Dept. P.O. Box 1110 Tampa, FL 33601 813-276-2927
Owner, Legal Name of Entity if Corporation — Address — City — Zip — Telephone Number

2. Southeast Landfill, CR 672, Picnic, Hillsborough County, FL
Well Location — Address, Road Name or Number, City

3. Archman & Associates Inc. 2368 941-533-0858
Well Drilling Contractor — License No. — Telephone No.

P.O. Box 812
Address

Bartow, Fl. 33831
City — State — Zip

4. NW (smallest) 1/4 of NW (biggest) 1/4 of Section 23

(Indicate Well on Chart)

5. Township 31S Range 21E

NW NE
X
SW SE

6. Hillsborough
County — Subdivision Name — Lot — Block — Unit

7. Number of proposed wells 1 Check the use of well: (See back of permit for additional choices) _____ Domestic Monitor (type) Peizometer
_____ Irrigation (type) (See Back) Public Water Supply (type) _____ (See Back) List Other _____
Distance from septic system NA ft. Description of facility Landfill Estimated start of construction date 4-25-97

8. Application for: X New Construction _____ Repair/Modify _____ Abandonment _____ (Reason for Abandonment)

Received Date Stamp
APR 21 '97
Bartow Reg

9. Estimated: Well Depth 15' Casing Depth 7' Screen Interval from 7' to 10'
Casing Material: Blk-Steel / Gal / (PVC) Casing Diameter 4 inch Seal Material _____

10. If applicable: Proposed Grouting Interval
From 0 to 12" Seal Material Chipped Bentonite
From 12" to 6' Seal Material Fine Sand (40/140)
From 6' to 10' Seal Material 20/30 Sand

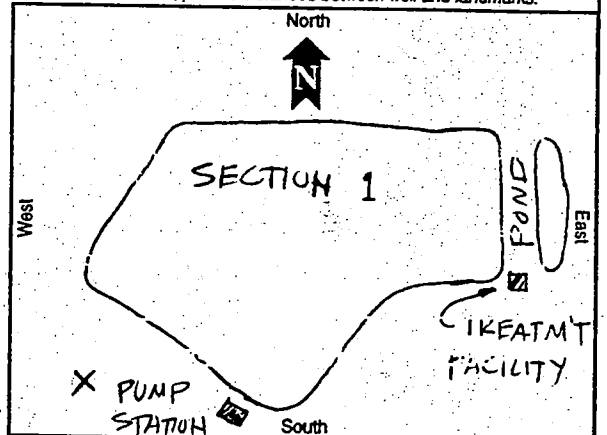
11. Telescope Casing _____ or Liner _____ (check one) Diameter _____
Blk-Steel / Galvanized / PVC Other (specify): _____

12. Method of Construction: _____ Rotary _____ Cable Tool _____ Combination
✓ Auger _____ Other (specify:) _____)

13. Indicate total No. of wells on site 25. List number of unused wells on site 6.

14. Is this well or any other well or water withdrawal on the owner's contiguous property covered under a Consumptive/Water Use Permit (CUP/WUP) or CUP/WUP Application? X No ___Yes
(If yes, complete the following) CUP/WUP No. _____
District well I.D. No. _____
Latitude _____ Longitude _____
Data obtained from GPS ___ or map ___ or survey ___ (map datum NAD 27___ NAD 83___)

Draw a map of well location and indicate well site with an "X". Identify known roads and landmarks; provide distances between well and landmarks.



15. I hereby certify that I will comply with the applicable rules of Title 40, Florida Administrative Code, and that a water use permit or artificial recharge permit, if needed, has been or will be obtained prior to commencement of well construction. I further certify that all information provided on this application is accurate and that I will obtain necessary approval from other federal, state, or local governments, if applicable. I agree to provide a well completion report to the District within 30 days after drilling or the permit expiration, whichever occurs first.

Signature of Contractor — 2368 License No.

I certify that I am the owner of the property, that the information provided is accurate, and that I am aware of my responsibilities under Chapter 373, Florida Statutes, to maintain or properly abandon this well; or, I certify that I am the agent for the owner, that the information provided is accurate, and that I have informed the owner of his responsibilities as stated above. Owner consents to personnel of the WMD or a representative access to the well site.

Owner's or Agent's Signature — 4-8-97 Date

DO NOT WRITE BELOW THIS LINE — FOR OFFICIAL USE ONLY

Approval Granted By: _____ Issue Date: 4-21-97 Hydrologist Approval _____
Owner Number: 6996 Fee Received: $50. Receipt No.: 97-012874 Check No.: 942 Initials

THIS PERMIT NOT VALID UNTIL PROPERLY SIGNED BY AN AUTHORIZED OFFICER OR REPRESENTATIVE OF THE WMD. IT SHALL BE AVAILABLE AT THE WELL SITE DURING ALL DRILLING OPERATIONS. ***This permit is valid for 90 days from date of issue.***

FORM 41.10 – 410 (1) REV. 4/95

WHITE: ORIGINAL FILE
YELLOW: DRILLING CONTRACTOR
PINK: OWNER

STIPULATION NUMBER 39 - WELL AND DRILLHOLE ABANDONMENT

It will be the **water well contractor's** responsibility to have any incomplete well or drillhole attempted under this permit properly abandoned.

Any incomplete or abandoned well or drillhole as described in 40D-3, F.A.C., shall be abandoned as follows:

A. The well examined from land surface to the original depth of construction for debris or obstructions (any debris or obstruction shall be removed prior to abandonment).
B. The well plugged from bottom to top by an approved method of grouting with either Portland neat cement grout or an approved Bentonite product as specified in 40D-3.517 2. (b), F.A.C.

It will be the **owner's** responsibility to have any well completed under this permit, or any existing well on this property, which meets the definition of an abandoned well as defined in Chapter 40D-3, Florida Administrative Code (F.A.C.), properly abandoned.
It will be the **owner's** responsibility to have any inactive well which does not meet the above criteria and is no threat to the water resource properly capped in an air and water tight manner with a threaded, welded or bolted cover or valve. If the pump and well seal are water tight, the pump may be left in place. If practical, a protective cover two (2) feet in height shall be placed around the well casing.

A. Wells with a diameter of six (6) inches or more without pumping equipment shall have the casing extended a minimum of two(2) ft. above land surface.
B. Wells with a diameter of less than six (6) inches without pumping equipment shall be securely set in a concrete slab and have either the well casing extended a minimum height of two (2) feet above land surface or a protective cover centered over the well casing. The concrete slab shall be a minimum of four (4) inches in thickness by two (2) feet by two (2) feet square. The protective cover shall be set in the concrete slab and extend a minimum of two (2) feet above land surface.

In flood prone areas all wells shall extend a minimum of one (1) foot above the 100 year flood elevation, if practical.

Any plugging operations shall be permitted separately from this permit by the Southwest Florida Water Management District and be witnessed by a designated District representative. Arrangement for a District representative shall be made with the local District Field Services office a minimum of twenty four (24) hours in advance of these operations. A District representative will be available for assignment during normal working hours (8:00 AM - 4:30 PM), Monday through Friday. Travel time must be taken into consideration. Exemptions may be made for extenuating circumstances. For scheduling, please contact the Field Service Coordinator, **Jim Calandra** , in our **BARTOW** office at **1-800-492-7862.**

Approved by: _____

Permit Number: 591582-02
591583-05
591587-01
591588-05

Date: 4-21-97

Stip#39
(1/31/97)

COPY TO OWNER

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

SERVICE OFFICE

STIPULATION # 8 - TEST/MONITOR WELL

A. This well is to be used as a test/monitor well. If it is to be converted into a production well, an additional permit shall be obtained prior to conversion.

B. There shall be no injection of fluids into the monitor well without prior written approval from the District. This includes, but is not limited to treated ground water, or the introduction of microbes for In-Situ aquifer restoration.

C. While drilling the well, if confining beds (i.e. clay or hardpan intervals) are encountered, then the well shall be constructed in such a manner as to prevent the unauthorized interchange of water between different water bearing zones as per Chapter 17-532.500(2)(C), Florida Administrative Code, (F.A.C.). This includes, but is not limited to the screened or open hole interval and the annular space.

D. Prior written approval from the District shall be required if the monitor well will be pumped for use in hydrodynamic control and/or contaminant plume management.

E. In the event the well needs to be abandoned, an abandonment permit shall be obtained prior to commencing with abandonment procedures.

F. An observer from our Enforcement Department is required on all abandonments to ensure compliance with Chapter 17-532, F.A.C. Please contact the Enforcement Coordinator, Jim Calandra, in our Bartow Office at (813) 534- 1448 for additional information.

1-800-492-7862

Approved by: _____

Permit # 591582-02, 591583-05, 591587-01, 591588, 05

Date: 4-21-97

Stip #8
(2/93)
COPY TO OWNER

WELL COMPLETION REPORT (Please complete in black ink or type.)

PERMIT # 591587.01 CUP/WUP # _____ DID # _____

If permit is for multiple wells indicate the number of wells drilled _____.

Indicate remaining wells to be cancelled _____.

WATER WELL CONTRACTOR'S SIGNATURE Edward D. Parker License # 2368

I certify that the information provided in this report is accurate and true.

Grout	No. of Bags	From (Ft.)	To (Ft.)
Neat Cement:			
Bentonite:	1/2	25lbs 0.0	1.0

WELL LOCATION: County Hillsborough

NW 1/4 of NW 1/4 of Section 23 Twp: 31S Rge: 21E

Latitude _____ Longitude _____

DATE STAMP

Official Use Only

Sketch of well location on property N

Give distances from septic tank and house or other reference points

CHEMICAL ANALYSIS WHEN REQUIRED

Iron: ____ ppm Sulfate: ____ ppm

Chloride: ____ ppm

[ ] Lab Test [ ] Field Test Kit

Pump Type

[ ] Centrifugal [ ] Jet [ ] Submersible [ ] Turbine

Horsepower _____ Capacity _____ G.P.M. _____

Pump Depth _____ Ft. Intake Depth _____ Ft.

Form 41.10-410(2) Rev. 6/95

OWNER'S NAME Hillsborough Co. Solid Waste Dep.

COMPLETION DATE 5-1-97 Florida Unique I.D. _____

WELL USE: DEP/Public ___ Irrigation ___ Domestic ___ Monitor ✓

HRS Limited ___ 62-524 ___ Other _____

DRILL METHOD [ ] Rotary [ ] Cable Tool [ ] Combination

[ ] Jet [✓] Auger Other _____

Measured Static Water Level 5.7 Measured Pumping Water Level ____

After ____ Hours at ____ G.P.M. Measuring Pt. (Describe): Top of Well

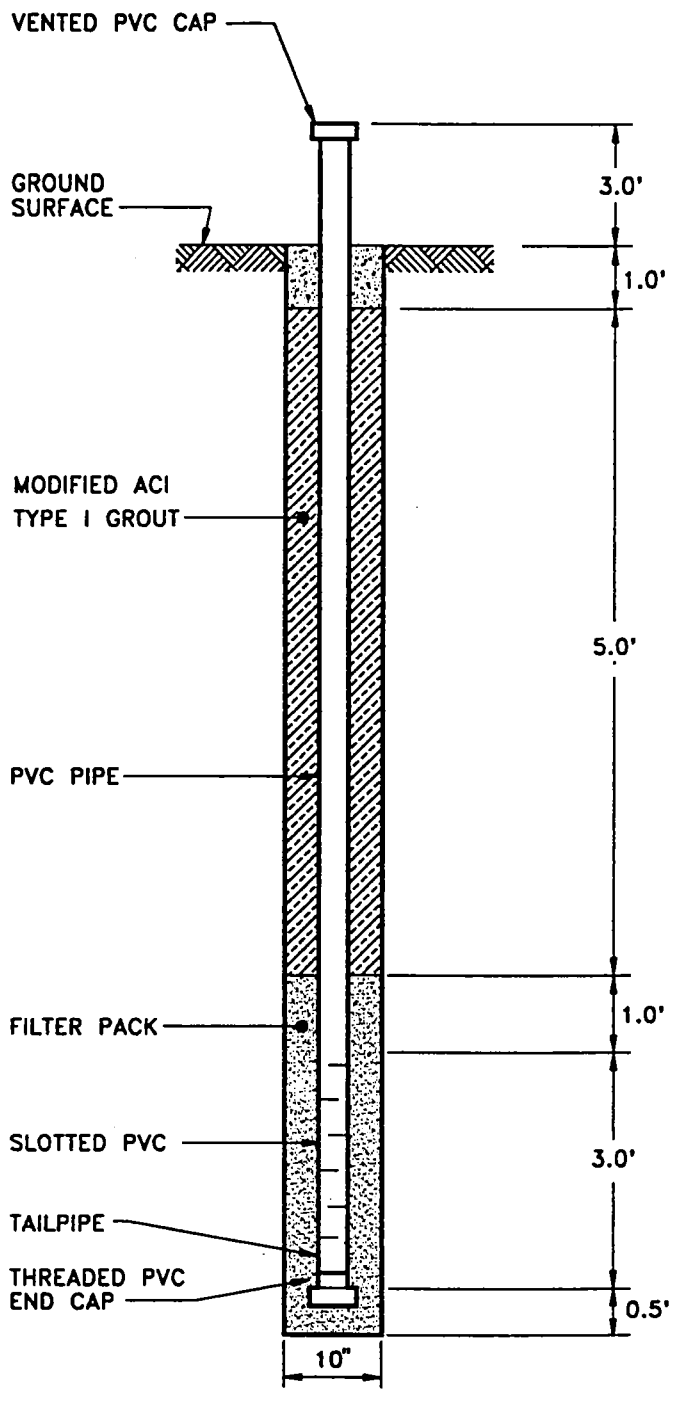
Which is 3.0 Ft. [X] Above [ ] Below Land Surface

Casing: [ ] Black Steel [ ] Galv. [X] PVC Other _____

[ ] Open Hole [X] Screen	Depth (Ft.)		DRILL CUTTINGS LOG Examine cuttings every 20 ft. or at formation changes. Note cavities, depth to producing zones. Color | Grain Size | Type of Material
Casing Diameter & Depth (Ft.)	From	To	
Diameter 4" From 0.0 To 7.0	0.0	10.5	Lt. BR. SA w/ PAOS (TR. Lmx)
			10.5 EOB
Diameter ____ From ____ To ____			
Liner [ ] or Casing [ ] Diameter ____ From ____ To ____			

Driller's Name: (print or type) Edward J. Parker

PIEZOMETER WELL INSTALLATION RECORD PZ-1



File No.: 97-9628
Project: SOUTH EAST LANDFILL
Client: HILLSBOROUGH COUNTY SOLID WASTE DEPT.

Well No.: PZ-1
Date Installed: 4-24-97
Crew Supervisor: E. PARKER
Well Location: N 1251313.22
E 596161.11
TOC (MSL): 126.9

Protective Casing: (size and type)
NONE
Concrete Pad: (size) BENTONITE CHIPS
PVC Pipe: (size and type)
4" SCHEDULE 40, THREADED
Seal: (type) NONE
Filter Pack: (type) 20/30 SILICA SAND
Slotted PVC: (size and type)
4"ø 0.01" SLOTTED WELL SCREEN

Total Length of PVC Pipe: 10 ft(BLS)
Total Length of Slotted PVC: 3 ft(BLS)
Total Length of End Point: 0 ft
Total Depth of Well: 10.5 ft(BLS)

No. Bags of Cement: N/A
No. Bags of Filter Pack: N/A
Amount of Seal: NONE

Remarks:

Water Level Readings:
Date: 4-24-97
Depth BTOC: 9'0" Depth BLS: 6'6"
Date:
Depth BTOC: Depth BLS:

Ardaman & Associates, Inc.
Consulting Engineers in Soils, Hydrogeology, Foundations, and Materials Testing

BLS: = Below Land Surface
BTOC: = Below Top of Casing
TOC: = Top of Casing
MSL: = Mean Sea Level

97-9628\PZ-1

PIEZOMETER INSTALLATION RECORD

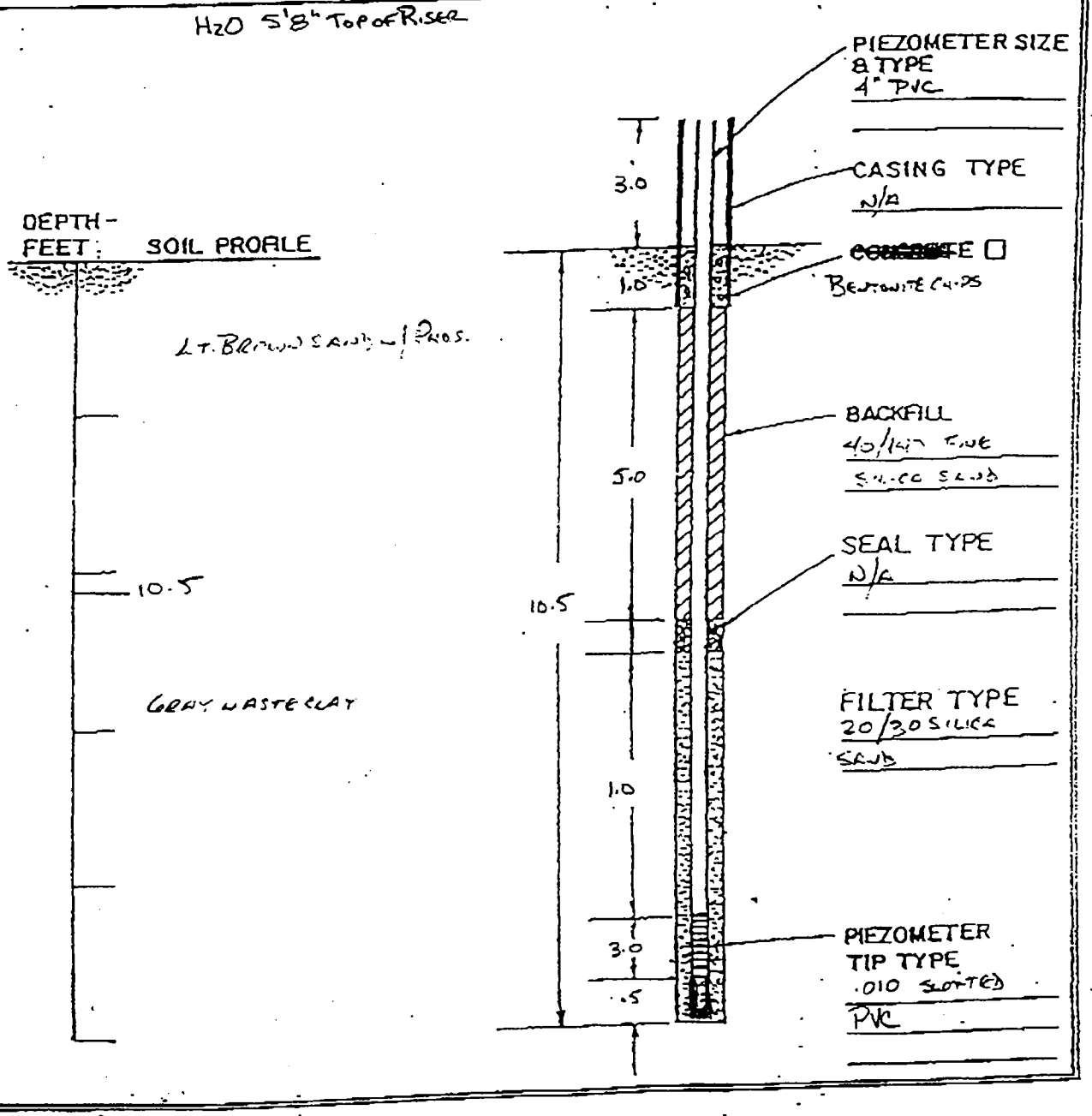
CLIENT: SCS PROJECT: SE. LANDFILL FILE NO: 97-4628

STATION NO. _____ PIEZOMETER NO. 4" PIEZ

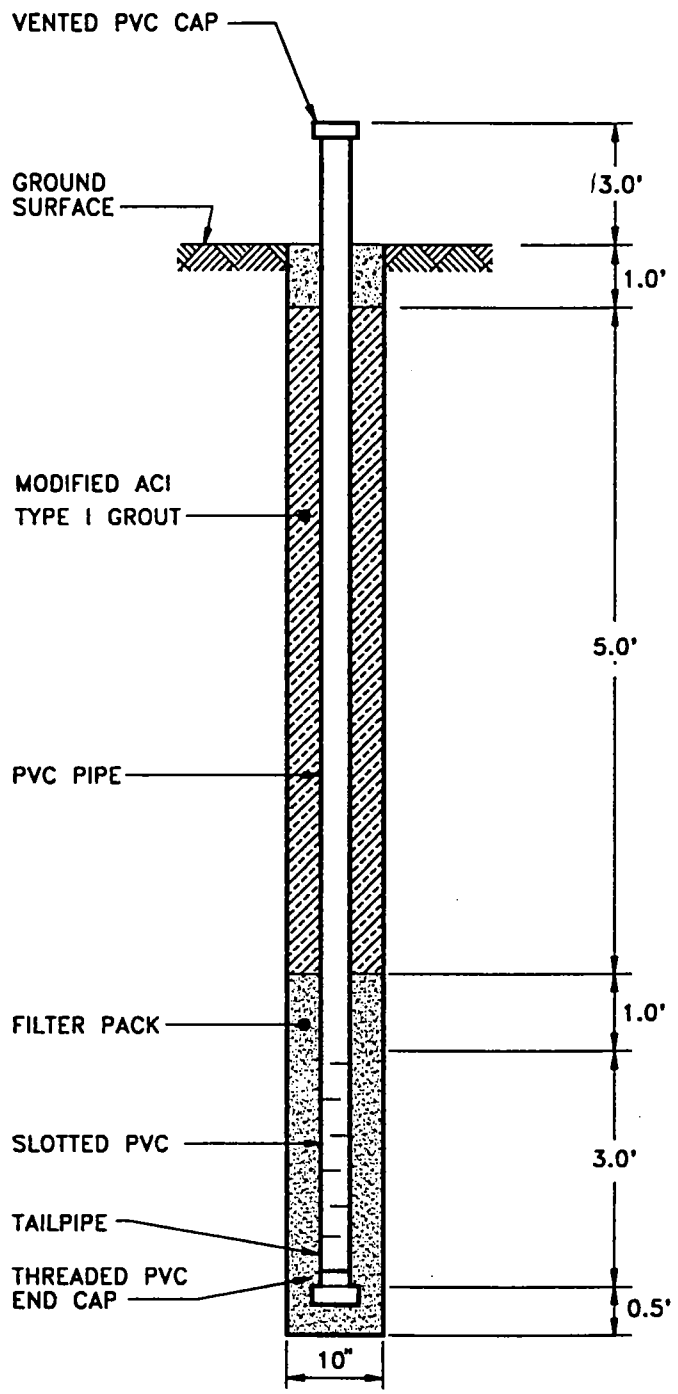
CREW SUPERVISOR: E. PARKER DATE INSTALLED: 4-24-97

PIEZOMETER LOCATION: PEE STAKE N 596500 ± 322 E 1251000 ± 283

GROUND ELEV: _____ PIEZ TOP ELEV. _____



PIEZOMETER WELL INSTALLATION RECORD PZ-1



File No.:	97-9628
Project:	SOUTH EAST LANDFILL
Client:	HILLSBOROUGH COUNTY SOLID WASTE DEPT.

Well No.:	PZ-1
Date Installed:	4-24-97
Crew Supervisor:	E. PARKER
Well Location:	X
	X
TOC (MSL):	X

Protective Casing: (size and type)
NONE

Concrete Pad: (size) BENTONITE CHIPS

PVC Pipe: (size and type)
4" SCHEDULE 40, THREADED

Seal: (type) NONE

Filter Pack: (type) 20/30 SILICA SAND

Slotted PVC: (size and type)
4"ø 0.01" SLOTTED WELL SCREEN

Total Length of PVC Pipe:	10	ft(BLS)
Total Length of Slotted PVC:	3	ft(BLS)
Total Length of End Point:	0	ft
Total Depth of Well:	10.5	ft(BLS)

No. Bags of Cement:	?
No. Bags of Filter Pack:	?
Amount of Seal:	NONE

Remarks:

Water Level Readings:

Date: 4-24-97
Depth BTOC: 9'0" Depth BLS: 6'6"
Date:
Depth BTOC: Depth BLS:

Ardaman & Associates, Inc.
Consulting Engineers in Soils, Hydrogeology, Foundations, and Materials Testing

BLS: = Below Land Surface
BTOC: = Below Top of Casing
TOC: = Top of Casing
MSL: = Mean Sea Level

97-9628\PZ-1

ATTACHMENT C

STRUCTURAL CALCULATION

(Prepared by Tondelli Engineering, P.A.)

TONDELLI ENGINEERING, P.A.
CIVIL, MECHANICAL, STRUCTURAL AND BUILDING DESIGN

DESIGN CALCULATIONS AND ASSUMPTIONS FOR HILLSBOROUGH COUNTY SOUTHEAST LANDFILL

PREPARED FOR SCS ENGINEERS, TAMPA, FL

ASSUMPTIONS

1. The following concrete vault was designed assuming that the settlement of the underlayment clay would not affect the level or alignment of the vault.

2. The vertical loading and horizontal lateral pressure at the walls and the top slabs were given as 9,800 psf, which are assumed to be the final pressures once the fill is completed to its highest point.

3. The leachate table was assumed to be no more than 1 ft. above the pipes. Therefore, the soil was not considered to be saturated.

4. The design of the access and dewatering pipes or manhole access shaft are not part of this vault design. They are not in any way the responsibility of Tondelli Engineering, P.A.

5. The structural adequacy of the dewatering pipes and access pipes, as well as their relative movement in terms of settlement are also not a part of this design and they are not Tondelli Engineering, P.A's responsibility.

6. Construction methods, safety precautions, or site conditions are not the responsibility of Tondelli Engineering, P.A.

J. Tondelli
10/14/97

1674note

3606 West Swann Avenue • Tampa, Florida 33609 • Phone 813/875-2929 • Fax 813/874-3001

TONDELLI ENGINEERING, P.A.
CIVIL, MECHANICAL, STRUCTURAL AND BUILDING DESIGN
3606 West Swann Avenue
Tampa, Florida 33609 813-875-2929

Customer: SCS ENGINEERING	Page: 1 Of: 3
HILLSBOROUGH COUNTY	Job: TE-1674
Description: S.E. LANDFILL, DEWATERING	Date: 5-8-97
CONCRETE VAULT	By: J. TONDELLI

GIVEN: MAXIMUM PRESSURE AT TOP OF VAULT

Soil Pressure W = 9,800 psf after fill is in place.

(per SCS Soils Engineers)

DEAD LOAD/VAULT WEIGHT

Min. Load,

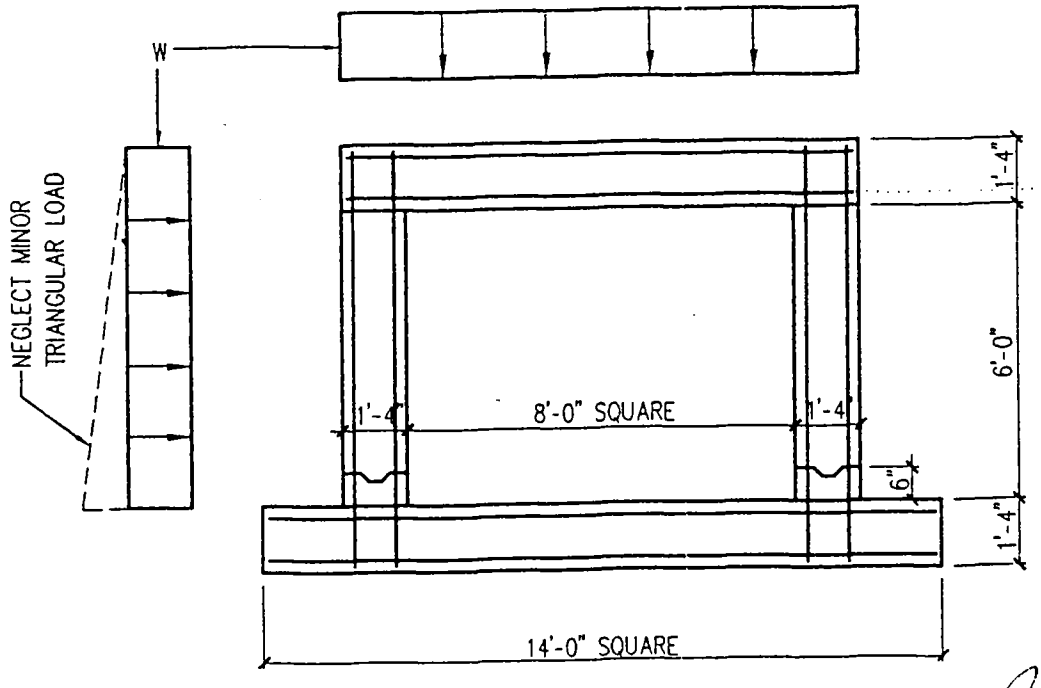
Pmin = $(0.15)(10.67^2)(1.33) + 0.15(6^2)(1.33)(4) + 0.15(14^2)(1.33)$

$= 22.7 + 28.7 + 39.1 = 90.5$ kips

SOIL PRESSURE ON SLABS

Max. Load,

Pmax = $90.5 + 9.8(10.67^2) = 1{,}206.2$ kips, Foundation Pressure = $\frac{1{,}206.2}{14^2} = 6.15$ ksf



Jim Tondelli
5/9/97

Fig. 1

TONDELLI ENGINEERING, P.A.
CIVIL, MECHANICAL, STRUCTURAL AND BUILDING DESIGN
3606 West Swann Avenue
Tampa, Florida 33609 813-875-2929

Customer: SCS ENGINEERING	Page: 2 Of: 3
HILLSBOROUGH COUNTY	Job: TE-1674
Description: S.E. LANDFILL, DEWATERING	Date: 5-8-97
CONCRETE VAULT	By: J. TONDELLI

CHECK SHEAR AT TOP OF SLAB

Slab Length = 8', concrete strength f'_c = 5,500 psi, steel yield strength, F_y = 60 ksi

Ultimate load = W_u = (9.8) (1.4) = 13.72 ksf (ACI 9.2.4)

Lateral pressure was given same as vertical pressure.

Using 16" slab thickness, depth distance to steel, d = 16.0 - 2.5 = 13.5"

Allow punching shear, $v = 2\sqrt{f'_c} = 2\sqrt{5,500} = 148.3$ psi

Actual punching shear, $v = \frac{(13,720)\,[8 - (2)\,(13.5/12)]^2}{(4)\,[8 - (2)\,(13.5/12)]\,(12)\times 13.5} = 121.7$ psi < 148 psi ok

Shear @ top slab OK. by inspection shear @ bottom slab OK due to extended slab giving double action at wall base.

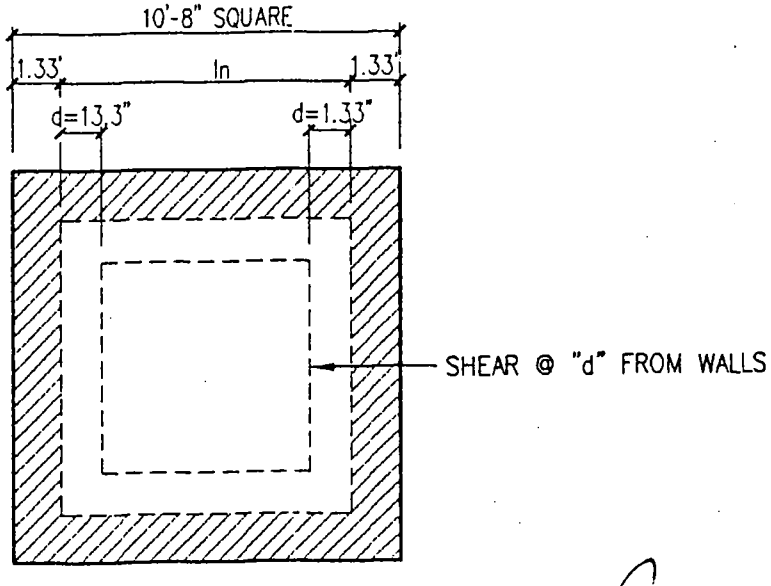


Fig. 2

5/8/97

TONDELLI ENGINEERING, P.A.
CIVIL, MECHANICAL, STRUCTURAL AND BUILDING DESIGN
3606 West Swann Avenue
pa, Florida 33609 813-875-2929

Customer: SCS ENGINEERING	Page: 3 Of: 3
HILLSBOROUGH COUNTY	Job: TE-1674
Description: S.E. LANDFILL, DEWATERING	Date: 5-8-97
CONCRETE VAULT	By: J. TONDELLI

CHECK REINFORCING FOR WALLS AND SLABS - ALL 16"

Critical Slab at Top

Try #9 @ 8" o.c. (area = 1.0 in^2) $\quad A_s = \frac{(1)\ (12")}{8"} = 1.5\ in.^2/ft.$

Ultimate Moment,

$M_u = 0.9\ [A_s\ F_y\ (d - \frac{a}{2})]$ $\quad a = \frac{A_s F_y}{0.85\ f'_c\ b} = \frac{1.5\ (60)}{0.85\ (5.5)\ (12)} = 1.60\ in.$

$M_u = 0.9\ [(1.5)\ (60)\ (13.5 - \frac{1.60}{2})] = 1{,}028.5\ in. - kip/ft.$

Actual Slab Moment,

$M_{actual} = \frac{W_u l_n^2}{10}$ (fixed ends) Top slabs most loaded

Allowed Ultimate Load,

$W_{allow'\ uct} = \frac{10\ M_u}{L_n^2} = \frac{(10)\ (1.028.5)\ (12"/ft.)}{(8\ X\ 12)^2} = 13.392/ksf$

$W_{allow} = \underline{13.39\ ksf} \cong W_{u\ actual} = \underline{13.72\ ksf}$, 2% overstressed, OK w/double reinf.

CHECK MINIMUM/MAXIMUM STEEL REINFORCING

Min. Steel Ratio,

$\rho_{min} = \frac{200}{F_y} = \frac{200}{60{,}000} = 0.0033$ $\quad \rho_{actual} = \frac{A_s}{bd}$

Max. Steel Ratio,

$\rho_{max} = 0.75\rho\ X\ 12" = 0.027$ (ACI 10.3.3)

Actual Steel Ratio,

$\rho_{actual} = \frac{1.5}{(12)\ (13.5)} = 0.009 > 0.0033 < 0.027$ OK

∴Use 16" thick walls and slabs with #9 @ 8" o.c. Use same reinforcement at each face of the walls and slabs for stress reversal and for corners.

5/8/97

ATTACHMENT D

PIPE CALCULATIONS

(Prepared by SCS Engineers)

Attachment D

PURPOSE: Determine the Standard Dimension Ratio (SDR) of the 18-inch diameter HDPE horizontal access pipe. The access pipe will be subjected to construction equipment loads (short-term scenario) and about 130 feet maximum of waste overburden (long-term scenario).

SUMMARY:

1. Use SDR 13.5 for the 18-inch dia. HDPE horizontal access pipe.

2. Use gravel trench per pipe manufacturer's recommendations.

3. Make provisions to facilitate pump movement in the concrete vault.

REFERENCES:

1. Construction Drawings for "Southeast County Landfill, Phase VI Pump Station "B", County of Hillsborough, Florida", dated March 7, 1997.

2. "Driscopipe Design Manual" by Phillips 66.

3. Caterpillar Performance Handbook, Edition 20.

ASSUMPTIONS:

1. Material Unit Weights:

   - Waste = 74 pounds per cubic feet (pcf), from field test pits information.

   - Granular backfill and final cover soil unit weight = 110 pcf.

2. Equipment Load: It is anticipated the heaviest equipment used during the installation of the HDPE pipes is a CAT 966E wheel loader with an operating weight of about 45,000 pounds and tire pressures of 50 psi. This is a very conservative assumption since it is likely that only tract type equipment (with contact pressure of about 5 to 15 psi) will be used during the pipe installation.

3. The settlement of the phosphatic clay due to overburden waste is uniform. Consequently, the settlement of the pipe/backfill envelope is also uniform. The assumption is reasonable since waste will be placed uniformly in horizontal lifts across the pipe.

4. The granular backfill material will be placed at about 80 % Standard Proctor density. The vertical strain of the granular fill after backfilling is about 3 %. This is a reasonable estimate since 80% compaction is a relatively low density for the granular backfill even if it is placed above soft phosphatic clay. The 3% strain value is after placement of the granular backfill material. Most of the settlement for the granular backfill will occur during placement. The granular backfill will be wrapped in a relatively strong geotextile (16 oz./sy min.) The entire pipe/backfill envelope will settle as an unit, and settlement is expected to be uniform along the alignment of the pipe.

APPROACH:

1. Determine the maximum vertical stress from short- and long-term scenarios.

2. Select a trial size SDR for the HDPE access pipe.

3. Use "Driscopipe Design Manual" to check:

   - Wall Crushing.
   - Wall Buckling.
   - Ring Deflection.

4. Determine if SDR is OK for the 18-inch dia. HDPE pipe.

5. If SDR is not OK, repeat steps (2) through (5).

SOLUTION:

1. Determine the maximum vertical stress from short- and long-term scenarios:

1a. Short-term or during construction scenario:

Anticipated maximum equipment load is from a CAT 966E wheel loader with an average tire pressure of 50 psi.

σ_{max} = 50 psi + ((1' x 110 pcf) / 144)
= 50.76 psi, say 51 psi.

where 1' represents the minimum backfill cover before traffic is allowed over the pipe.

1b. Long-term or closed landfill with maximum waste overburden scenario:

- For waste + final cover system:

  $\sigma_{overburden}$ = (128' x 74 pcf) + (3' x 110 pcf)
  = 9,820 psf = 68.07 psi, say 68 psi. > 51 psi. short-term load.

===> Long-term scenario, 68 psi, controls.

2. Select a trial size SDR for the HDPE pipes:

2a. Check "Wall Crushing":

$S_A = (SDR - 1) / 2 \times P_T$, where

S_A = actual compressive stress, psi.
SDR = Standard Dimension Ratio.
P_t = External pressure, psi. = 68 psi.

===> S_A = (13.5 - 1) / 2 x 68 psi = 425 psi.

From Driscopipe Design Manual, Compressive Yield Strength of Driscopipe HDPE = 1,500 psi.

===> Safety Factor for Wall Crushing = 1500 psi / 425 psi = 3.53 ===> OK.

(Manufacturer recommends a minimum safety factor of 2.0)

2b. Check "Wall Buckling":

$P_{CB} = 0.8 \times (E' \times P_C)^{0.5}$, where

P_{CB} = critical buckling soil pressure at top of pipe, psi.

E' = soil modulus, psi. = P_t / ϵ_s; P_t = vertical soil pressure = 68 psi, ϵ_s = soil strain, from Chart 26 of Design Manual (attached) ≈ 3.2% for granular soil.
= 68 psi / 3.2% = 2,125 psi.

P_C = hydrostatic critical collapse differential pressure, psi.
= (2.32 x E) / SDR^3, where E = stress and time dependent tensile modulus of elasticity, psi. From Chart 25 of Manual (attached), E ≈ 21,000 psi for 50-year @ 425 psi (= S_A).
= (2.32 x E) / SDR^3 = (2.32 x 21,000 psi) / $(13.5)^3$ = 19.8 psi.

===> $P_{CB} = 0.8 \times (E' \times P_C)^{0.5}$
$= 0.8 \times (2{,}125 \text{ psi} \times 19.8 \text{ psi})^{0.5}$
= 164.0 psi > P_t of 68 psi ===> OK.

===> Safety factor for wall buckling = 164.0 psi / 68.0 psi = 2.4 ===> OK.

2c. Check "Ring Deflection":

From Chart 27 "Allowable Ring Deflection" (attached) in the Manual:

For SDR 13.5, allowable ring deflection = 3.4 % > 3.2% of anticipated settlement of granular backfill material after compaction.

Ring deflection in this installation is not as important as that on rigid solid ground. Since the phosphatic clay will consolidate, the overburden stress due to waste will be transferred from the pipe/backfill envelope to the phosphatic clay. The envelope is not likely to experience the entire overburden stress as long as the phosphatic clay continue to consolidate. When the phosphatic clay is fully consolidated (acting as a rigid ground surface), the envelope will begin to take on the entire overburden stress. Even so, the compressive strength of HDPE pipe (1,500 psi) and the allowable ring deflection will accommodate the anticipated overburden (128 feet of waste) after full consolidation of the clay.

Therefore, use SDR 13.5 for the 18-inch diameter horizontal leachate access pipe.

Where: S_A = Actual compressive stress, psi
SDR = Standard Dimension Ratio
P_T = External Pressure, psi

Safety Factor = 1500 psi ÷ S_A where 1500 psi is the Compressive Yield Strength of Driscopipe.

Design by Wall Buckling: Local wall buckling is a longitudinal wrinkling of the pipe wall. Tests of *non-pressurized* Driscopipe show that buckling and collapse do not occur when the soil envelope is in full contact with the pipe and is compacted to a dense state. However, it can be forced to occur over the long term in *non-pressurized* pipe if the total external soil pressure, P_t, is allowed to exceed the pipe-soil system's critical buckling pressure, P_{cb}. If $P_t > P_{cb}$, gradual collapse may occur over the long term. A calculated, conservative value for the critical buckling pressure may be obtained by the following approximate formula. All pipe diameters with the same SDR in the same burial situation have the same critical collapse and critical buckling endurance

$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

Where:

P_t = Total vertical soil pressure at the top of the pipe, psi

P_{cb} = Critical buckling soil pressure at the top of the pipe, psi

E' = Soil modulus in psi calculated as the ratio of the vertical soil pressure to vertical soil strain at a specified density

P_C = Hydrostatic, critical-collapse differential pressure, psi

$$P_C = \frac{2E\,(t/D)^3\,(D_{MIN}/D_{MAX})^3}{(1-\mu^2)}$$

$$P_c = \frac{2.32\,E}{(SDR)^3}$$

Where: $(D_{MIN}/D_{MAX}) = .95$
μ = Poission's Ratio
μ = .45 for Driscopipe
E = stress and time dependent tensile modulus of elasticity, psi

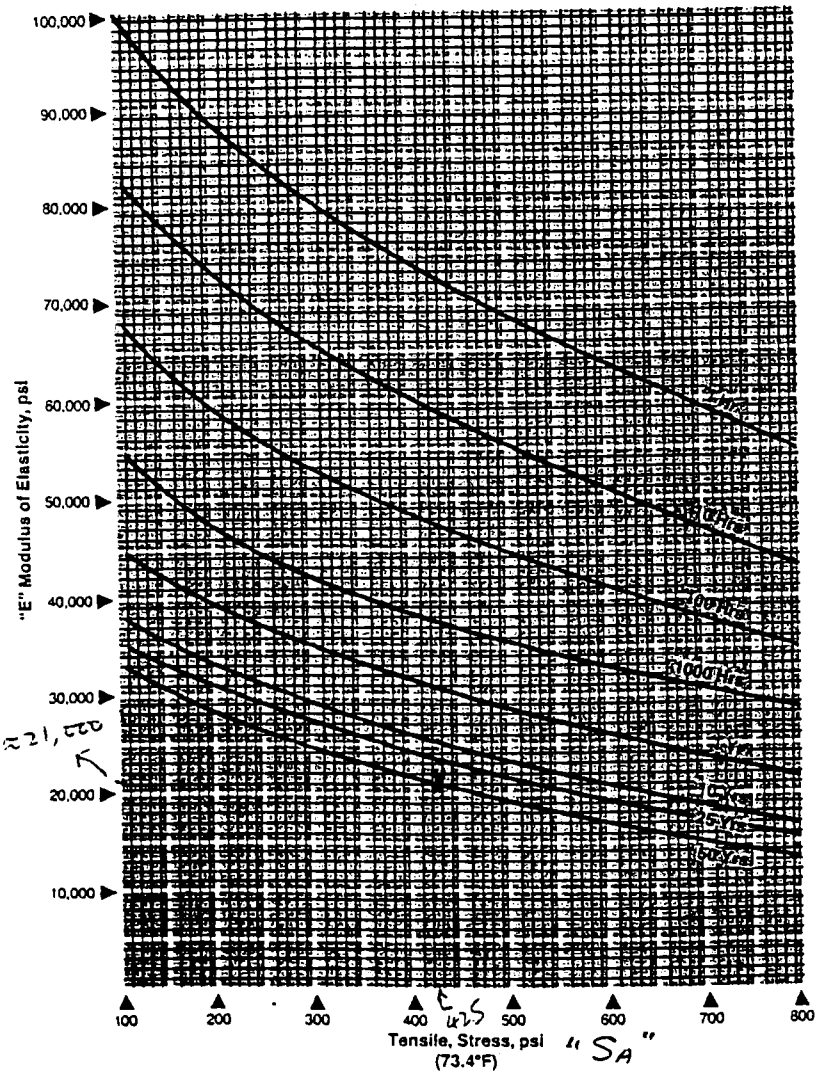
In a direct burial pressurized pipeline, the internal pressure is usually great enough to exceed the external critical-buckling soil pressure. When a pressurized line is to be shut down for a period, wall buckling should be examined.

Design by Wall Buckling Guidelines:
Although wall buckling is seldom the limiting factor in the design of a Driscopipe system, a check of non-pressurized pipelines can be made according to the following steps to insure $P_t < P_{cb}$.

1. Calculate or estimate the total soil pressure, P_t, at the top of the pipe.
2. Calculate the stress "S_A" in the pipe wall according to the formula:
$$S_A = \frac{(SDR - 1)\,P_t}{2}$$
3. Based upon the stress "S_A" and the estimated time duration of non-pressurization, use Chart 25 to find the value of the pipe's modulus of elasticity, E, in psi.

Chart 25

Time Dependent Modulus of Elasticity for Polyethylene Pipe vs. Stress Intensity (73.4°F)



NOTE: The short term modulus of elasticity of Driscopipe per ASTM D 638 is approximately 100,000 psi. Due to the cold flow (creep) characteristic of the pipe material, this modulus is dependent upon the stress intensity and the time duration of the applied stress.

4. Based upon the pipe SDR and the value of the polyethylene modulus of elasticity, E, calculate the pipe's hydrostatic, critical-collapse differential pressure, P_C:

$$P_C = \frac{2.32\,(E)}{(SDR)^3}$$

5. Calculate the soil modulus, E', by plotting the total external soil pressure, P_t, against a specified soil density to derive the soil strain as shown in the example problem on Chart 26.

6. Calculate the critical buckling pressure at the top of the pipe by the formula:

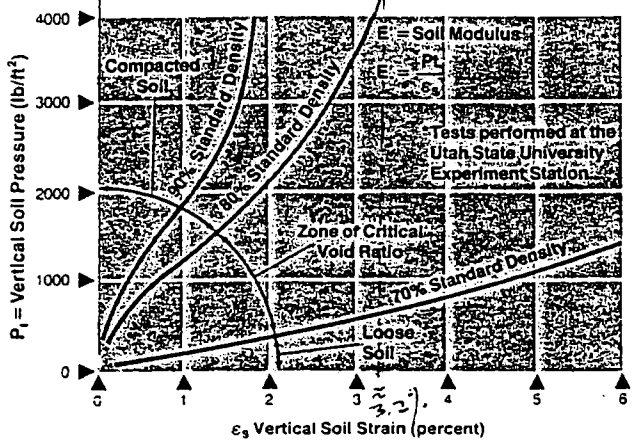
$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

7. Calculate the Safety Factor: $S.F. = P_{CB} \div P_t$
In burial applications, a safety factor of 1.0 may be considered a minimum because of the margin of safety provided by the arching action of the soil. However, Driscopipe endorses using a more conservative value approaching or exceeding a 2.0 safety factor.

8. The above procedures could be reversed to derive the minimum pipe SDR required for a given soil pressure and an estimated soil density. However, this procedure should permit the engineer to optimize the system design quickly by examining several combinations.

Chart 26

Plot of Vertical Stress-Strain Data for Typical Trench Backfill (Except Clay) from Actual Tests*



EXAMPLE
Find: E' @ 2000 PSF and 80% Density
Formula: $E' = P_t / \varepsilon_s$
Calculations: E' = 2000 PSF / .018 = 111111 PSF = 771 psi

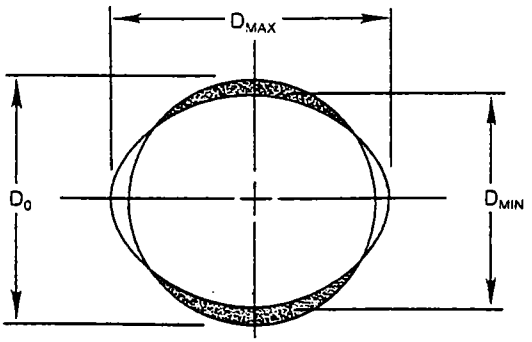
Note: The curves shown on this chart are sample curves for a granular soil. If other types of soil are used for backfill, such as clay or clay loam, curves should be developed from laboratory test data for the material used. Soil pressures greater than 4000 psf may be examined by extrapolating the slope of the curve or by generating curves by testing at those higher soil pressures. Probable error of curves is about half the distance between adjacent lines.

Design by Ring Deflection: Ring deflection is defined as the ratio of the vertical change in diameter to the original diameter. It is often expressed as a percentage. Ring deflection for buried Driscopipe is conservatively the same as (no more than) the vertical compression of the soil envelope around the pipe. Design by ring deflection matches the ability of Driscopipe to accommodate, without structural distress, the vertical compression of the soil enveloping the buried pipeline. *Design by ring deflection comprises a calculation of vertical soil strain to ensure it will be less than the allowable ring deflection of the pipe.* See Chart 27. The tabulation shows that with lower values of SDR, the allowable deflection is less. For installations which require this thicker wall to resist the external soil pressure, actual ring deflection can easily be limited to the tabular values by proper compaction of the backfill around the pipe. The recommended allowable deflection for the various SDR s are:

Chart 27

SDR	Allowable Ring Deflection
32.5	8.1%
26.0	6.5%
21.0	5.2%
19.0	4.7%
17.0	4.2%
15.5	3.9%
→ 13.5	3.4% ←
11.0	2.7%

The allowable ring deflection of polyethylene pipe is a function of the allowable tangential strain in the outer surface of the pipe wall. A conservative limit of 1-1½% tangential strain in the outer surface of the pipe wall due to vertical deflection of the pipe "ring" by soil compression can be understood by comparing two pipes of the same diameter but different wall thickness.



$$\% \text{ Ring Deflection} = \left(1 - \frac{D_{MIN}}{D_0}\right) \times 100\%$$

NOTE: 5% deflection decreases flow-area by ¼%. 10% deflection decreases flow-area by 1%.

PURPOSE: Estimate the total and differential settlements of the phosphatic clay along the alignment of the proposed 18-inch diameter HDPE horizontal access pipe under the maximum overburden scenario.

REFERENCES:

1. Construction Drawings for "Southeast County Landfill, Phase VI Pump Station "B", County of Hillsborough, Florida", dated March 7, 1997.

2. "Hydrogeological Investigation, Southeast County Landfill, Hillsborough County, Florida", prepared by Ardaman & Associates, dated February 22, 1983.

3. "Geotechnical Investigation at Southeast Landfill, Hillsborough County, Florida", prepared by Ardaman & Associates, dated March 7, 1994.

ASSUMPTIONS:

(Refer to the spreadsheet attached to this calculation).

APPROACH:

1. Determine the alignment of the proposed HDPE access pipe from drawing.

2. Use the one-dimensional consolidation equation to estimate total and differential settlements.

3. Plot pipe settlement profile to see if total and differential settlements will impact the performance of the HDPE pipe and backfill envelope

4. If pipe performance is adversely affected by settlements, provide recommendations for improvements.

SOLUTION:

1. Determine the alignment of the proposed HDPE access pipe from drawing. The station numbering system in the drawing was followed for the settlement profile. Station 0+00 or horizontal distance 0 feet represents the center line of the concrete vault and the beginning of the HDPE access pipe.

2. Use the one-dimensional consolidation equation to estimate total and differential settlements.

   See attached spreadsheet to this calculation. Values for the CR were taken from the Ardaman reports. Average value was used for CR. See Appendix 1 to this calculation.

3. Plot pipe settlement profile to see if total and differential settlements will impact the performance of the HDPE pipe and backfill envelope. See attached plot to this calculation.

4. From the attached spreadsheet results and profile, the total settlements under the anticipated maximum overburden at various locations along the pipe alignment range from 0.0 (at the end of pipe) to 3.64 feet (at the center of vault). These values assumed that the thicknesses of the existing phosphatic clay and sand layers as shown in the drawing are reasonably representative of the field conditions.

   The total differential settlement is about 3.62 feet for the entire length of the pipe (≈ 1,260 feet). This translates into a pipe/envelop deflection of 0.29 percent. This value is small when compared to the allowable ring deflection of 3.4 percent for a SDR 13.5 HDPE pipe.

   The maximum differential settlement is about 1.52 feet and occurs between Station 11+00 and Station 12+00. This translates into a pipe/envelope deflection of 1.52 percent over a 100-foot pipe section. This value is small when compared to the allowable ring deflection of 3.4 percent for a SDR 13.5 HDPE pipe. Consequently, the performance of the pipe/envelope should not be impacted by total and differential settlements.

Date: 05-14-97
Project: Southeast County Landfill, Hillsborough County, Florida
Filename: hill-set.wb2

Spreadsheet to calculate the amount of phosphatic clay settlement along HDPE access pipe alignment.

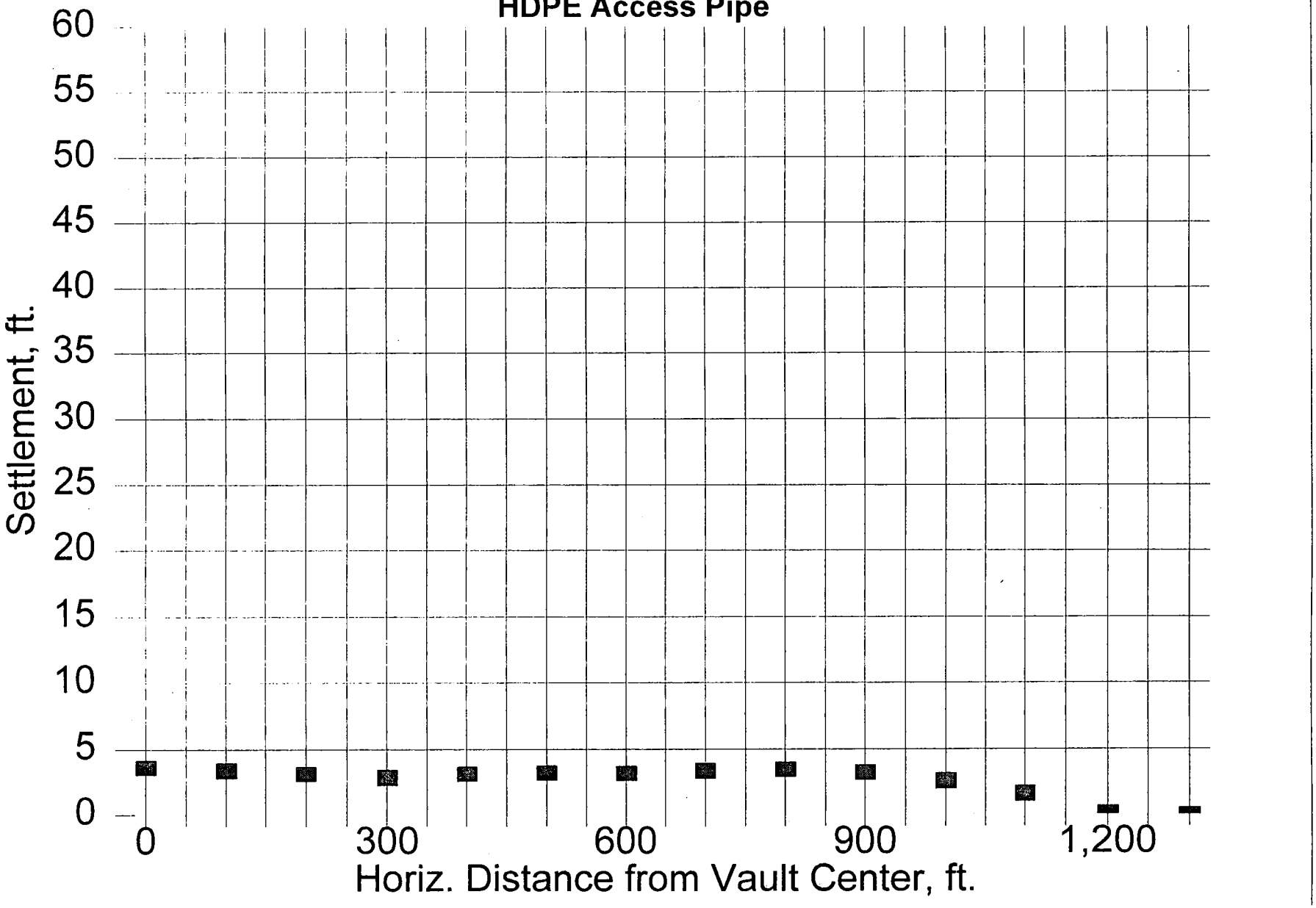
Equation: S = CR * H * log(P/Po), where
S = total settlement due to compression consolidation; feet.
CR = average virgin compression ratio = Cc/(1+eo) = 0.31 (See Appendix 1 to this calculation)
H = thickness of the compressible clay / foundation soil layer; feet.
P = total pressure acting on mid-height of the foundation soil layer,
(P = Po + surcharge, Q); psf.
Po = present effective overburden pressure at mid-height of the compressible clay / foundation soil layer; psf.
Q = surcharge = total waste overburden + earthfill (F) or - earth cut (C), psf.
Hs = Height of Waste, feet
C = Earth excavation, feet
F = Earthfill, feet

ASSUMPTIONS:
1. Average unit wt. of waste = 74 pcf.
2. Unit weight of existing sand layer soil = 110 pcf
3. Average unit weight of phosphatic clay = 80 pcf
4. PHASE 6 - Approx. maximum height of waste = 128 feet.

Location of Critical Points under Consideration	Top of Clay Elevation	Bottom of Clay Elevation	Top of Sand Elev.	Final Elev.	Clay Thick. H	Sand Thick.	Earth Fill F	Earth Cut C	Height of Waste Hs	CR	Surcharge Q	Po	P (Po + Q)	Total Settlement S	Differential Settlement Ds
	feet	feet	feet	feet	feet	feet	feet	feet	feet	-	psf	psf	psf	feet	feet
Horiz. Dist., ft															
(center of vault															
0	119.0	106.0	127.5	250.0	13.0	8.5	0	0	128	0.31	10,186	1,455	11,641	3.64	
															0.20
100	119.0	106.0	127.5	248.0	13.0	8.5	0	0	121	0.31	8,917	1,455	10,372	3.44	
															0.30
200	118.0	106.0	127.0	245.5	12.0	9.0	0	0	119	0.31	8,769	1,470	10,239	3.14	
															0.24
300	117.0	106.0	126.0	243.0	11.0	9.0	0	0	117	0.31	8,658	1,430	10,088	2.89	
															-0.25
400	118.0	106.0	126.5	241.0	12.0	8.5	0	0	115	0.31	8,473	1,415	9,888	3.14	
															-0.07
500	119.0	107.0	126.5	237.5	12.0	7.5	0	0	111	0.31	8,214	1,305	9,519	3.21	
															0.03
600	119.5	107.0	127.5	232.0	12.5	8.0	0	0	105	0.31	7,733	1,380	9,113	3.18	
															-0.23
700	120.5	107.5	127.0	227.5	13.0	6.5	0	0	101	0.31	7,437	1,235	8,672	3.41	
															-0.06
800	121.5	108.5	127.0	222.0	13.0	5.5	0	0	95	0.31	7,030	1,125	8,155	3.47	
															0.23
900	122.0	110.0	126.0	206.0	12.0	4.0	0	0	80	0.31	5,920	920	6,840	3.24	
															0.59
1,000	123.5	113.5	126.0	182.0	10.0	2.5	0	0	56	0.31	4,144	675	4,819	2.65	
															0.99
1,100	123.5	116.5	125.5	158.0	7.0	2.0	0	0	33	0.31	2,405	500	2,905	1.66	
															1.52
1,200	124.5	122.5	129.0	134.0	2.0	4.5	0	0	5	0.31	370	575	945	0.13	
															0.13
1,230	125.1	125.0	130.0	130.0	0.1	4.9	0	0	0	0.31	0	543	543	0.00	
(end of pipe)															

1. The surcharge, Q, of 10,186 psf at the center of vault includes 714 psf exerted by the weight of concrete vault + backfill.
2. Earth cut is ignored to be conservative on settlement value.

Figure 1. Settlement Profile
HDPE Access Pipe



APPENDIX 1

5.5 Consolidation Tests on Waste Phosphatic Clay

Seven incremental one-dimensional consolidation tests were performed on representative undisturbed samples of the waste phosphatic clay. The results of these tests are summarized in Appendix A.5, Figures A.5-1 through A.5-7.

Primary compression curves indicate that the waste clays are normally consolidated and highly compressible. The virgin compression ratio in terms of strain, CR, which governs the magnitude of primary virgin compression settlements, was found to range between 0.24 and 0.37. The recompression ratio, RR, was estimated to vary between 0.04 and 0.07.

Average CR= 0.31

The coefficient of consolidation, c_v, which governs the rate of consolidation, is on the order of 1.5×10^{-4} cm^2/sec for the normally consolidated range of stresses. Presented in Figure 5.5 is a plot of stress level versus coefficient of consolidation. The variation of effective vertical consolidation stress with void ratio is illustrated in Figure 5.6.

5.6 Clay Mineralogy

Three moist clay samples (No. 2, No. 4, and No. 7) from test hole 49 were supplied to R. T. Martin at MIT for mineralogical examination. After thorough mixing, a subsample was air dried and crushed to pass a sieve with 44 μm openings. The air dried powder was used to prepare random mounts for x-ray diffraction (XRD). The remainder of the moist sample was made into a 4% slurry based upon the air-dry water content. Small roots were removed from the slurries by pouring the slurry over a sieve with 44 μm openings. No mineral matter was retained on the sieve. The fairly uniform clay concentration facilitated comparison of clay relative peak amplitudes in the XRD data from the different samples.

The major crystalline phases were clay and apatite. Minor amounts of quartz, crandallite, wavellite, and dolomite were detected in the XRD data. The clay species were smectite, illite, and kaolin. Palygorskite was not detected. The results are summarized in Table 5.5 using relative peak amplitude, R, calculated from reference data generated specifically for phosphatic clay (Martin, 1982). The wavellite XRD peaks were too weak to allow a reliable estimate of R and no reference data were available for crandallite. While relative peak amplitude is not equivalent to weight percent, one normally expects the sum of R values from clay species to be approximately equal to total clay weight percent. The very low clay mineral sums are ascribed to inter-stratified clay material and/or nearly amorphous clay that gave no basal peaks but did contribute to the total clay XRD peak.

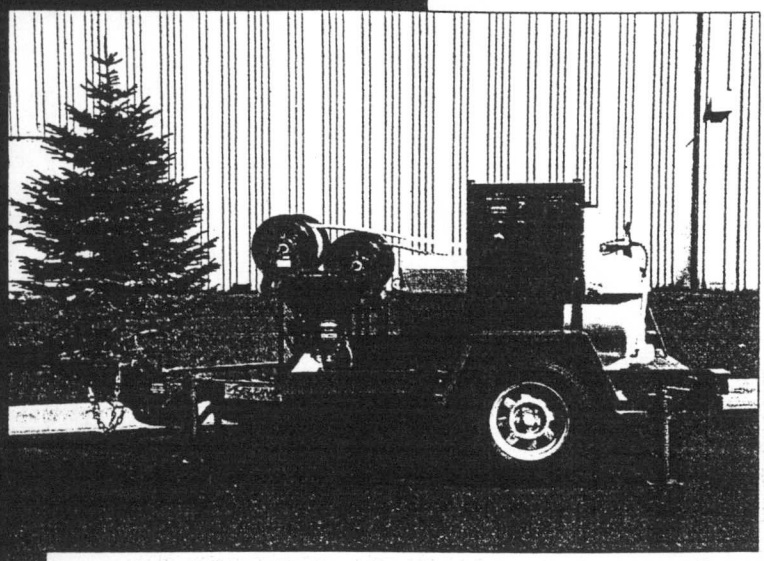
Partial X-ray diffractograms indicate the interstratified nature of the clay minerals. The smectite peak is a very broad doublet. Heat treatment increased significantly the low angle background which suggests interstratification. Both position and skewness of the kaolin peak suggest that kaolin probably is interstratified with the expandable layers. The poorly crystalline clay material in all three samples was dominantly an expandable phase that appeared to be interstratified with illite and probably also with kaolin.

SOURCE: ARDAMAN, 1983

ATTACHMENT E

PUMP DATA

(Prepared by SCS Engineers)



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Portable leachate pumping system is designed for sites with low leachate production eliminating the need for multiple dedicated pumping systems. State-of-the-art electronic level control and tank overfill protection facilitate automatic pumping operations. Features include: Baffled storage tank, power generator, patented wheeled sump drainer, and separate reels for hose and cables. Systems are available to meet a variety of flow and head requirements.

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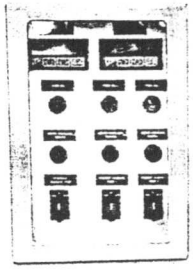
EPG PumpMaster™ control panels are all custom designed in our UL listed shop by specialists who understand the control requirements of the system. Available with a multitude of options, PumpMaster is a key component of your leachate collection system.



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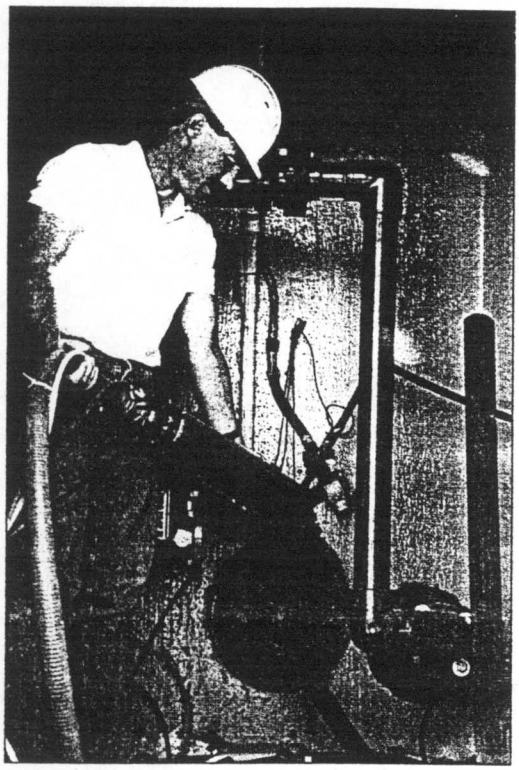

Innovative, patented design and accurate level sensing are reasons EPG's SurePump is the leachate pump of choice among landfill professionals. With thousands of successful applications, SurePump offers proven reliability.

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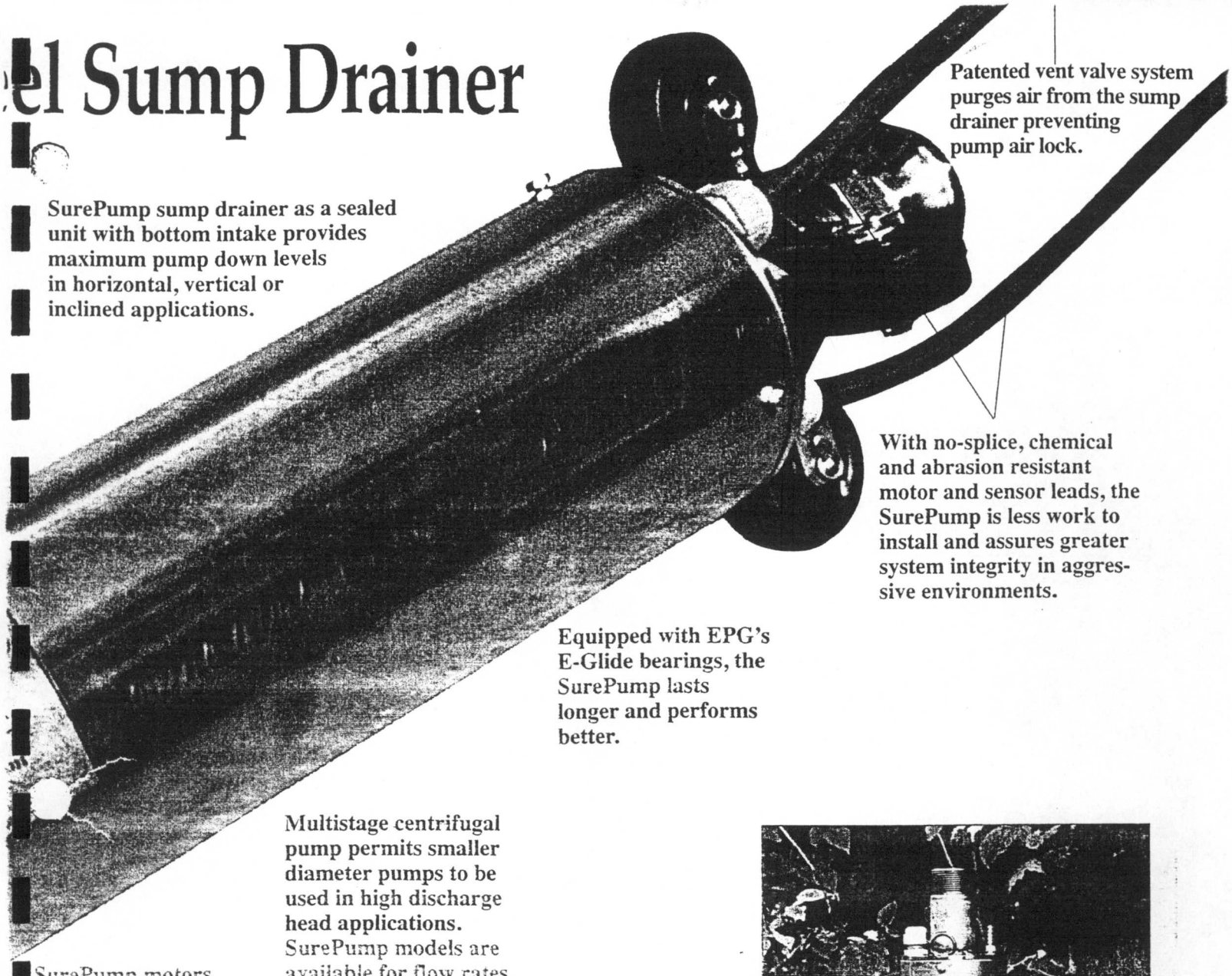
Unique design and wheel locations places at least four wheels in contact with the riser pipe surface at all times assuring easy installation and retrieval of the pump.

All stainless steel construction for maximum performance in aggressive environments.

Patented submersible level sensor mounting located along the central axis of the sump drainer assures accurate, repeatable level control.

SurePump runs cooler than other pumps because the intake screen is located below the motor. The sealed top assures that the liquid is only drawn from the bottom over the motor.

el Sump Drainer



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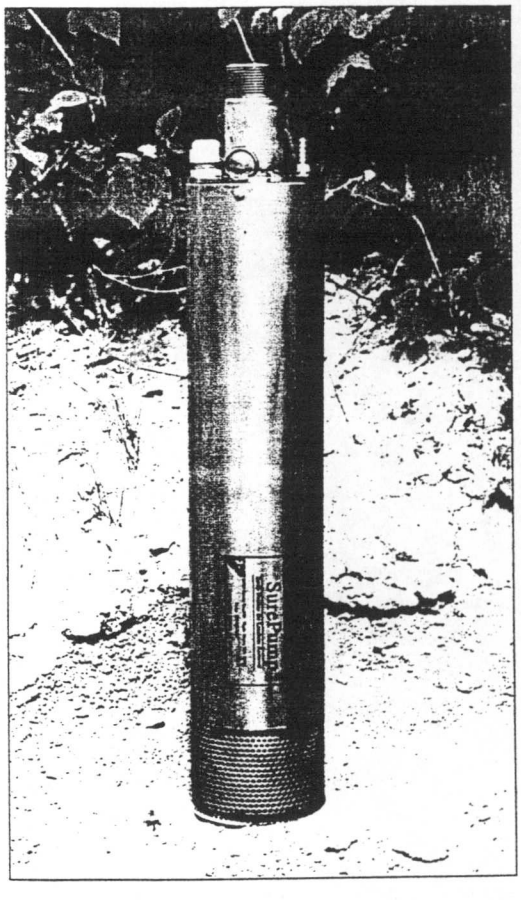

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WSD27 SurePump™
WHEELED SUMP DRAINER

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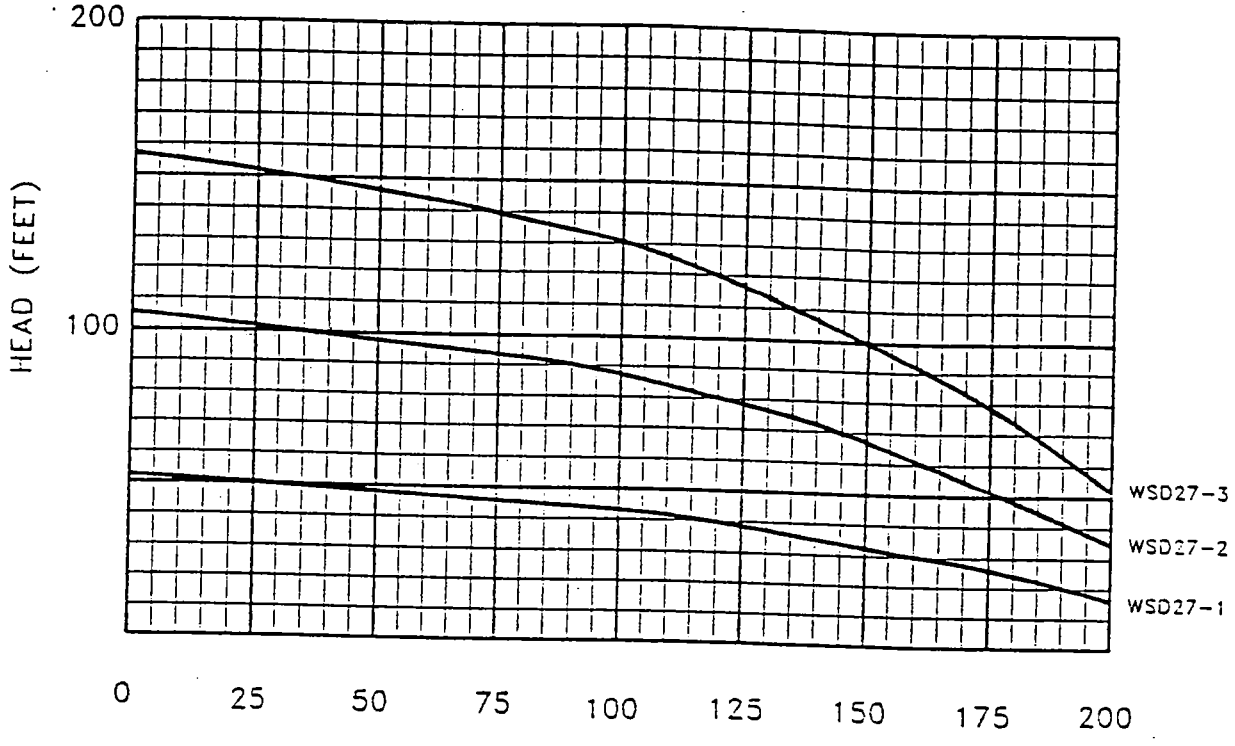
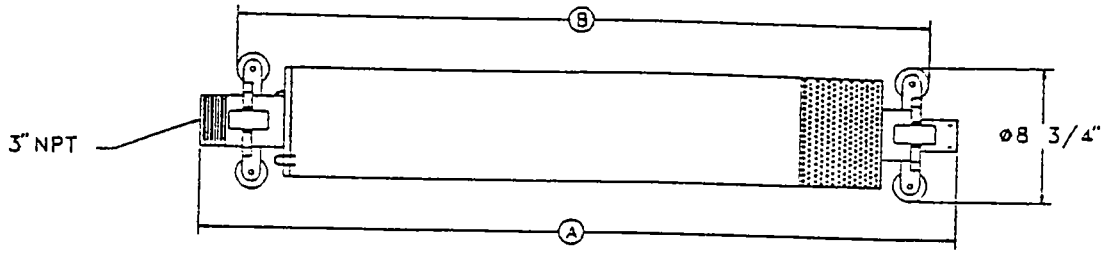




PUMP MODEL	SINGLE PHASE			THREE PHASE			SHIPPING WEIGHT (LBS)	
	MOTOR HP	A (in)	B (in)	MOTOR HP	A (in)	B (in)	1ø	3ø
WSD27-1	2.0	45.75	42.75	2.0	44.25	41.25	87.0	82.0
WSD27-2	5.0	63.50	60.50	5.0	57.50	54.50	140.2	120.5
WSD27-3	5.0	67.00	64.00	5.0	61.00	58.00	147.5	127.7

SEE 0579-2 FOR HIGH HEAD MODELS.

LANDFILL PROJECTS COMPLETED SINCE 1985

Achmar Landfill	Moody, AL
Adams Center	Fort Wayne, IN
Allan Park Ford Clay Mines	Dearborn, MI
Amelia Landfill	Amelia, VA
Anoka Landfill	Anoka, MN
Appeal Sanitary Landfill	Lusby, MD
Arbor Hills Landfill	Northville, MI
Arden Landfill	Washington, PA
Autumn Hills	Zealand, MI
Azusa Land Reclamation	Azusa, CA
Becker Ash Monofil	Becker, MN
BFI South Shelby County Landfill	Memphis, TN
BKK Landfill	West Covina, CA
Blackhawk County Landfill	Denver, IA
Bolten Road Landfill	Atlanta, GA
Brent Run Inc.	Genessee County, MI
C & C Landfill	Kalamazoo, MI
Carbon Limestone Landfill	Lowellville, OH
Carleton Farms Landfill	New Boston, MI
Cedar Ridge RD & F	Charlevoix, MI
Central Sanitary Landfill	Pompano Beach, FL
Central Vermont Landfill	East Montpelier, VT
Charles City County Landfill	Charles City, VA
Chemical Waste Management Inc.	Vickery, OH
Chestnut Ridge Landfill	Hieskill, TN
Citizens Disposal	Grand Blank, MI
City Environmental Services of Waters	Waters, MI
City Sand & Landfill	Sumpter, MI
County Landfill, Inc.	Leeper, PA
Countywide RDF	East Sparta, OH
Danville RDF	Danville, IN
Daubs Landfill	Fairfield, IL
Dauphin Meadows	Fleetwood, PA
Deep Valley	Oakdale, PA
Delaware County Landfill	
Diamond Reo	Flint, MI
Douglass County Landfill	Bennigton, NE
DPW Ash Ponds	Indianapolis, IN
Dubuque Landfill	Dubuque, IA
Eagle Valley RDF	Orion, MI

Envirosafe Services of Ohio	Oregon, OH
Evergreen RD & F	Northwood, OH
Forest View Landfill	Kansas City, KS
Gallatin National Landfill	Fairview, IL
Greater Wannachee Regional Landfill	Wannachee, WA
G.R.O.W.S. Waste Management	Morrisville, PA
Gulf Coast Landfill	Fort Meyers, FL
Hastings Landfill	Allegan, MI
Herrick Valley RDF	Adena, OH
Hickory Hills	Ridgeland, SC
Huron Monofill	Huron, MI
Imperial Landfill	Imperial, PA
Ironwood Landfill	Ironwood, MI
Kalmar Landfill	Rochester, MN
King William County Landfill	Williamsburg, VA
Laidlaw Waste Systems (Adrian)	Adrian, MI
Lake Area Disposal	Rice Lake, WI
Lakeview Landfill	Erie, PA
Lanchester-East Cell	Fleetwood, PA
LaPorte County Landfill	Michigan City IN
Laraway RDF	Elwood, IL
Little Dixie Landfill	Jackson, MS
Loraine County Landfill	Elyria, OH
Madison Prairie Landfill	Sun Prarie, WI
Mann 3 Landfill	Williamsburg, VA
Mar-Oco Landfill	Crivitz, WI
Masons Landfill	Suffolk, England
McLeod Landfill	Glencoe, MN
McKeen County	Mt. Jewett, PA
Medley Landfill	Miami, FL
Midland City Sanitary Landfill	Midland, MI
Mifflin County Solid Waste Authority	Lewistown, PA
Millersville Landfill	Severn, MD
Monroeville Landfill	Monroeville, PA
Modern Landfill	York, PA
Mount Lebanon	Mount Lebanon, PA
Mountain View Reclamation	Greencastle, PA
Northern Oaks	Harrison, MI
Oakridge Landfill	Dorchester, SC
Okeechobee Farms	Okeechobee, FL
Onieda County Landfill	WI
Orange County Landfill	Santa Anna, CA

Ottowa County Landfill	Port Clinton, OH
Outerloop RDF	Louisville, KY
Pasco Landfill	Pasco, WA
People's Disposal	Detroit, MI
Piedmont Landfill	Kernersville, NC
Pinnocle RDF	Dayton, OH
Pottstown Landfill	Pottstown, PA
Prairie View RDF	Wyatt, IN
Presque Isle Ash Monofil	Marquette, MI
Pueblo Disposal	Pueblo, CO
R.A. Bender Landfill	Chambersburg, PA
Red Hills Landfill	Kempster, WI
Red Wing Ash Monofil	Red Wing, MN
Riverbend Landfill	McMinnville, OR
St. Louis County Landfill	Virginia, MN
Seneca East RDF	Republic, OH
Seymour Road Landfill	Detroit, MI
Southern Alleghenies Disposal	Davidsville, PA
Statewide RDF	Canton, OH
Suburban Landfill	Brownsville, OH
Sullivan County Landfill	Monticello, NY
Three River Waste Management	Quebec, Canada
Tri-City RDF	Carsonville, MI
Vale Summitt Landfill	Frostburg, MD
Vernon County Landfill	Viroqua, WI
Vienna Junction Landfill	Erie, MI
Warner Company	Devault, PA
Washington County Landfill	St. Paul, MN
Westside RDF	Three Rivers, MI
Wilmarth Landfill	Wilmarth, MN
Woodland Meadows	Canton, MI
Y & S Landfill	Scottsdale, PA

ATTACHMENT F

PHOSPHATIC CLAY CALCULATIONS

(Prepared by SCS Engineers)

PURPOSE: Analyze the slope stability of the phosphatic clay under equipment load during excavation of the concrete vault.

REFERENCES:

1. Construction Drawings for "Southeast County Landfill, Phase VI Pump Station "B", County of Hillsborough, Florida", dated March 7, 1997.

2. "Hydrogeological Investigation, Southeast County Landfill, Hillsborough County, Florida", prepared by Ardaman & Associates, dated February 22, 1983.

3. "Geotechnical Investigation at Southeast Landfill, Hillsborough County, Florida", prepared by Ardaman & Associates, dated March 7, 1994.

4. PCSTABL5M slope stability program, developed by Purdue University.

ASSUMPTIONS:

1. Average shear strength of the phosphatic clay: c=180 psf, $\varnothing$ = 0 degree. (From Ardaman's report and recommendation)

2. Average shear strength of existing sand layer: c= 0 psf, $\varnothing$ = 30 degrees.

3. Maximum depth of excavation into the phosphatic clay = 3.5 feet.

4. Anticipated range of track-type equipment ground pressures: 5 to 10 psi.

APPROACH:

1. Draw cross section of excavation showing proposed cut slopes of 3 to 1.

2. Use the PCSTABL5M program to calculate the lowest safety factor under different loading conditions. Input equipment load as uniform load and test the sensitivity on safety factors by using 5 psi and 10 psi equipment loads. Vary the thickness of the sand layer above the clay to test the sensitivity on safety factors. The thickness of the sand can be changed during construction by using a "step" excavation method.

3. Summarize results and present recommendations.

SOLUTION:

1. See attached cross section for the excavation. The critical cross section analyzed has maximum excavation slopes of 3 to 1. The thicknesses of the existing sand and phosphatic clay layers around the vault area are about 8 and 15 feet, respectively. The maximum depth of excavation for the vault is about 3.5 feet. As a result, the cross section depicts a 3 to 1 cut slope of about 11.5 feet deep. A track-type equipment is located right at the edge or 5 feet from the cut slope with ground pressure ranges from 5 to 10 psi.

2. See attached graphs showing failure surfaces and corresponding critical safety factors.

3. The following table summarizes the slope stability results:

Equipment Load psi	Sand Thickness above clay feet	Clay Shear Strengths	Sand Shear Strengths	Failure Mode	Safety Factor	Filename
5 @ 5' from cut	2.0	C=180 psf	⌀ = 30°	circular	1.5 <= OK	Hill5.out
5@ edge of cut	2.0	C=180 psf	⌀ = 30°	circular	1.1	Hill7.out
10 @ 5' from cut	2.0	C=180 psf	⌀ = 30°	circular	0.8	Hill6.out

CONCLUSIONS AND RECOMMENDATIONS

1. In general, the thinner the sand layer above the phosphatic clay, the higher is the safety factor for stability as less overburden is exerted on the clay. However, a minimum of 2 feet of sand separation from the phosphatic clay is recommended to avoid bearing capacity failure since the sand will "bridge" the equipment load on the clay.

2. Only track-type equipment should be used during the excavation of the concrete vault. The maximum ground pressure exerted by the track-type equipment should be limited to about 5 psi, with minimum track width of 20 inches in order to have adequate safety factor against instability during construction depending on the site conditions during actual construction and approval by the engineer.

3. Excavation equipment shall keep a minimum of 5 feet from the edge of the slopes. All other equipment shall keep a minimum of 15 feet from the edge of cut slopes.

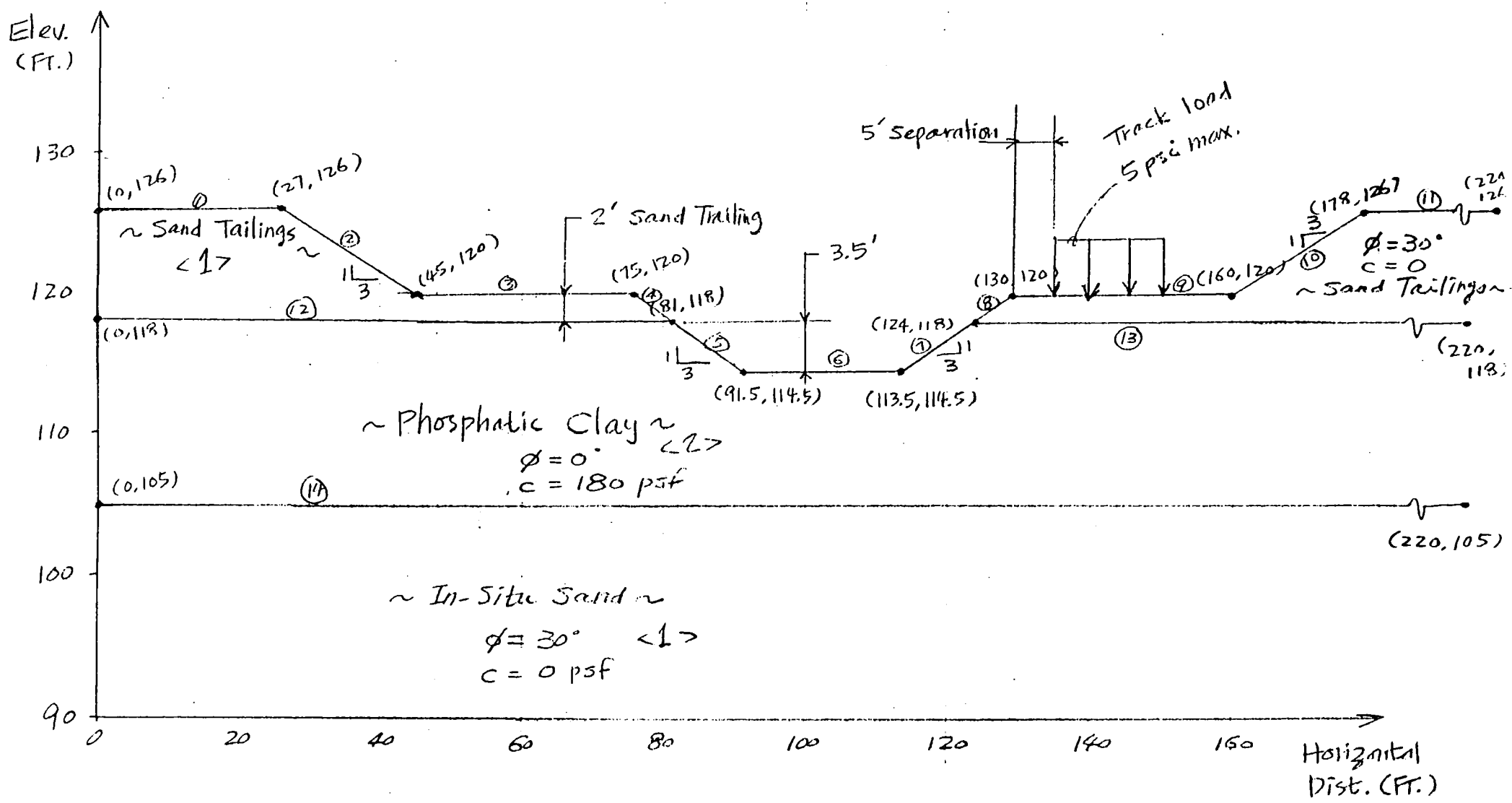
4. A "step" excavation is recommended to improve stability and construction efficiency. An exhibit is provided for the"step" excavation. Computer printouts for the stability analyses are also included.

5. Contractor shall be aware of all the potential risks during construction in soft clay. Although analyses indicate stability, bearing capacity and ground heave should not be a problem, local soil shear strenghths may be lower than what were assumed in the analyses. As a result, contractor shall have the necessary means to continue construction when weaker materials are encountered. Construction means and schedule shall be adjusted, if necessary, to accommodate such condition.

Project: Hillsborough County Southeast Landfill, Sump B design 09950297.12

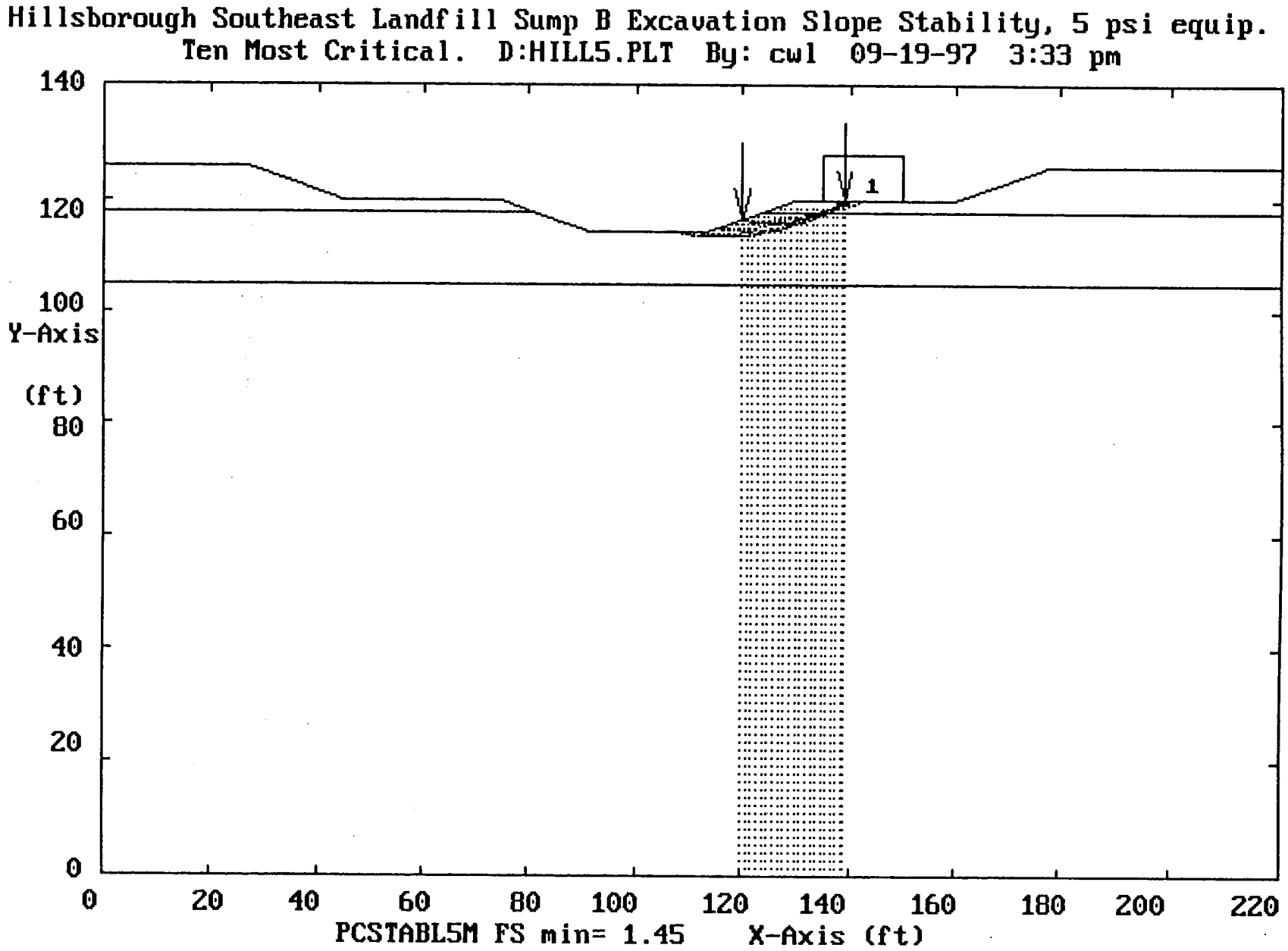
09/19/97

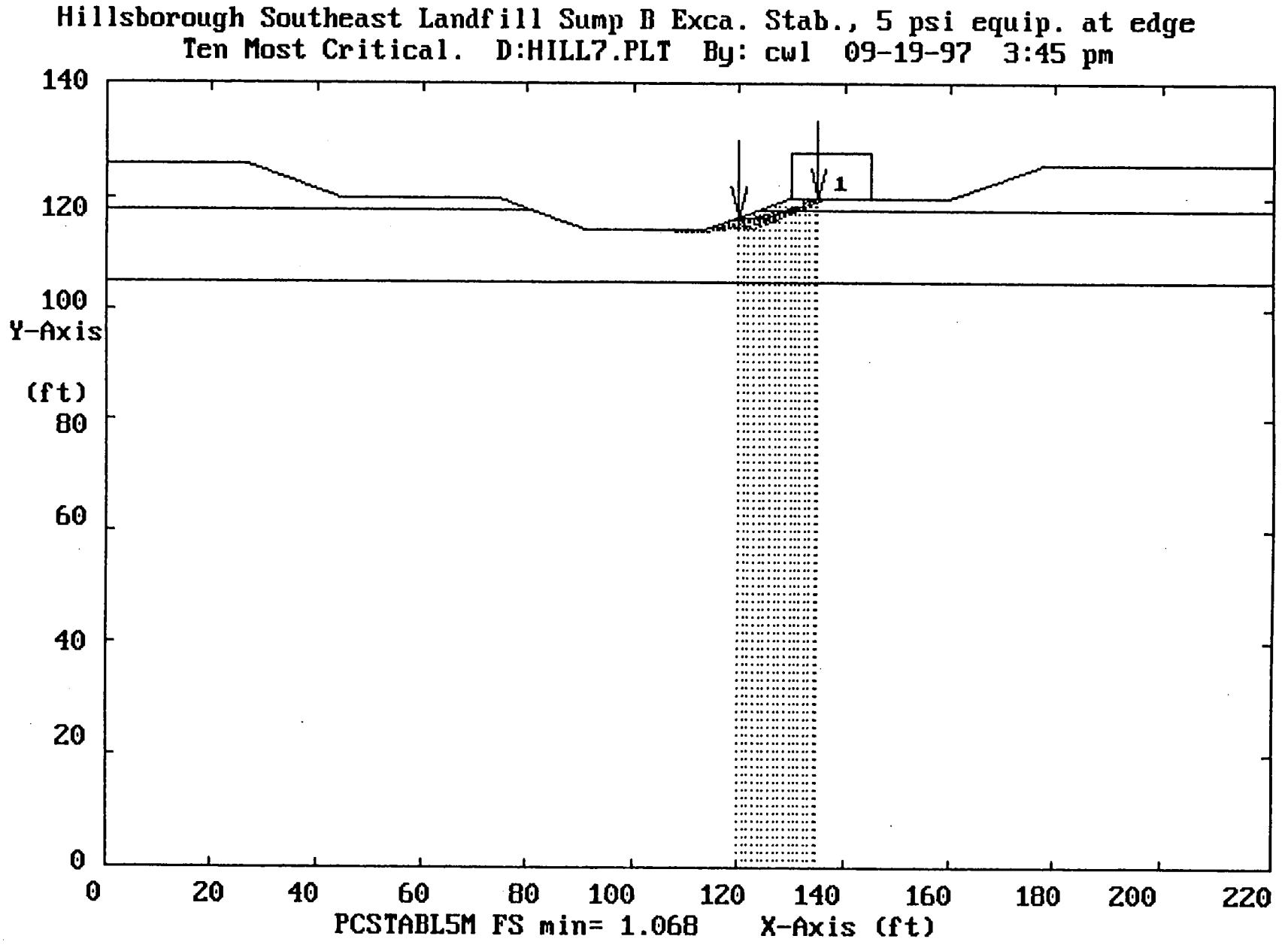
Excavation Plan & Stability Analysis.

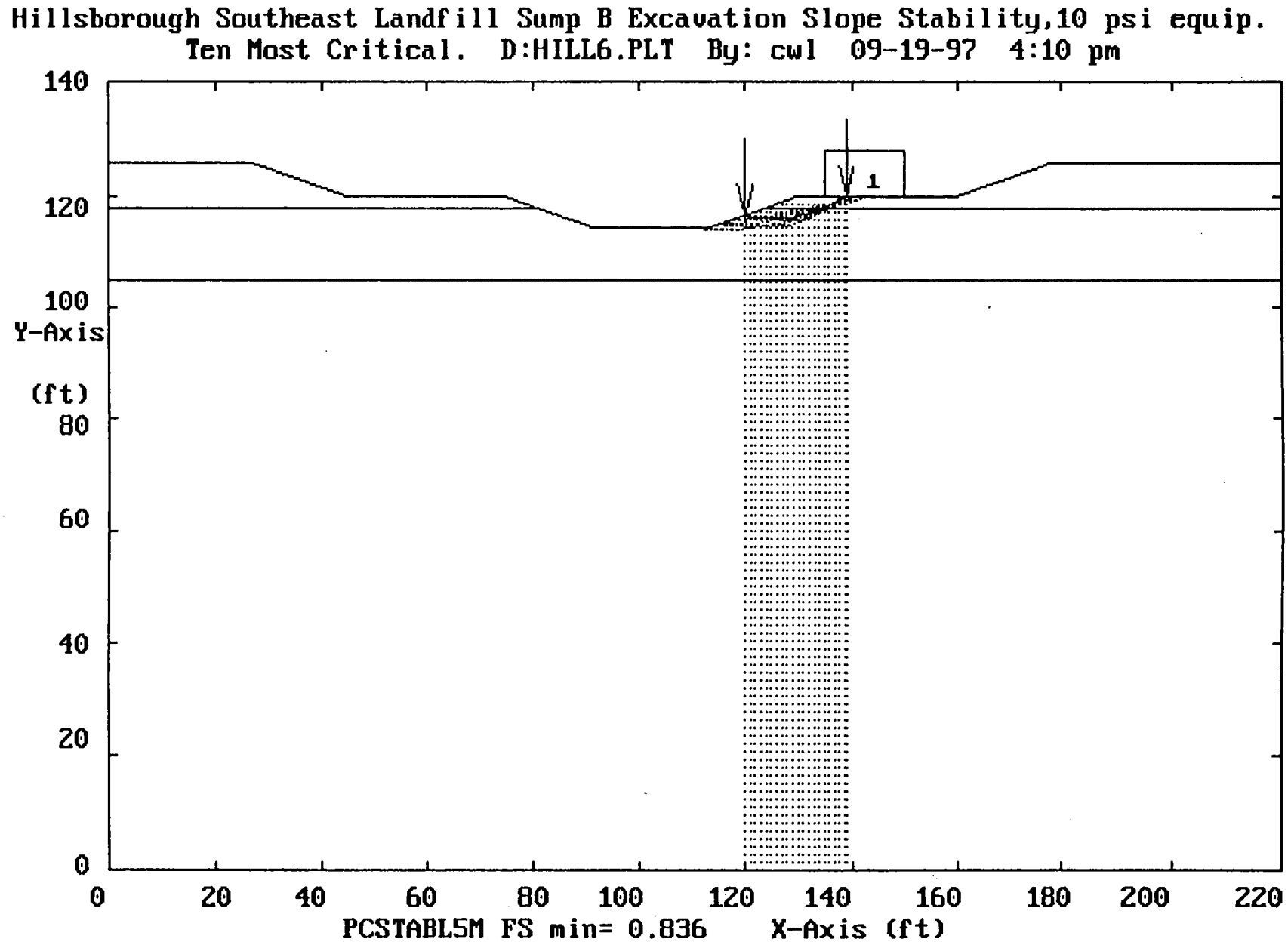


Vertical Scale: 1" = 10 FT.

Horizontal Scale: 1" = 20 FT.


Hillsborough Southeast Landfill Sump B Excavation Slope Stability, 5 psi equip.
Ten Most Critical. D:HILL5.PLT By: cwl 09-19-97 3:33 pm
140
120
100
Y-Axis
(ft)
80
60
40
20
0
1
0
20
40
60
80
100
120
140
160
180
200
220
PCSTABL5M FS min= 1.45
X-Axis (ft)


Hillsborough Southeast Landfill Sump B Exca. Stab., 5 psi equip. at edge
Ten Most Critical. D:HILL7.PLT By: cwl 09-19-97 3:45 pm
140
120
100
Y-Axis
(ft)
80
60
40
20
0
1
0
20
40
60
80
100
120
140
160
180
200
220
PCSTABL5M FS min= 1.068
X-Axis (ft)


Hillsborough Southeast Landfill Sump B Excavation Slope Stability,10 psi equip.
Ten Most Critical. D:HILL6.PLT By: cwl 09-19-97 4:10 pm
140
120
100
Y-Axis
(ft)
80
60
40
20
0
1
0
20
40
60
80
100
120
140
160
180
200
220
PCSTABL5M FS min= 0.836
X-Axis (ft)

PURPOSE: Estimate the allowable bearing capacity of the phosphatic clay under the load of the concrete vault and subsequent backfill during construction.

REFERENCES:

1. Construction Drawings for "Southeast County Landfill, Phase VI Pump Station "B", County of Hillsborough, Florida", dated March 7, 1997.

2. "Hydrogeological Investigation, Southeast County Landfill, Hillsborough County, Florida", prepared by Ardaman & Associates, dated February 22, 1983.

3. "Geotechnical Investigation at Southeast Landfill, Hillsborough County, Florida", prepared by Ardaman & Associates, dated March 7, 1994.

ASSUMPTIONS:

(Refer to the spreadsheet attached to this calculation.)

APPROACH:

1. Estimate the undrained shear strength (cohesion) of the phosphatic clay from the Ardaman reports and recent pocket penetrometer tests at the Phase 6 area.

2. Estimate the allowable bearing capacities of the phosphatic clay using the Terzaghi's equation in a spreadsheet format for the excavation equipment load and the concrete vault.

3. Recommend the maximum equipment ground pressure for excavation equipment.

4. If the allowable bearing capacity of the phosphatic clay is greater than the Required bearing capacity under the concrete vault and backfill during construction, ===> OK. Otherwise, need to provide reinforcement to make up the difference so that the concrete vault & backfill will not settle under its own weight during construction. The vault and backfill envelope is allowed to settle when waste placement begins.

SOLUTION:

1. From the Ardaman reports and results of recent pocket penetrometer tests performed at representative clay samples, the phosphatic clay could have an undrained shear strength (cohesion) of 180 pounds per square feet (psf) on the average-to-low end, and an average value of 250 psf.

2. See attached spreadsheet for bearing capacity calculations.

3. The allowable bearing capacity of the phosphatic clay for excavation equipment during construction is 5 pounds per square inches (psi).

4. The allowable bearing construction of the phosphatic clay during construction is estimated to be 3 psi. It is unlikely that the clay can carry the load from concrete vault and backfill during construction. The actual load exerted by the concrete vault and backfill will be calculated by a structural engineer as part of the vault design. As a result, reinforcement such as geogrid will be needed to keep the vault and backfill from settling during construction.

Project: Southeast Landfill, Hillsborough County, Florida
Project No.: 0995029.12
Date: 05/13/1997, Revised 09/18/97

Spreadsheet to Calculate the Allowable Bearing Capacity of Phosphatic Clay Underneath Proposed Concrete Vault DURING Construction

Terzaghi's equation of calculating bearing capacity (for Square Footing) is used:

Q ult = a1*(c * Nc)+(a2* B * g1 * Ng)+(g2 * Df * Nq), where

Q ult = ultimate gross bearing capacity of material, psf.
Q all = allowable bearing capacity of material, psf.
a1, a2 = shape factors. For square footings, a1 = 1.2, a2 = 0.4
c = cohesion of the material below footing/track level, psf.
Nc, Ng, Nq = soil bearing capacity factors whose values depend on the internal friction angle, from attached graph.
B = footing/track width, ft.
g1 = effective unit weight of soil BELOW footing/track level.
g2 = effective unit weight of soil ABOVE footing/track level.
Df = depth of footing/track BELOW lowest adjacent soil surface.

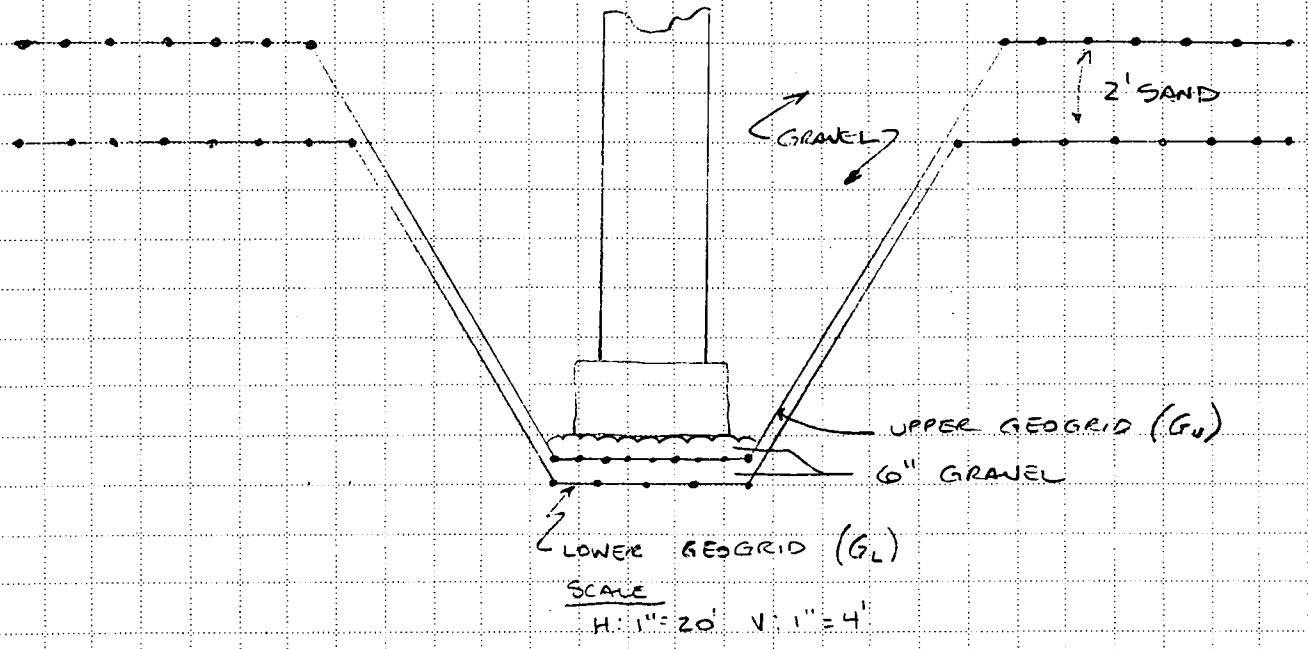
Assumptions:
1. Average unit weight of phosphatic clay = 80 pcf =g1.
2. Width of square footing for concrete vault = 14 ft. = B, width of equipment track width = 20 inches = 1.7 ft. = B.
3. Average unit weight of in-situ sand underneath footing/track = 110 pcf = g2, internal friction angle = 25 degrees.
4. Assume the track of equipment penetrates 1 foot of the 2-foot thick sand buffer ==> Df = 1 ft. (conservative, not to use Df = 2 ft.)
5. Undrained shear strength / cohesion of phosphatic clay = 180 psf (per Ardaman report and recommendation)
6. Internal friction angle of phosphatic clay = 0 degree during construction.
7. A safety factor of 3.0 is used in the allowable bearing capacity.

Scenario Description	a1	c psf	Nc	a2	B ft.	g1 pcf	Ng	g2 pcf	Df ft.	Nq	Q ult psf	Q all psf	Q all psi	
Vault, average-low cohesion	1.2	180	5.2	0.4	14	80	0	110	0	0	1,123	374	**3**	**<== use for const.**
Vault, high cohesion	1.2	250	5.2	0.4	14	80	0	110	0	0	1,560	520	4	
Equipment, avg-low cohesion	1.2	180	5.2	0.4	1.7	80	0	110	1	10	2,223	741	**5**	**<== use for const.**

Notes:
1. **Use reinforcement like geogrids to make up the difference between REQUIRED and ALLOWABLE bearing capacity DURING construction.**
2. **Use 180 psf cohesion and/or 3 psi as the allowable bearing capacity for the phosphatic clay to design the reinforcement.**
3. **Use track-type excavation equipment with maximum ground track pressure of 5 psi, with minimum track width of 20 inches.**
4. **The built-out (final graded) scenario for the concrete vault is not necessary since there will be approx. 128 feet of surcharge pressure on all sides of the vault foundation, and the applied bearing pressure exerted by the concrete vault at the base of the vault is small in comparison to the surcharge pressure.**

CLIENT	PROJECT	JOB NO.
HILLS COUNTY	PUMP STATION B	09950279.12
SUBJECT	BY	DATE
GEOGRID REINFORCEMENT UNDER VAULT	KAS	4-16-97
	CHECKED SCD	DATE 10-15-97

OBJECTIVE: ANALYZE CLAY'S BEARING CAPACITY, & IF NECESSARY, CALCULATE TYPE & INSTALLATION METHOD FOR A GEOGRID BENEATH THE CONCRETE VAULT



SCALE
H: 1"=20' V: 1"=4'

APPROACH: USE TENSION MEMBRANE THEORY DEVELOPED BY GIROUD, ET AL (1990) FOR THE CONDITION WHERE AN INFINITELY LONG VOID FORMS BENEATH THE VAULT.

1.) CALCULATE ANTICIPATED TENSION IN GEOGRID: (SEE ATTACHMENT 1)

$\alpha = p\,b\,\Omega$ WHERE: α = TENSION DEVELOPED IN GRID

p = EFFECTIVE PRESSURE ON GRID

b = VOID WIDTH (FOOTER DIMENSION)
= 14 FT (CONC. PAD WIDTH)

Ω = DIMENSIONLESS FACTOR USING 5% STRAIN IN CLAY (ASSUMING SUMP REGION SETTLES UNIFORMLY)
= 0.97 (SEE ATTACHMENT 2) ✓

CLIENT	PROJECT	JOB NO.
HILLS CNTY	PUMP STATION B	09952.12
SUBJECT	BY	DATE
GEOGRID — CONT.	KAS	4-16-97
	CHECKED	DATE
	SCD	10-15-97

THE EFFECTIVE PRESSUE WILL BE DERIVED BY SUBTRACTING THE BEARING CAPACITY (IN PSF) FROM THE ANTICIPATED OVERBURDEN UNIT PRESSURE (IN PSF), FOR BOTH THE INITAL CONSTRUCTION CONDITION AND FINAL BUILD OUT.

INITAL CONSTRUCTION

ANTICIPATED OVERBURDEN FROM VAULT + GRAVEL = 1,200 PSF ← ATTACH 3

BEARING CAPACITY (BY LEVNG) = 3 PSI = 432 PSF (ATTACH. 4)

INITIAL PRESSURE (p_i) = 1,200 − 432 = 768 PSF

FINAL CONSTRUCTION

ANTICIPATED OVERBURDEN = 9,472 PSF (ATTACHMENT 5) + 1200 PSF = 10,672 PSF

BEARING CAPACITY = 18,944 (ATTACHMENT 6).

FINAL PRESSURE (p_F) = 10,672 − 18,944 = −8,272 PSF ∴ NO GRID REQUIRED

THEREFORE, THE GEOGRID TENSION IS:

$$\alpha_i = (768\ \text{PSF} + \underbrace{0.5' \times 130\ \text{PSF}}_{6''\ \text{GRAVEL}}) \cdot (14\ \text{FT}) 0.97 \div \underbrace{2}_{\text{No. of GRIDS}} = 5,656\ \text{PSF}$$

2.) CALCULATE EMBEDMENT LENGTH DUE TO ANTICIPATED TENSION WITH:

$L = \alpha / 2C\sigma(\tan\phi)$ ← EQ. FROM ATTACHMENT 7 WHERE: L = RUNOUT LENGTH (FT)

α = CALCULATED TENSION (PSF)

$L_i = [5656\ \text{PSF} \times 1\ \text{FT WIDTH}] / 2(0.72)\,345 \tan 23°$ C = INTERACTION COEFFICIENT ← ATTACH 8

$\doteq 27$ FT = 0.72 (CONSERVATIVE)

ACTUAL RUNOUT > 27' ∴ O.K. ϕ = 29° IN GRAVEL, 20° IN SAND ← ATTACH 9

$\bar{\phi} = (0.35)(29) + (0.65)(20)$

$= 23°$

$\sigma_i = \bar{\gamma} * \bar{h}$

$\bar{\gamma} = 0.65(110) + 0.35(130)$

$= 117$ PCF

$\bar{h} = 0.65(4) + 0.35(1)$

$= 2.95$ FT

$\sigma_i = 2.95' \times 117\ \text{PCF} = 345\ \text{PSF}$

CLIENT	PROJECT	JOB NO.
HILLS CNTY	PUMP STATION B	09950129.12
SUBJECT	BY	DATE
GEOGRID — CONT.	KAS	4-16-97
	CHECKED SGD	DATE 10-15-97

3.) CHOOSE MATERIAL BASED ON SHORT TERM CONDITIONS, BECAUSE CLAYS BEARING CAPACITY WILL INCREASE AS CONSOLIDATION CONTINUES WITH THE BUILD-OUT OF THE LANDFILL.

SEE ATTACHMENT 10 FOR MATERIALS

USE WIDE-WIDTH TENSILE STRENGTH @ 5% STRAIN & TENSION (α) = 5,650 #/FT-WIDTH

ATTACHMENT 1

void (i.e. the deflected portion of the geosynthetic) is uniformly distributed; and (ii) the strain in the portion of the geosynthetic outside the void area is zero and, therefore, that portion of the geosynthetic does not move (i.e. the geosynthetic does not slide toward the void). These two assumptions greatly simplify the analysis, but no attempt has been made to evaluate their range of validity.

Infinitely Long Void

In the case of an infinitely long void, the deflected shape of the geosynthetic across the width of the void is cylindrical with a circular cross section, the strain is uniform, and the following relationships exist

$$1 + \varepsilon = 2\Omega \sin^{-1}[1/(2\Omega)] \qquad \text{(valid if } y/b \leqq 0{\cdot}5) \tag{11}$$

$$1 + \varepsilon = 2\Omega\{\pi - \sin^{-1}[1/(2\Omega)]\} \qquad \text{(valid if } y/b \geqq 0{\cdot}5) \tag{12}$$

where: ε = geosynthetic strain; y = geosynthetic deflection; b = width of the infinitely long void; and Ω= dimensionless factor. Basic SI units : y(m) and b(m); ε and Ω are dimensionless.

The dimensionless factor Ω is defined by

$$\Omega = (1/4)[2y/b + b/(2y)] \tag{13}$$

As a result of eqns (11), (12) and (13), there is a unique relationship between y/b, ε and Ω, which is given in Table 2 and shown in Fig. 10.

It is interesting to note that as ε tends towards zero eqn (11) tends toward

$$\Omega = 1/\sqrt{24\varepsilon} \tag{14}$$

This equation gives a good approximation of Ω when ε is less than 1% (see Fig. 10).

Giroud[3,7] has also shown that the tension in the geosynthetic, in the case of an infinitely long void, is given by

$$\alpha = pb\Omega \tag{15}$$

where: α = geosynthetic tension; p = pressure on the geosynthetic over the void area (i.e. vertical stress at the bottom of the soil layer over the void area); b = width of the infintely long void; Ω = dimensionless factor

y/b or y/(2r)
0·000
0·010
0·020
0·030
0·040
0·050
0·060
0·061
0·070
0·080
0·087
0·090
0·100
0·107
0·110
0·120
0·123
0·130
0·138
0·140
0·150
0·151
0·160
0·164
0·170
0·175
0·180
0·186
0·190
0·197
0·200
0·210
0·216
0·220
0·230
0·240

This table a
also Fig. 10
the geosyn
2r = diame
circular voi

SOURCE: " DESIGN OF SOIL LAYER - GEOSYNTHETIC SYSTEM OVERLYING VOIDS" GIROUD,

ATTACHMENT 2

TABLE 2
Values of Ω as a Function of Deflection or Strain

y/b or y/(2r)	*ε(%)*	*Ω*	*y/b or y/(2r)*	*ε(%)*	*Ω*
0·000	0·000	∞	0·242	15·00	0·64
0·010	0·027	12·51	0·250	15·91	0·62
0·020	0·107	6·26	0·260	17·15	0·61
0·030	0·240	4·18	0·270	18·43	0·60
0·040	0·425	3·15	0·280	19·75	0·59
0·050	0·663	2·53	0·282	20·00	0·58
0·060	0·960	2·11	0·290	21·10	0·58
0·061	1·000	2·07	0·300	22·50	0·57
0·070	1·30	1·82	0·310	23·93	0·56
0·080	1·70	1·60	0·317	25·00	0·55
0·087	2·00	1·47	0·320	25·39	0·55
0·090	2·15	1·43	0·330	26·89	0·54
0·100	2·65	1·30	0·340	28·43	0·54
0·107	3·00	1·23	0·350	30·00	0·53
0·110	3·20	1·19	0·360	31·60	0·53
0·120	3·80	1·10	0·370	33·23	0·52
0·123	4·00	1·08	0·380	34·90	0·52
0·130	4·45	1·03	0·381	35·00	0·52
0·138	5·00	0·97	0·390	36·60	0·52
0·140	5·15	0·96	0·400	38·32	0·51
0·150	5·90	0·91	0·410	40·00	0·52
0·151	6·00	0·90	0·420	41·86	0·51
0·160	6·69	0·86	0·430	43·67	0·51
0·164	7·00	0·84	0·437	45·00	0·50
0·170	7·54	0·82	0·440	45·51	0·50
0·175	8·00	0·80	0·450	47·38	0·50
0·180	8·43	0·78	0·460	49·27	0·50
0·186	9·00	0·76	0·464	50·00	0·50
0·190	9·36	0·75	0·470	51·18	0·50
0·197	10·00	0·73	0·480	53·13	0·50
0·200	10·35	0·72	0·490	55·00	0·50
0·210	11·37	0·70	0·500	57·08	0·50
0·216	12·00	0·69	0·562	70·00	0·50
0·220	12·44	0·68	0·631	85·00	0·51
0·230	13·56	0·66	0·696	100·00	0·53
0·240	14·71	0·64	0·819	130·00	0·56

This table also gives values of the strain as a function of the deflection, and vice versa. (See also Fig. 10.) Notations: Ω = dimensionless factor used for the calculation of the tension in the geosynthetic; y = geosynthetic deflection; b = width of the infinitely long void; $2r$ = diameter of the circular void; and ε = geosynthetic strain. (Note: in the case of a circular void, the values of ε and Ω given in this table are approximate.)

SOURCE: "DESIGN OF SOIL LAYER-GEOSYNTHETIC SYSTEM OVERLYING VOIDS", GIROUD, BONAPARTE, BEECH, GROSS, 1990.

ATTACHMENT 3

TONDELLI ENGINEERING, P.A. CIVIL, MECHANICAL, STRUCTURAL AND BUILDING DESIGN 3606 West Swann Avenue pa, Florida 33609 813-875-2929	Customer: SCS ENGINEERING	Page: 1 Of: 3
	HILLSBOROUGH COUNTY	Job: TE-1674
	Description: S.E. LANDFILL, DEWATERING	Date: 5-8-97
	CONCRETE VAULT	By: J. TONDELLI

GIVEN: MAXIMUM PRESSURE AT TOP OF VAULT

Soil Pressure W = 9,800 psf after fill is in place.

(per SCS Soils Engineers)

DEAD LOAD/VAULT WEIGHT

Min. Load,

Pmin = $(0.15)(10.67^2)(1.33) + 0.15(6^2)(1.33)(4) + 0.15(14^2)(1.33)$

$= 22.7 + 28.7 + 39.1 = 90.5$ kips + GRAVEL @ $[14^2 - 11^2] \times 9.5' + [14^2(2')] \times 130$ (LEVING)

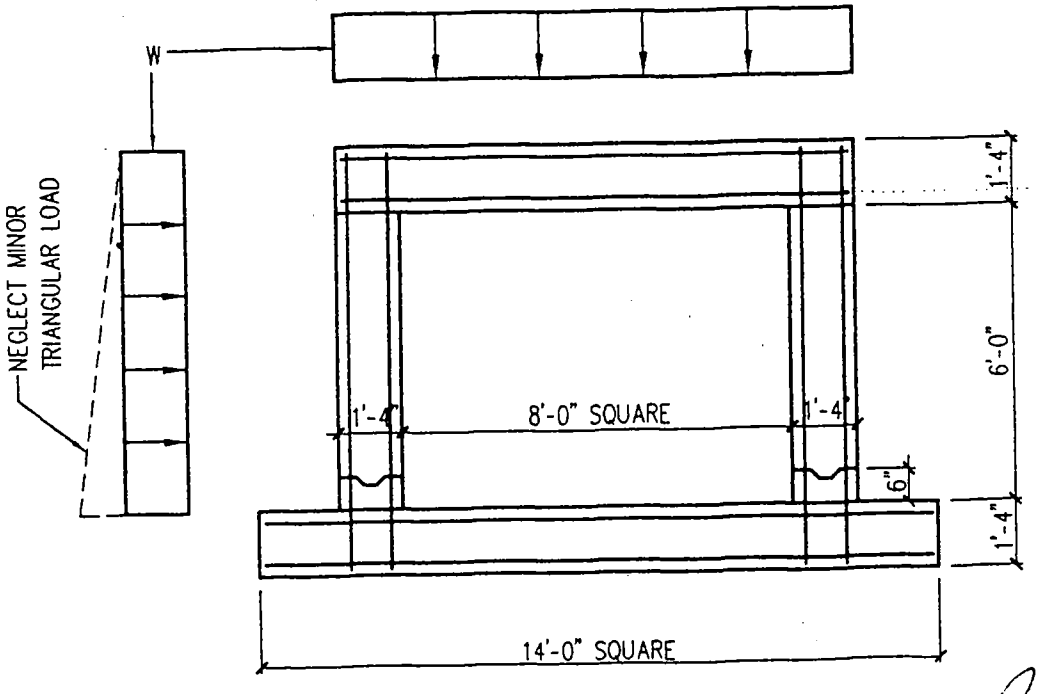
$= 90.5$ KIPS + 143.6 KIPS ✓

$= 234.1 \div 14^2 = 1200$ PSF OR 8.3 PSI ✓

SOIL PRESSURE ON SLABS

Max. Load,

Pmax = $90.5 + 9.8(10.67^2) = 1{,}206.2$ kips, Foundation Pressure = $\frac{1{,}206.2}{14^2} = 6.15$ ksf



Jon Tondelli 5/9/97

Fig. 1

Project: Southeast Landfill, Hillsborough County, Florida
Project No.: 0995029.12
Date: 05/13/1997, Revised 09/18/97

Spreadsheet to Calculate the Allowable Bearing Capacity of Phosphatic Clay Underneath Proposed Concrete Vault DURING Construction

Terzaghi's equation of calculating bearing capacity (for Square Footing) is used:

Q ult = a1*(c * Nc)+(a2* B * g1 * Ng)+(g2 * Df * Nq), where

Q ult = ultimate gross bearing capacity of material, psf.
Q all = allowable bearing capacity of material, psf.
a1, a2 = shape factors. For square footings, a1 = 1.2, a2 = 0.4
c = cohesion of the material below footing/track level, psf.
Nc, Ng, Nq = soil bearing capacity factors whose values depend on the internal friction angle, from attached graph.
B = footing/track width, ft.
g1 = effective unit weight of soil BELOW footing/track level.
g2 = effective unit weight of soil ABOVE footing/track level.
Df = depth of footing/track BELOW lowest adjacent soil surface.

Assumptions:
1. Average unit weight of phosphatic clay = 80 pcf =g1.
2. Width of square footing for concrete vault = 14 ft. = B, width of equipment track width = 20 inches = 1.7 ft. = B.
3. Average unit weight of in-situ sand underneath footing/track = 110 pcf = g2, internal friction angle = 25 degrees.
4. Assume the track of equipment penetrates 1 foot of the 2-foot thick sand buffer ==> Df = 1 ft. (conservative, not to use Df = 2 ft.)
5. Undrained shear strength / cohesion of phosphatic clay = 180 psf (per Ardaman report and recommendation)
6. Internal friction angle of phosphatic clay = 0 degree during construction.
7. A safety factor of 3.0 is used in the allowable bearing capacity.

Scenario Description	a1	c psf	Nc	a2	B ft.	g1 pcf	Ng	g2 pcf	Df ft.	Nq	Q ult psf	Q all psf	Q all psi	
Vault, average-low cohesion	1.2	180	5.2	0.4	14	80	0	110	0	0	1,123	374	**3**	**<== use for const.**
Vault, high cohesion	1.2	250	5.2	0.4	14	80	0	110	0	0	1,560	520	4	
Equipment, avg-low cohesion	1.2	180	5.2	0.4	1.7	80	0	110	1	10	2,223	741	**5**	**<== use for const.**

Notes:
1. **Use reinforcement like geogrids to make up the difference between REQUIRED and ALLOWABLE bearing capacity DURING construction.**
2. **Use 180 psf cohesion and/or 3 psi as the allowable bearing capacity for the phosphatic clay to design the reinforcement.**
3. **Use track-type excavation equipment with maximum ground track pressure of 5 psi, with minimum track width of 20 inches.**
4. **The built-out (final graded) scenario for the concrete vault is not necessary since there will be approx. 128 feet of surcharge pressure on all sides of the vault foundation, and the applied bearing pressure exerted by the concrete vault at the base of the vault is small in comparison to the surcharge pressure.**

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SOLUTION: (Cont'd) (LEUNG)

2. Calculate the required bearing capacity under the landfill final build out scenario.

   Waste overburden over sump "B" = 128 ft of ash x 74 pcf = 9,472 pcf.

   Concrete vault (14' x 14') + backfill ≈ 70 tons = ~~70 tons~~ x 2,000 lb./ton / (14' x 14')
   = ~~714~~ pcf.

===> Total overburden or require bearing capacity = 9,472 + 714 pcf = 10,186 pcf = 70.7 psi.

3. See attached spreadsheet for bearing capacity calculations.

4. The allowable bearing capacity (with a safety factor of 3.0) of the phosphatic clay during construction is estimated to be 44 pounds per square inches (psi), which is smaller than the required capacity, 70.7 psi. It means the concrete vault will continue to settle. However, the magnitude of settlement should be relatively small, since majority of the settlement would have occurred during the active filling period. In addition, the vault and the piping system is designed to settle during the life of the landfill.

Project: Southeast Landfill, Hillsborough County, Florida
Project No.: 0995029.12
Date: 05/13/1997

Spreadsheet to Calculate the Allowable Bearing Capacity of Phosphatic Clay Underneath Proposed Concrete Vault @ FINAL Landfill Build Out

Terzaghi's equation of calculating bearing capacity (for Square Footing)is used:

Q ult = a1*(c * Nc)+(a2* B * g1 * Ng)+(g2 * Df * Nq), where

Q ult = ultimate gross bearing capacity of material, psf.
a1, a2 = shape factors. For square footings, a1 = 1.2, a2 = 0.4
c = cohesion of the material below footing/track level, psf.
Nc, Ng, Nq = soil bearing capacity factors whose values depend on the internal friction angle, from attached graph.
B = footing/track width, ft.
g1 = effective unit weight of soil BELOW footing/track level.
g2 = effective unit weight of soil ABOVE footing/track level.
Df = depth of footing/track BELOW lowest adjacent soil surface.

Assumptions:

1. Maximum waste overburden height = 128 feet of ash (approx.) over Sump "B" in Phase 6, average unit weight of ash = 74 pcf = g2 .
2. Local shear condition is considered.
3. Width of square footing for concrete vault = 14 ft.
4. The phosphatic clay will be allowed to consolidate and gains in shear strengths with time.
5. A safety factor of 3.0 is used for long-term bearing capacity.
6. Shear strengths information is derived from "undrained shear strength vs. effective vertical stress" graph in 1993 Ardaman report. cohesion = 0 psf, internal friction angle = 12.4 degrees, based on CU tests derived failure envelop.
7. Average unit weight of soil (phosphatic clay) below footing = 80 pcf = g1.

Scenario Description	a1	c psf	Nc	a2	B ft.	g1 pcf	Ng	g2 pcf	Df ft.	Nq	Q ult psf	Q all psf	Q all psi
Local shear	1.2	0	3.5	0.4	14	80	0	74	128	2	18,944	6,315	44
General shear	1.2	0	5.2	0.4	14	80	0	74	128	3	28,416	9,472	66

Notes:
1. Bearing capacity factors ref.: "Essentials of Soil Mechanics & Foundations", 2nd Ed., D.F. McCarthy, Reston Publishing, 1982. (attached)

D:\09\0995029.12\BEAR-FNL.WB2 (BY LEUNG)

ATTACHMENT 6

ATTACHMENT 7

longitudinal ribs and the flexibility and load-extension properties of the transverse ribs [5].

The following considerations are important for a soil pullout test setup to determine anchorage strength:

1. The test box must be deep enough to permit soil deformation above and below the geogrid as it pulls out of the soil mass. For gravel-size soils this probably requires 12 in. (30 cm) of soil above and below the geogrid.
2. The test box must be long enough to allow for the applied stress on the geogrid to dissipate fully. The number of transverse ribs that are required is dependent on both the geogrid and soil type. Clearly, a box *at least* 3 ft. (1 m) long is necessary.
3. To monitor the geogrid's deformation behavior, a number of telltales on different parts of the embedded geogrid are necessary—that is, the incremental movement should be determined. These telltales are often piano wires attached to the geogrid's nodes and extended out through the rear of the box to which dial indicators are attached.
4. The applied normal force on such a large box can be enormous, requiring a very strongly braced and supported system.
5. The geogrid must be gripped from within the encapsulated soil mass. If gripped from outside of the text box, passive pressure may be set up against the face of the box, which could impose additional (and quite unknown) normal stresses on the front portion of the test specimen.
6. Geogrids, which are quite strong, will require a high-strength pullout system for the actual geogrid withdrawal.

Figures 3.5a and b show a soil pullout box (schematic diagrams and photographs) for testing the anchorage behavior of geogrids. While the preceding test description is clearly not simple (the test is probably the most sophisticated and expensive of all geosynthetic performance tests at this time), tests have been conducted in the aforementioned manner. Results from the preceding type of soil pullout testing are shown in Figure 3.6

Analysis of the type of data shown in Figure 3.6 leads to the determination of an interaction coefficient C_i, which can be used for the design of a specific type of geogrid embedded in the anchorage zone behind a potential failure plane. It is obviously geogrid, soil type, and testing parameter specific. For example, if a geogrid anchorage test is conducted according to failure by sheet pullout, the following equation can be formulated:

$$A = 2C_i L_e \sigma_n' \tan \phi' \tag{3.4}$$

where A = the anchorage capacity per unit width (lb./ft.),
C_i = the interaction coefficient, (DOES NOT INCLUDE COHESION FROM CLAY).
L_e = the length of geogrid embedment,
σ_n' = the effective normal stress on the geogrid, and
ϕ' = the effective soil friction angle. (INTERNAL FRICTION ONLY, NOT INTERFACE)

SOURCE: "DESIGNING W/ GEOSYNTHETICS", KOERNER, 3rd EDITION.

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Table 3.3 Results of direct shear tests using various geogrids*

	Test #1		Test #2	
Test Condition	*Friction Angle (deg.)*	*Efficiency*	*Friction Angle (deg.)*	*Efficiency*
Soil to soil	44	100%	44	100%
Soil to biaxial geogrid #1	43	96%	44	100%
Soil to biaxial geogrid #2	45	103%	45	103%
Soil to biaxial geogrid #3	46	107%	46	107%
Soil to uniaxial geogrid #1	35	72%	37	78%
Soil to uniaxial geogrid #2	37	78%	39	84%
Soil to uniaxial geogrid #3	42	93%	43	96%

USE THIS

*The geogrids were firmly attached to a wooden platen in the movable portion of the shear box and slid over the stationary soil in the bottom of the shear box. The shear box was 18 in. (450 mm) square.

available from Sarsby [2], who investigated the influence of aperture size versus soil particle size on the frictional efficiency of a number of geogrids. He has found that the optimum transfer of shear stress, that is, the highest efficiency, occurs when

$$B_{GG} \geq 3.5\, d_{50} \tag{3.3}$$

where B_{GG} = the minimum width of geogrid aperture, and
d_{50} = the average particle size of the backfilling soil.

This is an important consideration when selecting the type of backfill to be used around geogrids. This criterion can usually be accommodated by a wide selection of soil types for backfilling purposes.

3.1.2.4 Anchorage Strength from Soil Pullout The intrinsic merit of geogrids comes about by their anchorage strength or pullout resistance, which can far exceed the direct shear strength that was just discussed. Interesting comparison tests between steel grids, steel plate, polymer geogrids, and polymer geonets are reported by Ingold [3]. This behavior comes about by virtue of the large apertures in the geogrid allowing for soil strike-through from one side of the geogrid to the other. Obviously, the soil particles must be sufficiently small to allow for full penetration; thus the d_{50} value in Equation 3.3 represents the recommended maximum particle size for a particular geogrid's minimum aperture width.

The anchorage strength, or pullout resistance, is a result of three separate mechanisms (see Figure 3.4). One is the shear strength along the top and bottom of the longitudinal ribs of the geogrid. The second is the shear strength contribution along top and bottom of the transverse ribs. The third mechanism is that of passive resistance against the front of the transverse ribs (see Figure 3.4). The soil goes into a passive state and resists pullout by means of bearing capacity. It has been analytically shown that this bearing capacity can be a major contributor to the overall anchorage strength of geogrids [4]. It indeed is a geogrid's forte and can be used admirably in this application mode. Experimental evidence follows the same trends. A hypothetical example of this follows:

SOURCE: "DESIGNING W/ GEOSYNTHETICS", KOERNER, 3rd EDITION.

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If the pile diameter, B, is small, the $\frac{1}{2}\rho B N_\gamma$ term can be omitted. There is also some evidence that the $\rho z(N_q - 1)$ term does not increase without bound, but rather, has as upper limit of $N_q \tan\phi$.

The *skin friction coefficient*, f_o, includes both cohesive and adhesive terms. In evaluating f_o and the bearing capacity factors, the friction angle ϕ should be increased by 2° to 5° for piles driven into sand. For drilled or jetted piles, no increase is necessary.

$$f_o = \text{smaller of} \left\{ \begin{matrix} c + p_h \tan\phi \\ c_a + p_h \tan\delta \end{matrix} \right\} \qquad 10.25$$

The friction angle, δ, can be obtained from table 10.6. The lateral earth pressure depends on the depth, down to a *critical depth*, after which it is essentially constant.[11]

$$p_h = k(\rho z - \mu) \qquad 10.26$$

[11] Between relative densities of 30% and 70%, the critical depth can be interpolated between 10 and 20 diameters.

$$z_{\text{critical}} = \left\{ \begin{matrix} 10B \text{ for relative density} < 30\% \\ 20B \text{ for relative density} > 70\% \end{matrix} \right\} \qquad 10.27$$

The *adhesion*, c_a, should be obtained from testing. In the absence of such tests, it can be approximated as a fraction of the cohesion. For rough concrete, rusty steel, and corrugated metal, $c_a = c$. For wood, $0.9c \le c_a \le c$. For smooth concrete, $0.8c \le c_a \le c$. For clean steel, $0.5c \le c_a \le 0.9c$.

For driven piles, the *coefficient of lateral earth pressure at failure*, k, also depends on the relative density. For loose sands (relative density < 30%), $2 \le k \le 3$. For driven piles in dense sand (relative density > 70%), $3 \le k \le 4$. For drilled piles, the coefficients of lateral earth pressure are approximately 50% of the values for driven piles. For jetted piles, the coefficients are approximately 25% of the driven values.

Of course, the pore pressure will not develop in drained sandy soils. For sand below the water table, the pore pressure will be

$$\mu = 62.4 \times \text{depth} \qquad 10.28$$

Table 10.6
Friction Angles

interface materials*	friction angle, δ, degrees
concrete or masonry on the following foundation materials:	
clean, sound rock	35
clean gravel, gravel-sand mixtures, and coarse sand	29–31
clean fine to medium sand, silty medium to coarse sand, and silty or clayey gravel	24–29
clean fine sand, and silty or clayey fine to medium sand	19–24
fine sandy silt, and non-plastic silt	17–19
very stiff clay, and hard residual or preconsolidated clay	22–26
medium stiff clay, stiff clay, and silty clay	17–19
steel sheet piles against the following soils:	
clean gravel, gravel-sand mixtures, and well-graded rock fill with spalls	22
clean sand, silty sand-gravel mixtures, and single-size hard rock fill	17
silty sand, gravel or sand mixed with silt or clay	14
fine sandy silt, and non-plastic silt	11
formed concrete or concrete sheet piling against the following soils:	
clean gravel, gravel-sand mixtures, and well-graded rock fill with spalls	22–26
clean sand, silty sand-gravel mixtures, and single-size hard rock fill	17–22
silty sand, and gravel or sand mixed with silt or clay	17
fine sandy silt, and non-plastic silt	14
miscellaneous combinations of structural materials:	
masonry on masonry, igneous and metamorphic rocks:	
dressed soft rock on dressed soft rock	35
dressed hard rock on dressed soft rock	33
dressed hard rock on dressed hard rock	29
masonry on wood (cross grain)	26
steel on steel at sheet-steel interlocks	17

* Angles given are ultimate values. Sufficient movement is required before failure will occur.

SOURCE: "CIVIL ENGR REF MANUAL" LINDEBURG, 5TH EDITION

ATTACHMENT 10

Product Name	Manufacturing process	Coating Type	Polymer Type[1]	Dimensional Properties			Wide Width Strip Tensile Strength ASTM D 4595-86 kN/m (lb/ft)/%				Long Term Design Strength GRI GG4[2] lb/ft	Manufacturer's Suggested Applications[3]
				Mass/Unit Area ASTM D 5261-92 g/m^2 (oz/yd^2)	Aperture Size mm (in)		Strength 5% strain		Ultimate Strength/%			
					MD	XD	MD	XD	MD	XD	Tallow (in sand)	

Nicolon/Mirafi Group

Miragrid 12XT	woven	PVC	PET	593 (17.5)	81.3 (3.2)	12.7 (0.5)	51.7 (3540)	NA	92.9 (6360) /10-15	NA	39.4 (2700)	W, S, E
Miragrid 18XT	woven	PVC	PET	661 (19.5)	81.3 (3.2)	12.7 (0.5)	64.8 (4440)	NA	136.7 (9360) /10-15	NA	57.6 (3945)	W, S, E
Miragrid 20XT	woven	PVC	PET	746 (22.0)	81.3 (3.2)	7.6 (0.3)	78.0 (5340)	NA	181 (12420) /10-15	NA	76.3 (5230)	W, S, E
Miragrid 22XT	woven	PVC	PET	1017 (30)	81.3 (3.2)	7.6 (0.3)	104.2 (7140)	NA	259 (17760) /10-15	NA	109.3 (7490)	W, S, E
Miragrid 24XT	woven	PVC	PET	1288 (38)	81.3 (3.2)	5.1 (0.2)	146.3 (10020)	NA	370 (25380) /10-15	NA	156.2 (10705)	W, S, E

The Reinforced Earth Co.

MX30	woven	PVC	PET	(9.8)	(3.2)	(0.5)	(1650)	NP	(3300)	NP	1056	W, S, E, B
MX60	woven	PVC	PET	(17.5)	(3.2)	(0.5)	(3540)	NP	(6360)	NP	2035	W, S, E, B
MX90	woven	PVC	PET	(19.5)	(3.2)	(0.5)	(4440)	NP	(9360)	NP	2995	W, S, E, B
MX120	woven	PVC	PET	(22.0)	(3.2)	(0.3)	(5340)	NP	(12420)	NP	3974	W, S, E, B
MX180	woven	PVC	PET	(30.0)	(3.2)	(0.3)	(7140)	NP	(17760)	NP	5210	W, S, E, B
MX240	woven	PVC	PET	(38.0)	(3.2)	(0.2)	(10020)	NP	(25380)	NP	7445	W, S, E, B

All values were requested to be minimum average roll values and all claims are the responsibility of the manufacturer. All product data are intended as a guide and are not all-inclusive. *Geotechnical Fabrics Report* recommends you contact manufacturers before making any specifying/purchasing decisions.

Product Name	Manufacturing process	Coating Type	Polymer Type[1]	Dimensional Properties			Wide Width Strip Tensile Strength ASTM D 4595-86 kN/m (lb/ft)/%				Long Term Design Strength GRI GG4[2] lb/ft	Manufacturer's Suggested Applications[3]
				Mass/Unit Area ASTM D 5261-92 g/m^2 (oz/yd^2)	Aperture Size mm (in)		Strength 5% strain		Ultimate Strength/%			
					MD	XD	MD	XD	MD	XD	Tallow (in sand)	

Tensar Technologies Inc. (cont.)

BX1300	PSD[B]	NA	PP	247 (7.3)	46 (1.8)	64 (2.5)	11 (740)	17 (1160)	17 (1160)	29 (1970)	NP	B
BX1400 (AR)	PSD[B]	NA	PP	247 (7.3)	46 (1.8)	64 (2.5)	10 (670)	15 (1010)	17 (1150)	25 (1700)	NP	asphalt reinforcement
BX1500	PSD[B]	NA	PP	473 (13.9)	25 (1)	30 (1.2)	17 (1160)	23 (1560)	29 (1990)	39 (2670)	NP	E
BX4100 (SG1)	PSD[B]	NA	PP	184 (5.4)	36 (1.4)	36 (1.4)	10 (650)	12 (850)	13 (900)	16 (1080)	NP	B, E
BX4200 (SG2)	PSD[B]D	NA	PP	260 (7.7)	36 (1.4)	36 (1.4)	13 (890)	18 (1230)	18 (1250)	23 (1570)	NP	B, E
GC1400 (ARC)	PSD[A]	NA	PP/PET	383 (11.0)	46 (1.8)	64 (2.5)	10 (670)	15 (1000)	17 (1150)	25 (1700)	NP	asphalt reinforcement, waterproofing
UX1000SB	PSD[B]	NA	HDPE	371 (10.9)	NP	NP	18 (1270)	NA	35 (2400)	NA	810	W, S, E
UX1400SB	PSD[B]	NA	HDPE	510 (15.0)	NP	NP	28 (1920)	NA	61 (4170)	NA	1335	W
UX1400HT	PSD[B]	NA	HDPE	434 (12.8)	NP	NP	31 (2150)	NA	65 (4430)	NA	1525	W, S, E, L, V
UX1500SB	PSD[B]	NA	HDPE	835 (24.6)	NP	NP	53 (3640)	NA	98 (6580)	NA	2190	W
UX1500HT	PSD[B]	NA	HDPE	635 (18.7)	NP	NP	56 (3850)	NA	103 7070	NA	2525	W, S, E, L, V
UX1600SB	PSD[B]	NA	HDPE	1134 (33.4)	NP	NP	70 (4820)	NA	125 (8540)	NA	2855	W
UX1600HT	PSD[B]	NA	HDPE	922 (27.2)	NP	NP	76 (5210)	NA	132 (9040)	NA	3285	W, S, E, L, V
UX1700HT	PSD[B]	NA	HDPE	1220 (36.0)	NP	NP	96 (6600)	NA	168 (11500)	NA	4000	W, S, E, L, V

[1] PET = Polyester
PP = Polypropylene
PE = Polyethylene

[2] $T_{allow} = T_{uk}\left[\frac{1}{FS_{ID} \times FS_{CR} \times FS_{CD} \times FS_{BD} \times FS_{JNT}}\right]$
where
FS_{ID} = partial factor of safety for installation damage
FS_{CR} = partial factor of safety for creep deformation
FS_{CD} = partial factor of safety for chemical degradation
FS_{BD} = partial factor of safety for biological degradation
FS_{JNT} = partial factor of safety for joints

[3] B = Base Reinforcement
W = Walls
S = Slopes
E = Embankments
[A] Punched sheet drawn laminated NPNW geotextile
[B] Punched sheet drawn
NP = Data not provided by manufacturer
NA = Manufacturer determined that this data was not applicable to the product or the data was unavailable.

ATTACHMENT G

CONSTRUCTION SPECIFICATIONS

(Prepared by SCS Engineers)

TABLE OF CONTENTS

SOUTHEAST COUNTY LANDFILL PERMANENT PUMP STATION B

SECTION 02220 - EXCAVATION, BACKFILL, FILL, AND GRADING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes excavating, trenching, shoring, transporting, stockpiling, placing, backfilling, compacting, grading, disposing materials, field testing, and quality control/quality assurance laboratory services required for the completion of all earthwork as shown on the Drawings and as specified herein, and in accordance with the provisions of the Contract for the Continuing Construction and Operation of the Southeast County Landfill, Contract/RFP No. C-206-89, and all documents referenced there in.

B. Where referenced, conduct earthwork in conformance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 1991 edition.

1.02 DEFINITIONS

A. DRAWINGS - The drawings or plans which show the character and scope of the Work to be performed and which have been prepared or approved by the ENGINEER. The Drawings are titled "Southeast County Landfill Phase VI Permanent Pump Station B Construction".

B. SPECIFICATIONS - Those portions of the Contract Documents consisting of written technical descriptions of material, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

C. CONTRACT DOCUMENTS - Includes the Bidding Documents, Agreement, Addendas, Drawings, Specifications, and current CONTRACTOR's Contract relating to operation and construction of the Southeast County Landfill (Contract No. RFP No. C-206-89), and all documents referenced there in.

D. CONTRACTOR - Waste Management Inc. of Florida.

E. COUNTY - Hillsborough County Solid Waste Management Department.

F. ENGINEER - SCS Engineers, U.S. Highway 301 North, Suite 700, Tampa, Florida, 33619.

1.03 RESPONSIBILITIES

A. Excavation, backfilling, sampling, and testing shall be performed by the CONTRACTOR only when the COUNTY or ENGINEER are present. A written notification shall be submitted to the ENGINEER a minimum of 24-hours prior to the CONTRACTOR performing any work. The CONTRACTOR shall be reimbursed for down-time costs incurred in the event a representative of the COUNTY or ENGINEER is not present for pre-approved scheduled work. Conversely, the CONTRACTOR shall reimburse the COUNTY or ENGINEER for down-time costs incurred in the event pre-approved scheduled work is not performed by the CONTRACTOR (with the exception of weather delays).

B. Health and Safety:

1. The CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. The CONTRACTOR shall take all necessary precautions for the safety of all employees on the work site and other persons who may be affected by the work.

2. The CONTRACTOR shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons and property or to protect them from damage, injury or loss. CONTRACTOR shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection.

3. The CONTRACTOR shall designate a responsible member of its organization as on-site health and safety officer whose duty shall be the prevention of accidents at the site.

1.04 SUBMITTALS

A. Health and Safety Plan: The CONTRACTOR shall submit a Health and Safety Plan for this work which includes, as a minimum:

1. The name of CONTRACTOR's on-site health and safety officer.
2. Safety procedures in the vicinity of excavations, trenches, and structures.
3. Response procedures to emergencies.

B. Excavation Plan: The CONTRACTOR shall provide a detailed construction plan for excavation and backfilling of phosphatic clay beneath the area of the work. The CONTRACTOR shall conduct test borings of the phosphatic clay in the area of construction to verify field conditions. The Excavation Plan and test boring results shall be submitted to the ENGINEER for review prior to starting construction activities, and shall, as a minimum, include the following:

1. A description of addressing safety issues in consideration of OSHA, Federal, State, and local safety requirements for excavations of this type.

2. Methods for the following activities shall be described:

    a. Excavation and slope stabilization.
    b. Stockpiling of materials.
    c. Shoring and Trenching (if necessary).
    d. Dewatering.
    e. Backfilling.

3. A description of the low-ground pressure equipment being used for excavation activities, such as Caterpillar E120B, or ENGINEER approved equivalent.

4. Controls for stormwater runoff and erosion control explaining how stormwater runoff will be diverted from entering into excavated areas.

5. A schedule describing the sequence of construction activities, which includes, as a minimum:

    a. Excavation (including a contingency plan if clays are not consolidated as estimated).
    b. Geogrid placement and backfill.
    c. Geotextile placement and 6" gravel cover.
    d. Placement of precast vault.
    e. Pipe connections.
    f. Gravel backfill to the top of surrounding phosphatic clay.
    g. Placement of sand backfill.
    h. Completion of gravel backfill.
    I. Geotextile placement over top of gravel.
    j. Completion of sand backfill.

C. Sand: The CONTRACTOR shall submit laboratory testing results for the sand to verify conformance to requirements of paragraph 2.01 (A), this Section. Results shall be submitted to and reviewed for completeness by the ENGINEER prior to material being incorporated into the project. Data required shall include, as a minimum, the following;

    1. Name of supplier.
    2. Two permeability tests (ASTM D5084).
    3. Two gradation tests (ASTM D422).

D. Gravel: The CONTRACTOR shall submit a material sample and laboratory testing results for the gravel to verify conformance to requirements of paragraph 2.02 (A), this Section. The sample and testing results shall be

submitted to and reviewed for completeness by the ENGINEER prior to material being incorporated into the project. Data required shall include, as a minimum, the following;

1. Name of supplier.
2. Written verification of stone mineral content (i.e., quartz or granite).
3. Los Angeles abrasion test results and soundness test results.
4. One gradation test (ASTM D422).

E. As-Built Survey: Horizontal and vertical topographic information depicting the actual grades, lengths, elevations and quantities of constructed items. Include the location and elevation of the top of each corner for the concrete vault and the location and invert elevations for pipes entering the vault, and for the pipes at termination.

1. Drawings shall be plotted on sheets measuring 24 inches by 36 inches and in a scale similar to the Contract Drawings. If multiple sheets are required, each sheet must include match lines.

2. All survey information shall reference the coordinate system as depicted in the Contract Drawings, and include a north arrow and scale designation.

3. Contour intervals of 1 foot, with index contours at every fifth contour.

4. Submit to the ENGINEER computer disks containing the as-built record drawing in AutoCAD® (version 12) or at a scale of 1:1. Prior to reducing data to electronic media, CONTRACTOR shall coordinate with ENGINEER on the layering system to be used for the computer files.

5. Contour lines shall be polylines with a width of zero, and an elevation (z-coordinate) assigned according to the elevation of the contour line.

6. Submit certificate signed by registered surveyor ensuring that elevations and locations of improvements are in conformance with the Contract Documents, or if not in conformance, certify as to variances from the Contract Documents.

1.05 EXISTING SITE CONDITIONS

A. Damage to property caused directly or indirectly, in whole or in part, by the CONTRACTOR shall be restored to the original condition by the CONTRACTOR at no cost to the COUNTY.

PART 2 - PRODUCTS

2.01 SAND

A. Sand shall be clean and free from organic and deleterious materials. Sand used for trenching backfill may be obtained on site and used upon the approval of the ENGINEER.

B. The sand used as backfill in the area of the PPS-B concrete vault shall be clean and free from organic and deleterious materials and have a minimum hydraulic conductivity of $1x10^{-2}$ cm/sec.

2.02 GRAVEL

A. Gravel shall be composed of naturally occurring, rounded river rock that is evenly graded and free of sand, roots, vegetation, and other non-mineral debris or injurious coatings of any kind. The gravel size shall conform to Florida Department of Transportation (FDOT) Size Number 5 of Coarse Aggregate.

2.03 GRANITE ROCK

A. Granite rock shall consist of crushed angular granite and shall be free from any limestone or deleterious materials. The gravel size shall conform to Florida Department of Transportation (FDOT) gradation Size Number 4.

PART 3 - EXECUTION

3.01 GENERAL EXCAVATION

A. Layout all excavations, structures, and piping, and establish elevations as shown on the Drawings. Perform all other layout work required. Layout work shall be performed by a licensed land surveyor registered in the State of Florida.

B. During construction, shape and drain excavation. Maintain ditches and berms to provide drainage and control erosion at all times. Protect graded areas against the action of elements prior to acceptance of work. Re-establish grade where settlement, washouts, or erosion damage occurs. Damaged areas shall be repaired at no additional cost to the COUNTY.

C. Excavated sand or soils not used for backfill shall be removed from the vicinity of the excavation and disposed of as directed by the ENGINEER as described in Part 3.06 of this section.

D. The phosphatic clays shall be excavated in cuts not to exceed 12 inches each in depth, maintaining side slopes as noted in 3.01(E), this Section.

E. At no time will the slopes of any excavation be steeper than 2 horizontal to 1 vertical (2:1).

F. When excavation has reached prescribed depths, the ENGINEER and COUNTY shall be notified to allow for inspection. If materials and conditions are not satisfactory to the ENGINEER, the ENGINEER will issue instructions as to the procedures to be followed to satisfactorily complete the contract within its intended scope.

G. If the bottom of any excavation is beyond the limits as shown on the Drawings or as directed by the ENGINEER, it shall be backfilled at the CONTRACTOR's expense with ENGINEER approved material.

H. Excavation into the phosphatic clay area shall be maintained well drained. The CONTRACTOR shall be responsible for dewatering during excavation and construction.

I. Excavated soil stockpiles shall not exceed 5 feet in height in areas underlain by phosphatic clay. Stockpiles shall be located a sufficient distance from the excavation so as not to induce slope failure into the excavation.

J. Excavation shall be a continuous operation through completion. The CONTRACTOR shall not leave any phosphatic clay excavations, boreholes, or tenches open overnight. All open holes shall be backfilled to the top of the phosphatic clay layer or covered, at the ENGINEER's direction, with acceptable material prior to leaving the site. Excavation of the phosphatic clay shall not begin if weather conditions show a high probability of significant rainfall.

K. All excavations shall conform to the Health and Safety Plan submitted under part 1.04(A), this Section.

L. Excavation equipment shall be kept a minimum of 5 feet from the edge of cut slopes. All other equipment shall be kept a minimum of 15 feet from the edge of cut slopes to protect against slope failure into the excavation. Heavy equipment used during construction and excavation shall have a maximum ground pressure of 5 psi and have a minimum track width of 20 inches.

3.02 HORIZONTAL ACCESS PIPES

A. Trenching operations shall proceed with due caution and protection of the existing leachate collection and removal system.

B. Excavate trench for horizontal access pipe as indicated on the Drawings and in such a manner as will give suitable room for laying the pipe within the trenches. The CONTRACTOR shall render the bottom of the excavations firm and dry. Excavations shall be approved by the ENGINEER prior to backfilling.

C. Place geotextile into completed trench.

D. Place bedding gravel in accordance with FDOT Standard Specifications (1991) Section 125-4.4 for Class B Bedding. Gravel shall be shaped to conform to the shape of the outside of the pipe.

E. After the installation of the horizontal access pipe is complete, the remaining gravel backfill may be placed.

F. Upon completing the placement of gravel, the geotextile shall be brought together and sewn in a manner which packs the gravel and prevents the gravel pack from sagging after the sewing operation is complete.

G. Pipe excavations shall be backfilled with the previously excavated soils. Backfill shall be placed in 8-inch loose lifts and compacted with mechanical tampers suitable for this purpose.

H. Special care shall be taken during the placing and compacting of the backfill to protect the integrity of the pipe.

I. Observe specific pipe manufacturer's recommendations regarding methods of backfilling and compaction.

J. Excavation equipment shall be kept a minimum of 5 feet from the edge of cut slopes. All other equipment shall be kept a minimum of 15 feet from the edge of cut slopes to protect against slope failure into the excavation. Heavy equipment used over pipe trenching shall have a maximum ground pressure of 5 psi and have a minimum track width of 20 inches.

3.03 VAULT

A. Excavation for the vault shall proceed with due caution and protection of the existing leachate collection and removal system.

B. At no time shall any equipment enter the excavation. As the vault is being placed, failure of the soil overburden may result in persons or equipment sinking into the phosphatic clay. Inspection of the phosphatic clay shall not include the use of heavy equipment.

C. Backfilling shall proceed immediately after placement of the vault. Gravel shall be placed around the perimeter of the vault to approximately the same elevation in 12-inch lifts. Sand backfill shall be placed in two-foot (24") lifts.

3.04 COMPACTION REQUIREMENTS

A. The sand shall be placed loosely.
B. The gravel shall be placed to achieve a firm and unyielding surface.

3.05 GRADING

A. All backfilled and/or regraded slopes shall be uniformly dressed to the grades shown on the Drawings.

B. The ENGINEER reserves the right to make adjustments or revisions in lines or grades as the work progresses in order to incorporate any surplus fill materials at the end of the project while still achieving the intent of the grading plan.

3.06 DISPOSAL OF PHOSPHATIC CLAY AND SURPLUS OR UNSUITABLE SOILS

A. No materials shall be removed from the site or disposed of by the CONTRACTOR except as directed by the ENGINEER or COUNTY.

B. CONTRACTOR shall coordinate disposal activities with the ENGINEER. Materials shall be placed in an area of sufficient distance from excavations so as to not create a surcharge loading adjacent to any excavation, and within the limits and to the fill heights as directed by the ENGINEER or COUNTY.

C. Suitable excavated material, as directed by the ENGINEER, may be used for fill or backfill.

- END OF SECTION -

SECTION 02940 - GEOTEXTILE

Part 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes the manufacture, testing, and installation of geotextile as shown on the Drawings and as specified herein, in accordance with provisions of the Contract Documents.

1.02 SUBMITTALS

A. Submit prequalification test reports, manufacturer's data, specifications, installation instructions, roll dimensions, and geotextile approval form.

B. Copies of evaluation reports provided by manufacturers demonstrating that properties for the materials comply with specification requirements.

C. ENGINEER's approval shall be obtained prior to the use of any materials in the project. Response time by the ENGINEER will be approximately one working day from the date of receipt of the complete submittal.

1.03 PROTECTION AND STORAGE

A. Each roll of material shall have a manufacturer's identification label. Each roll shall be labeled to provide product identification adequate for inventory and quality control purposes. The label shall provide as a minimum the manufacturer's name, product identification, lot number, roll number, and roll dimensions. Rolls shall be labeled as per ASTM D 4873, Guide for Identification, Storage, and Handling of Geotextiles.

B. Materials shall be shipped and stored in rolls furnished at the manufacturing facility to prevent exposure of the geotextile to ultraviolet light, precipitation, moisture, mud, dirt, dust, puncture, or other damaging conditions.

C. Rolls of geotextiles should not be stacked upon one another to the extent that deformation of the core occurs and outdoor storage should not be allowed to exceed six months. For storage more than six months, a temporary enclosure shall be constructed or they should be moved to within an enclosed facility. If stored outdoors, they shall be elevated from the ground and protected with a waterproof cover.

Part 2 - PRODUCTS

2.01 GEOTEXTILE

A. Material shall be a non-woven, needle-punched polypropylene or polyester geotextile as manufactured by Advanced Drainage Systems, Polyfelt, Amoco, Synthetic Industries, or ENGINEER approved equivalent conforming to the following properties:

Characteristics	Specifications	Test Method
Weight, oz/yd^2	> 8	ASTM D 5261
Thickness, mils	> 105	ASTM D 5199
Permittivity, sec^{-1}	> 1.2	ASTM D 4491
Apparent Opening Size, Sieve #	< 70	ASTM D 4751
Grab Strength, lbs	> 230	ASTM D 4632
Puncture Strength, lbs	> 100	ASTM D 4833
Mullen Burst Strength, psi	> 380	ASTM D 3786
Trapezoidal Tear Strength, lbs	> 8	ASTM D 4533

Part 3 - EXECUTION

3.01 GENERAL

A. Geotextile shall be tested during manufacturing for the compliance with the following minimum test frequencies shall be observed:

Property	Test Method	Minimum Frequency
Weight per Unit Area	ASTM D 5261	1/100,000 sf
Thickness	ASTM D 5199	1/100,000 sf
Grab Strength	ASTM D 4632	1/100,000 sf
Puncture Resistance	ASTM D 4833	1/100,000 sf
Mullen Burst Strength	ASTM D 3786	1/100,000 sf
Trapezoidal Tear Strength	ASTM D 4533	1/100,000 sf

The surface where the geotextile is to be placed shall be smoothly graded and free of debris, depressions, holes, or obstructions which may damage the material.

B. Geotextiles shall be installed in accordance with the manufacturer's recommendations. No equipment shall be allowed to operate on the geotextile, and any tears or damage to the geotextile shall be repaired prior to placement of sand-cement riprap, or rocks. The surface of the geotextile shall be kept relatively clean and free of debris during installation.

C. Overlap between geotextile panels shall be as recommended by manufacturer for application. Anchoring pins or staples shall not be used.

D. Geotextile sheets shall be joined by sewing. Sewing shall be accomplished by a chain-stitching sewing machine. The thread shall be polymeric thread which complies with geotextile manufacturer's recommendations and is a color which contrasts with the color of the geotextile. The seam shall be folded a minimum of 4 inches to one side ("J") seam and be secured with a double row of stitches. There shall be no horizontal seams on slopes unless approved by the ENGINEER.

E. The CONTRACTOR shall place all cover materials in such a manner to prevent damage to the materials, slippage of the underlying layers, and excessive tensile stresses in the materials.

3.03 REPAIRS

A. Any geotextile damaged during placement shall be replaced or repaired at the CONTRACTOR'S expense. A geotextile patch shall be placed over damaged areas and shall extend a minimum of 12 inches beyond the perimeter of the tear or damage. Patches shall be secured in place by sewing or thermal bonding. If thermal bonding is conducted, care shall be taken to prevent excessive heat damage to the high density polyethylene pipes and to the surrounding material. The CONTRACTOR shall be responsible for the documentation of repairs describing location and type of repair. Repair documentation shall be submitted to the COUNTY or ENGINEER.

3.04 GEOTEXTILE EXPOSURE FOLLOWING PLACEMENT

A. Exposure of geotextiles to the elements between lay down and cover shall be limited to a maximum of 30 days to minimize ultraviolet damage. Any geotextile exposed to sunlight for more than 30 days shall be removed and replaced with new material at the CONTRACTOR'S expense.

- END OF SECTION -

SECTION 02950 - GEOGRID

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes subgrade preparation, placement, and installation as required for the completion of the geogrid as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents.

1.02 QUALIFICATIONS

A. Manufacturer Qualifications: A qualified Manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacturer of geogrids with a history of successful production of geogrid for a minimum period of 3 years. The geogrid shall be manufactured by a single Manufacturer. The Manufacturer shall submit written information on the following:

1. Quality Control procedures for production or a Quality Control Procedures Manual. Sampling procedures, test frequencies, and methods shall be defined. The Manufacturer shall, at a minimum, comply with the quality control specification for this project.

2. Verification that the Manufacturer has successfully supplied geogrid during the last 3 years. The Manufacturer shall submit written information as follows:

    a. Name and location of project and date of installation.

    b. Contact name and phone number for each project.

    c. Geogrid type and surface area of geogrid installed.

1.03 SUBMITTALS

A. Thirty days prior to the delivery of the geogrid to the site the following information shall be submitted to the ENGINEER for review:

1. Manufacturer's Qualification.
2. Installation Plan.
3. Sample Warranties.
4. Geogrid Resin Information & Quality Control Certificates.
5. Geogrid Manufacturer Material Information & Quality Control Certificates.
6. Loading, unloading, and storage equipment recommendations.
7. A list indicating correlation between the Manufacturers Quality Control Certificates and individual geogrid rolls.

B. Roll Certification: Written on company letterhead, roll certification shall be provided for each roll of geogrid, including roll identification number, and the results of quality assurance/quality control testing performed by the manufacturer. At a minimum, the following tests shall be performed at a frequency of one per 44,000 square feet:

TEST	PROCEDURE
Mass/Unit Area	ASTM D 5261
Wide Width Tensile Strength (5% strain strength and ultimate strength)	ASTM D 4595 (each direction)

C. Warranty: The Manufacturer shall warranty the geogrid material for a period of not less than 20 years. The CONTRACTOR shall warranty workmanship for a period of not less than 1 year from the date of final acceptance.

D. Record Drawings: The CONTRACTOR shall submit a layout drawing reflecting as-built conditions and related installation details (i.e., panel layout, penetrations) of the actual geogrid system. The layout record drawings shall:

1. Be at the same scale as the Contract Drawings, and use applicable drafting standards including a border identifying the project.

2. Indicate the installed field panel and seam number, configuration, dimensions, and geogrid penetrations.

3. Include the installed area, in square feet, with surveyed coordinates of the location for the limits of installed geogrid.

4. Include a topographic survey reflecting the installed elevation of the upper geogrid, signed and sealed by a professional surveyor in the State of Florida. The survey shall include spot elevations taken a minimum of every 50 feet.

PART 2 - PRODUCTS

2.01 GEOGRID

A. Material shall be manufactured by Tensar, TC Mirafi, or ENGINEER approved equivalent and at a minimum, meet the following properties:

PROPERTY	TEST METHOD	VALUE
Mass/Unit Area	ASTM D 5261	30 oz/yd^2
Wide Width Tensile Strength (at 5% strain)	ASTM D 4595	5,700 lb/ft

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. The geogrid shall be packaged and shipped by manufacturer in a manner to protect the integrity of the geogrid from damage.

B. Each roll shall be delivered to the site bearing markings which provide: the roll and manufacturer's lot number, type, length and width of the material; and the proper direction to unroll the material to facilitate layout and positioning in the field.

C. The CONTRACTOR shall provide transportation, labor, and handling for delivery of the geogrid to and from the project location. Special transportation or handling requirements required for the geogrid shall be provided by the CONTRACTOR.

D. The equipment for transportation, handling, loading and unloading the geogrid shall be of sufficient size and capacity to safely and efficiently handle geogrid materials without damage occurring. The type, size and capacity shall be according to Manufacturer requirements.

E. The geogrid shall not be stored or unloaded in areas which will impair the operations of the landfill facility or cause damage.

F. Storage and protection requirements of the materials shall be provided by the CONTRACTOR in accordance with manufacturer's recommendations.

3.02 GEOGRID INSTALLATION

A. Geogrid shall be laid at the proper elevation and alignment as shown on the Drawings.

B. Overlap, joints, and repairs shall be in accordance with manufacturer's recommendations.

3.03 BACKFILL

A. Backfill material shall be placed as shown on the Drawings and in a manner which prevents the geogrids position from changing.

B. No vehicles, including trucks or 3- and 4-wheeled ATV's are allowed on the geogrid once it is placed until the 2 foot layer of sand has been placed on top of the geogrid. If ruts are created in the backfill during construction, they shall be filled with additional soil rather than blading adjacent material into the rut.

3.04 FINAL ACCEPTANCE

A. The CONTRACTOR shall retain ownership and responsibility for the geogrid until final acceptance by the COUNTY.

B. Final acceptance of the geogrid by the COUNTY will occur when:

1. Installation activities are completed.

2. Documentation of installation is completed and the CONTRACTOR's final report is submitted to, and approved by the ENGINEER.

3. Documents presented in Part 1.03, this Section have been submitted to the ENGINEER and approved.

- END OF SECTION -

SECTION 03410 - PRECAST CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes the casting, delivery, and installation required for the completion of the concrete vault as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, materials, workmanship and practices shall be in accordance with the current editions of the following standards.

1. Standard Building Code.

2. ACI 318, Building Code Requirements for Reinforced Concrete.

3. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.

4. ACI Detailing Manual SP-66

5. CRSI Manual of Standard Practice MSP-2-01.

1.03 SUBMITTALS

A. Fabrication shall not begin until the following information has been submitted and reviewed to the satisfaction of the ENGINEER:

1. Quality Control: Verification demonstrating that the plant and production methods meet the requirements of PCI MNL 116.

2. Drawings: Complete fabrication and erection drawings, signed and sealed by a Professional Engineer registered in the State of Florida. Include the bending list, steel placement drawing, and location of lifting lugs.

3. Manufacturer's data sheets shall be submitted on the following:

    1. Waterstops.
    2. Grout.
    3. Coating.

4. Compressive strength specimen test results (i.e., cylinder breaks).

PART 2 - PRODUCTS

2.01 CONCRETE

A. Cement shall be Portland cement Type II.

B. Aggregates. The aggregates, fine and coarse, other than lightweight aggregate shall conform to ASTM C 33. Lightweight aggregates, fine and coarse, shall conform to ASTM C 330. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide. Both types of aggregate shall be graded in a manner so as to produce a homogenous concrete mix. The materials are to be accurately weighted at a central batching facility for mixing.

C. Minimum compressive strength of concrete used for vault shall be 5,500 psi at 28 days.

2.02 DEFORMED REINFORCING BARS

A. Deformed billet-steel bars conforming to ASTM A 615, Grade 60, including Supplemental Requirements S1.

2.03 GROUT

A. Grout shall be a water-proof non-shrink type.

2.05 COATINGS

A. Both the interior and exterior surfaces of the vault shall be coated with one of the following and applied in accordance with manufacturer's recommendations:

1. Industrial Concrete Sealer by Burke.
2. StoProtective Epoxy Coating No. CR646 by StoPoxy.
3. Concresive No. 3042 by Master Builders Technologies.
4. ENGINEER approved equivalent.

PART 3 - EXECUTION

3.01 FABRICATION

A. Forms used for precast concrete shall be of metal and sufficiently designed and braced to maintain their alignment under pressures of the concrete during placing.

B. Joints shall be as shown on the Drawings including waterstops.

C. Steel reinforcing shall be as indicated on the Drawings and sufficiently tied to withstand any displacement during the pouring operation.

D. Splices other than lap splices shall not be used. Lap splices shall achieve a minimum overlap length of 40 times the diameter of the bar.

E. Placing: The concrete shall be handled from the mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients, until the approved unit is completed. Maximum elapsed time from batching to placement shall be 2 hours. Concrete shall be placed in layers not over 2 feet deep. Each layer shall be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.

F. Lifting holes through the vault are not permitted. Equally spaced lifting lugs, rings or non-penetrating lift inserts shall be provided at the time of fabrication.

G. Curing:

1. For purposes of early reuse of forms, precast concrete may be steam cured after an initial set has taken place. The steam temperature shall not exceed 160°F, and the temperature shall be raised from normal ambient temperatures at a rate not to exceed 40°F per hour.

2. The steam cured unit shall not be removed from the forms until sufficient strength is obtained for the unit to withstand any structural strain to which it may be subjected during the form stripping operation. After the stripping of forms, further curing by means of water spraying or a membrane curing compound may be used, and shall be of a clear or white type, conforming to ASTM C 309.

3.02 TESTS

A. Five compression specimens representative of each day's work shall be poured in accordance with ASTM C 192. The specimens shall be broken at 3, 7, 14, and 28 days from the pour (with one reserved for a 56 day break) to demonstrate the strength of the concrete. Results shall be submitted to the ENGINEER.

3.03 INSTALLATION

A. Prior to placement, the CONTRACTOR shall notify the ENGINEER and COUNTY when the vault is ready to be inspected.

B. The openings to the vault shall be blocked to prevent construction materials from entering throughout the installation activities. The vault shall be cleaned of all construction materials by the CONTRACTOR prior to acceptance by the COUNTY.

C. The vault shall be suspended in-place and not allowed to transmit a dead load onto the excavated sub-grade until all pipe connections are completed and the backfill is placed up to the elevation corresponding to the top of the surrounding phosphatic clay.

D. Backfill shall be placed as shown on the Drawings. Backfill material and placement technique shall be in accordance with the requirements of Section 02220.

- END OF SECTION -

SECTION 11200 - LEACHATE PUMPS

Part 1 - GENERAL

1.01 GENERAL

A. The work specified in this section includes the installation of leachate pumps and appurtenances as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents.

B. Pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

C. The CONTRACTOR shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the COUNTY of any discrepancy before performing the work.

D. Pumps shall be tested by the manufacturer or a nationally recognized testing agency in compliance with Hydraulic Institute Standards. Certified test results shall be submitted to the COUNTY.

1.02 SUBMITTALS

A. Shop Drawings shall be submitted in accordance with the Contract Conditions and Division 1, "GENERAL SPECIFICATIONS" and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cut sheets and schematic diagrams, equipment layout and anchorage, and any other details required to demonstrate that the system has been coordinated and will operate as a unit.

B. After approval of the Shop Drawings, and not later than 2 weeks prior to the date of final completion, the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

C. OPERATING AND MAINTENANCE INSTRUCTIONS

1. The CONTRACTOR shall furnish to the COUNTY five complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and a brief description of all equipment and basic operating features.

2. The CONTRACTOR shall furnish to the COUNTY five complete copies of maintenance instructions listing routine maintenance procedures,

possible breakdowns and repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the system as installed.

3. The CONTRACTOR shall conduct training on the operation of the pump system. The training period shall start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the Operating and Maintenance Instructions.

4. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form for the wiring and control diagrams, and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted to the COUNTY for approval prior to posting. The instructions shall be posted before acceptance testing of the systems.

D. PERFORMANCE TEST REPORT

1. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

E. PUMP CHARACTERISTIC CURVES

1. Pump characteristic curves showing capacity in gpm, NPSH, Total Dynamic Head (TDH), efficiency, and pumping horsepower from 0 gpm to 110 percent of design capacity shall be submitted.

1.03 MANUFACTURER'S SERVICES

A. The CONTRACTOR shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.04 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from weather, dirt and dust, and other contaminants.

Part 2 - PRODUCTS

2.01 GENERAL

A. Pump materials and equipment shall conform to the respective standards and other requirements specified herein.

B. Miscellaneous fasteners such as bolts, nuts, washers, and all other types of supports necessary for installation of pump-motor assemblies shall be furnished and shall be of 304 stainless steel.

2.02 PUMP CHARACTERISTICS

A. The CONTRACTOR shall provide two submersible pumps constructed for performance in the corrosive environment of pumping leachate. The CONTRACTOR shall install one of the submersible pumps and provide the second as a back-up. The pump will be a sealed unit with bottom intake and level control sensor. A transmitter mount shall be welded at the center bottom for liquid level control. The unit shall be capable of pumping from 24 inches down to within 10 inches of the sump bottom without any loss of performance or damage to the pump.

B. The pump must fit through HDPE pipe, 18 inches in diameter, SDR 13.5, and must be able to be moved through the HDPE pipe a distance of at least 1,000 feet. Each pump shall be equipped with a disconnect system. The discharge of the pump will have a welded flange of 304 stainless steel capable of being connected to the flange of a 4-inch diameter SDR 11 HDPE pipe.

C. The pump shall be a centrifugal submersible EPG SurePump Wheeled Sump Drainer, Model WSD PT 27-1, or an ENGINEER-approved equal. The unit shall come with a 2.0 horsepower submersible electric motor for operation on 230 volts, 3 phase, 60 hertz service with 1100 feet of power cable.

D. The pump shall have a 3-inch welded flange connection as above and be capable of delivering 150 G.P.M. at 10 feet of TDH. The unit will be fitted with 1100 feet of 4-inch diameter SDR 11 HDPE pipe.

E. The motor shall be a submersible, hermetically sealed Franklin motor or ENGINEER-approved equal, designed for continuous duty, capable of sustaining up to 120 starts per day. The motor shall be connected to the pump via a motor adaptor and coupling in 304 stainless steel. The three-phase motor shall have thermal protection located in the control panel which is to be manually reset in the event of over-load. The motor leadwire shall be no-splice with waterproof "chemically resistant" insulation and be of the length as shown on the drawings.

F. Pump Controls shall be EPG's L925 PT PumpMaster three-phase Control Panel or an ENGINEER-approved equal as in Section 16920 of these

Specifications. Pump controls shall be matched to operate with the pump as specified, and as indicated on the Drawings.

G. The manufacturer shall warrant the units against defects in materials and workmanship for a period of twelve (12) months from the date of installation.

2.03 MATERIALS

A. Major pump components and fasteners, diffuser chambers and impeller(s) shall be made of 304 stainless steel. Seals are to be made of Teflon™. Each unit shall include a built-in check valve with housing and disc of 304 stainless steel and check valve seat of Teflon. The shaft shall be of 304 stainless steel and rotate on bearings which are product lubricated. The diffuser chambers shall be fitted with Teflon™ impeller seal rings. The impeller(s) shall be closed.

2.04 LEVEL SENSOR

A. The submersible pressure transmitter level sensor shall have a range of 0 to 11.5 feet with a 4 to 20 mA output signal. Transmitter construction shall be stainless steel body, stainless steel diaphragm and Viton seals with chemical resistant signal cable. The transmitter circuit shall be protected by intrinsically safe barriers.

B. The system shall be designed to start the pump on a change in liquid level as sensed by the pressure transmitter. The pump will continue to run until the selected level is reached. If the liquid level changes beyond set points, a high and/or low level will be annunciated.

C. The system shall be environmentally safe. No pumped liquid/compressed air mixture allowed to atmosphere.

Part 3 - EXECUTION

3.01 PUMP INSTALLATION

A. Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including but not limited to such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, starters, power supply, and controls.

3.02 PIPING

A. Installation of pipes shall be as specified in SECTION 15080 "High Density Polyethylene Pipes".

3.03 WIRING

A. Wiring shall follow manufacturer's instructions and as shall be as indicated on the Drawings.

3.04 PAINTING

A. Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer.

3.05 FIELD TESTING AND ADJUSTING EQUIPMENT

A. Prior to acceptance, an operational test of all pumps, starters, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

B. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.06 WARRANTY

A. The pumps and component parts shall be warranted against defects in material and workmanship for a period of one year from the date pumps are installed at the site and tested satisfactorily to the COUNTY. Defective pumps and parts shall be replaced at no charge to the COUNTY for the duration of the warranty period. All service shall be performed by factory authorized representatives. Replacement parts and components shall be new.

- END OF SECTION -

SECTION 15080 - HIGH DENSITY POLYETHYLENE PIPES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes supplying, fabricating, transporting, storing, quality control/quality assurance laboratory services required for the installation of the High Density Polyethylene (HDPE) horizontal access pipe, drain pipes, and leachate collection pipes as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents.

1.02 SUBMITTALS

A. All product data shall be submitted, to the ENGINEER for approval, at least 14 calender days prior to installation.

B. Certification and Test Reports: The CONTRACTOR shall submit to the COUNTY a manufacturer's certification that the HDPE pipe was manufactured from resins in compliance with these Specifications. The certificate shall state the specific resin, its source and the specific information required by ASTM D 1248.

C. The manufacturer must warrant the pipe to be free from defects in material and workmanship in accordance with ASTM D 3350 and F 714.

D. Manufacturer instructions for installation of the piping systems, including method of joining pipe sections.

E. Manufacturer's recommendations for storage, handling, installation, inspection, and repair for the piping systems.

F. Verification that CONTRACTOR's pipe welding technician has been certified by the manufacturer to conduct heat fusion connections.

PART 2 - PRODUCTS

2.01 HORIZONTAL ACCESS PIPE

A. Polyethylene pipe resins shall be high performance, high molecular weight, high density polyethylene (HDPE) conforming to ASTM D 1248 (Type III, Class C, Category 5, Grade P34), and ASTM D 3350 (Cell Classification PE 345434C, with material designation of PE 3408). The pipe and fittings shall be manufactured with a minimum of 2 percent carbon black to withstand outdoor exposure without loss of properties. All HDPE pipe shall meet the requirements of ASTM F 714. The pipe shall be as manufactured by Driscopipe, or ENGINEER approved equal.

B. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, class, and Standard Dimension Ratio (SDR) of 13.5.

C. All HDPE pipe and fittings shall be furnished by a single manufacturer who is experienced, reputable, and qualified in the manufacture of the items to be furnished. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same manufacturer's specification as the raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index and other physical properties.

PART 3 - EXECUTION

3.01 TRANSPORTATION, HANDLING, AND STORAGE

A. Transportation: Care shall be taken not to cut, kink or otherwise damage the pipe material during transportation.

B. Handling:

1. Ropes, fabric or rubber-protected slings and straps shall be used when handling pipe materials.

2. Chains, cables, or hooks inserted into the pipe ends shall not be used. A sling with a spreader bar shall be used for lifting each length of pipe section. Pipe materials shall not be dropped or dragged on rocky or rough ground.

C. Storage:

1. Pipe materials shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage them.

2. Stacking of the pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions.

3. Where necessary due to ground conditions, the pipe shall be stored on wooden pallets and supported to prevent deformation of the pipe.

D. Pipe material which is damaged by the CONTRACTOR shall be replaced at no additional cost to the COUNTY.

3.02 EXCAVATION AND BACKFILL

A. All excavation in the preparation of horizontal access pipe shall be performed in accordance with the requirements of Section 02220 - Excavation, Backfill, Fill and Grading.

3.03 HORIZONTAL ACCESS PIPE

A. The installation of pipe shall be in accordance with the manufacturer's recommendations.

B. Upon satisfactory excavation of the pipe trench, pipe bedding shall be constructed as to provide continuous uniform support for the piping.

C. The interior of all pipes shall be thoroughly cleaned of all foreign material before being lowered in the trench and shall be kept clean during laying operations by means of caps, or other industry-approved methods.

D. Each pipe shall be carefully examined for damage (i.e., cuts, scratches, gouges) before being laid, and sections of pipe with damage exceeding manufacturer recommendations shall be replaced at CONTRACTOR's expense. Pipe shall be repaired according to manufacturer's recommendations.

E. Under no circumstances shall pipe be installed in watered-in trenching. No pipe shall be laid when trench or weather conditions are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

F. Cutting shall be done with approved mechanical methods in a manner that will not damage the pipe. Pipe shall be firmly and uniformly supported during cutting and fusion activities. Care shall be taken that pipe is not disturbed until joints are cured.

G. Each pipe section shall be joined in strict conformance with the pipe manufacturer's recommendations using approved equipment. Joining and installation of pipe shall be accomplished by a trained and authorized technician.

H. The CONTRACTOR shall protect the pipe and workers from the build-up of static electricity, which can be generated in the pipe by friction from the handling of pipe in storage, shipping, and installation. The CONTRACTOR shall minimize the hazard of discharge by following recommendations by the pipe manufacturer, such as applying a film of water to the work surface to drain away the static electricity.

I. When work is not being performed, the open ends of the pipe shall be closed by fabricated caps, or by other approved means. All caps shall be outside diameter fitting caps. No caps will be allowed that require insertion of the cap into the pipe.

Any sediment or other contaminants allowed to enter pipe by failure to place cap over end shall be removed at CONTRACTOR's expense.

J. The ENGINEER shall be notified prior to pipe being backfilled. The ENGINEER will inspect the following items at this time:

1. All joints.
2. Pipe integrity.
3. Pipe foundation for rocks and foreign material.
4. Proper trench or foundation slope.
5. Trench or foundation contour to ensure the pipe will have uniform and continuous support.

Any pipe which is disturbed or found to be defective after laying shall be taken up and relaid or replaced by the CONTRACTOR.

K. The pipes shall be grouted at the vault connections as shown on the Drawings.

L. The portion of pipe in the vault shall receive endcaps as shown on the Drawings.

M. The termination of the pipes shall be as shown on the Drawings.

3.04 LEACHATE COLLECTION PIPES

A. The leachate collection pipes shall be connected to the vault at the locations shown on the Drawing 7 of 7.

3.05 PERFORATIONS

A. Horizontal Access Pipe: Where indicated on the Drawings, perforations shall be a minimum of 90 degrees apart on the circumference of the pipe, a minimum of 0.5 inches in diameter and spaced every 6 inches along the length of the pipe.

B. Leachate Collection Pipe and Drain Pipe: Where indicated on the Drawings, perforations shall be a minimum of 120 degrees apart on the circumference of the pipe, a minimum of 0.5 inches in diameter and spaced every 6 inches along the length of the pipe.

3.06 HYDROSTATIC TESTING

A. The non-perforated pipes shall be tested to verify there are no leaks. The CONTRACTOR shall notify the ENGINEER prior to beginning tests and shall conduct the test in the presence of the ENGINEER.

B. Safety: All testing of piping systems shall be done with due regard for the safety of employees and the public during the tests. Bulkheads, anchorage, and bracing

suitably designed to resist test pressures shall be installed as necessary and prudent.

C. Equipment: Equipment and personnel for the testing procedures will be furnished by the CONTRACTOR. Water is available onsite for the hydrostatic testing. The CONTRACTOR shall be responsible for cost associated with obtaining and transporting the water. Equipment shall consist of a polyethylene flange adaptor with a HDPE blind flange. HDPE reducers shall be utilized to adapt test flange to size of pipe being tested. Tapped and threaded into the blind flange will be a pressure gauge capable of reading pressures from 0 to 40 psi (graduated in 0.1 psi increments), hydraulic pump, suitable hose and suction pipe as required, graduated containers.

D. Like sizes of polyethylene piping shall be butt welded together into testing segments not to exceed 1,000 feet. Segments shall be connected to a testing apparatus on one end and fitted with temporary caps on all openings and at the point of transition between solid and perforated pipe.

E. The segment to be tested should be allowed to reach constant and/or ambient temperature before initiating timing of the test. The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations.

F. After all free air is removed from the test section, raise the pressure at a steady rate to the required pressure. The initial test pressure shall be applied and allowed to stand without makeup pressure for a sufficient time to allow for diametric expansion or pipe stretching to stabilize (usually within 2-3 hours). After this stabilizing period, the test section can be returned to the test pressure, the pump turned off, and a final test pressure of 35 pounds per square inch-gauge (psig) for 1 hour.

G. A leakage test shall be conducted concurrently with the hydrostatic pressure test. Leakage shall be defined as the measured quantity of water that must be supplied from the calibrated graduated cylinder into the pipe to maintain the pressure within 5 psig of the specified test pressure during the pressure test portion the testing. The allowable amount of makeup water for expansion during the pressure test is outlined in Table 15080-1.

H. If there are no visual leaks or significant pressure drops or leakage during the final test period, the pipeline passes the test. A significant pressure drop is defined as an observable pressure drop of 0.1 psi or greater. Refer to ANSI B 31.8 Appendix N for a general recommended practice and procedure for hydrostatic testing. The ENGINEER shall be notified prior to commencement of the testing procedure and shall be present during the test.

TABLE 15080-1
ALLOWANCE FOR EXPANSION
(U.S. Gals./ 100 feet of Pipe)

Nominal Pipe Dia. (in)	TEST DURATION		
	1 Hour	2 Hour	3 Hour
8	0.50	1.00	1.50
18	0.50	1.00	1.50

I. Test Failure: The following steps shall be performed when a pipe segment fails the test described above:

1. The pipe and all joints shall be inspected for cracks, pinholes, or perforations.

2. All blocked risers and capped ends shall be inspected for leaks.

J. All pipe and joint leaks shall be repaired by cutting out the leaking area and rewelding the pipe. After all leaks are repaired, a retest shall be performed. This process shall be repeated until a successful test is achieved.

3.07 CERTIFICATION OF COMPLETION

A. Upon completion of the covering operation over the pipe, the CONTRACTOR shall certify the following to the COUNTY:

1. The piping system has been constructed in accordance with the approved project plans and specifications.

2. The piping system has not been damaged during construction or the backfilling operation.

- END OF SECTION -

SECTION 16010 - GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work specified in this section includes labor, material, equipment and services necessary for complete, safe installation in conformity with all applicable codes and authorities having jurisdiction, including temporary light and power, cutting and patching as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents.

B. The work shall include coordinating, furnishing, installing, and testing of the following:

1. Electrical service to the site with coordination of the power company as necessary.

2. Conduit, wire, and field connections for all motors, motor controllers, control devices, control panels, and any packaged equipment furnished.

3. Field wiring for all field-mounted instruments. All conduit, wire, and interconnections between process instrumentation primary elements, transmitters, local indicators and control panels.

4. Lightning and surge protection equipment, wiring, and cables at process instrumentation transmitters.

5. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no additional cost to the COUNTY.

1.02 SUBMITTALS

A. Shop Drawings shall be submitted in accordance with the Contract Conditions and Division 1 "GENERAL SPECIFICATIONS" and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cut sheets and schematic diagrams, equipment layout and grounding and any other details required to demonstrate that the system has been coordinated and will operate as a unit.

B. All product data shall be submitted to the ENGINEER for approval, at least 14 calendar days prior to installation. No items nor systems shall be delivered to the site, or installed until approved. After the proposed materials have been

approved, no substitution will be permitted except where approved by the ENGINEER in writing.

C. After approval of the Shop Drawings and not later than one (1) month prior to the date of acceptance, the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies with current unit prices and sources of supply.

D. The CONTRACTOR shall furnish to the COUNTY five complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown as noted in Section 15452 - Leachate Pumps.

E. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.03 MANUFACTURER'S SERVICES

A. The CONTRACTOR shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.04 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, dirt and dust, and other contaminants.

1.05 REFERENCES

A. The National Electrical Code and Publications of the Organizations listed below are included in these specifications by reference. All work shall be manufactured, tested and installed in accordance with the latest issue of such standards.

1. American Society for Testing and Materials (ASTM)

2. Underwriters' Laboratories, Inc. (UL)

3. Insulated Power Cable Engineers Association (IPCEA).

4. National Electrical Manufacturers Association (NEMA).

5. Institute of Electrical and Electronic Engineers (IEEE).

6. American National Standards Institute, Inc. (ANSI)

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

A. The materials and equipment used shall be new, free from defects and listed by the Underwriters' Laboratories, Inc.

2.02 MATERIALS AND INSTALLATION

A. All conduits shall be galvanized rigid steel with lock nuts and bushings, with the exception that where specifically allowed by the National Electrical Code and applicable local codes, branch circuit raceways may be Electrical Metallic Tubing (EMT) or PVC Schedule 40. (PVC may be used below grade only). Final connections to motors and other vibrating equipment shall be made with flexible type conduit.

B. All conduits must be sealed. Each open end of conduit should be properly sealed as per Section 501-5 of the NEC.

C. Branch circuit conductors shall be THWN Copper No.12, unless otherwise noted. No aluminum shall be permitted. All branch circuits shall be wired with color coded wire.

2.03 ELECTRICAL SERVICE SYSTEM

A. In general, all electrical equipment, metallic conduit, motor frames, panelboards, etc., shall be grounded with a separate system. The grounding conductor shall run from the main switch ground to all panels and from grounding lugs on each panel to each branch circuit device and fixture in accordance with the specific rules of Article 250 of the NEC. All panels shall have a separate neutral bar isolated from the standard neutral bar for grounding.

B. The facilities and equipment required to provide all power for construction, lighting, balancing and testing prior to final acceptance of the project shall be provided by the CONTRACTOR.

2.04 NAMEPLATES

A. The CONTRACTOR shall provide nameplates for disconnect switches, transformers, circuit breakers, panels, cabinets, transformer enclosures, motor controllers, motor control centers and motor control panels.

1. White laminated plastic nameplates with 3/4 inch black lettering shall be provided and attached with fasteners using epoxy cement.

2. The inscription shall be subject to review by the ENGINEER and shall identify the name of the process equipment it serves (i.e. Pump Station B), and the voltage.

2.05 PROTECTION OF WORK

A. The CONTRACTOR shall protect the work against damage from all causes, provide and maintain protective coverings to exclude dirt, dust, and paint from the equipment and components.

B. The CONTRACTOR shall thoroughly clean all equipment upon completion of the work. All dust, dirt, paint spatter, stains and discolorations of the factory finish shall be removed. Finishes shall be restored to the original condition.

C. The CONTRACTOR will repair all damaged equipment, cables, surfaces and finishes equal to new and have such work approved by the ENGINEER before acceptance of the work.

D. All metallic materials shall be protected against corrosion. Metallic parts exposed to weather shall be given a rust-inhibiting treatment and standard finish by the MANUFACTURER. Aluminum where connected to dissimilar metal shall be protected by approved metals, and zinc-coated in accordance with ASTM A123 or A153 except where other equivalent protective treatment is specifically approved by the ENGINEER. Corrosion-resistant steel shall not be used in this application.

2.06 EXECUTION

A. Electrical equipment and appurtenances shall be installed as required for proper operation and in accordance with the manufacturer's written instructions. All components required for a complete and operating electrical system shall be provided.

PART 3 - EXECUTION (NOT USED)

- END OF SECTION -

SECTION 16920 - PUMP CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide labor, material, equipment and services necessary for complete, safe installation in conformity with all applicable codes and authorities having jurisdiction, including temporary light and power, cutting and patching and in general as specified herein, as shown on the Drawings, and in accordance with the provisions of the Contract Documents.

B. The work shall include coordinating, furnishing, installing, and testing of the following: one EPG Companies Inc., U.L. listed, L925 PT 3-phase control panel or ENGINEER-approved equal to operate pump motor and auxiliary equipment in manual or automatic mode.

1. It is the intent of these Specifications that the pump control system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no additional cost to the COUNTY.

1.02 SUBMITTALS

A. Shop Drawings shall be submitted in accordance with the Contract Conditions and Division 1 "GENERAL SPECIFICATIONS" and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cut sheets and schematic diagrams, equipment layout and grounding and any other details required to demonstrate that the system has been coordinated and will operate as a unit.

B. All product data shall be submitted to the ENGINEER for approval, at least 14 calendar days prior to installation. No items nor systems shall be delivered to the site, nor installed until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the ENGINEER in writing.

C. After approval of the Shop Drawings and not later than one (1) month prior to the date of acceptance, the CONTRACTOR shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies with current unit prices and sources of supply.

D. The CONTRACTOR shall furnish to the COUNTY six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown as noted in Section 15452 - Leachate Pumps.

E. Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

1.03 MANUFACTURER'S SERVICES

A. The CONTRACTOR shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.04 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, dirt and dust, and other contaminants.

1.05 REFERENCES

A. Materials and installation, as a minimum, shall conform with local and state codes and ordinances. Equipment shall conform to National Electrical Manufacturers Association (NEMA) standards, and the National Electric Code (NEC). Standards of quality workmanship established by any stated codes and ordinances in these specifications or on the drawings shall not be reduced.

B. The National Electrical Code and Publications of the Organizations listed below are included in these specifications by reference. All work shall be manufactured, tested and installed in accordance with the latest issue of such standards.

1. American Society for Testing and Materials (ASTM)

2. Underwriters' Laboratories, Inc. (UL)

3. Insulated Power Cable Engineers Association (IPCEA).

4. National Electrical Manufacturers Association (NEMA).

5. Institute of Electrical and Electronic Engineers (IEEE).

6. American National Standards Institute, Inc. (ANSI)

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

A. The materials and equipment used shall be new, free from defects and listed by the Underwriters' Laboratories, Inc.

2.02 PANEL ENCLOSURE

A. The CONTRACTOR shall provide a NEMA type 4 panel enclosure. The enclosure shall come equipped with an inner door, stainless steel drip shield and tamper resistant latch. The NEMA 4 enclosure shall be finished with polyester urethane paint. There shall be permanently affixed to the interior side of the exterior enclosure door a nameplate containing the following information: voltage, phase, rated horsepower, amps, date built, and location information of the pump and control panel manufacturer.

2.03 CONTROL SYSTEM

A. The control system will operate from site power of 230 volt, 60 hertz, 3 phase power supply. Pump control components will be sized to operate the pump motor of specified horsepower.

B. The control panel shall include the following as standard features:

1. A main 40 amp Disconnect Switch with 230 Volt, 12 Amp dual element type fuses.

2. A "Hand-Off-Auto" selector switch will be provided to allow for manual or automatic operation. The selector switch shall be a heavy duty, oil tight, NEMA 4 rated switch mounted on the inner door.

3. The motor starter will be sized to the pump motor horsepower, and shall be equipped with built in single phasing protection and ambient compensated, quick trip adjustable thermal overloads.

4. A motor overload light will indicate motor not running due to overload condition. Light shall be heavy duty, oil tight, NEMA 4 rated with voltage surge suppressor to prolong lamp life.

5. The control transformer will have a fused primary to isolate control circuit from power circuit and for easier and safer field wiring of accessories. It shall lower incoming voltage to 120 Volts.

6. The level control will be EPG Companies Inc., LevelMaster™ Level Control or an ENGINEER-approved equal. The LevelMaster shall be mounted on the inner door. The meter shall have a digital readout and the capability to monitor and maintain pumping operations as well as at least two other level signals. Level control shall be accurate to within 0.1 inch.

7. The heater with adjustable thermostat will be provided to promote even distribution of heat and elimination of hot spots and condensation. Heater element shall be mounted in the space between the subpanel and the back of the enclosure and provide a minimum of 100 inches square of heating area.

8. The lightning arrestor shall be grounded, metal to metal, to water strata.

9. A terminal strip shall be provided for easy connection of external components. Terminal points shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.

    a. An electrical schematic diagram shall be permanently affixed to the interior side of the exterior enclosure door and a copy supplied to the OWNER at start-up. The schematic diagram shall include the rated amperage, voltage, horsepower, and full-load amps for all components. Included on the mylar drawing shall also be the wire code, power schematic, control schematic, physical layout, terminal schedule and detailed parts list identifying each component, manufacturer, and part number in the control panel.

10. An industrial corrosion inhibitor emitter will be provided that shall protect internal components of the control panel from corrosion for one year.

C. The level sensor shall be EPG Companies submersible pressure transmitter or ENGINEER-approved equal. It shall have a range of 0 to 11.5 feet with a 4 to 20 MA output signal. Transmitter construction shall be stainless steel body, stainless steel diaphragm and Viton seals with a chemical resistant signal cable. The transmitter circuit shall be protected by intrinsically safe barriers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The control panel, equipment, and appurtenances shall be installed in the position indicated on the drawings as required for proper operation and in accordance with the manufacturer's written instructions. All components, wiring, and connections for power to the system required for a complete and operating pump control system shall be provided.

3.02 PROTECTION OF WORK

A. The CONTRACTOR shall protect the work against damage from all causes, provide and maintain protective coverings to exclude dirt, dust, and paint from the equipment and components.

B. The CONTRACTOR shall thoroughly clean all equipment upon completion of the work. All dust, dirt, paint spatter, stains and discolorations of the factory finish shall be removed. Finishes shall be restored to the original condition.

C. The CONTRACTOR will repair all damaged equipment, cables, surfaces and finishes equal to new and have such work approved by the ENGINEER before acceptance of the work.

D. All metallic materials shall be protected against corrosion. Metallic parts exposed to weather shall be given a rust-inhibiting treatment and standard finish by the MANUFACTURER.

- END OF SECTION -