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ALT. CLOSURE PLAN

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INDUSTRIAL LANDFILL CLOSURE PLAN AND FIBER RESIDUAL CAP PERFORMANCE DEMONSTRATION DELTA PROJECT E000-604

Prepared For:

Weyerhaeuser Company
New Bern Pulp Mill
New Bern, North Carolina

Prepared By:

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August 2000

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INDUSTRIAL LANDFILL
CLOSURE PLAN AND
FIBER RESIDUAL CAP PERFORMANCE DEMONSTRATION
DELTA PROJECT E000-604

1.0 PURPOSE AND OBJECTIVES

Weyerhaeuser Company (Weyerhaeuser) proposes to use dewatered wastewater treatment solids, or pulp and paper mill fiber residual, as the barrier layer in the final cap system for its industrial landfill (Permit No. 25-02). The purpose of this document is to demonstrate the technical viability of using this material for closure and final cover performance features.

This document was prepared for the Solid Waste Section of the North Carolina Department of Environmental and Natural Resources (DENR) to support the use of pulp and paper mill fiber residual as landfill final cover. Final cover systems that incorporate pulp and paper mill fiber residual as the barrier layer have been constructed and demonstrated to be effective at several sites in the United States (refer to Section 4.0 – References), including locations in Alabama, Massachusetts, Michigan and Minnesota. This demonstration is based on operating experience at these sites and on site-specific data for the Weyerhaeuser landfill and fiber residual.

Weyerhaeuser has established the objective of closing its New Bern Mill landfill (approximately 40 acres) in an environmentally sound manner using fiber residual from its Plymouth Mill wastewater treatment plant as the barrier layer in the final cap system. Closure will occur in stages, as portions of the site reach final grades.

The objectives of this report include the following:

- To summarize the regulatory status and requirements for the proposed closure.
- To present engineering data to demonstrate that the proposed final cover system is technically viable and meets DENR performance criteria for final cap systems.
- To present plans for construction of the final cap system.

1.1 Applicable Regulations and Related Documents

The landfill is permitted under DENR Rule .1600. Closure and post-closure care requirements are described in R .1627. Weyerhaeuser has addressed other aspects of landfill closure in prior submittals. This document is intended to address only the final cap system design and final grading plan for the site.

2.0 FINAL COVER DESIGN

The information in this section demonstrates that the final cover system for the New Bern Mill landfill can be constructed using fiber residual as the barrier layer, as allowed under Rule .1627(c)(2). Fiber residual for the final cover system will be obtained from the Weyerhaeuser pulp and paper mill in Plymouth, North Carolina (Weyerhaeuser Plymouth Mill). Supporting data and calculations are included in Appendices A, B and C.

DENR requirements for final cover systems are based on the assumption that soils and geosynthetic materials will be used in the final cover. Pulp mill fiber residual exhibits many soil-like properties, and many traditional soils tests can be used to characterize the material for engineering purposes. However, pulp mill fiber residual is not a soil. Data from soils tests performed on pulp mill fiber residual cannot necessarily be applied to engineering analyses as the results for soils would be applied. The unique properties of this material must be taken into consideration during the design process.

2.1 Performance Requirements

The landfill will be closed using a final cap system that meets governing DENR requirements (Solid Waste Management Rule Section .1627). The cap system design includes the cap components listed in Section 2.2.2 of this document and meets the following performance criteria:

- Permeability (hydraulic conductivity) no greater than 1×10^{-5} cm/sec (Rule .1627(c)(1)(A)).
- Eighteen-inch minimum thickness (Rule .1627(c)(1)(B)).
- An erosion control layer that consists of at least 6 inches of earthen material that is capable of sustaining native plant growth (Rule .1627(c)(1)(C)).
- Final grades ranging from 5% to 25% (Rule .1627(c)(3)(A)).

Alternative final cover designs are allowed under Rule .1627(c)(2) providing that performance equivalent to a traditional cap can be demonstrated. Comparison of the performance of the proposed final cover with a traditional soil cap is presented in Section 2.3.1 of this document.

2.2 Material Properties

Pulp and paper mill fiber residual is composed primarily of cellulose fiber that is lost during the pulping and papermaking process. Moisture contents are typically reported as percent solids (typically 45 to 55 percent for Weyerhaeuser Plymouth Mill fiber residual) or as values in excess of 100 percent (refer to

Section 2.2.3 of this report). Unlike soils, where the specific gravity of the soil components far exceeds that of water, cellulose fiber can be buoyant. The greatest distinction between soils and fiber residuals is the response to compactive effort, as discussed in the following paragraphs. Cellulose fiber is to a considerable degree hollow, and is therefore absorbent. Finally, cellulose fiber collapses with time and pressure, reducing its volume and increasing the density of any material that contains it.

Fiber residual from the dewatering plant in a pulp and paper mill wastewater treatment system is a unique material with the following properties:

- Water can be squeezed from it, but it will also absorb additional water.
- Compactive effort is largely ineffective because the material rebounds after the load is removed.
- It will consolidate with time under its own weight or the weight of a bearing load.

Research published by Kraus *et al.* indicates that the lowest hydraulic conductivity of a pulp and paper mill fiber residual occurs at moisture/density conditions 50 to 100 percent above optimum as determined by the standard Proctor test. Findings reported in McGee *et al.* indicate that confined layers of pulp and paper mill fiber residual (as in a cap system) tend to consolidate to moisture/density conditions close to the lowest hydraulic conductivity for the given material. Taylor *et al.*, describe test methods necessary to evaluate fiber residual properties and to develop design factors for a fiber residual barrier layer.

The design of the final cap system described in this document has been developed to take advantage of the unique properties of fiber residuals and the specific properties of fiber residual from the Plymouth Mill wastewater treatment system.

2.2.1 Physical Description

The primary component of the proposed cap system is pulp mill fiber residual. The Plymouth Mill produces fiber residual using two screw presses in the wastewater treatment plant. The fiber residual press operating data for the samples submitted for analysis is included in Table 1, and the as-received moisture content and unit weight data for each sample are summarized in Table 2. As-received moisture contents for the samples ranged from 110 to 186 percent.

Table 1. Sample Descriptions

SAMPLE	DATE	DESCRIPTION	% SOLIDS (PLANT)	% SOLIDS (LAB)	pH	POLYMER (lbs/bdt)	COAGULANT (lbs/bdt)	CAPTURE RATE
1	4/11/00	Fiber residual from trailer (normal operating conditions)	48.6	37.3		19	7.5	97.8%
2		Pond fiber residual and OCC fiber residual	41.3	35.0		22	7.4	92.5%
3	4/16/00	OCC fiber residual only	44.8	37.0	7.4	polymer dose 1,000 ml at a make-up percent of 0.66%, 12 gpm polymer with 1,500 gpm fiber residual	0	96.7%
4		Mill sample (normal operating conditions)	46.3	44.8		13.7	7.3	94.5%

Table 2. Engineering Properties of Plymouth Mill Fiber residual

SAMPLE	AS-RECEIVED MOISTURE CONTENT	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT	INFLECTION MOISTURE CONTENT	COMPACTED UNIT WEIGHT (pcf)	HYDRAULIC CONDUCTIVITY (cm/sec)
1	168 % (37.3% solids)	25.0	150%	225%	65.6	6.5×10^{-6}
2	186 % (35.0% solids)	38.0	88%	130%	71.3	Not tested
3	170 % (37.0% solids)	24.0	170%	240%	64.6	Not tested
4	123% (44.8% solids)	26.0	125%	250%	71.6	1.9×10^{-5}

Influent solids to the dewatering system come from two sources:

- A dredge in a settling basin, and
- Discharge from the secondary fiber (OCC) plant.

The dredge pumps to a holding tank during day shift five days a week. By Sunday, influent to the dewatering process is solely from the secondary fiber (OCC) plant. Occasionally, the dredge encounters large quantities of inorganic sediment in the basin, resulting in disrupted operating conditions.

Samples 1 and 4 were generated under normal operating conditions. Sample 2 was collected while an unusual amount of sediment was in the influent solids, as indicated by the high dry density (Table 2). Sample 3 was collected on a Sunday with influent from the secondary fiber (OCC) operation only. Based on the nature of the materials, standard operating procedures, and the material properties, it was decided that only fiber residual produced under normal dewatering conditions would be used in the New Bern Mill landfill final cap.

Based on the Proctor curve, the inflection point on the wet side is approximately 225% moisture content for Sample 1, and 250% for Sample 4 (Appendix A).

The test results described in the following sections demonstrate that the proposed cap can to be placed as a stable, low-permeability barrier layer. The following tests were performed on the fiber residual:

- Moisture content and unit weight (ASTM D2216)
- Hydraulic conductivity (ASTM D 5084)
- Triaxial shear strength (ASTM D 4767)
- Unconfined compression (ASTM D 2166)

Low confining pressures and strain rates were used in the shear tests to simulate cap conditions.

2.2.2 DENR Requirements

The New Bern Mill landfill will be closed in accordance with governing DENR minimum requirements that include the following final cover system components and performance criteria:

- 6-inch layer of topsoil.
- 18-inch (final thickness) barrier layer having a permeability $\leq 1 \times 10^{-5}$ cm/s.

- 5% ≤ cover slope ≤ 25% with the exception of terraces and ditches

2.2.3 Compaction

Two representative samples of the fiber residual to be used as the cap barrier layer were tested using the standard Proctor test procedure (ASTM D698) to determine moisture/density characteristics. The conditions of lowest hydraulic conductivity were determined by identifying the inflection point (approximately 220 percent moisture for Sample 1 and 250 percent moisture for Sample 2) in the Proctor curve (Kraus *et al.*). These test results are illustrated in Appendix A.

2.2.4 Hydraulic Conductivity

DENR regulations require that the hydraulic conductivity of the barrier layer in a final cover system is no greater than 1×10^{-5} cm/s. Two representative samples of fiber residual were tested in a flexible wall permeameter in accordance with ASTM D 5084. The median of the two test results (tabulated in Table 2) is 7.5×10^{-6} cm/sec. It is important to note that these samples were compacted to densities comparable to the pad pressure of a low-ground-pressure bulldozer. After the consolidation documented by Maltby and Eppstein occurs, the material will exhibit greater density and lower hydraulic conductivity (reductions from one-half to one order of magnitude are typical). Based on those data, hydraulic conductivity values ranging from 6.5×10^{-6} to 6.5×10^{-7} cm/sec are anticipated using Plymouth Mill fiber residual.

2.2.5 Strength Properties

Representative samples of the fiber residual to be used as the cap barrier layer were tested to characterize its strength properties. The samples were tested in a triaxial shear apparatus, and found to have the internal shear strength, ϕ, and cohesion, c, shown in Table 3. The effective stress values (ϕ', c') relate to longer-term drained conditions. These values reflect a relatively wide range of confining stress. Actual design values were derived from this data for specific cover soil thicknesses.

Traditional soil strength testing using a triaxial apparatus and ASTM Method D 4767 may not accurately determine the cohesion and friction angle of a soil or soil-like material at very low or

zero confinement pressures (such as in these final cover materials). Because of this uncertainty, cohesion determined by ASTM Method D 4767 is often ignored. However fiber residual exhibits a cohesion-like property, referred to as "apparent" cohesion. For this reason, it is important to consider cohesion in the stability analysis of the fiber residual final cover. To this end, cohesion values from unconfined compression testing in accordance with ASTM Method D 2166 (modified) have been cautiously used for stability analyses herein. This zero confinement testing better defines the "apparent" cohesion of the fiber residual.

Table 3
Geotechnical Properties of Plymouth Mill Fiber residual

Sample	Shear Strength Test	Fiber residual Type	Confinement Stress (psf)	ϕ'	c' (psf)	q_u (psf)	S_u (psf)	γ_{wet} (pcf)
1	CD	Normal	100, 300, 600	70	130			65.6
1	EAC	Normal	0			548	274	65.6
4	CD	Normal	100, 300, 600	62	115			65.6
4	EAC	Normal	0			460	230	65.6

CD = Confined Drained
ϕ' = effective friction angle
q_u = unconfined compression strength
γ_{wet} = total unit weight
pcf = pounds per cubic foot
EAC = Effective "Apparent" Cohesion
c' = effective cohesion
S_u = undrained shear strength
psf = pounds per square foot

2.3 Performance of Proposed Final Cover

The performance of the final cover system was evaluated using models and solid waste engineering experience. The data presented in the following sections addresses the requirements of Rule .1627 (c)(1)(A).

2.3.1 Run-off, Infiltration, and Evapotranspiration

The proposed final cover (6" topsoil and 18" consolidated fiber residual) has been evaluated to assess its effectiveness in minimizing infiltration of precipitation into the landfill. The evaluation was performed using the HELP (Hydraulic Evaluation of Landfill Performance) computer program, version 3.07.

Three conditions were modeled to evaluate the immediate and long-term performance of the barrier layer. Model predictions for evapotranspiration, run-off and infiltration through the final cover system were run for the compacted soil cap that is required by R .1627 and two conditions for the proposed fiber residual cap. All model runs were performed for final slopes of 6.7 percent (15:1), which will be the slope of the majority of the site after closure.

The initial condition for the fiber residual cap, which will occur immediately after placement of the fiber residual and overlying topsoil, was modeled assuming a 30-inch thickness and a worst-case hydraulic conductivity value of 7.5×10^{-6} cm/sec. However, the fiber residual layer is expected to consolidate over time to a 20-inch thickness, increasing the density of the layer, thereby reducing permeability. At a minimum, the permeability of the fiber residual will be reduced by half an order of magnitude to 6.5×10^{-6} cm/sec value exhibited by sample 1. Therefore, the ultimate closure condition was also modeled to evaluate performance. Maltby and Eppstein have documented the reduction of fiber residual permeability due to the consolidation of this material.

Based on these parameters, the proposed final cover design will initially reject 65% percent of expected precipitation on an annual basis, with an ultimate predicted rejection of 66%. Both of these conditions are better than the permitted final cover system that prevents 62% of the site precipitation from infiltrating. The HELP results are summarized in Table 4 and model outputs are included in Attachment B.

Table 4. HELP Model Results
Average Annual Totals
Predicted Annual Precipitation (44.86")

Parameter / Closure Condition	Evapotranspiration	Run-Off	Infiltration
18-inch Compacted Soil Layer $k = 1.0 \times 10^{-5}$ cm/sec Fair Vegetation	27.1" / 60.4%	0.9" / 2.0%	16.9" / 37.2%
30-inch Fiber residual Layer $k = 7.5 \times 10^{-6}$ cm/sec Bare Soil	27.2" / 60.5%	3.7" / 8.1%	14.0" / 31.3%
18-inch Fiber residual Layer $k = 6.5 \times 10^{-6}$ cm/sec Fair Vegetation	27.4" / 61.0%	2.4" / 5.4%	15.0" / 33.4%

The model conditions for the fiber residual cap are considered to be worst-case estimates. The proposed cap system will meet the DENR minimum thickness and permeability requirements. Sandy soils underlie the landfill footprint. The maximum hydraulic conductivity for the fiber residual barrier is expected to be approximately 7.5 x 10^{-6} cm/sec, which is less than the hydraulic conductivity of a sandy subgrade soil.

2.3.2 Stability

Cover soil stability was modeled to assess the stability of the proposed final cover on the slopes at the final cover layer thickness anticipated. The evaluation was performed using an effective "apparent" cohesion model described by Day (1994), assuming a fully saturated cover soil condition subject to seepage. For stability analysis, fiber residual properties (c', ϕ', γ) were selected to represent this critical condition. The results of the long-term stability analyses demonstrate that the proposed final cover design will have a factor of safety for cover stability in excess of 2.0 for slopes of approximately 20% (*i.e.,* 5:1) and using fiber residual barrier layer thickness up to approximately 3 feet. The short-term stability analysis produced safety factors greater than or equal to 1.9. The cover soil stability sensitivity analysis using fiber residual and thickness specific "apparent" effective cohesion and effective friction values is included in Appendix C.

In addition to the cover stability, the global stability of the landfill was modeled using the data from the samples and confirming data from the field. Both rotational and wedge failures were modeled under both static and seismic conditions. Factors of safety (FS) are summarized in Table 5 and calculations are included in Appendix C. Factors of safety in excess of 1.5 are acceptable for static analyses, and greater than 1.1 are acceptable for seismic conditions.

Table 5. Summary of Stability Modeling

Failure Mode	60 feet high	
	FS_{static}	$FS_{seismic}$
Cover (Sliding) Stability**	> 1.5	> 1.5
Global (Rotational) Stability***	1.68	1.19
Global (Wedge) Stability***	1.61	1.14

** using "apparent cohesion" analysis *** using GARDS stability software

3.0 CLOSURE

The purpose of this narrative is to address the closure requirements for the New Bern Mill Landfill established by the North Carolina Department of Environmental and Natural Resources in DENR Rule .1627.

3.1 Final Grading Plan

Drawing Number 3, which illustrates the final grading plan, site access, and storm water control measures for the landfill is included in Appendix D. Final grades on the landfill cover range from a minimum of 5 percent at the crest to a maximum of 20 percent around the perimeter. The maximum height of the landfill will be 45 feet above mean sea level, or 40 feet above the perimeter road. A terrace has been graded into the slope at approximately 20 vertical feet above the toe of slope elevation. These slopes and grade breaks meet the requirements of Rule .1627(c)(3)(A).

The drainage channels on the north, south, and east slopes of the landfill have been designed to carry storm water from a 100-year storm without erosion or damage to the structure. Calculations are included in Appendix C. In compliance with Rule .1627(c)(1)(C), erosion of the cap system will be prevented by a topsoil vegetative layer and, where necessary, synthetic turf reinforcement.

3.2 Grade Control

As the final elevations of the waste fill are approached, the area will be surveyed and grade stakes will be installed to guide the operator in placing refuse. Areas that have been filled beyond final waste subgrades will be regraded. Grade stake will be installed at curves and slope breaks to obtain the final grades.

3.3 Final Closure Requirements for Barrier Layers

Final grading activities will commence within 90 days of approval of this plan. The area on the west end of the site will be prepared immediately for the placement of final cover. Final cover will be established within 90 days after the final grading has been completed. The final cover will consist of a nominal 30-inch thick layer of fiber residual overlain by a minimum of 6 inches of topsoil. Quality Assurance / Quality Control (QA/QC) procedures for each type of material are described in the following paragraphs.

3.3.1 Fiber Residual Barrier Layer

Because the stability of the fiber residual barrier layer increases with thickness, fiber residual will be placed in relatively thick layers (2 to 3 feet). Fiber residual will be tracked in by a bulldozer,

but no attempt to compact the material will be made (refer to Section 2 of this document). Thickness will be controlled by the use of grade stakes. Fiber residual will be placed against the perimeter berm at a depth of 30 inches.

In general, areas ranging from one-half to two acres of fiber residual infiltration layer will be completed prior to placement of the overlying soil layer. Two weeks to a maximum of two months will be required to prepare areas for placement of the topsoil cover.

All run-off from the site is channeled via an existing perimeter ditch and pump system to the mill wastewater treatment system. At no time will uncontrolled run-off from the barrier layer construction area leave the site.

The effectiveness of the fiber residual infiltration layer will be confirmed by testing the hydraulic conductivity (ASTM D5884) of undisturbed samples of the layer. Samples will be collected using Shelby tubes at a frequency of one sample per 3 acres of closed landfill. Samples will be collected at least 6 months after completion of the final cover system to ensure that sufficient consolidation has occurred to provide representative hydraulic conductivity properties. Test results will be reported to DENR in the closure certification report (refer to Section 3.7 of this document).

3.4 Topsoil

A six-inch layer of topsoil will be placed over the fiber residual layer and all disturbed areas will be seeded to minimize erosion. Placement of the topsoil layer over the fiber residual infiltration layer will proceed as soon as practicable after completion of the fiber residual layer. In general, a section of fiber residual cap will be ready for subsequent layers when the following conditions are met:

- Surface elevation is at final grade as shown on Drawing Number 3 less 0.5 foot.
- Fiber residual has been placed down the full length of the slope from the top of the section or crest of the landfill to the terrace or perimeter road.
- Sufficient surface area, or width along the slope, is available to cover with the overlying soils.

3.5 Vegetative Cover

Vegetative cover will be established on all final grades within 90 days of completion. Upon completion of borrow activities, all disturbed areas will be stabilized through the establishment of permanent vegetation (native grasses and voluntary trees). The following items will be performed to ensure the establishment of permanent vegetation:

- All disturbed areas will be roughened to leave a loose, uncompacted surface prior to seed application.
- Use hydraulic seeding equipment to apply permanent seed (200 lb/acre Annual Rye and 200 lb/acre Kentucky 31 Fescue), fertilizer (1,000 lb/acre 10-10-10), fiber mulch, and a mulch tackifier.
- Inspect and repair seeding and mulch, as necessary, until vegetation established. Topdress with 10-10-10 fertilizer and reseed deficient areas if growth not fully adequate.

3.6 Closure Documentation

A Closure Documentation Report verifying and documenting all aspects of site construction will be prepared following the final closure of the site and submitted to DENR by Weyerhaeuser. The report will contain the following information:

1. A plan sheet illustrating final grades with spot elevations; the location of grassed waterways, drainage ditches, gas vents, and other information as appropriate.
2. A minimum of two cross sections drawn every 500 feet through the closed site.
3. A comprehensive narrative explaining how closure of the site was accomplished. This report shall also include an Appendix containing all the raw data from the field and any laboratory soil testing performed.
4. A letter sealed by a Registered Professional Engineer certifying that the final cap was placed in substantial compliance with the revised closure plan. Any deviations from the approved plans shall be noted.

3.7 Closure Notification

When the entire landfill site has been filled, covered, and closed, notification will be filed with the county for recording existence of landfill on the permanent land deed records. DENR will be copied on the Final Closure Notice.

3.8 Records

Documentation of all work performed on the landfill will be kept on file by the Environmental Department at Weyerhaeuser New Bern Mill.

4.0 POST CLOSURE

The purpose of this narrative is to address the post closure requirements for the New Bern Mill Landfill established by the North Carolina Department of Environmental and Natural Resources in Rule .1630.

4.1 Post Closure Maintenance

Post closure maintenance will consist of a semi-annual inspection by the owner. Items to be addressed and corrected during the inspection will include regrading, eroded topsoil and vegetation, and settled or cracked areas. Other items include inspection and maintenance of all pumping and water conveying equipment, such as pumps, pipes and manholes, and inspection and maintenance of all monitoring equipment, such as groundwater monitoring wells. Post closure care will be conducted for 15 years after the landfill is closed.

A certified copy of the recording instrument will be submitted and a copy placed in the operating records within 120 days after permit expiration or revocation. Within 90 days after permit expiration, revocation or when final closure requirements are achieved, a notation on the land deed containing the property utilized for disposal, or some other legal instrument that is normally examined during a title search, will be recorded notifying any potential purchaser of the property of its previous use.

4.2 Post Closure Monitoring

Groundwater monitoring will continue in accordance with existing plans for the duration of the post-closure period.

5.0 REFERENCES

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APPENDIX A

GEOTECHNICAL TEST RESULTS

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

July 31, 2000

Mr. Mark Taylor
The Fletcher Group
c/o Mr. Joel Sprague
Sprauge & Sprague
P.O. Box 9192
Greenville, SC 29604

Dear Mr. Taylor:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your testing needs for the Weyerhaueser Plymouth Mill Project. TRI is pleased to submit this final report for laboratory testing.

TRI Job Reference Number:	E2128-17-02; E2128-25-08
Material(s) Tested:	Paper Mill Sludge Sample No.'s Weyco # 1 through Weyco #4
Test(s) Requested:	Moisture Content (ASTM D 2216) Hydraulic Conductivity (ASTM D 5084) Triaxial Test (ASTM D 4767) True Cohesion (ASTM D 2166 - mod.) Proctor Compaction (ASTM D 698)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Mark E. Sebesta, P.E.
Laboratory Director

9063 Bee Caves Road • Austin, TX 78733-6201 • (512) 263-2101 • FAX (512) 263-2558

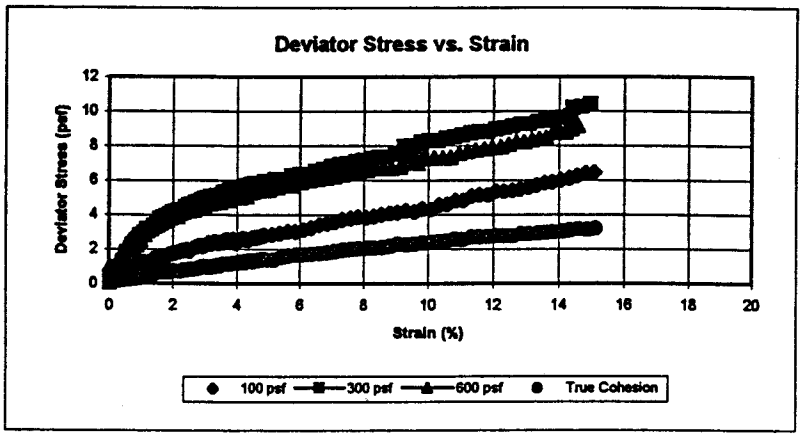
TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

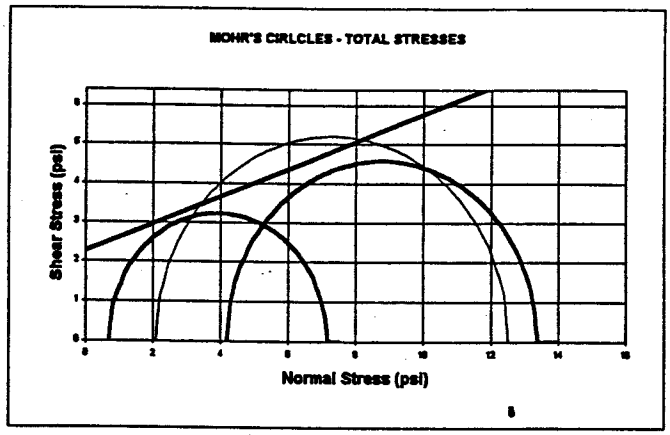
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

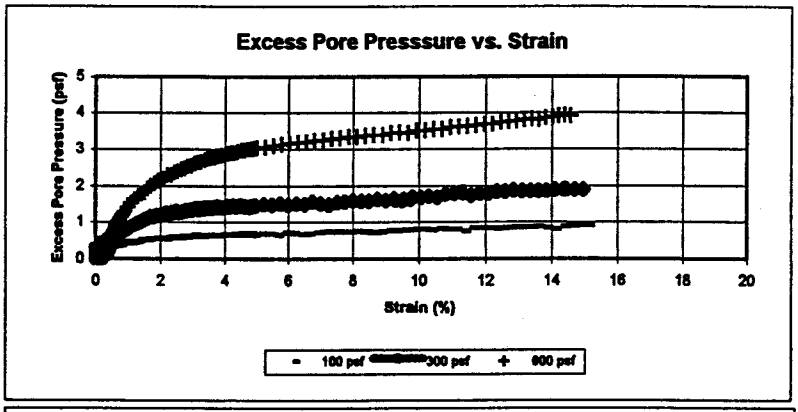
Project	Weyerhaueser Plymouth Mill
Sample No.	#4
TRI Log No.	2128-25-08

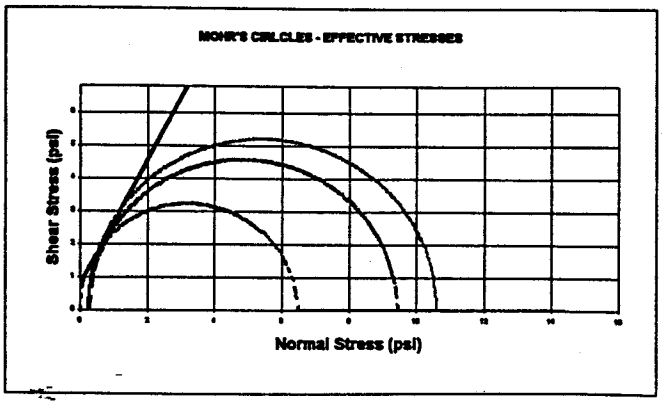
TEST RESULTS			
Total Stresses:			
phi angle	φ′	(deg)	19.3
cohesion	c	(psi)	2.3
Effective Stresses:			
phi angle	φ	(deg)	62.1
cohesion	c'	(psi)	0.8

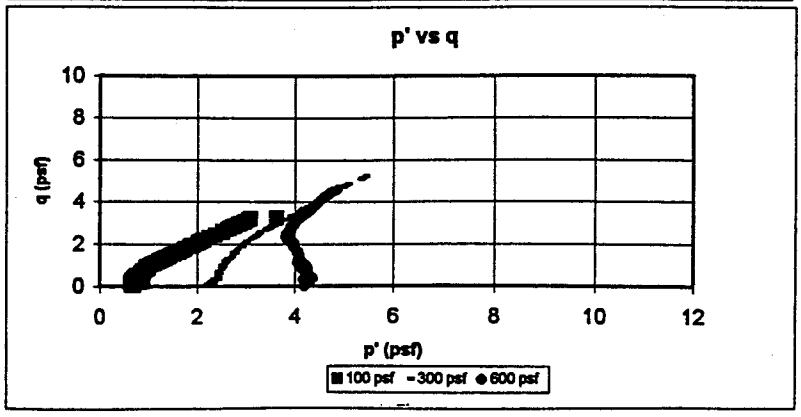
Trial Number	1	2	3
Confining Pressure (psf)	100	300	600
Diameter (in)	2.78	2.78	2.85
Height (in)	5.60	5.78	5.69
Moisture Content (%)	226	226	226
Bulk Density (pcf)	72.2	73.6	71.5
Dry Density (pcf)	22.2	22.0	21.9
Percent Compaction	85	85	84
Percent over OMC	101	101	101
Strain Rate (in/min)	.03%	.03%	.03%











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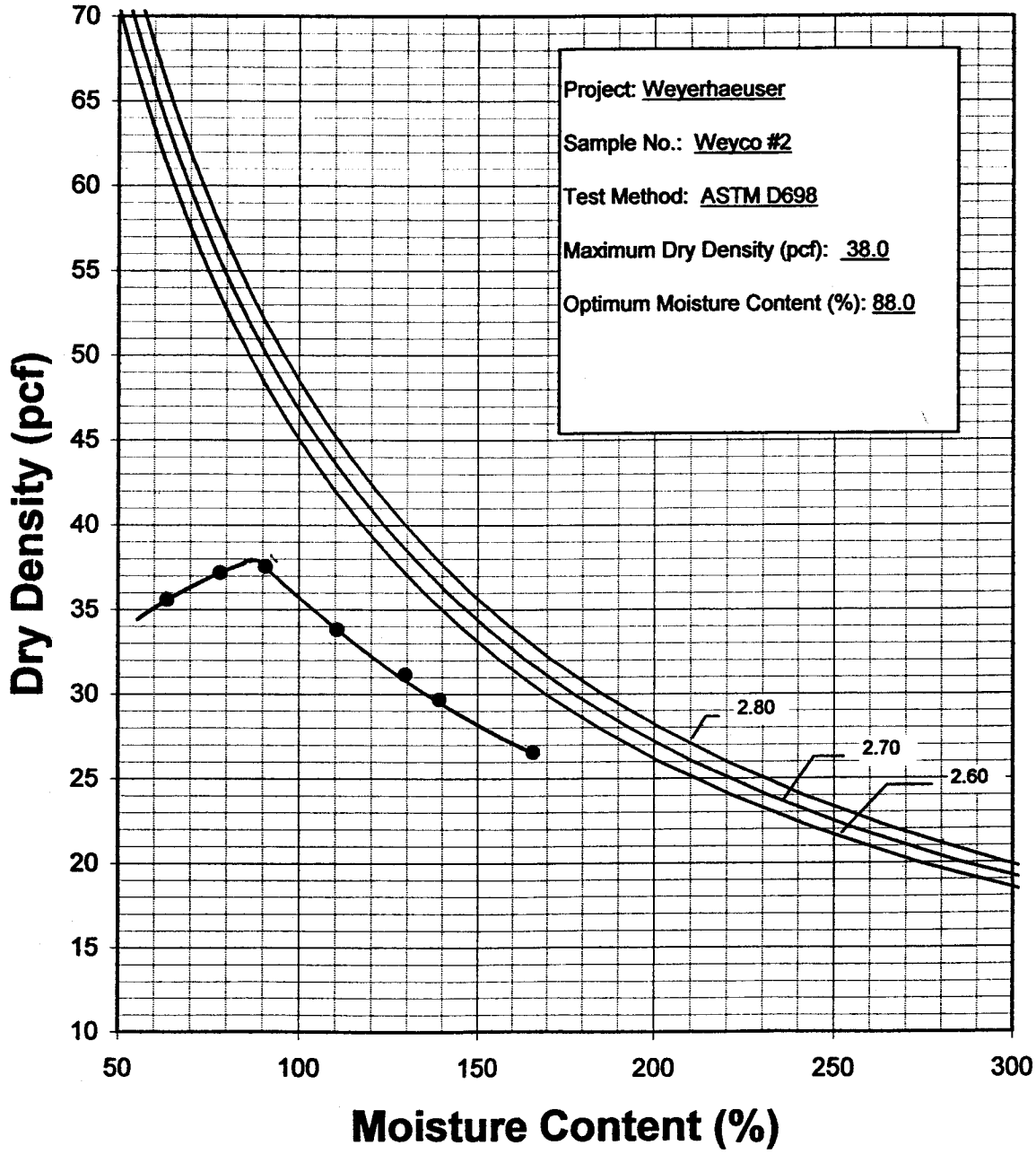
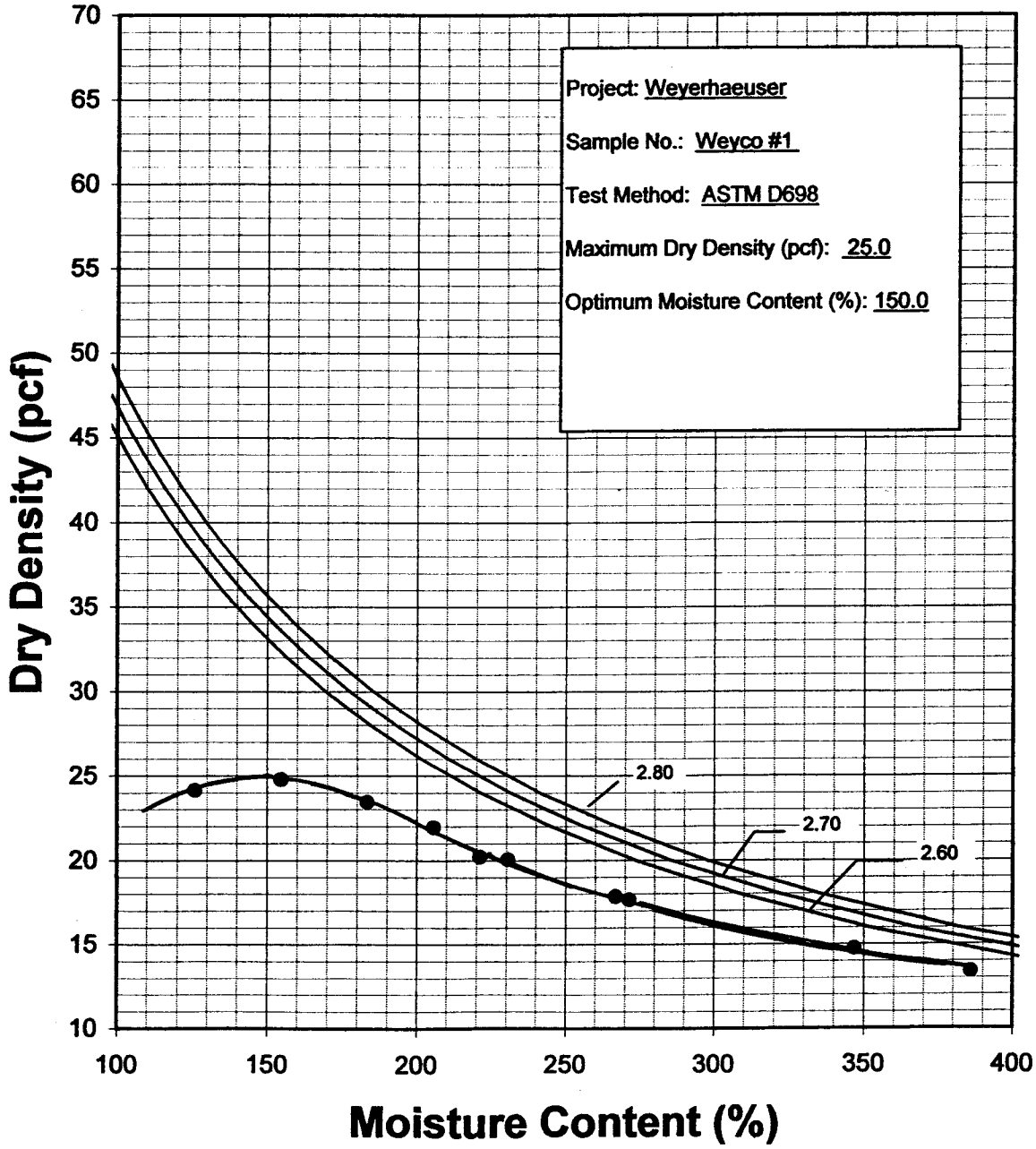
Proctor Compaction Test



TRI Log No. E2128-17-02

MLS 5-9-00
Quality Review/Date

Proctor Compaction Test



TRI Log No. E2128-17-02

MES 5-9-00
Quality Review/Date

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

FIBER SLUDGE TEST RESULTS

Client: The Fletcher Group
Project: Weyerhaeuser - Plymouth Mill

Material: Fiber Sludge
Sample Identification: Weyco #1
TRI Log #: E2128-17-02, E2128-25-08

MLS 7-31-00
Quality Review/Date

PARAMETER	TEST REPLICATE NUMBER	MEAN	STANDARD DEV.	COEFF. OF VAR.
Hydraulic Conductivity - ASTM D 5084 (2 psi effective stress - 1.5 Gradient)				
Hydraulic Conductivity (cm/sec)	6.5 E -06	6.5 E -06		
Moisture Content (%)	226	226		

Material: Fiber Sludge
Sample Identification: Weyco #4
TRI Log #: E2128-17-02

Hydraulic Conductivity - ASTM D 5084 (2 psi effective stress - 1.5 Gradient)				
Hydraulic Conductivity (cm/sec)	1.9 E -05	1.9 E -05		
Moisture Content (%)	226	226		

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

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TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

TEST RESULTS

The Fletcher Group
Project: Weyerhaeuser - Plymouth Mill

Material: Fiber Sludge
Sample Identification: Weyco #1
TRI Log #: E2128-17-02, E2128-25-08

MCJ 7-31-00
Quality Review/Date

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STANDARD DEV.
Moisture Content ASTM D 2216												
Sample ID: Weyco #1												
Moisture Content (%)	168										168	
Sample ID: Weyco #2												
Moisture Content (%)	186										186	
Sample ID: Weyco #3												
Moisture Content (%)	170										170	
Sample ID: Weyco #4												
Moisture Content (%)	123										123	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

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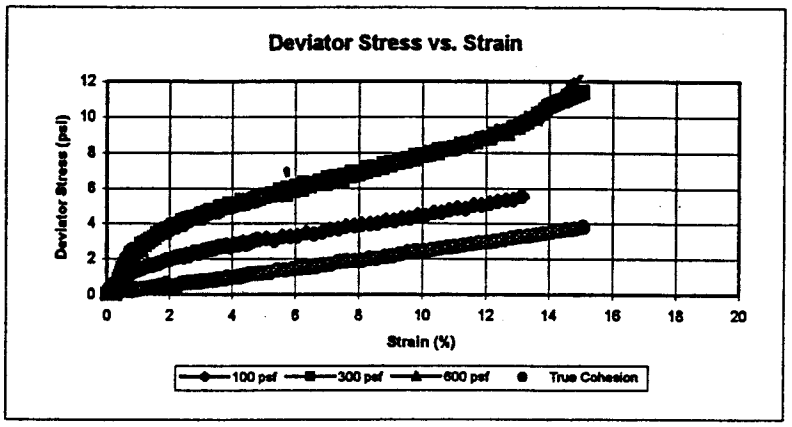
TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

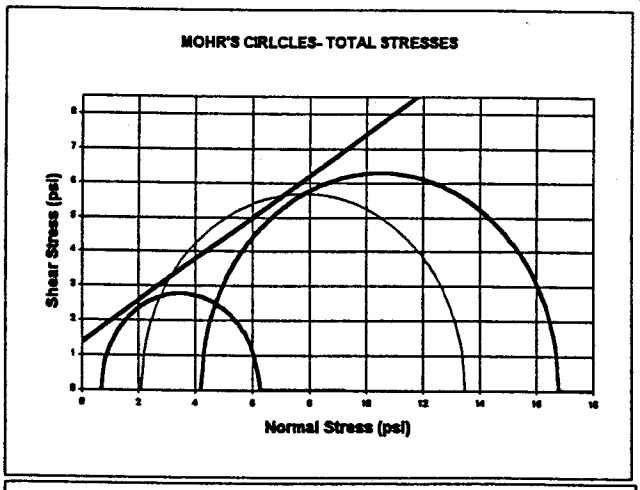
CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

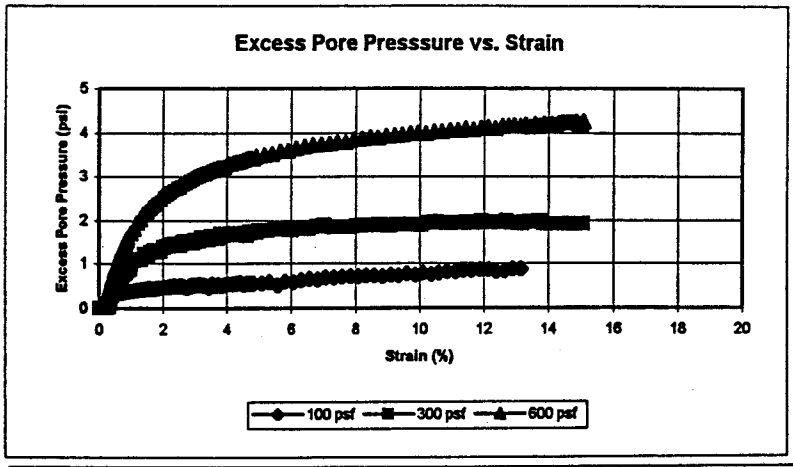
Project	Weyerhaueser Plymouth Mill
Sample No.	#1
TRI Log No.	2128-17-02

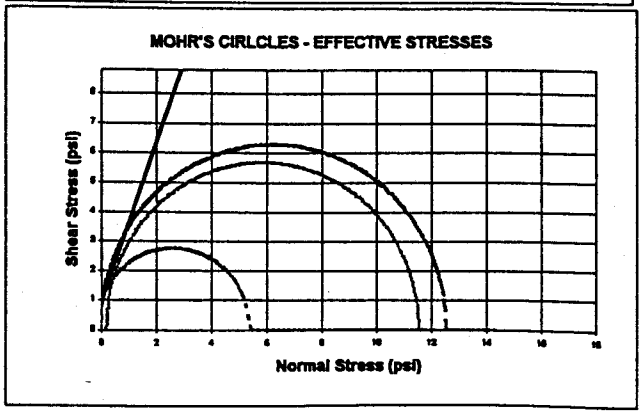
TEST RESULTS		
Total Stresses:		
phi φ′	(deg)	31.2
coh c	(psi)	1.4
Effective Stresses:		
phi φ	(deg)	69.7
coh c'	(psi)	0.9

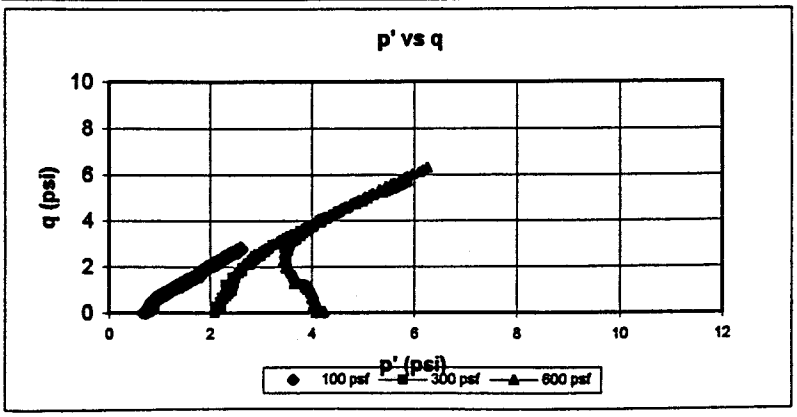
Trial Number	1	2	3
Confining Pressure (psf)	100	300	600
Diameter (in)	2.84	2.85	2.84
Height (in)	5.7	5.9	5.9
Moisture Content (%)	226	226	226
Bulk Density (pcf)	74.9	67	68.5
Dry Density (pcf)	23	20.0	21
Percent Compaction	92	80	84
Percent over OMC	76	76	76
Strain Rate (in/min)	.03%	.03%	.03%











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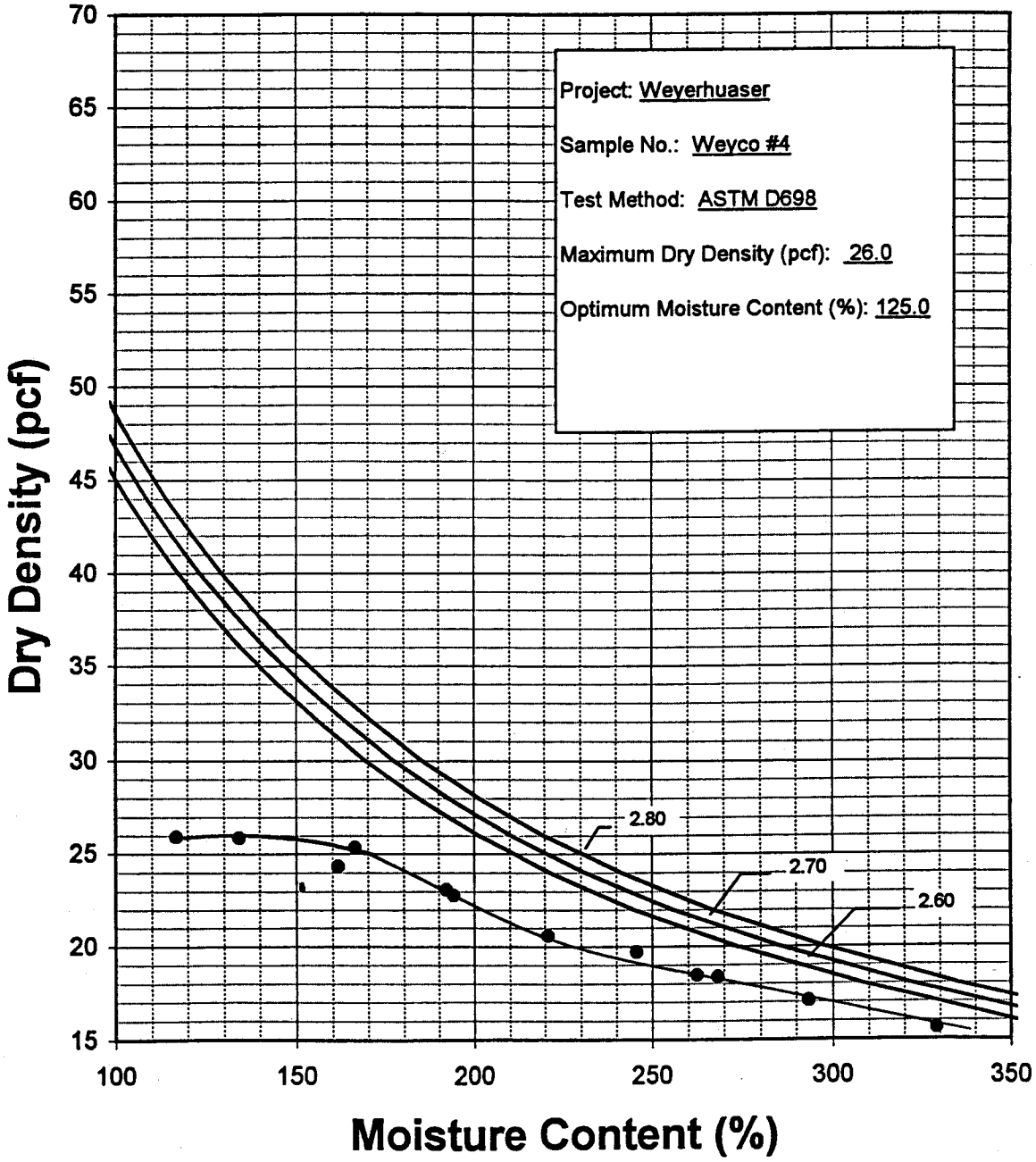
TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

Proctor Compaction Test



TRI Log No. E2128-25-08

MD 7-31-00
Quality Review/Date

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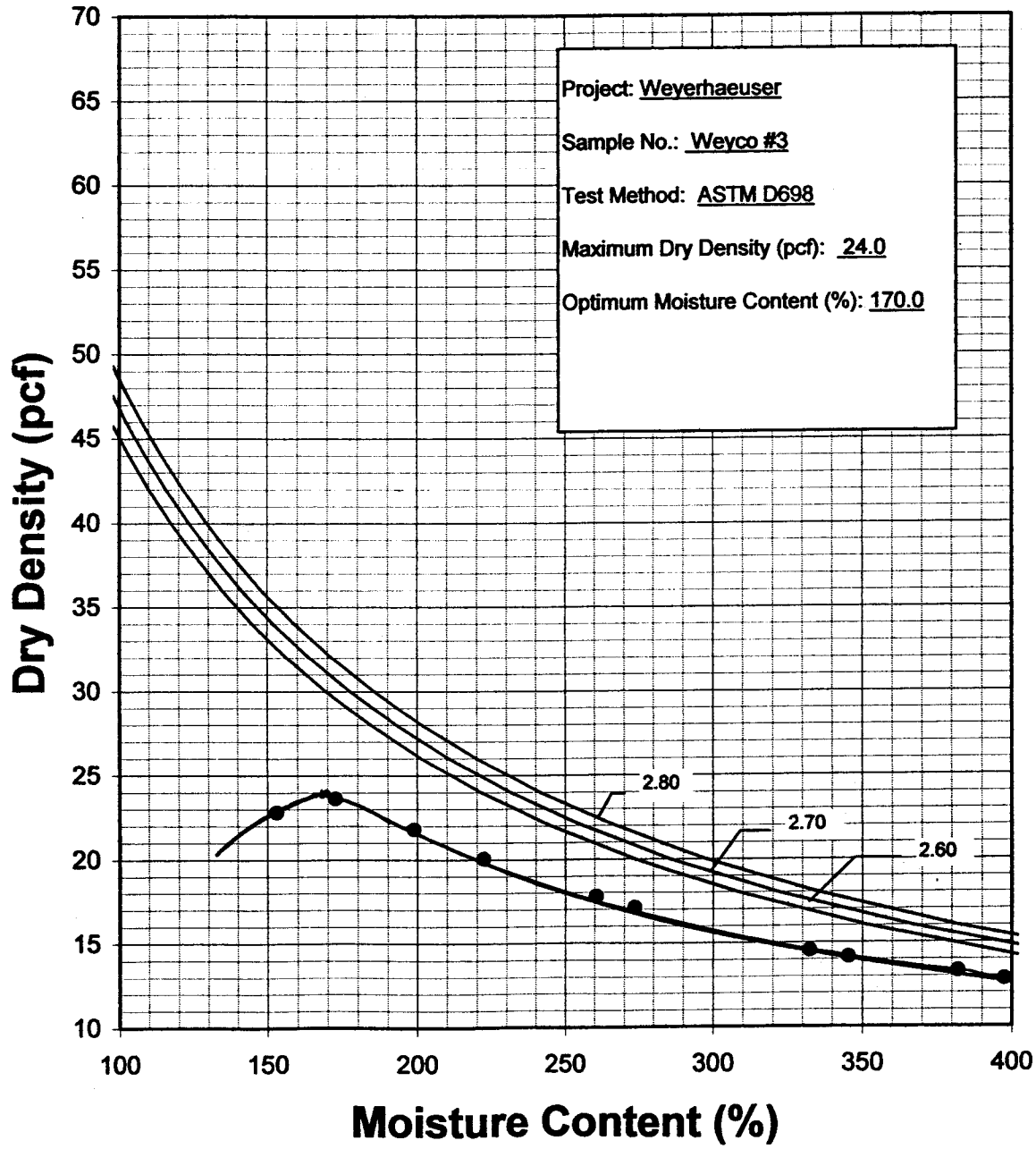
Proctor Compaction Test



TRI Log No. E2128-17-02

MLS 5-9-00
Quality Review/Date

APPENDIX B

HELP MODEL RESULTS

Fletcher Group
ENGINEERING & ENVIRONMENTAL SOLUTIONS
322 South Main Street • Greenville, South Carolina 29601
(864) 421-9999 • (864) 421-9909 FAX

JOB Weyerhaesuer Landfill
PROJECT NO. 511.01 SHEET 1 OF 1
CALCULATED BY DJD DATE 7-31-00
CHECKED BY dgl DATE 8-1-00
SCALE

Landfill Runoff Calculations for Weyerhaesuer Landfill New Bern, NC

Area = 565,617 ft² = 12.98 acres
Use a C=0.25 for vegetated slopes greater than 5%
Use Rainfall Data for Wilmington, NC
Hydraulic Length = 1,430 ft
Average Slope = 0.52%

Calculate Runoff for 25 and 100 year storm events:

T_c = 46 minutes
I_{25} = 3.4 in/hr
I_{100} = 4.2 in/hr

$Q = CIA$

$Q_{25} = (0.25)(3.4 \text{ in/hr})(12.98 \text{ acres})$
$Q_{25} = 11.03 \text{ ft}^3/\text{s}$

$Q_{100} = (0.25)(4.2 \text{ in/hr})(12.98 \text{ acres})$
$Q_{100} = 13.63 \text{ ft}^3/\text{s}$

Drainage Channel

Slope = 11.4%
Length = 188 feet
Use 12' wide with 2:1 side slopes
See attached calculations

Weyerhaeuser Drainge Channel Design

Manning's Formula Q=(KA(R)2/3(s)1/2)/n

Q= Flow Rate
A = cross sectional area of flow
R = hydraulic radius (cross sectional area of flow divided by the wetted perimeter)
S = Slope of the hydraulic gradient
n = manning coefficient
K = Constant

Channel Velocity (ft/s) =	5.14282	
Solve Flow Rate(MGD) =	8.808936	13.62945 CFS
Area (s.f.)=	2.65019	
H Radius (ft) =	0.204588	
Slope (ft/ft) =	0.114	
n =	0.034	

Hydraulic Radius = A/W.P.

H Radius =	0.204588
Wetted Perimeter (ft) =	12.95377
Area (ft^2) =	2.65019
Channel Base Width (ft) =	12
Water Depth (ft) =	0.213269
Channel Side Slope (ft/ft) =	2

****

NORTH AMERICAN GREEN CHANNEL PROTECTION
USER SPECIFIED CHANNEL LINING ANALYSIS

****

PROJECT NAME: Weyerhaesuer Drainage Channel PROJECT NO.: 511.01
COMPUTED BY: David DePratter DATE: 08-01-2000
FROM STATION/REACH: TO STATION/REACH:
DRAINAGE AREA: 12.98 Acres DESIGN FREQUENCY:

Channel Bottom Width (ft)	Side Slope Lt. (Horz. to 1)	Side Slope Rt. (Horz. to 1)	Channel Slope (ft/ft)
12.00	2.0	2.0	0.114

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (ft/sec)	Area (sf)	Hydraulic Radius (ft)	Normal Depth (ft)
13.6	0.5	5.13	2.66	0.21	0.21

Lining Type	Manning Coefficient	Permissible Shear (lb/sf)	Calculated Shear (lb/sf)	Safety Factor	Remark
P300 Staple E Phase 1 (Unvegetated)	0.034	3.00	1.52	1.97	STABLE

****

NORTH AMERICAN GREEN CHANNEL PROTECTION
USER SPECIFIED CHANNEL LINING BACK-UP COMPUTATIONS

****

PROJECT NAME: Weyerhaesuer Drainage Channel PROJECT NO.: 511.01

COMPUTED BY: David DePratter DATE: 08-01-2000
FROM STATION/REACH: TO STATION/REACH:
DRAINAGE AREA: 12.98 Acres DESIGN FREQUENCY:

****
INPUT PARAMETERS
****

Channel Discharge : 13.6 cfs
Peak Flow Period : 0.5 hours
Channel Slope : 0.114 (ft/ft)
Channel Bottom Width : 12.00 ft
Left Side Slope : 2.0:1
Right Side Slope : 2.0:1

Channel Lining Type : P300 Staple E Permissible Shear(Tp) : 3.00 psf
Phase = 1

****
CALCULATIONS
****

Initial Depth Estimate = 0.16 * (13.6 /(0.114^0.5))^0.375 = 0.64 ft
Final Channel Depth (after 11 iterations) = 0.21 ft
Flow Area = (12.00 * 0.21) + (0.5 * 0.21^2 * (2.0 + 2.0)) = 2.66 ft^2
Wet Perim. = 12.00+(0.21*(((2.0^2)+1)^.5 +((2.0^2) + 1)^.5)) = 12.96 ft
Hydraulic Radius = (2.66 / 12.96) = 0.21 ft
Channel Velocity = (1.486 / 0.034) * (0.21^0.667) * (0.114^.5) = 5.13 fps

Channel Effective Manning's Roughness = 0.0340
Calculated Shear (Td) = 62.4 * 0.21 * 0.114 = 1.52 psf
Safety Factor = (Tp/Td) = (3.00 / 1.52) = 1.97

****
NORTH AMERICAN GREEN CHANNEL PROTECTION
MATERIAL SPECIFICATIONS
****

P300 Specification

The North American Green P300P permanent erosion control/turf reinforcement mat is constructed of 100% UV stabilized high denier polypropylene fiber sewn between a black UV stabilized 1/2" mesh polypropylene netting on the top (5 lbs/1000 ft^2) and a black UV stabilized 5/8" mesh polypropylene netting on the bottom (3 lbs/1000 ft^2) with polyester thread. The mat is resistant to photo and chemical degradation. The following list contains further physical properties of the P300P erosion

control/turf reinforcement mat.

Property	Test Method	Value	Units
Thickness	ASTM D1777	.56	in
Resiliency	100 PSI-3 cycles	94	%
Mass Per Unit Area	ASTM D3776	11.2	oz/sq yd
Tensile Strength	ASTM D4632	35.2	lbs
Elongation	ASTM D4632	25.5	%
Tensile Strength	ASTM D4595	259.2	lbs/ft
Elongation	ASTM D4595	20.9	%
Tensile Strength	ASTM D5035	300	lbs/ft
Elongation	ASTM D5035	51	%
Tensile Strength	ASTM D1682	89	lbs
Elongation	ASTM D1682	21	%
UV Stability*	ASTM D4355	81*	lbs
		90*	%

*ASTM D1682 Tensile Strength and % Strength Retention of material after 1000 hours of exposure in Xenon-Arc Weatherometer.

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP3\weyer1.D4
TEMPERATURE DATA FILE:       C:\HELP3\weyer1.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\weyer1.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\weyer1.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\weyer1.D10
OUTPUT DATA FILE:            C:\HELP3\weyer1ot.OUT

TIME:  15:32     DATE:   7/31/2000


******************************************************************************

     TITLE:      Weyerhaeuser Landfill Sludge Cap
                 18" Compacted Soil Layer (k= 1.0 x 10^-5 cm/sec)
                 Fair Vegetation

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   7
          THICKNESS                  =      6.00   INCHES
          POROSITY                   =      0.4730 VOL/VOL
          FIELD CAPACITY             =      0.2220 VOL/VOL
          WILTING POINT              =      0.1040 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.2085 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.520000001000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 15

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4750	VOL/VOL
FIELD CAPACITY	=	0.3780	VOL/VOL
WILTING POINT	=	0.2650	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4750	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.170000003000E-04	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 7 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 7.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	75.40	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	31.400	ACRES
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.251	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.838	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.624	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	9.801	INCHES
TOTAL INITIAL WATER	=	9.801	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
39.60	41.60	49.30	59.50	67.20	73.90
77.70	77.00	71.00	59.70	50.00	42.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA
AND STATION LATITUDE = 35.87 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.26	2.82	4.37	2.63	3.53	5.42
	4.57	6.26	2.81	3.77	2.52	2.90
STD. DEVIATIONS	2.96	0.95	1.30	1.89	2.64	1.99
	2.29	5.93	1.69	2.69	1.66	1.28
RUNOFF						
TOTALS	0.004	0.002	0.004	0.000	0.017	0.011
	0.005	0.623	0.193	0.020	0.000	0.000
STD. DEVIATIONS	0.009	0.004	0.008	0.000	0.038	0.018
	0.005	1.394	0.424	0.039	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.397	1.835	2.375	2.410	2.612	3.672
	3.510	3.237	2.052	1.629	1.314	1.037
STD. DEVIATIONS	0.248	0.221	0.313	1.181	1.468	0.982
	1.556	1.398	0.975	0.479	0.507	0.192
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	1.8033	1.1242	1.6915	0.5177	0.9841	1.7756
	1.1488	2.0382	0.8662	1.8635	1.3345	1.7572
STD. DEVIATIONS	2.6384	0.8563	0.9105	0.7686	1.6898	1.2819
	0.9386	2.9193	0.9565	2.3521	1.2622	1.4477

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2						
AVERAGES	0.1743	0.0869	0.1298	0.0198	0.1105	0.1271
	0.0853	0.1791	0.1100	0.1944	0.0757	0.1137
STD. DEVIATIONS	0.2641	0.0939	0.1420	0.0353	0.2334	0.1079
	0.0557	0.3342	0.1647	0.3075	0.0799	0.0902

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.86	(9.753)	5113687.5	100.00
RUNOFF	0.880	(1.8297)	100256.67	1.961
EVAPOTRANSPIRATION	27.081	(0.7032)	3086734.25	60.362
PERCOLATION/LEAKAGE THROUGH LAYER 2	16.90475	(7.39865)	1926836.620	37.67999
AVERAGE HEAD ON TOP OF LAYER 2	0.117	(0.081)		
CHANGE IN WATER STORAGE	-0.001	(0.1180)	-140.20	-0.003

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	5.22	594986.000
RUNOFF	2.946	335772.7810
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.753497	85885.05470
AVERAGE HEAD ON TOP OF LAYER 2	5.455	
SNOW WATER	1.50	170761.2030

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4730

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1040

****

****

FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	1.2447	0.2075
2	8.5500	0.4750
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
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**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP3\weyer1.D4
TEMPERATURE DATA FILE:       C:\HELP3\weyer1.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\weyer1.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\weyer1.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\weyer2.D10
OUTPUT DATA FILE:            C:\HELP3\weyer2ot.OUT

TIME:  12:26     DATE:   8/ 8/2000

******************************************************************************
```

TITLE: **Weyerhaeuser Landfill Sludge Cap**
30" Fiber Residual Layer (k = 7.5 x 10^{-6} cm/sec)
Bare Soil

```
******************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   7
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4730 VOL/VOL
          FIELD CAPACITY               =      0.2220 VOL/VOL
          WILTING POINT                =      0.1040 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2090 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.520000001000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	30.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.3730	VOL/VOL
WILTING POINT	=	0.2660	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4370	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.749999981000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 7 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 7.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	88.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	31.400	ACRES
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.254	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.838	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.624	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	14.364	INCHES
TOTAL INITIAL WATER	=	14.364	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
39.60	41.60	49.30	59.50	67.20	73.90
77.70	77.00	71.00	59.70	50.00	42.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA
AND STATION LATITUDE = 35.87 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.26	2.82	4.37	2.63	3.53	5.42
	4.57	6.26	2.81	3.77	2.52	2.90
STD. DEVIATIONS	2.96	0.95	1.30	1.89	2.64	1.99
	2.29	5.93	1.69	2.69	1.66	1.28
RUNOFF						
TOTALS	0.278	0.117	0.251	0.045	0.207	0.329
	0.319	1.076	0.378	0.377	0.125	0.144
STD. DEVIATIONS	0.430	0.128	0.279	0.089	0.457	0.252
	0.227	2.148	0.572	0.582	0.149	0.145
EVAPOTRANSPIRATION						
TOTALS	1.397	1.840	2.374	2.409	2.618	3.684
	3.547	3.254	2.067	1.627	1.307	1.038
STD. DEVIATIONS	0.246	0.216	0.319	1.178	1.493	0.997
	1.594	1.397	0.988	0.478	0.506	0.191
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	1.3642	1.1548	1.4381	0.4997	0.7918	1.4322
	0.8038	1.5323	0.7096	1.5085	1.2145	1.5807
STD. DEVIATIONS	1.8628	0.9175	0.6301	0.6676	1.2457	1.0752
	0.6917	2.1402	0.6971	1.8248	1.1185	1.4141

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2						
AVERAGES	0.4079	0.2306	0.2567	0.0382	0.1788	0.2183
	0.1164	0.3777	0.1709	0.3587	0.1950	0.3439
STD. DEVIATIONS	0.6985	0.2292	0.2638	0.0710	0.3641	0.1890
	0.0971	0.7381	0.2828	0.5007	0.2431	0.3245

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.86	(9.753)	5113687.5	100.00
RUNOFF	3.646	(3.5095)	415586.69	8.127
EVAPOTRANSPIRATION	27.162	(0.8014)	3095933.00	60.542
PERCOLATION/LEAKAGE THROUGH LAYER 2	14.03013	(5.57445)	1599182.370	31.27259
AVERAGE HEAD ON TOP OF LAYER 2	0.241	(0.167)		
CHANGE IN WATER STORAGE	0.026	(0.1641)	2985.71	0.058

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	5.22	594986.000
RUNOFF	3.370	384111.9370
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.302533	34483.30080
AVERAGE HEAD ON TOP OF LAYER 2	5.576	
SNOW WATER	1.50	170761.2030

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4730

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1040

****

****

FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	1.3848	0.2308
2	13.1100	0.4370
SNOW WATER	0.000	

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****

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************

PRECIPITATION DATA FILE:     C:\HELP3\weyer1.D4
TEMPERATURE DATA FILE:       C:\HELP3\weyer1.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\weyer1.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\weyer1.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\weyer3.D10
OUTPUT DATA FILE:            C:\HELP3\weyer3ot.OUT

TIME:  15:48     DATE:   7/31/2000


******************************************************************************

     TITLE:      Weyerhaeuser Landfill Sludge Cap
                 18" Fiber Residual Layer (k = 6.5 x 10^-6 cm/sec)
                 Fair Vegetation

******************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   7
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.4730 VOL/VOL
          FIELD CAPACITY               =      0.2220 VOL/VOL
          WILTING POINT                =      0.1040 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2100 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.520000001000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	30.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.3730	VOL/VOL
WILTING POINT	=	0.2660	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4370	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.649999993000E-05	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 7 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 7.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	75.40	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	31.400	ACRES
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.260	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.838	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.624	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	14.370	INCHES
TOTAL INITIAL WATER	=	14.370	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM RALEIGH NORTH CAROLINA

STATION LATITUDE	=	35.87	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	86	
END OF GROWING SEASON (JULIAN DATE)	=	310	
EVAPORATIVE ZONE DEPTH	=	6.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	78.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.55	3.43	3.69	2.91	3.67	3.66
4.38	4.44	3.29	2.73	2.87	3.14

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
39.60	41.60	49.30	59.50	67.20	73.90
77.70	77.00	71.00	59.70	50.00	42.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR RALEIGH NORTH CAROLINA
AND STATION LATITUDE = 35.87 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.26	2.82	4.37	2.63	3.53	5.42
	4.57	6.26	2.81	3.77	2.52	2.90
STD. DEVIATIONS	2.96	0.95	1.30	1.89	2.64	1.99
	2.29	5.93	1.69	2.69	1.66	1.28
RUNOFF						
TOTALS	0.334	0.006	0.178	0.000	0.149	0.019
	0.006	0.913	0.373	0.339	0.000	0.117
STD. DEVIATIONS	0.650	0.014	0.398	0.000	0.334	0.034
	0.007	2.042	0.827	0.751	0.000	0.261
EVAPOTRANSPIRATION						
TOTALS	1.398	1.852	2.375	2.418	2.660	3.703
	3.603	3.284	2.076	1.626	1.314	1.039
STD. DEVIATIONS	0.244	0.202	0.320	1.193	1.558	1.040
	1.683	1.413	0.998	0.479	0.507	0.192
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	1.3123	1.2035	1.5198	0.5512	0.8243	1.7045
	1.0095	1.6939	0.7487	1.5227	1.3594	1.5351
STD. DEVIATIONS	1.6768	0.9632	0.4670	0.6804	1.2705	1.2142
	0.8472	2.2029	0.5799	1.7054	1.2607	1.4078

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2						
AVERAGES	0.4702	0.3273	0.3644	0.0551	0.2525	0.4768
	0.2611	0.5441	0.2114	0.5241	0.3100	0.4259
STD. DEVIATIONS	0.7427	0.3025	0.2742	0.0945	0.5193	0.4039
	0.2046	0.9969	0.2537	0.6523	0.3865	0.3642

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 5

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.86	(9.753)	5113687.5	100.00
RUNOFF	2.436	(3.7716)	277629.28	5.429
EVAPOTRANSPIRATION	27.347	(0.8078)	3117048.00	60.955
PERCOLATION/LEAKAGE THROUGH LAYER 2	14.98493	(5.33490)	1708012.000	33.40079
AVERAGE HEAD ON TOP OF LAYER 2	0.352	(0.199)		
CHANGE IN WATER STORAGE	0.096	(0.3249)	10999.05	0.215

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****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 5

	(INCHES)	(CU. FT.)
PRECIPITATION	5.22	594986.000
RUNOFF	3.376	384773.3440
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.265306	30240.14450
AVERAGE HEAD ON TOP OF LAYER 2	5.998	
SNOW WATER	1.50	170761.2030

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4730

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1040

****

****

FINAL WATER STORAGE AT END OF YEAR 5

LAYER	(INCHES)	(VOL/VOL)
1	1.7427	0.2904
2	13.1100	0.4370
SNOW WATER	0.000	

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****

APPENDIX C

COVER SOIL STABILITY RESULTS

WEYERHAUSER NEW BERN FIBER RESIDUAL CAP STABILITY

Fiber Residual Cap Geometry:
Cover Slope = 5:1
Max. Slope Length = 102 ft (benches @ 20 ft. vertical)

Fiber Residual and Soil Properties:

Measured Properties of Fiber residual	Sample #1	Sample #2	Sample #3	Sample #4	Design Value
As-Rec'd Moisture, %	188	186	170	123	-
Max. Dry Density, pcf	25.0	38.0	24.0	26.0	-
Optimum Moisture Content, %	150.0	88.0	170.0	125.0	-
Target As-Placed Density, pcf	20.5	31.0	19.0	20.5	-
Target As-Placed Moisture Content, %	220	130	240	220	-
Compacted Unit Weight, pcf	65.6	71.3	64.6	65.6	66
Permeability, cm/s	6.5×10^{-6}	-	-	1.9×10^{-5}	1×10^{-5}
Triaxial – total friction, N - degrees	31	-	-	19	24
Triaxial – total cohesion, c - psf	202	-	-	243	100
Triaxial – effective friction, N - degrees	70	-	-	62	35
Triaxial – effective cohesion, c - psf	130	-	-	115	100
Unconfined "Apparent" Cohesion, psf	274	-	-	230	135

Material	Design Properties		
	Unit Weight, pcf	c, psf	phi, deg
Fiber Residual	66	100	24
Waste Material*	88	100	12
Subgrade Soils*	114	0	30

*As recommended and used in the original analyses by Delta.

Analysis Summary:

	60 ft. high		80 ft. high	
	FS_{static}	$FS_{seismic}$	FS_{static}	$FS_{seismic}$
Cover (Sliding) Stability**	> 1.5	> 1.5	> 1.5	> 1.5
Global (Rotational) Stability***	1.64	1.17	1.52	1.08
Global (Wedge) Stability***	1.61	1.16	1.57	1.11

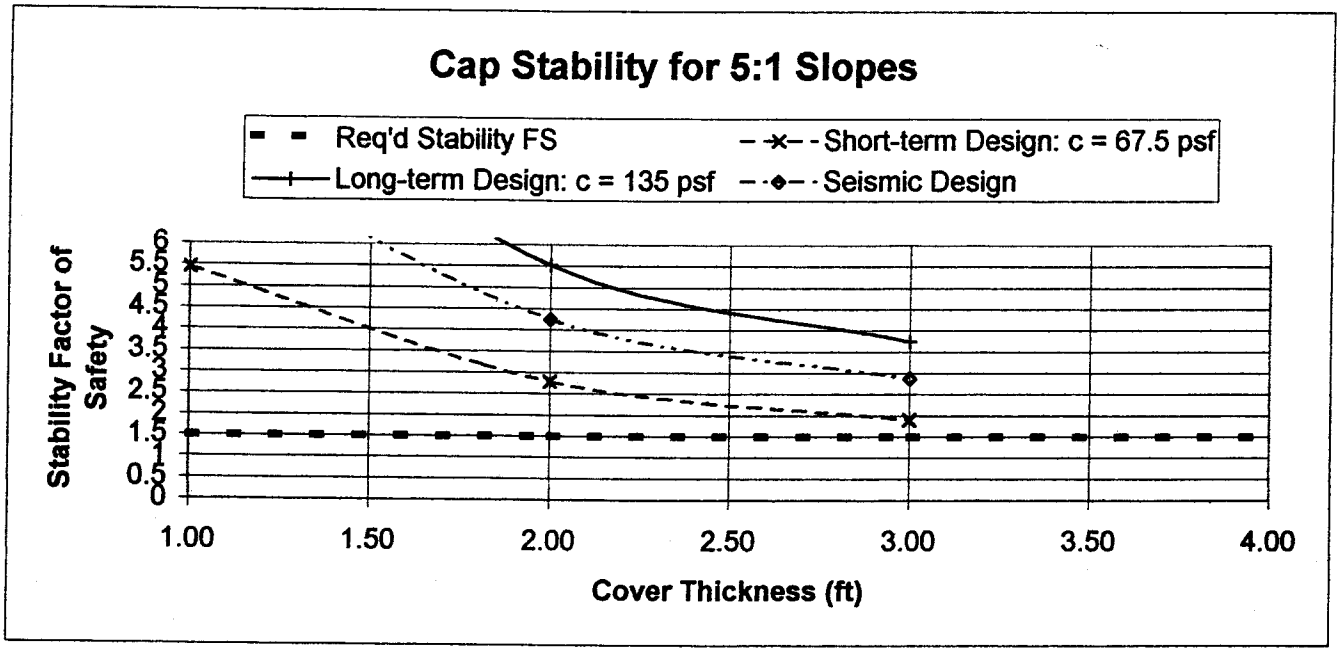
** using "apparent cohesion" analysis *** using GARDS stability software

These factors of safety provide acceptable assurance of closure stability.

~~Weyerhauser - Plymouth Mill~~
Landfill Sludge Cap
COVER SOIL STABILITY USING EFFECTIVE "APPARENT" COHESION (after Day, 1989)

FS = [effective"apparent"cohesion + (bouyant unit weight)(seepage depth)cos2(slope angle)tan(eff.friction angle)]
[(total unit weight)(seepage depth)cos(slope angle)sin(slope angle)]

Sludge Type	effective "apparent" cohesion (psf)	bouyant unit weight (pcf)	seepage depth (ft)	slope angle (deg.)	effective friction angle (deg.)	total unit weight (pcf)	frictional resisting force	down slope pull	total resisting force	Stability Factor of Safety
Short-term Design: "Worst Case" Sludge (i.e. FS=4 on measured "apparent cohesion and conservative unit weight)										
	67.50	3.60	1.00	11.30	24.00	66.00	1.54	12.68	69.04	5.44
	67.50	3.60	2.00	11.30	24.00	66.00	3.08	25.36	70.58	2.78
	67.50	3.60	3.00	11.30	24.00	66.00	4.62	38.05	72.12	1.90
Long-term Design: "Typical Case" Sludge (i.e. FS=2 on measured "apparent cohesion and conservative unit weight)										
	135.00	3.60	1.00	11.30	35.00	66.00	2.42	12.68	137.42	10.84
	135.00	3.60	2.00	11.30	35.00	66.00	4.85	25.36	139.85	5.51
	135.00	3.60	3.00	11.30	35.00	66.00	7.27	38.05	142.27	3.74
Seismic Design: Long-term design case with 1.3 factor on down-slope pull for horizontal acceleration.										
	135.00	3.60	1.00	11.30	35.00	66.00	2.42	16.49	137.42	8.34
	135.00	3.60	2.00	11.30	35.00	66.00	4.85	32.97	139.85	4.24
	135.00	3.60	3.00	11.30	35.00	66.00	7.27	49.46	142.27	2.88



~~F = 1.553~~

GARDS ANALYSIS JUNE 2000

Material	Unit Wt	C	Phi	Pieze	Ru
	pcf	psf	deg	Surf.	
FIBER SLUDGE	66	100	24		
~~CLAY COVER~~	~~125~~	~~500~~	~~25~~	0	0
WASTE MATERIAL	88	100	12	1	0
NATIVE SAND	114	0	30	1	0

~~Delta Environmental Charlotte NC~~

EXSE-159-2.002

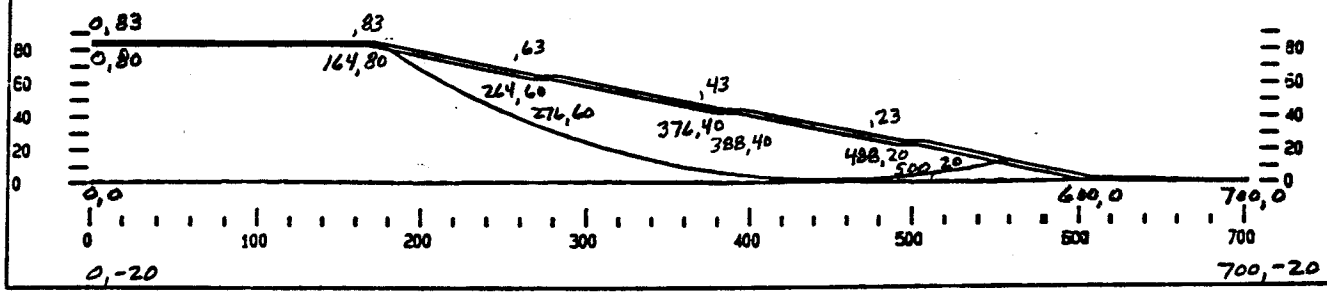
NEW BERM LANDFILL

8/25/97

BENCHED 5 : SLOPE

SLIP SURFACE FAILURES

COVER 25:



60 ft high - static
-sludge cap -

```
*********************************************************************
*                                                                   *
*                      G A R D S   S U M M A R Y                    *
*                                                                   *
*    Project:   *
*       File:  wyrhsr6a                                             *
*                                                                   *
*                          GARDS  Version 2.00                      *
*                             developed by                          *
*          Department of Civil and Environmental Engineering        *
*                        University of Cincinnati                   *
*                            under contract to                      *
*                 U.S. Environmental Protection Agency              *
*                   Land Pollution Control Division                 *
*            Hazardous Waste Engineering Research Laboratory        *
*                                                                   *
*********************************************************************
```

```
*********************************************************************
*                         Site Characteristics                      *
*********************************************************************
*                                                                   *
*      The seismic coefficient is. . . . . . . . . . . . . . 0.07   *
*                                                                   *
*      The design earthquake magnitude is. . . . . . . . . . 6.00   *
*                                                                   *
*      The maximum flood elevation in this case is . . . . .    0   *
*                                                                   *
*      The elevation of the seasonal high ground water is. .    0   *
*                                                                   *
*      The design waste elevation in the cell is . . . . . .    0   *
*                                                                   *
*      The soil number representing the clay liner is. . . .    0   *
*                                                                   *
*********************************************************************
```

```
*********************************************************************
*                          Section Geometry                         *
*********************************************************************
*                                                                   *
*      The number of soil boundary lines for this section is  4     *
*-------------------------------------------------------------------*
*     Line  1        Point          X             Y                 *
*                   ------        ------        ------              *
*                      1            0            -20                 *
*                      2          700            -20                 *
*-------------------------------------------------------------------*
```

Line 2	Point	X	Y
	1	0	0
	2	600	0

Line 3	Point	X	Y
	1	0	60
	2	164	60
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	63
	2	164	63
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained

```
*   Cohesion          0            0          100        (lb/sq.ft)  *
*   Phi Angle         0            0           12         (degrees)  *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . .   88.000   (lb/cu.ft)         *
*        Clay Content . . . . . . . . .     0.000   (%)                *
*        Overconsolidation Ratio . . . .    0.000                      *
*        Initial Void Ratio . . . . . .     0.000                      *
*        Compression Index . . . . . . .    0.000                      *
*        Recompression Index . . . . . .    0.000                      *
*        Permeability . . . . . . . .       0.000   (ft/yr)            *
*        Median Grain Size . . . . . . .    0.000   (mm)               *
*        Plasticity Index . . . . . . .     0.000   (%)                *
*        Liquid Limit . . . . . . . . .     0.000   (%)                *
*        Standard Penetration Number . .    0.000   (blows/ft)         *
*************************************************************************


*************************************************************************
*                          Soil  3 Properties                           *
*************************************************************************
*                                                                       *
*             Unconsolidated  Consolidated  Consolidated               *
*                 Undrained     Undrained      Drained                  *
*                ----------    ----------    ----------                *
*   Cohesion          0            0          100        (lb/sq.ft)  *
*   Phi Angle         0            0           24         (degrees)  *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . .   66.000   (lb/cu.ft)         *
*        Clay Content . . . . . . . . .     0.000   (%)                *
*        Overconsolidation Ratio . . . .    0.000                      *
*        Initial Void Ratio . . . . . .     0.000                      *
*        Compression Index . . . . . . .    0.000                      *
*        Recompression Index . . . . . .    0.000                      *
*        Permeability . . . . . . . .       0.000   (ft/yr)            *
*        Median Grain Size . . . . . . .    0.000   (mm)               *
*        Plasticity Index . . . . . . .     0.000   (%)                *
*        Liquid Limit . . . . . . . . .     0.000   (%)                *
*        Standard Penetration Number . .    0.000   (blows/ft)         *
*************************************************************************


*************************************************************************
*                     Automatically Generated                           *
*             Piezometric Surface for Hydraulic Condition               *
*             1: Deep Static Ground Water Table                         *
*************************************************************************
*                                                                       *
*                  Point          X            Y                       *
*                 ------        ------       ------                    *
*                    1            0            0                       *
*                    2          700            0                       *
*************************************************************************
*************************************************************************
*                          Hydraulics Results                           *
*************************************************************************
*                                                                       *
*        Seepage In . . . . . . . .        0.000   (cu.ft/yr)          *
*                                                                       *
*        Seepage Out . . . . . . . .       0.000   (cu.ft/yr)          *
*                                                                       *
*        Critical Exit Gradient . . .      0.000                       *
*                                                                       *
```

For this hydraulic condition there is no liner uplift.

R O T A T I O N A L F A I L U R E R E S U L T S

Automatic Grid Search

The slopes were analyzed for failure arcs having centers in areas defined by the following parallelograms:

Slope 1

Co-ord.	Point 1	Point 2	Point 3	Point 4
X	276	600	660	336
Y	78	18	123	183

The number of divisions between points 1 and 2 were 4
The number of divisions between points 2 and 3 were 4
The X-increment used in the search was 10
The Y-increment used in the search was 10

R O T A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient Not Applied

Safety Factor	Failure Radius	X-Co-ord	Y-Co-ord
1.64	263.0	424.5	263.0
1.64	260.5	424.5	260.5
1.64	265.5	424.5	265.5
1.64	268.0	424.5	268.0
1.64	270.5	424.5	270.5
1.65	262.9	422.0	263.0
1.65	267.9	422.0	268.0
1.66	267.7	419.5	268.0
1.66	257.4	417.0	268.0
1.66	247.5	417.0	258.0
1.66	267.4	417.0	278.0
1.66	247.7	417.0	248.0
1.67	236.9	407.0	248.0
1.67	246.9	407.0	258.0
1.67	256.9	407.0	268.0
1.67	227.0	407.0	238.0
1.67	227.3	407.0	228.0
1.67	217.3	407.0	218.0
1.68	207.4	407.0	208.0
1.68	197.4	407.0	198.0
1.69	187.4	407.0	188.0

1.70	177.4	407.0	178.0
1.72	167.5	407.0	168.0
1.74	167.1	397.0	168.0
1.78	158.1	417.0	168.0
1.78	158.1	417.0	168.0
1.81	141.1	402.0	141.8
1.84	248.2	427.0	268.0
1.84	248.2	427.0	268.0
1.84	243.3	427.0	263.0
1.86	228.5	427.0	248.0
1.96	149.5	427.0	168.0
1.96	114.5	387.0	115.5
1.99	154.0	336.0	183.0
2.05	60.3	453.0	74.3
2.07	88.2	468.0	100.5
2.09	126.1	321.0	156.8
2.11	116.1	483.0	126.8
2.11	144.0	498.0	153.0
2.14	110.3	564.0	111.8
2.15	82.4	549.0	85.5
2.25	87.7	372.0	89.3
2.28	54.6	534.0	59.3
2.35	138.2	579.0	138.0
2.39	98.2	306.0	130.5
2.61	32.5	438.0	48.0
2.78	27.1	357.0	63.0
2.90	26.7	519.0	33.0
3.01	70.3	291.0	104.3

T R A N S L A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient Not Applied

Central block endpoints automatically generated.

The minimum factor of safety is 1.61

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	320.0	0.0	376.0	0.0
2	376.0	0.0	388.0	0.0
3	388.0	0.0	488.0	0.0
4	488.0	0.0	500.0	0.0
5	500.0	0.0	600.0	0.0
6	320.0	0.0	276.0	54.3
7	276.0	54.3	271.4	60.0
8	271.4	60.0	269.5	63.0
9	600.0	0.0	600.0	0.0

RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY

Shear Strength	Confidence of	Recommended

Parameter	Strength Measurement	Minimum F.S.
UU (end of construction, no waste or pool containment)	low	1.40
	high	1.20
CU	low	1.50
	high	1.30
CU (drawdown pool condition)	low	1.40
	high	1.20
CD (long-term, no seismic effects)	low	1.60
	high	1.40
CD (long-term with seismic effects)	low	1.50
	high	1.30

If the dike > 30 feet in height, add 0.10 to the F.S. in each case.

S E T T L E M E N T R E S U L T S

Settlement analysis was not performed.

L I Q U E F A C T I O N R E S U L T S

Liquefaction analysis was not performed.

G A R D S S U M M A R Y

File: wyrhsr6a Date: 08-02-2000 Time: 12:06:13

Project: *

Hydraulic Condition 1: Deep Static Ground Water Table

Rotational Failure Analysis Safety Factor	
Unconsolidated Undrained Case	Not Run
Consolidated Undrained Case	Not Run
Consolidated Drained Case	1.64

Translational Failure Analysis Safety Factor	
Unconsolidated Undrained Case	Not Run
Consolidated Undrained Case	Not Run
Consolidated Drained Case	1.61

Settlement Analysis	Not Run
Liquefaction Analysis	Not Run

60 ft high-seismic
- sludge cap -

```
*****************************************************************
*                                                               *
*                    G A R D S   S U M M A R Y                  *
*                                                               *
*    Project:   *
*       File:  wyrhsr6b                                         *
*                                                               *
*                        GARDS  Version 2.00                    *
*                           developed by                        *
*          Department of Civil and Environmental Engineering    *
*                       University of Cincinnati                *
*                          under contract to                    *
*                U.S. Environmental Protection Agency           *
*                  Land Pollution Control Division              *
*            Hazardous Waste Engineering Research Laboratory    *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                      Site Characteristics                     *
*****************************************************************
*                                                               *
*      The seismic coefficient is. . . . . . . . . . . . . 0.07 *
*                                                               *
*      The design earthquake magnitude is. . . . . . . . . . 6.00 *
*                                                               *
*      The maximum flood elevation in this case is . . . . .    0 *
*                                                               *
*      The elevation of the seasonal high ground water is. .    0 *
*                                                               *
*      The design waste elevation in the cell is . . . . . .    0 *
*                                                               *
*      The soil number representing the clay liner is. . . .    0 *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                        Section Geometry                       *
*****************************************************************
*                                                               *
*      The number of soil boundary lines for this section is  4 *
*---------------------------------------------------------------*
*     Line  1        Point          X            Y              *
*                    ------       ------       ------            *
*                       1            0          -20              *
*                       2          700          -20              *
*---------------------------------------------------------------*
```

Line 2	Point	X	Y
	1	0	0
	2	600	0

Line 3	Point	X	Y
	1	0	60
	2	164	60
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	63
	2	164	63
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained

```
*   Cohesion          0            0            100        (lb/sq.ft)  *
*   Phi Angle         0            0             12         (degrees)  *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . .   88.000   (lb/cu.ft)         *
*        Clay Content  . . . . . . . . .    0.000   (%)                *
*        Overconsolidation Ratio . . . .    0.000                      *
*        Initial Void Ratio  . . . . . .    0.000                      *
*        Compression Index . . . . . . .    0.000                      *
*        Recompression Index . . . . . .    0.000                      *
*        Permeability  . . . . . . . .      0.000   (ft/yr)            *
*        Median Grain Size . . . . . . .    0.000   (mm)               *
*        Plasticity Index  . . . . . . .    0.000   (%)                *
*        Liquid Limit  . . . . . . . . .    0.000   (%)                *
*        Standard Penetration Number . .    0.000   (blows/ft)         *
*************************************************************************


*************************************************************************
*                          Soil  3 Properties                           *
*************************************************************************
*                                                                       *
*             Unconsolidated  Consolidated  Consolidated               *
*                 Undrained     Undrained      Drained                  *
*               ------------  ------------  ------------               *
*   Cohesion          0            0            100        (lb/sq.ft)  *
*   Phi Angle         0            0             24         (degrees)  *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . .   66.000   (lb/cu.ft)         *
*        Clay Content  . . . . . . . . .    0.000   (%)                *
*        Overconsolidation Ratio . . . .    0.000                      *
*        Initial Void Ratio  . . . . . .    0.000                      *
*        Compression Index . . . . . . .    0.000                      *
*        Recompression Index . . . . . .    0.000                      *
*        Permeability  . . . . . . . .      0.000   (ft/yr)            *
*        Median Grain Size . . . . . . .    0.000   (mm)               *
*        Plasticity Index  . . . . . . .    0.000   (%)                *
*        Liquid Limit  . . . . . . . . .    0.000   (%)                *
*        Standard Penetration Number . .    0.000   (blows/ft)         *
*************************************************************************


*************************************************************************
*                       Automatically Generated                         *
*             Piezometric Surface for Hydraulic Condition               *
*             1: Deep Static Ground Water Table                         *
*************************************************************************
*                                                                       *
*                  Point          X            Y                       *
*                 ------        ------       ------                     *
*                    1            0            0                        *
*                    2          700            0                        *
*************************************************************************
*************************************************************************
*                          Hydraulics Results                           *
*************************************************************************
*                                                                       *
*        Seepage In  . . . . . . . .        0.000   (cu.ft/yr)         *
*                                                                       *
*        Seepage Out . . . . . . . .        0.000   (cu.ft/yr)         *
*                                                                       *
*        Critical Exit Gradient  . . .      0.000                      *
*                                                                       *
```

For this hydraulic condition there is no liner uplift.

R O T A T I O N A L F A I L U R E R E S U L T S

Automatic Grid Search

The slopes were analyzed for failure arcs having centers in areas defined by the following parallelograms:

Slope 1

Co-ord.	Point 1	Point 2	Point 3	Point 4
X	276	600	660	336
Y	78	18	123	183

The number of divisions between points 1 and 2 were 4
The number of divisions between points 2 and 3 were 4
The X-increment used in the search was 10
The Y-increment used in the search was 10

R O T A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient = 0.07

Safety Factor	Failure Radius	X-Co-ord	Y-Co-ord
1.17	277.9	424.5	278.0
1.17	280.4	424.5	280.5
1.17	275.4	424.5	275.5
1.17	277.8	422.0	278.0
1.17	277.7	419.5	278.0
1.18	277.6	417.0	278.0
1.18	267.6	417.0	268.0
1.18	287.6	417.0	288.0
1.19	256.9	407.0	268.0
1.19	246.9	407.0	258.0
1.19	266.9	407.0	278.0
1.19	266.9	407.0	278.0
1.19	247.3	407.0	248.0
1.19	237.3	407.0	238.0
1.19	227.3	407.0	228.0
1.19	217.3	407.0	218.0
1.20	207.4	407.0	208.0
1.20	197.4	407.0	198.0
1.21	187.4	407.0	188.0
1.22	177.4	407.0	178.0
1.24	167.5	407.0	168.0

1.24	167.1	397.0	168.0
1.27	158.1	417.0	168.0
1.27	158.1	417.0	168.0
1.30	141.1	402.0	141.8
1.30	258.1	427.0	278.0
1.30	258.1	427.0	278.0
1.31	248.2	427.0	268.0
1.39	154.0	336.0	183.0
1.39	149.5	427.0	168.0
1.40	114.5	387.0	115.5
1.44	126.1	321.0	156.8
1.50	144.0	498.0	153.0
1.50	88.2	468.0	100.5
1.50	116.1	483.0	126.8
1.51	60.3	453.0	74.3
1.57	110.3	564.0	111.8
1.58	82.4	549.0	85.5
1.60	76.9	372.0	89.3
1.61	98.2	306.0	130.5
1.67	54.6	534.0	59.3
1.72	138.2	579.0	138.0
1.93	32.5	438.0	48.0
1.93	70.3	291.0	104.3
2.02	38.3	357.0	63.0
2.12	26.7	519.0	33.0
2.97	42.7	276.0	78.0
3.38	90.5	630.0	70.5
3.51	129.3	660.0	123.0
3.51	111.3	645.0	96.8
3.56	64.3	615.0	44.3
4.37	34.1	600.0	18.0

T R A N S L A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient = 0.07

Central block endpoints automatically generated.

The minimum factor of safety is 1.16

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	328.0	0.0	376.0	0.0
2	376.0	0.0	388.0	0.0
3	388.0	0.0	488.0	0.0
4	488.0	0.0	500.0	0.0
5	500.0	0.0	600.0	0.0
6	328.0	0.0	280.1	59.2
7	280.1	59.2	277.8	62.6
8	600.0	0.0	600.0	0.0

RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY

Shear Strength Parameter	Confidence of Strength Measurement	Recommended Minimum F.S.
UU (end of construction, no waste or pool containment)	low	1.40
	high	1.20
CU	low	1.50
	high	1.30
CU (drawdown pool condition)	low	1.40
	high	1.20
CD (long-term, no seismic effects)	low	1.60
	high	1.40
CD (long-term with seismic effects)	low	1.50
	high	1.30

If the dike > 30 feet in height, add 0.10 to the F.S. in each case.

S E T T L E M E N T R E S U L T S

Settlement analysis was not performed.

L I Q U E F A C T I O N R E S U L T S

Liquefaction analysis was not performed.

G A R D S S U M M A R Y

File: wyrhsr6b Date: 08-02-2000 Time: 12:04:51

Project: *

Hydraulic Condition 1: Deep Static Ground Water Table

Rotational Failure Analysis Safety Factor	
Unconsolidated Undrained Case	Not Run
Consolidated Undrained Case	Not Run
Consolidated Drained Case	1.17

Translational Failure Analysis Safety Factor	
Unconsolidated Undrained Case	Not Run
Consolidated Undrained Case	Not Run
Consolidated Drained Case	1.16

Settlement Analysis	Not Run
Liquefaction Analysis	Not Run

80 ft high - static
- sludge cap -

```
*****************************************************************
*                                                               *
*                    G A R D S   S U M M A R Y                  *
*                                                               *
*    Project:   *
*       File:  wyrhsr8a                                         *
*                                                               *
*                        GARDS  Version 2.00                    *
*                           developed by                        *
*          Department of Civil and Environmental Engineering    *
*                       University of Cincinnati                *
*                          under contract to                    *
*                 U.S. Environmental Protection Agency          *
*                    Land Pollution Control Division            *
*            Hazardous Waste Engineering Research Laboratory    *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                       Site Characteristics                    *
*****************************************************************
*                                                               *
*      The seismic coefficient is. . . . . . . . . . . . . 0.07 *
*                                                               *
*      The design earthquake magnitude is. . . . . . . . . 6.00 *
*                                                               *
*      The maximum flood elevation in this case is . . . . .   0 *
*                                                               *
*      The elevation of the seasonal high ground water is. .   0 *
*                                                               *
*      The design waste elevation in the cell is . . . . . .   0 *
*                                                               *
*      The soil number representing the clay liner is. . . .   0 *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                        Section Geometry                       *
*****************************************************************
*                                                               *
*      The number of soil boundary lines for this section is  4 *
*---------------------------------------------------------------*
*     Line  1        Point          X            Y              *
*                    ------       ------       ------            *
*                       1            0          -20              *
*                       2          700          -20              *
*---------------------------------------------------------------*
```

Line 2	Point	X	Y
	1	0	0
	2	600	0

Line 3	Point	X	Y
	1	0	80
	2	164	80
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	83
	2	164	83
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained

```
*   Cohesion          0            0           100        (lb/sq.ft)  *
*   Phi Angle         0            0            12         (degrees)  *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . .   88.000   (lb/cu.ft)         *
*        Clay Content  . . . . . . . . .    0.000   (%)                *
*        Overconsolidation Ratio . . . .    0.000                      *
*        Initial Void Ratio  . . . . . .    0.000                      *
*        Compression Index . . . . . . .    0.000                      *
*        Recompression Index . . . . . .    0.000                      *
*        Permeability  . . . . . . . .      0.000   (ft/yr)            *
*        Median Grain Size . . . . . . .    0.000   (mm)               *
*        Plasticity Index  . . . . . . .    0.000   (%)                *
*        Liquid Limit  . . . . . . . . .    0.000   (%)                *
*        Standard Penetration Number . .    0.000   (blows/ft)         *
*************************************************************************


*************************************************************************
*                          Soil  3 Properties                           *
*************************************************************************
*                                                                       *
*            Unconsolidated  Consolidated  Consolidated                 *
*                Undrained     Undrained      Drained                   *
*              ------------  ------------  ------------                 *
*   Cohesion          0            0           100        (lb/sq.ft)  *
*   Phi Angle         0            0            24         (degrees)  *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . .   66.000   (lb/cu.ft)         *
*        Clay Content  . . . . . . . . .    0.000   (%)                *
*        Overconsolidation Ratio . . . .    0.000                      *
*        Initial Void Ratio  . . . . . .    0.000                      *
*        Compression Index . . . . . . .    0.000                      *
*        Recompression Index . . . . . .    0.000                      *
*        Permeability  . . . . . . . .      0.000   (ft/yr)            *
*        Median Grain Size . . . . . . .    0.000   (mm)               *
*        Plasticity Index  . . . . . . .    0.000   (%)                *
*        Liquid Limit  . . . . . . . . .    0.000   (%)                *
*        Standard Penetration Number . .    0.000   (blows/ft)         *
*************************************************************************


*************************************************************************
*                        Automatically Generated                        *
*             Piezometric Surface for Hydraulic Condition               *
*             1: Deep Static Ground Water Table                         *
*************************************************************************
*                                                                       *
*                 Point          X            Y                        *
*                ------        ------       ------                     *
*                   1            0            0                         *
*                   2          700            0                         *
*************************************************************************
*************************************************************************
*                          Hydraulics Results                           *
*************************************************************************
*                                                                       *
*        Seepage In  . . . . . . . .        0.000   (cu.ft/yr)         *
*                                                                       *
*        Seepage Out . . . . . . . .        0.000   (cu.ft/yr)         *
*                                                                       *
*        Critical Exit Gradient  . . .      0.000                      *
*                                                                       *
```

```
*        For this hydraulic condition there is no liner uplift.        *
*                                                                      *
************************************************************************

************************************************************************
*                                                                      *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S          *
*                                                                      *
*                     Automatic Grid Search                            *
*                                                                      *
*     The slopes were analyzed for failure arcs having centers in      *
*     areas defined by the following parallelograms:                   *
************************************************************************
*                                                                      *
*                              Slope  1                                *
*                                                                      *
*    Co-ord.        Point 1        Point 2        Point 3        Point 4   *
*    -------        -------        -------        -------        -------   *
*       X             164            600            680            244     *
*       Y             103             23            163            243     *
*----------------------------------------------------------------------*
*                                                                      *
*        The number of divisions between points 1 and 2 were  4        *
*        The number of divisions between points 2 and 3 were  4        *
*        The X-increment used in the search was  . . . . . . 10        *
*        The Y-increment used in the search was  . . . . . . 10        *
*                                                                      *
************************************************************************

************************************************************************
*                                                                      *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S          *
*                                                                      *
************************************************************************
*                                                                      *
*            Hydraulic Condition 1: Deep Static Ground Water Table     *
*                                                                      *
*                    Consolidated Drained (CD) Case                    *
*                    Seismic Coefficient Not Applied                   *
*----------------------------------------------------------------------*
*          Safety        Failure        X-            Y-               *
*          Factor        Radius       Co-ord        Co-ord             *
*          --------      --------     --------      --------           *
*            1.52         588.0        445.5         588.0             *
*            1.52         585.5        445.5         585.5             *
*            1.52         583.0        445.5         583.0             *
*            1.52         590.5        445.5         590.5             *
*            1.52         582.9        443.0         583.0             *
*            1.52         587.9        443.0         588.0             *
*            1.52         592.8        443.0         593.0             *
*            1.52         572.9        443.0         573.0             *
*            1.52         563.0        443.0         563.0             *
*            1.52         553.0        443.0         553.0             *
*            1.53         552.4        433.0         553.0             *
*            1.53         562.4        433.0         563.0             *
*            1.53         542.5        433.0         543.0             *
*            1.53         532.6        433.0         533.0             *
*            1.53         582.2        433.0         583.0             *
*            1.53         522.6        433.0         523.0             *
*            1.53         522.0        423.0         523.0             *
*            1.53         512.0        423.0         513.0             *
*            1.53         531.9        423.0         533.0             *
*            1.53         502.1        423.0         503.0             *
*            1.53         492.2        423.0         493.0             *
```

1.53	491.5	413.0	493.0	
1.53	481.6	413.0	483.0	
1.53	492.7	433.0	493.0	
1.53	501.4	413.0	503.0	
1.53	471.6	413.0	473.0	
1.53	461.7	413.0	463.0	
1.54	451.8	413.0	453.0	
1.54	441.8	413.0	443.0	
1.54	431.9	413.0	433.0	
1.55	422.0	413.0	423.0	
1.55	412.0	413.0	413.0	
1.56	402.1	413.0	403.0	
1.56	392.2	413.0	393.0	
1.57	382.2	413.0	383.0	
1.57	372.3	413.0	373.0	
1.58	362.3	413.0	363.0	
1.58	352.3	413.0	353.0	
1.59	342.3	413.0	343.0	
1.60	578.1	448.0	588.0	
1.60	332.4	413.0	333.0	
1.60	573.2	448.0	583.0	
1.60	322.4	413.0	323.0	
1.61	573.4	453.0	583.0	
1.61	312.4	413.0	313.0	
1.61	523.0	443.0	523.0	
1.62	302.4	413.0	303.0	
1.62	543.6	453.0	553.0	
1.62	292.4	413.0	293.0	
1.63	282.4	413.0	283.0	
1.63	272.5	413.0	273.0	
1.64	262.5	413.0	263.0	
1.65	252.5	413.0	253.0	
1.65	242.5	413.0	243.0	
1.66	232.5	413.0	233.0	
1.66	222.6	413.0	223.0	
1.67	222.2	403.0	223.0	
1.67	221.9	393.0	223.0	
1.68	221.3	383.0	223.0	
1.68	220.6	373.0	223.0	
1.69	220.0	363.0	223.0	
1.69	219.3	353.0	223.0	
1.69	219.3	353.0	223.0	
1.70	213.2	423.0	223.0	
1.76	183.3	333.0	188.0	
1.85	134.3	313.0	153.0	
1.91	202.7	244.0	243.0	
1.92	151.4	442.0	168.0	
1.95	188.6	462.0	203.0	
2.00	149.9	224.0	208.0	
2.04	114.3	422.0	133.0	
2.08	97.6	293.0	118.0	
2.08	97.6	402.0	98.0	
2.17	181.5	571.0	183.0	
2.22	112.2	204.0	173.0	
2.25	144.4	551.0	148.0	
2.38	107.2	531.0	113.0	
2.68	70.1	511.0	78.0	
2.75	74.5	184.0	138.0	
2.82	75.3	273.0	83.0	
2.87	62.0	382.0	63.0	
3.57	34.3	491.0	43.0	
4.85	54.3	164.0	103.0	

T R A N S L A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient Not Applied

Central block endpoints automatically generated.

The minimum factor of safety is 1.57

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	224.0	0.0	264.0	0.0
2	264.0	0.0	276.0	0.0
3	276.0	0.0	376.0	0.0
4	376.0	0.0	388.0	0.0
5	388.0	0.0	488.0	0.0
6	488.0	0.0	500.0	0.0
7	500.0	0.0	600.0	0.0
8	224.0	0.0	164.0	74.1
9	164.0	74.1	159.2	80.0
10	159.2	80.0	157.3	83.0
11	600.0	0.0	600.0	0.0

RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY

Shear Strength Parameter	Confidence of Strength Measurement	Recommended Minimum F.S.
UU (end of construction, no waste or pool containment)	low	1.40
	high	1.20
CU	low	1.50
	high	1.30
CU (drawdown pool condition)	low	1.40
	high	1.20
CD (long-term, no seismic effects)	low	1.60
	high	1.40
CD (long-term with seismic effects)	low	1.50
	high	1.30

If the dike > 30 feet in height, add 0.10 to the F.S. in each case.

S E T T L E M E N T R E S U L T S

Settlement analysis was not performed.

```
*********************************************************************
*                                                                   *
*              L I Q U E F A C T I O N   R E S U L T S              *
*                                                                   *
*              Liquefaction analysis was not performed.             *
*                                                                   *
*********************************************************************

*********************************************************************
*                                                                   *
*                      G A R D S   S U M M A R Y                    *
*                                                                   *
*    File:  wyrhsr8a            Date: 08-02-2000    Time: 12:02:38 *
*    Project:   *
*    Hydraulic Condition 1: Deep Static Ground Water Table          *
*                                                                   *
*-------------------------------------------------------------------*
*             Rotational Failure Analysis Safety Factor             *
*-------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . Not Run     *
*       Consolidated Undrained Case . . . . . . . . . . Not Run     *
*       Consolidated Drained Case . . . . . . . . . . . . 1.52      *
*-------------------------------------------------------------------*
*            Translational Failure Analysis Safety Factor           *
*-------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . Not Run     *
*       Consolidated Undrained Case . . . . . . . . . . Not Run     *
*       Consolidated Drained Case . . . . . . . . . . . . 1.57      *
*-------------------------------------------------------------------*
*             Settlement Analysis . . . . . . . . . . . Not Run     *
*-------------------------------------------------------------------*
*             Liquefaction Analysis . . . . . . . . . . Not Run     *
*********************************************************************
```

80 ft high-seismic
- sludge cap -

```
*****************************************************************
*                                                               *
*                    G A R D S   S U M M A R Y                  *
*                                                               *
*    Project:   *
*       File:  wyrhsr8b                                         *
*                                                               *
*                        GARDS  Version 2.00                    *
*                           developed by                        *
*          Department of Civil and Environmental Engineering    *
*                      University of Cincinnati                 *
*                          under contract to                    *
*                 U.S. Environmental Protection Agency          *
*                   Land Pollution Control Division             *
*            Hazardous Waste Engineering Research Laboratory    *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                       Site Characteristics                    *
*****************************************************************
*                                                               *
*      The seismic coefficient is. . . . . . . . . . . . . 0.07 *
*                                                               *
*      The design earthquake magnitude is. . . . . . . . . . 6.00 *
*                                                               *
*      The maximum flood elevation in this case is . . . . .    0 *
*                                                               *
*      The elevation of the seasonal high ground water is. .    0 *
*                                                               *
*      The design waste elevation in the cell is . . . . . .    0 *
*                                                               *
*      The soil number representing the clay liner is. . . .    0 *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                        Section Geometry                       *
*****************************************************************
*                                                               *
*      The number of soil boundary lines for this section is  4 *
*---------------------------------------------------------------*
*     Line  1        Point          X             Y            *
*                   ------        ------        ------          *
*                      1            0            -20            *
*                      2          700            -20            *
*---------------------------------------------------------------*
*     Line  2        Point          X             Y            *
```

```
*                    ------        ------        ------                    *
*                      1             0             0                       *
*                      2           600             0                       *
*-----------------------------------------------------------------------*
*     Line  3        Point          X             Y                       *
*                    ------        ------        ------                    *
*                      1             0            80                       *
*                      2           164            80                       *
*                      3           264            60                       *
*                      4           276            60                       *
*                      5           376            40                       *
*                      6           388            40                       *
*                      7           488            20                       *
*                      8           500            20                       *
*                      9           600             0                       *
*-----------------------------------------------------------------------*
*     Line  4        Point          X             Y                       *
*                    ------        ------        ------                    *
*                      1             0            83                       *
*                      2           164            83                       *
*                      3           264            63                       *
*                      4           276            63                       *
*                      5           376            43                       *
*                      6           388            43                       *
*                      7           488            23                       *
*                      8           500            23                       *
*                      9           600             3                       *
*                     10           700             0                       *
***********************************************************************


***********************************************************************
*                          Soil  1 Properties                           *
***********************************************************************
*                                                                       *
*             Unconsolidated  Consolidated  Consolidated               *
*                Undrained     Undrained      Drained                   *
*               ------------  ------------  ------------                *
*   Cohesion          0             0             0       (lb/sq.ft)    *
*   Phi Angle         0             0            30        (degrees)    *
*-----------------------------------------------------------------------*
*                                                                       *
*        Unit Weight . . . . . . . . . . .  114.000   (lb/cu.ft)       *
*        Clay Content  . . . . . . . . . .    0.000   (%)              *
*        Overconsolidation Ratio . . . .      0.000                    *
*        Initial Void Ratio  . . . . . .      0.000                    *
*        Compression Index . . . . . . .      0.000                    *
*        Recompression Index . . . . . .      0.000                    *
*        Permeability  . . . . . . . .        0.000   (ft/yr)          *
*        Median Grain Size . . . . . . .      0.000   (mm)             *
*        Plasticity Index  . . . . . . .      0.000   (%)              *
*        Liquid Limit  . . . . . . . . .      0.000   (%)              *
*        Standard Penetration Number . .      0.000   (blows/ft)       *
***********************************************************************


***********************************************************************
*                          Soil  2 Properties                           *
***********************************************************************
*                                                                       *
*             Unconsolidated  Consolidated  Consolidated               *
*                Undrained     Undrained      Drained                   *
*               ------------  ------------  ------------                *
*   Cohesion          0             0           100       (lb/sq.ft)    *
```

Phi Angle	0	0	12	(degrees)

Unit Weight	88.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 3 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	100	(lb/sq.ft)
Phi Angle	0	0	24	(degrees)

Unit Weight	66.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Automatically Generated Piezometric Surface for Hydraulic Condition 1: Deep Static Ground Water Table

Point	X	Y
1	0	0
2	700	0

Hydraulics Results

Seepage In	0.000	(cu.ft/yr)
Seepage Out	0.000	(cu.ft/yr)
Critical Exit Gradient . . .	0.000	

For this hydraulic condition there is no liner uplift.

```
*                                                                    *
**********************************************************************

**********************************************************************
*                                                                    *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S         *
*                                                                    *
*                     Automatic Grid Search                          *
*                                                                    *
*     The slopes were analyzed for failure arcs having centers in    *
*     areas defined by the following parallelograms:                 *
**********************************************************************
*                                                                    *
*                              Slope  1                              *
*                                                                    *
*    Co-ord.        Point 1       Point 2       Point 3       Point 4 *
*    -------        -------       -------       -------       -------*
*       X             164           600           680           244  *
*       Y             103            23           163           243  *
*--------------------------------------------------------------------*
*                                                                    *
*        The number of divisions between points 1 and 2 were  4      *
*        The number of divisions between points 2 and 3 were  4      *
*        The X-increment used in the search was  . . . . . . 10      *
*        The Y-increment used in the search was  . . . . . . 10      *
*                                                                    *
**********************************************************************

**********************************************************************
*                                                                    *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S         *
*                                                                    *
**********************************************************************
*                                                                    *
*            Hydraulic Condition 1: Deep Static Ground Water Table   *
*                                                                    *
*                    Consolidated Drained (CD) Case                  *
*                    Seismic Coefficient = 0.07                      *
*--------------------------------------------------------------------*
*          Safety        Failure        X-           Y-              *
*          Factor        Radius       Co-ord       Co-ord            *
*         --------      --------     --------     --------           *
*            1.08         615.5        448.0        615.5            *
*            1.08         613.0        448.0        613.0            *
*            1.08         618.0        448.0        618.0            *
*            1.08         615.3        445.5        615.5            *
*            1.08         612.9        445.5        613.0            *
*            1.08         612.7        443.0        613.0            *
*            1.08         602.8        443.0        603.0            *
*            1.08         622.6        443.0        623.0            *
*            1.08         592.8        443.0        593.0            *
*            1.08         582.9        443.0        583.0            *
*            1.08         582.2        433.0        583.0            *
*            1.08         572.3        433.0        573.0            *
*            1.08         592.2        433.0        593.0            *
*            1.08         562.4        433.0        563.0            *
*            1.08         612.0        433.0        613.0            *
*            1.08         552.4        433.0        553.0            *
*            1.09         553.0        443.0        553.0            *
*            1.09         551.8        423.0        553.0            *
*            1.09         541.8        423.0        543.0            *
*            1.09         561.7        423.0        563.0            *
*            1.09         531.9        423.0        533.0            *
*            1.09         522.0        423.0        523.0            *
```

3.52	134.1	660.0	128.0
3.90	35.2	600.0	23.0

T R A N S L A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient = 0.07

Central block endpoints automatically generated.

The minimum factor of safety is 1.11

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	232.0	0.0	264.0	0.0
2	264.0	0.0	276.0	0.0
3	276.0	0.0	376.0	0.0
4	376.0	0.0	388.0	0.0
5	388.0	0.0	488.0	0.0
6	488.0	0.0	500.0	0.0
7	500.0	0.0	600.0	0.0
8	232.0	0.0	167.8	79.2
9	167.8	79.2	165.6	82.7
10	600.0	0.0	600.0	0.0

RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY

Shear Strength Parameter	Confidence of Strength Measurement	Recommended Minimum F.S.
UU (end of construction, no waste or pool containment)	low	1.40
	high	1.20
CU	low	1.50
	high	1.30
CU (drawdown pool condition)	low	1.40
	high	1.20
CD (long-term, no seismic effects)	low	1.60
	high	1.40
CD (long-term with seismic effects)	low	1.50
	high	1.30

If the dike > 30 feet in height, add 0.10 to the F.S. in each case.

S E T T L E M E N T R E S U L T S

```
*                Settlement analysis was not performed.                 *
*                                                                       *
*************************************************************************

*************************************************************************
*                                                                       *
*              L I Q U E F A C T I O N   R E S U L T S                  *
*                                                                       *
*              Liquefaction analysis was not performed.                 *
*                                                                       *
*************************************************************************

*************************************************************************
*                                                                       *
*                      G A R D S   S U M M A R Y                        *
*                                                                       *
*    File:  wyrhsr8b            Date: 08-02-2000    Time: 12:01:57     *
*    Project:   *
*    Hydraulic Condition 1: Deep Static Ground Water Table              *
*                                                                       *
*-----------------------------------------------------------------------*
*             Rotational Failure Analysis Safety Factor                 *
*-----------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . . Not Run       *
*       Consolidated Undrained Case . . . . . . . . . . . Not Run       *
*       Consolidated Drained Case . . . . . . . . . . . . . 1.08        *
*-----------------------------------------------------------------------*
*            Translational Failure Analysis Safety Factor               *
*-----------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . . Not Run       *
*       Consolidated Undrained Case . . . . . . . . . . . Not Run       *
*       Consolidated Drained Case . . . . . . . . . . . . . 1.11        *
*-----------------------------------------------------------------------*
*             Settlement Analysis . . . . . . . . . . . . Not Run       *
*-----------------------------------------------------------------------*
*             Liquefaction Analysis . . . . . . . . . . . Not Run       *
*************************************************************************
```

60 ft high - static
- clay cap -

```
*********************************************************************
*                                                                   *
*                      G A R D S   S U M M A R Y                    *
*                                                                   *
*    Project:   *
*       File:  wyrhsr60                                             *
*                                                                   *
*                          GARDS  Version 2.00                      *
*                             developed by                          *
*          Department of Civil and Environmental Engineering        *
*                       University of Cincinnati                    *
*                          under contract to                        *
*                 U.S. Environmental Protection Agency              *
*                    Land Pollution Control Division                *
*            Hazardous Waste Engineering Research Laboratory        *
*                                                                   *
*********************************************************************
```

```
*********************************************************************
*                        Site Characteristics                       *
*********************************************************************
*                                                                   *
*      The seismic coefficient is. . . . . . . . . . . . . . 0.07   *
*                                                                   *
*      The design earthquake magnitude is. . . . . . . . . . 6.00   *
*                                                                   *
*      The maximum flood elevation in this case is . . . . .    0   *
*                                                                   *
*      The elevation of the seasonal high ground water is. .    0   *
*                                                                   *
*      The design waste elevation in the cell is . . . . . .    0   *
*                                                                   *
*      The soil number representing the clay liner is. . . .    0   *
*                                                                   *
*********************************************************************
```

```
*********************************************************************
*                         Section Geometry                          *
*********************************************************************
*                                                                   *
*      The number of soil boundary lines for this section is  4     *
*-------------------------------------------------------------------*
*     Line  1        Point          X             Y                 *
*                    ------       ------        ------              *
*                       1            0           -20                 *
*                       2          700           -20                 *
*-------------------------------------------------------------------*
```

```
*        For this hydraulic condition there is no liner uplift.        *
*                                                                      *
************************************************************************

************************************************************************
*                                                                      *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S         *
*                                                                      *
*                     Automatic Grid Search                            *
*                                                                      *
*     The slopes were analyzed for failure arcs having centers in      *
*     areas defined by the following parallelograms:                   *
************************************************************************
*                                                                      *
*                              Slope  1                                *
*                                                                      *
*    Co-ord.        Point 1       Point 2       Point 3       Point 4  *
*    -------        -------       -------       -------       -------  *
*       X             276           600           660           336    *
*       Y              78            18           123           183    *
*----------------------------------------------------------------------*
*                                                                      *
*        The number of divisions between points 1 and 2 were  4        *
*        The number of divisions between points 2 and 3 were  4        *
*        The X-increment used in the search was  . . . . . . 10        *
*        The Y-increment used in the search was  . . . . . . 10        *
*                                                                      *
************************************************************************

************************************************************************
*                                                                      *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S         *
*                                                                      *
************************************************************************
*                                                                      *
*            Hydraulic Condition 1: Deep Static Ground Water Table     *
*                                                                      *
*                    Consolidated Drained (CD) Case                    *
*                    Seismic Coefficient Not Applied                   *
*----------------------------------------------------------------------*
*          Safety        Failure        X-            Y-               *
*          Factor        Radius       Co-ord        Co-ord             *
*         --------      --------      --------      --------            *
*           1.68          263.0         424.5         263.0             *
*           1.68          260.5         424.5         260.5             *
*           1.68          258.0         424.5         258.0             *
*           1.68          265.5         424.5         265.5             *
*           1.68          257.9         422.0         258.0             *
*           1.68          255.4         422.0         255.5             *
*           1.68          260.4         422.0         260.5             *
*           1.68          252.9         422.0         253.0             *
*           1.68          262.9         422.0         263.0             *
*           1.68          250.4         422.0         250.5             *
*           1.68          247.9         422.0         248.0             *
*           1.69          247.8         419.5         248.0             *
*           1.69          247.7         417.0         248.0             *
*           1.69          237.7         417.0         238.0             *
*           1.70          257.6         417.0         258.0             *
*           1.71          236.9         407.0         248.0             *
*           1.71          246.9         407.0         258.0             *
*           1.71          227.0         407.0         238.0             *
*           1.71          253.2         427.0         263.0             *
*           1.71          227.3         407.0         228.0             *
*           1.72          217.3         407.0         218.0             *
```

Line 2	Point	X	Y
	1	0	0
	2	600	0

Line 3	Point	X	Y
	1	0	60
	2	164	60
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	63
	2	164	63
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained

1.72	207.4	407.0	208.0
1.73	197.4	407.0	198.0
1.74	187.4	407.0	188.0
1.74	238.1	424.5	248.0
1.74	238.3	427.0	248.0
1.75	177.4	407.0	178.0
1.77	167.5	407.0	168.0
1.77	167.1	397.0	168.0
1.83	158.1	417.0	168.0
1.83	158.1	417.0	168.0
1.85	141.1	402.0	141.8
1.94	238.3	427.0	258.0
2.01	114.5	387.0	115.5
2.07	149.5	427.0	168.0
2.10	154.0	336.0	183.0
2.19	126.1	321.0	156.8
2.23	60.3	453.0	74.3
2.24	88.2	468.0	100.5
2.26	144.0	498.0	153.0
2.26	116.1	483.0	126.8
2.32	87.7	372.0	89.3
2.38	82.4	549.0	85.5
2.40	110.3	564.0	111.8
2.52	98.2	306.0	130.5
2.53	138.2	579.0	138.0
2.56	54.6	534.0	59.3
2.90	32.5	438.0	48.0
3.07	38.3	357.0	63.0
3.18	70.3	291.0	104.3
3.36	26.7	519.0	33.0

T R A N S L A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient Not Applied

Central block endpoints automatically generated.

The minimum factor of safety is 1.61

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	320.0	0.0	376.0	0.0
2	376.0	0.0	388.0	0.0
3	388.0	0.0	488.0	0.0
4	488.0	0.0	500.0	0.0
5	500.0	0.0	600.0	0.0
6	320.0	0.0	276.0	54.3
7	276.0	54.3	271.4	60.0
8	271.4	60.0	269.4	63.0
9	600.0	0.0	600.0	0.0

RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY

60 ft high - seismic
- clay cap -

```
*********************************************************************
*                                                                   *
*                      G A R D S   S U M M A R Y                    *
*                                                                   *
*    Project:   *
*       File:  wyrhsr6s                                             *
*                                                                   *
*                          GARDS  Version 2.00                      *
*                             developed by                          *
*          Department of Civil and Environmental Engineering        *
*                       University of Cincinnati                    *
*                          under contract to                        *
*                 U.S. Environmental Protection Agency              *
*                   Land Pollution Control Division                 *
*            Hazardous Waste Engineering Research Laboratory        *
*                                                                   *
*********************************************************************
```

```
*********************************************************************
*                        Site Characteristics                       *
*********************************************************************
*                                                                   *
*      The seismic coefficient is. . . . . . . . . . . . . . 0.07   *
*                                                                   *
*      The design earthquake magnitude is. . . . . . . . . . 6.00   *
*                                                                   *
*      The maximum flood elevation in this case is . . . . .    0   *
*                                                                   *
*      The elevation of the seasonal high ground water is. .    0   *
*                                                                   *
*      The design waste elevation in the cell is . . . . . .    0   *
*                                                                   *
*      The soil number representing the clay liner is. . . .    0   *
*                                                                   *
*********************************************************************
```

```
*********************************************************************
*                          Section Geometry                         *
*********************************************************************
*                                                                   *
*      The number of soil boundary lines for this section is  4     *
*-------------------------------------------------------------------*
*     Line  1        Point          X             Y                 *
*                    ------       ------        ------              *
*                       1            0            -20                *
*                       2          700            -20                *
*-------------------------------------------------------------------*
```

Line 2	Point	X	Y
	1	0	0
	2	600	0

Line 3	Point	X	Y
	1	0	60
	2	164	60
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	63
	2	164	63
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained

Shear Strength Parameter	Confidence of Strength Measurement	Recommended Minimum F.S.
UU (end of construction, no waste or pool containment)	low	1.40
	high	1.20
CU	low	1.50
	high	1.30
CU (drawdown pool condition)	low	1.40
	high	1.20
CD (long-term, no seismic effects)	low	1.60
	high	1.40
CD (long-term with seismic effects)	low	1.50
	high	1.30

If the dike > 30 feet in height, add 0.10 to the F.S. in each case.

S E T T L E M E N T R E S U L T S

Settlement analysis was not performed.

L I Q U E F A C T I O N R E S U L T S

Liquefaction analysis was not performed.

G A R D S S U M M A R Y

File: wyrhsr60 Date: 06-14-2000 Time: 08:54:19

Project: *

Hydraulic Condition 1: Deep Static Ground Water Table

Rotational Failure Analysis Safety Factor	
Unconsolidated Undrained Case	Not Run
Consolidated Undrained Case	Not Run
Consolidated Drained Case	1.68 / 1.64 w/ sludge

Translational Failure Analysis Safety Factor	
Unconsolidated Undrained Case	Not Run
Consolidated Undrained Case	Not Run
Consolidated Drained Case	1.61

Settlement Analysis	Not Run
Liquefaction Analysis	Not Run

Cohesion	0	0	100	(lb/sq.ft)
Phi Angle	0	0	12	(degrees)

Unit Weight	88.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 3 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	500	(lb/sq.ft)
Phi Angle	0	0	23	(degrees)

Unit Weight	123.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Automatically Generated Piezometric Surface for Hydraulic Condition 1: Deep Static Ground Water Table

Point	X	Y
1	0	0
2	700	0

Hydraulics Results

Seepage In	0.000	(cu.ft/yr)
Seepage Out	0.000	(cu.ft/yr)
Critical Exit Gradient . . .	0.000	

1.26	177.4	407.0	178.0
1.27	167.5	407.0	168.0
1.27	167.1	397.0	168.0
1.31	158.1	417.0	168.0
1.31	158.1	417.0	168.0
1.33	141.1	402.0	141.8
1.39	238.3	427.0	258.0
1.44	114.5	387.0	115.5
1.46	154.0	336.0	183.0
1.47	149.5	427.0	168.0
1.51	126.1	321.0	156.8
1.60	144.0	498.0	153.0
1.61	116.1	483.0	126.8
1.62	88.2	468.0	100.5
1.64	60.3	453.0	74.3
1.66	87.7	372.0	89.3
1.69	98.2	306.0	130.5
1.75	82.4	549.0	85.5
1.76	110.3	564.0	111.8
1.86	138.2	579.0	138.0
1.87	54.6	534.0	59.3
2.04	70.3	291.0	104.3
2.15	32.5	438.0	48.0
2.21	49.4	357.0	63.0
2.45	26.7	519.0	33.0
3.08	90.5	630.0	70.5
3.11	56.5	276.0	78.0
3.16	64.3	615.0	44.3
3.39	111.3	645.0	96.8
3.51	129.3	660.0	123.0
3.60	26.4	600.0	18.0

T R A N S L A T I O N A L F A I L U R E R E S U L T S

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient = 0.07

Central block endpoints automatically generated.

The minimum factor of safety is 1.14

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	320.0	0.0	376.0	0.0
2	376.0	0.0	388.0	0.0
3	388.0	0.0	488.0	0.0
4	488.0	0.0	500.0	0.0
5	500.0	0.0	600.0	0.0
6	320.0	0.0	276.0	54.3
7	276.0	54.3	271.4	60.0
8	271.4	60.0	269.4	63.0
9	600.0	0.0	600.0	0.0

```
*       RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY        *
*************************************************************************
*  Shear Strength                    Confidence of            Recommended  *
*    Parameter                    Strength Measurement       Minimum F.S. *
*-----------------------------------------------------------------------*
*  UU (end of construction, no          low                       1.40    *
*      waste or pool containment)       high                      1.20    *
*                                                                         *
*  CU                                   low                       1.50    *
*                                       high                      1.30    *
*                                                                         *
*  CU (drawdown pool condition)         low                       1.40    *
*                                       high                      1.20    *
*                                                                         *
*  CD (long-term, no seismic            low                       1.60    *
*      effects)                         high                      1.40    *
*                                                                         *
*  CD (long-term with seismic           low                       1.50    *
*      effects)                         high                      1.30    *
*                                                                         *
*  If the dike > 30 feet in height, add 0.10 to the F.S. in each case. *
*************************************************************************


*************************************************************************
*                                                                       *
*                S E T T L E M E N T    R E S U L T S                  *
*                                                                       *
*                Settlement analysis was not performed.                 *
*                                                                       *
*************************************************************************


*************************************************************************
*                                                                       *
*              L I Q U E F A C T I O N    R E S U L T S                 *
*                                                                       *
*              Liquefaction analysis was not performed.                 *
*                                                                       *
*************************************************************************


*************************************************************************
*                                                                       *
*                      G A R D S   S U M M A R Y                        *
*                                                                       *
*    File:  wyrhsr6s            Date: 06-14-2000    Time: 08:55:53     *
*    Project:   *
*    Hydraulic Condition 1: Deep Static Ground Water Table              *
*                                                                       *
*-----------------------------------------------------------------------*
*             Rotational Failure Analysis Safety Factor                 *
*-----------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . Not Run         *
*       Consolidated Undrained Case . . . . . . . . . . Not Run         *
*       Consolidated Drained Case . . . . . . . . . . . . 1.19          *
*-----------------------------------------------------------------------*
*            Translational Failure Analysis Safety Factor               *
*-----------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . Not Run         *
*       Consolidated Undrained Case . . . . . . . . . . Not Run         *
*       Consolidated Drained Case . . . . . . . . . . . . 1.14          *
*-----------------------------------------------------------------------*
*             Settlement Analysis . . . . . . . . . . . Not Run         *
*-----------------------------------------------------------------------*
*             Liquefaction Analysis . . . . . . . . . . Not Run         *
```

80 ft. high - static
- clay cap -

```
*****************************************************************
*                                                               *
*                    G A R D S   S U M M A R Y                  *
*                                                               *
*    Project:   *
*       File:  wyrhsr80                                         *
*                                                               *
*                        GARDS  Version 2.00                    *
*                           developed by                        *
*          Department of Civil and Environmental Engineering    *
*                       University of Cincinnati                *
*                          under contract to                    *
*                 U.S. Environmental Protection Agency          *
*                    Land Pollution Control Division            *
*             Hazardous Waste Engineering Research Laboratory   *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                      Site Characteristics                     *
*****************************************************************
*                                                               *
*      The seismic coefficient is. . . . . . . . . . . . . 0.07 *
*                                                               *
*      The design earthquake magnitude is. . . . . . . . . . 6.00 *
*                                                               *
*      The maximum flood elevation in this case is . . . . .   0 *
*                                                               *
*      The elevation of the seasonal high ground water is. .   0 *
*                                                               *
*      The design waste elevation in the cell is . . . . . .   0 *
*                                                               *
*      The soil number representing the clay liner is. . . .   0 *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                       Section Geometry                        *
*****************************************************************
*                                                               *
*      The number of soil boundary lines for this section is  4 *
*---------------------------------------------------------------*
*     Line  1        Point          X            Y              *
*                    ------       ------       ------           *
*                       1            0          -20              *
*                       2          700          -20              *
*---------------------------------------------------------------*
*     Line  2        Point          X            Y              *
```

1	0	0
2	600	0

Line 3	Point	X	Y
	1	0	80
	2	164	80
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	83
	2	164	83
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	100	(lb/sq.ft)

```
*   Phi Angle          0              0              12          (degrees)  *
*-----------------------------------------------------------------------------*
*                                                                             *
*        Unit Weight . . . . . . . . . .    88.000    (lb/cu.ft)             *
*        Clay Content  . . . . . . . . .     0.000    (%)                    *
*        Overconsolidation Ratio . . . .     0.000                           *
*        Initial Void Ratio  . . . . . .     0.000                           *
*        Compression Index . . . . . . .     0.000                           *
*        Recompression Index . . . . . .     0.000                           *
*        Permeability  . . . . . . . .       0.000    (ft/yr)                *
*        Median Grain Size . . . . . . .     0.000    (mm)                   *
*        Plasticity Index  . . . . . . .     0.000    (%)                    *
*        Liquid Limit  . . . . . . . . .     0.000    (%)                    *
*        Standard Penetration Number . .     0.000    (blows/ft)             *
*******************************************************************************


*******************************************************************************
*                          Soil  3 Properties                                 *
*******************************************************************************
*                                                                             *
*             Unconsolidated  Consolidated  Consolidated                      *
*                Undrained     Undrained      Drained                         *
*               ------------  ------------  ------------                      *
*   Cohesion          0             0            500        (lb/sq.ft)        *
*   Phi Angle         0             0             23         (degrees)        *
*-----------------------------------------------------------------------------*
*                                                                             *
*        Unit Weight . . . . . . . . . .   123.000    (lb/cu.ft)             *
*        Clay Content  . . . . . . . . .     0.000    (%)                    *
*        Overconsolidation Ratio . . . .     0.000                           *
*        Initial Void Ratio  . . . . . .     0.000                           *
*        Compression Index . . . . . . .     0.000                           *
*        Recompression Index . . . . . .     0.000                           *
*        Permeability  . . . . . . . .       0.000    (ft/yr)                *
*        Median Grain Size . . . . . . .     0.000    (mm)                   *
*        Plasticity Index  . . . . . . .     0.000    (%)                    *
*        Liquid Limit  . . . . . . . . .     0.000    (%)                    *
*        Standard Penetration Number . .     0.000    (blows/ft)             *
*******************************************************************************


*******************************************************************************
*                       Automatically Generated                               *
*             Piezometric Surface for Hydraulic Condition                     *
*             1: Deep Static Ground Water Table                               *
*******************************************************************************
*                                                                             *
*                 Point          X            Y                              *
*                ------        ------       ------                           *
*                   1            0            0                              *
*                   2          700            0                              *
*******************************************************************************
*******************************************************************************
*                          Hydraulics Results                                 *
*******************************************************************************
*                                                                             *
*        Seepage In  . . . . . . . .        0.000    (cu.ft/yr)             *
*                                                                             *
*        Seepage Out . . . . . . . .        0.000    (cu.ft/yr)             *
*                                                                             *
*        Critical Exit Gradient  . . .      0.000                           *
*                                                                             *
*        For this hydraulic condition there is no liner uplift.               *
```

ROTATIONAL FAILURE RESULTS

Automatic Grid Search

The slopes were analyzed for failure arcs having centers in areas defined by the following parallelograms:

Slope 1

Co-ord.	Point 1	Point 2	Point 3	Point 4
X	164	600	680	244
Y	103	23	163	243

The number of divisions between points 1 and 2 were 4
The number of divisions between points 2 and 3 were 4
The X-increment used in the search was 10
The Y-increment used in the search was 10

ROTATIONAL FAILURE RESULTS

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient Not Applied

Safety Factor	Failure Radius	X-Co-ord	Y-Co-ord
1.54	588.0	445.5	588.0
1.54	585.5	445.5	585.5
1.54	583.0	445.5	583.0
1.54	580.5	445.5	580.5
1.54	578.0	445.5	578.0
1.54	575.5	445.5	575.5
1.54	573.0	445.5	573.0
1.54	590.5	445.5	590.5
1.54	572.9	443.0	573.0
1.54	582.9	443.0	583.0
1.54	563.0	443.0	563.0
1.54	587.9	443.0	588.0
1.54	553.0	443.0	553.0
1.54	543.0	443.0	543.0
1.55	542.5	433.0	543.0
1.55	552.4	433.0	553.0
1.55	532.6	433.0	533.0
1.55	522.6	433.0	523.0
1.55	572.3	433.0	573.0
1.55	512.7	433.0	513.0
1.55	512.0	423.0	513.0
1.55	522.0	423.0	523.0

*	1.55	502.1	423.0	503.0	*
*	1.55	492.2	423.0	493.0	*
*	1.55	482.2	423.0	483.0	*
*	1.55	481.6	413.0	483.0	*
*	1.55	471.6	413.0	473.0	*
*	1.55	491.5	413.0	493.0	*
*	1.55	461.7	413.0	463.0	*
*	1.56	451.8	413.0	453.0	*
*	1.56	451.1	403.0	453.0	*
*	1.56	461.0	403.0	463.0	*
*	1.56	441.2	403.0	443.0	*
*	1.56	482.8	433.0	483.0	*
*	1.56	431.2	403.0	433.0	*
*	1.56	421.3	403.0	423.0	*
*	1.56	452.4	423.0	453.0	*
*	1.56	420.7	393.0	423.0	*
*	1.56	430.6	393.0	433.0	*
*	1.56	410.7	393.0	413.0	*
*	1.56	400.8	393.0	403.0	*
*	1.57	390.8	393.0	393.0	*
*	1.57	380.9	393.0	383.0	*
*	1.57	422.0	413.0	423.0	*
*	1.57	371.0	393.0	373.0	*
*	1.58	361.0	393.0	363.0	*
*	1.59	351.1	393.0	353.0	*
*	1.60	341.2	393.0	343.0	*
*	1.60	331.2	393.0	333.0	*
*	1.61	321.3	393.0	323.0	*
*	1.62	311.4	393.0	313.0	*
*	1.63	301.4	393.0	303.0	*
*	1.63	578.1	448.0	588.0	*
*	1.64	563.2	448.0	573.0	*
*	1.64	291.5	393.0	293.0	*
*	1.65	563.5	453.0	573.0	*
*	1.65	281.6	393.0	283.0	*
*	1.65	503.1	443.0	513.0	*
*	1.66	533.6	453.0	543.0	*
*	1.66	271.6	393.0	273.0	*
*	1.67	261.7	393.0	263.0	*
*	1.68	251.8	393.0	253.0	*
*	1.69	241.8	393.0	243.0	*
*	1.69	231.9	393.0	233.0	*
*	1.70	221.9	393.0	223.0	*
*	1.71	221.3	383.0	223.0	*
*	1.71	220.6	373.0	223.0	*
*	1.72	222.2	403.0	223.0	*
*	1.72	220.0	363.0	223.0	*
*	1.72	219.3	353.0	223.0	*
*	1.72	219.3	353.0	223.0	*
*	1.79	183.3	333.0	188.0	*
*	1.91	134.3	313.0	153.0	*
*	1.98	202.7	244.0	243.0	*
*	2.05	151.4	442.0	168.0	*
*	2.09	188.6	462.0	203.0	*
*	2.13	165.6	224.0	208.0	*
*	2.14	111.1	293.0	118.0	*
*	2.15	97.6	402.0	98.0	*
*	2.17	114.3	422.0	133.0	*
*	2.34	128.4	204.0	173.0	*
*	2.47	181.5	571.0	183.0	*
*	2.55	144.4	551.0	148.0	*
*	2.65	107.2	531.0	113.0	*
*	2.90	91.2	184.0	138.0	*
*	2.92	75.3	273.0	83.0	*
*	2.93	70.1	511.0	78.0	*
*	3.00	62.0	382.0	63.0	*

3.94	34.3	491.0	43.0

TRANSLATIONAL FAILURE RESULTS

Hydraulic Condition 1: Deep Static Ground Water Table

Consolidated Drained (CD) Case
Seismic Coefficient Not Applied

Central block endpoints automatically generated.

The minimum factor of safety is 1.57

Failure Surface Segment #	Xn Co-ord	Yn Co-ord	Xn+1 Co-ord	Yn+1 Co-ord
1	224.0	0.0	264.0	0.0
2	264.0	0.0	276.0	0.0
3	276.0	0.0	376.0	0.0
4	376.0	0.0	388.0	0.0
5	388.0	0.0	488.0	0.0
6	488.0	0.0	500.0	0.0
7	500.0	0.0	600.0	0.0
8	224.0	0.0	164.0	74.1
9	164.0	74.1	159.2	80.0
10	159.2	80.0	157.2	83.0
11	600.0	0.0	600.0	0.0

RECOMMENDED MINIMUM FACTOR OF SAFETY FOR SLOPE STABILITY

Shear Strength Parameter	Confidence of Strength Measurement	Recommended Minimum F.S.
UU (end of construction, no waste or pool containment)	low	1.40
	high	1.20
CU	low	1.50
	high	1.30
CU (drawdown pool condition)	low	1.40
	high	1.20
CD (long-term, no seismic effects)	low	1.60
	high	1.40
CD (long-term with seismic effects)	low	1.50
	high	1.30

If the dike > 30 feet in height, add 0.10 to the F.S. in each case.

SETTLEMENT RESULTS

80 ft. high - seismic
- clay cap -

```
*****************************************************************
*                                                               *
*                    G A R D S   S U M M A R Y                  *
*                                                               *
*    Project:   *
*       File:  wyrhsr8s                                         *
*                                                               *
*                        GARDS  Version 2.00                    *
*                           developed by                        *
*          Department of Civil and Environmental Engineering    *
*                       University of Cincinnati                *
*                          under contract to                    *
*                 U.S. Environmental Protection Agency          *
*                   Land Pollution Control Division             *
*            Hazardous Waste Engineering Research Laboratory    *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                      Site Characteristics                     *
*****************************************************************
*                                                               *
*      The seismic coefficient is. . . . . . . . . . . . . 0.07 *
*                                                               *
*      The design earthquake magnitude is. . . . . . . . . . 6.00 *
*                                                               *
*      The maximum flood elevation in this case is . . . . .   0 *
*                                                               *
*      The elevation of the seasonal high ground water is. .   0 *
*                                                               *
*      The design waste elevation in the cell is . . . . . .   0 *
*                                                               *
*      The soil number representing the clay liner is. . . .   0 *
*                                                               *
*****************************************************************
```

```
*****************************************************************
*                        Section Geometry                       *
*****************************************************************
*                                                               *
*      The number of soil boundary lines for this section is  4 *
*---------------------------------------------------------------*
*     Line  1        Point          X            Y              *
*                    ------       ------       ------            *
*                       1            0          -20              *
*                       2          700          -20              *
*---------------------------------------------------------------*
```

Line 2	Point	X	Y
	1	0	0
	2	600	0

Line 3	Point	X	Y
	1	0	80
	2	164	80
	3	264	60
	4	276	60
	5	376	40
	6	388	40
	7	488	20
	8	500	20
	9	600	0

Line 4	Point	X	Y
	1	0	83
	2	164	83
	3	264	63
	4	276	63
	5	376	43
	6	388	43
	7	488	23
	8	500	23
	9	600	3
	10	700	0

Soil 1 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained	
Cohesion	0	0	0	(lb/sq.ft)
Phi Angle	0	0	30	(degrees)

Unit Weight	114.000	(lb/cu.ft)
Clay Content	0.000	(%)
Overconsolidation Ratio	0.000	
Initial Void Ratio	0.000	
Compression Index	0.000	
Recompression Index	0.000	
Permeability	0.000	(ft/yr)
Median Grain Size	0.000	(mm)
Plasticity Index	0.000	(%)
Liquid Limit	0.000	(%)
Standard Penetration Number . .	0.000	(blows/ft)

Soil 2 Properties

	Unconsolidated Undrained	Consolidated Undrained	Consolidated Drained

```
*        For this hydraulic condition there is no liner uplift.        *
*                                                                      *
************************************************************************

************************************************************************
*                                                                      *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S          *
*                                                                      *
*                      Automatic Grid Search                           *
*                                                                      *
*     The slopes were analyzed for failure arcs having centers in      *
*     areas defined by the following parallelograms:                   *
************************************************************************
*                                                                      *
*                              Slope  1                                *
*                                                                      *
*    Co-ord.        Point 1       Point 2       Point 3       Point 4  *
*    -------        -------       -------       -------       -------  *
*       X             164           600           680           244    *
*       Y             103            23           163           243    *
*----------------------------------------------------------------------*
*                                                                      *
*        The number of divisions between points 1 and 2 were  4        *
*        The number of divisions between points 2 and 3 were  4        *
*        The X-increment used in the search was  . . . . . . 10        *
*        The Y-increment used in the search was  . . . . . . 10        *
*                                                                      *
************************************************************************

************************************************************************
*                                                                      *
*        R O T A T I O N A L   F A I L U R E   R E S U L T S          *
*                                                                      *
************************************************************************
*                                                                      *
*           Hydraulic Condition 1: Deep Static Ground Water Table      *
*                                                                      *
*                   Consolidated Drained (CD) Case                     *
*                   Seismic Coefficient = 0.07                         *
*----------------------------------------------------------------------*
*          Safety        Failure        X-          Y-                *
*          Factor        Radius       Co-ord      Co-ord              *
*         --------      --------     --------    --------             *
*            1.09         615.5        448.0       615.5              *
*            1.09         613.0        448.0       613.0              *
*            1.10         610.5        448.0       610.5              *
*            1.10         608.0        448.0       608.0              *
*            1.10         605.6        448.0       605.5              *
*            1.10         618.0        448.0       618.0              *
*            1.10         603.1        448.0       603.0              *
*            1.10         615.3        445.5       615.5              *
*            1.10         602.9        445.5       603.0              *
*            1.10         602.8        443.0       603.0              *
*            1.10         612.7        443.0       613.0              *
*            1.10         592.8        443.0       593.0              *
*            1.10         582.9        443.0       583.0              *
*            1.10         572.9        443.0       573.0              *
*            1.10         572.3        433.0       573.0              *
*            1.10         562.4        433.0       563.0              *
*            1.10         582.2        433.0       583.0              *
*            1.10         552.4        433.0       553.0              *
*            1.10         602.1        433.0       603.0              *
*            1.10         542.5        433.0       543.0              *
*            1.10         543.0        443.0       543.0              *
```

```
*********************************************************************
*                                                                   *
*                S E T T L E M E N T    R E S U L T S               *
*                                                                   *
*                Settlement analysis was not performed.             *
*                                                                   *
*********************************************************************

*********************************************************************
*                                                                   *
*             L I Q U E F A C T I O N    R E S U L T S              *
*                                                                   *
*             Liquefaction analysis was not performed.              *
*                                                                   *
*********************************************************************

*********************************************************************
*                                                                   *
*                     G A R D S   S U M M A R Y                     *
*                                                                   *
*    File:  wyrhsr8s            Date: 06-14-2000    Time: 08:52:46  *
*    Project:   *
*    Hydraulic Condition 1: Deep Static Ground Water Table           *
*                                                                   *
*-------------------------------------------------------------------*
*             Rotational Failure Analysis Safety Factor             *
*-------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . Not Run     *
*       Consolidated Undrained Case . . . . . . . . . . Not Run     *
*       Consolidated Drained Case . . . . . . . . . . . 1.09        *
*-------------------------------------------------------------------*
*            Translational Failure Analysis Safety Factor           *
*-------------------------------------------------------------------*
*       Unconsolidated Undrained Case . . . . . . . . . Not Run     *
*       Consolidated Undrained Case . . . . . . . . . . Not Run     *
*       Consolidated Drained Case . . . . . . . . . . . 1.11        *
*-------------------------------------------------------------------*
*             Settlement Analysis . . . . . . . . . . . Not Run     *
*-------------------------------------------------------------------*
*             Liquefaction Analysis . . . . . . . . . . Not Run     *
*********************************************************************
```