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Landfill Expansion/Permit Modification

Solid Waste Permit No. 97-03

Louisiana-Pacific Corporation
Roaring River, North Carolina

July 2007

NORTH CAROLINA PROFESSIONAL SEAL 7/6/07 No. 17543 ENGINEER R. KENT NILSSON

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Section 1
Background

Louisiana-Pacific Corporation (LP) owns a hardboard siding mill located in Roaring River, North Carolina. LP operates a solid waste landfill at the facility, which was originally permitted to operate on January 7, 1981 under Permit No. 97-03. A vertical expansion of the landfill was later included in the *Landfill Design Plan* (Joyce Engineering, Inc., November 24, 1997). The Joyce Engineering, Inc. design plan was submitted in conformance to North Carolina Department of Environment and Natural Resources' (NC DENR's) solid waste management rules requiring operations plans shown in one-year phases through the end of 2002. The report also provided a water quality monitoring plan and a final closure plan. The permit was reissued in 2002, but the operations phasing and final closure remain as previously submitted.

1.1 Purpose

The purpose of this set of documents is to present NC DENR with the information necessary to renew the solid waste Permit No. 97-03 and modify it for the inclusion of zinc borate sludge. The existing landfill currently receives only fly ash. The sludge will be mixed with fly ash at a maximum 3:1 sludge to ash weight ratio, with an average of 2:1 sludge to ash being placed in the landfill. Supporting technical information on the geotechnical and hydraulic characteristics of the site and on the chemical and physical properties of the combined waste materials is included in the appendices to this application.

1.2 General Information

Facility Name:	Louisiana-Pacific Wood Products Landfill
Site Owner and Operator:	Louisiana-Pacific Corporation PO Box 98 Highway 268 Roaring River, NC 28669
Primary Contact:	Joe Hoeflein, Environmental Manager
Production Facility Location:	Wilkes County, North Carolina
Acreage:	7 acres (footprint of landfill only)
Facility Capacity Remaining:	140,800 cubic yards

Anticipated Facility Life:	8 years based upon current ash generation rates and proposed sludge generation rates.
Waste Types:	Fly ash from boilers used in the hardwood product manufacturing process and zinc/borate sludge from the proposed wastewater treatment system upgrade.

1.3 Site Location

The operating landfill is located to the north-northwest of the manufacturing facility. The manufacturing facility is located on Abtco Road, south of State Highway 268 and west of the community of Roaring River, North Carolina. An overall site plan showing the proposed landfill expansion is presented in Sheet 1 of the engineering drawings. The proposed landfill expansion is to be constructed entirely on property owned by LP.

1.4 Expanded Landfill Footprint

The landfill footprint is designed to be extended up the natural hillside immediately adjacent to the north side of the existing landfill site. This expansion area encompasses the undeveloped, wooded hillside located between the northern-most graveled access road and the power line easement. By using this area, the landfill can be expanded beyond its current 5-acre footprint to one that covers approximately 7 acres. The expanded footprint will still be within the area covered by the existing groundwater monitoring system.

A widened landfill footprint will allow the waste material to be stacked to a higher final grade than was presented in the 1997 closure design proposed. Final grades for an expanded footprint will reach a maximum elevation of approximately 1,104 mean sea level (msl) rather than the previously permitted maximum elevation final grade of 1,070 msl. This will provide significantly more landfill airspace. By comparing the proposed final grade of the conceptual footprint expansion with the most recent topographic survey (Current Surveying and Mapping, March 23, 2007) remaining landfill airspace of 140,800 cubic yards has been estimated. Based on an average annual disposal rate of 6,000 tons of ash and 12,775 tons of zinc borate sludge (in place) and an assumed unit weight of 77 pounds per cubic foot (pcf) for the mixture, the expanded landfill will provide an estimated life of approximately 8 years.

1.5 Capacity and Anticipated Life

The landfill will be developed and closed in 3 phases as shown on Sheet 5, Phase Progression Plan. The individual phase capacities and anticipated life estimations are shown in Table 1. These capacities are based on the ash/sludge mixture. The actual lifetime of Phase I will vary slightly depending on the timing of implementation of the upgraded wastewater treatment system. Until the zinc borate sludge is generated, only ash will placed into Phase I at the current generation rate.

Table 1
Phase Capacity

PHASE	CAPACITY (cubic yards)	ANTICIPATED LIFE (1) AT 18,000 CUBIC YARDS PER YEAR (years)
1	22,749	1.3
2	73,507	4.1
3	43,038	2.4

(1) Assumes immediate disposal of zinc borate sludge in addition to the ash currently disposed

1.6 Permit Modification for Sludge Disposal

Within the current year, LP is proposing to construct and operate a new wastewater treatment process that will impact sludge generation rate and disposal practices. Upon construction of an upgraded wastewater treatment system, LP would dispose of generated sludge in the facility's on-site landfill. LP submitted the report entitled *Authorization to Construct (ATC) Application for a Zinc Treatment System* to NC DENR on May 23, 2007. This report is currently being reviewed by the Construction Grants and Loans Section of the Division of Water Quality. This report includes the engineering design details of the wastewater treatment process that will generate the zinc sludge, including a description of the zinc sludge.

NC DENR-approval of the ATC application is expected by August 2007. Construction is scheduled to start in August and to be completed by December 15, 2007. The zinc treatment system that will generate the zinc sludge is scheduled to start up by the end of 2007.

1.7 Simulated Sludge Generation Pilot Test

In December 2007, LP is planning to start the addition of zinc borate to their hardboard production process to render the siding more decay-resistant. Because 100 percent of the zinc borate will not be retained on the siding products, process wastewaters will contain zinc and boron residuals. A treatment process has been designed and is being constructed for the removal of zinc in the wastewaters. Boron will remain soluble in the wastewaters and will not be removed by this treatment process.

The treatment process will generate a zinc phosphate sludge that will be dewatered to approximately 20 percent solids, and then disposed of in conjunction with the ash. RMT North

Carolina, Inc. (RMT) performed a pilot-scale simulation of the zinc treatment process in order to generate zinc sludge for stability and SPLP testing. A summary of the pilot-scale treatment process is as follows:

- 50 gallons of process wastewaters added to 55 gallon drum.
- A zinc solution was added to the 50 gallons to result in a zinc concentration of 100 mg/L in the wastewater. With this pilot-scale, the addition of a boron solution was not practical.
- The zinc treatment process was simulated in the drum on a batch basis with the addition of phosphoric acid and adjusting the pH to 8. This chemistry resulted in the precipitation of soluble zinc into zinc phosphate solids. The wastewater was well-mixed during this process.
- Polymer was added to the well-mixed treated wastewater in the drum to enhance the coagulation of precipitated solids. Then, the mixing was stopped to allow the solids to settle.
- The settled solids were collected and dewatered in filter bags to approach a solids concentration of 20 percent. This level of sludge dewatering is equivalent to the planned full-scale scale dewatering system using belt filter presses.

A total of 16 drums were processed to generate a sufficient quantity of dewatered zinc phosphate sludge for stability and SPLP testing in conjunction with the ash. The projected maximum dewatered zinc phosphate sludge generation rate is 50 tons/day, which is approximately 3 times the ash generation rate. The projected long-term average dewatered zinc phosphate sludge generation rate is between 25 to 30 tons/day.

1.8 Groundwater Analytical and Mass Balance Results

Based on current boiler ash and proposed sludge generation rates, a composite waste with up to an estimated 3:1 sludge to ash weight ratio is expected. This waste mixture was used to develop groundwater and stability models for the landfill.

North Carolina groundwater standards (15A NCAC 2L) may not be exceeded at the compliance points, the existing landfill groundwater monitoring wells. Synthetic Precipitation Leaching Procedure (SPLP) was used on the modified waste stream in order to estimate the potential groundwater impact and confirm that 15A NCAC 2L levels would not be exceeded. The analysis was performed by a North Carolina certified laboratory. The constituents analyzed for and analytical results are presented in Table 2. The laboratory report is presented in Appendix A.

Table 2
Synthetic Precipitation Leaching Procedure Testing Results

ANALYTE	NC GROUNDWATER STANDARD (mg/L)	RESULT
Arsenic	0.05	ND
Barium	2	ND
Cadmium	0.00175	ND
Chromium	0.05	ND
Lead	0.015	ND
Selenium	0.05	ND
Silver	0.0175	ND
Zinc	1.05	ND
Fluoride	2	0.59
Total Dissolved Solids	1,000	306

No analytes were found to exceed North Carolina groundwater standards based on the SPLP testing, eliminating the need for groundwater modeling for these constituents. Because boron was not a part of the generation of simulated zinc sludge, the impact of boron on groundwater has been estimated based on known characteristics of boron in conjunction with best judgments regarding soil and groundwater conditions in the landfill area.

RMT treatability testing determined that boron in the wastewaters will be not be removed in either in the new zinc treatment process or any of the existing wastewater treatment processes. The boron will remain completely soluble throughout the entire wastewater treatment process. Because none of the boron will partition into the dry solids phase of the zinc sludge, the zinc sludge will contain boron that is soluble in the water phase.

The zinc sludge will be dewatered to approximately 20 percent solids. Therefore, 80 percent of the sludge by weight will be water. The projected soluble boron concentration in the water phase of the sludge is 30 mg/L.

Groundwater mass balance calculations are presented in Appendix B. The results indicate that boron concentrations in the groundwater would be below the 2L standards at the point of compliance.

Section 2
Slope Stability Calculations

In order to represent the strength parameters of the landfill, a composite waste sample, including both the ash presently landfilled and the new wastewater treatment plant sludge were generated. A sample of wastewater was retrieved from the primary clarifier inlet at the site so a representative sludge sample could be made (refer to Subsection 1.7 for details regarding the sludge making process). The sludge was then mixed with fly ash at a 3:1 weight ratio, in order to conservatively represent the highest anticipated mix ratio for waste going to the landfill. This ratio is based on current ash generation rates and expected sludge generation rates. RMT soils laboratory technicians in Madison, Wisconsin then conducted a Triaxial Shear Test (TST) to determine the waste mix strength parameters for stability calculations. Based on our test results, the average wet density, γ_{wet}, used in the slope stability calculations for the waste-sand mixture was 76.8 pcf. Additionally, the TST results showed a Cohesion (C) of 95 psf, and a Friction Angle (ϕ) for Total Stress Conditions of 16.3 degrees. (Refer to Appendix C for test data.)

Stability modeling for the naturally occurring silty clay layer immediately underlying the landfill and the residual soil layer located further into the soil strata was completed by Joyce Engineering, Inc. in November 1997. The soil characterization data in that report was used by RMT in order to complete the slope stability modeling for the proposed landfill expansion and is presented in Table 3.

Table 3
Slope Stability Modeling

SOIL	VALUES
Silty clay layer	γ_{wet} = 115 pcf, C = 800 and ϕ = 16 degrees
Residual soil layer	γ_{wet} =120 pcf, C = 300 and ϕ = 28 degrees

Bedrock is located at depths beyond 60 feet from the base of the landfill footprint. The stiff residual soil layer above the bedrock is thick enough to be a sufficient bottom layer for slope stability modeling calculations.

A groundwater monitoring report by Joyce Engineering, Inc. (August 1999) was used in order to determine depth to groundwater. For the area of landfill being modeled for slope stability calculations, the water table map showed groundwater occurred from elevations ranging from

1,015 feet to 995 feet. Groundwater was therefore located at depths of 30 feet to 50 feet below the base of the landfill and well into the residual layer. Therefore, groundwater will not have a significant effect on slope stability calculations.

While Joyce Engineering, Inc. completed a slope stability analysis for the western portion of the landfill, the modeling, RMT has performed an additional stability evaluation for the eastern portion of the proposed expansion. This area will have the most significant change from current conditions with addition of the sludge waste stream. Since the sludge/ash mixture is generally weaker than ash alone, and stacking heights are greater, the expansion area would have highest probability of shear failure.

Strength parameters developed from the sampling and testing were input into the slope stability analysis program SLOPE/W developed by GEO-SLOPE International, Ltd. Graphic outputs of the analysis are attached.

The factor of safety against slope failure for each of three methods is shown in Table 4. The minimum factor of safety calculated was 3.0. Slope stability modeling data is presented in Appendix D.

Table 4
Slope Failure Methods

METHOD	FACTOR OF SAFETY
Bishop	3.5
Ordinary	3.3
Janbu	3.0

The landfill was designed with slide slopes at a 3:1 ratio and a maximum waste elevation of 1,104 feet msl as shown on the Grading Plan, Sheet 2, and Cross Sections, Sheet 3.

Section 3
Design Calculations for Sedimentation Basin

A run-on control system to prevent flow onto the active portion of the landfill and a run-off control system from the active portion of the landfill was designed to control the peak discharge and water volume from a 25-year, 24 hour storm event. A drainage ditch will be constructed around the perimeter of the north side of the landfill to divert stormwater run-on around the landfill. Riprap will be used in ditches and check dams will be installed as necessary to obtain reduce flow velocities and prevent erosion. Diversion ditches and berms will also be constructed as necessary to direct stormwater run-on around the active portion of the landfill. Terraces and ditches will be used to convey stormwater run-off from the active portions of the landfill to the sediment basin. The following subsections summarize stormwater and sediment pond calculations.

3.1 Surface Water Run-off Calculations

The methods for computing surface water run-off are based on the methodologies presented in the Technical Release No. 55 - "Urban Hydrology for Small Watersheds" by the United States Soil Conservation Service (SCS).

Surface water run-off calculations consisted of delineating drainage areas (watersheds) and estimating run-off characteristics. The SCS TR-55 method was then used to estimate the peak and total run-off rate and volume for each drainage area.

The calculations were performed using rainfall quantities, storm distributions, surface run-off characteristics, drainage areas, times of concentration, and travel times to generate a hydrograph from which the volume of surface water run-off and the peak discharge are obtained.

The times of concentration and travel times were computed using the TR-55 program. These calculations combined overland flow time, shallow concentrated flow time, and channel flow time to obtain a total time of concentration for the area being evaluated.

Assumptions

The following assumptions were made in developing the hydrographs:

- A 2-year, 24-hour storm event in the vicinity of the landfill equates to 3.4 inches according to figures provided in the TR-55 manual.
- A 25-year, 24-hour storm event in the vicinity of the landfill equates to 5.4 inches according to figures provided in the TR-55 manual.
- A Type II rainfall distribution was used based on SCS storm distribution maps provided in the TR-55 manual.
- For the post-development conditions, a run-off curve number of 86 (bare soil) was assumed, based on values provided in the TR-55 manual. This is a conservative number based on conditions after the final cover has been placed but prior to seeding.
- Based on soils samples collected and analyzed in RMT's soil laboratory, impacted soils can be classified as a sandy clay or clayey sand corresponding to a hydrologic soil group of B.

Surface water run-off results are presented in Appendix E.

3.2 Sediment Pond Calculations

The PondPack computer program developed by Haestad Methods was used to evaluate the performance of the sedimentation basins. PondPack incorporates the capacity of each basin at various elevations, the stage-storage-discharge (SSD) relationship, the outlet structure geometry, and the incoming hydrograph to output the peak reservoir elevation and discharge flow rate.

The surface areas at various elevations were digitized and input into the computer program. PondPack then computed the basin volumes using the conic method to compute the incremental volume between basin contours. The SSD relationship was developed based on the basin and outlet structure geometry inputted into the program. The inflow hydrographs were then routed through their respective sedimentation basins.

The ratio of the surface area at the peak reservoir elevation to the peak outflow was used to determine the minimum particle size that can be settled out in the basin.

Assumptions

The following assumptions were made in designing the sedimentation basin:

- The sedimentation basins were sized to accommodate the run-off from a 25-year, 24-hour storm.
- The sedimentation basin outlet structures are designed to dewater the basin completely.
- The incoming hydrographs were as determined in Subsection 3.1, Surface Water Run-off Calculations.
- The layout of the sedimentation basins are as shown on the Grading Plan Sheet.
- The outlet structure is as shown on Sheet 10.

Sediment pond calculations are presented in Appendix E.

3.3 Results

The sedimentation basin was adequately designed to accommodate the surface water run-off from a 25-year, 24-hour storm without overtopping. In addition, the sedimentation basins will settle out particles greater than 0.06 mm and will dewater appropriately. The lateral drain pipe from the existing sediment basin will tie into the existing 18 inch corrugated plastic pipe located in the depression on the southeast side of the landfill. Flow rates and velocities in this pipe will not exceed conditions encountered prior to the landfill expansion.

Section 4
Operating Procedures

4.1 Waste Route

Waste transport vehicles will enter the facility through the existing access road. Trucks will unload at the active end of the phase. Access roads will be maintained as necessary for each phase of development.

4.2 Waste Handling and Placement

The ash and sludge will be mixed in place with a bulldozer at approximately a 2:1 weight ratio based on projected generation rates. The waste will be applied to the landfill in one foot lifts and compacted by field equipment.

4.3 Stormwater Monitoring

All surface run-off from the landfill will be directed to the sediment pond or towards designated discharge locations. Stormwater discharge from these ponds will be controlled with a normally open outlet valve in the spillway outlet pipe. The pond is sized to retain the run-off from the 10-year frequency, 24-hour storm at the elevation of the principal spillway. The principal spillway has the capacity to carry a 25-year frequency, 24-hour storm event without overflowing into the emergency spillway.

Section 5
Closure/Post-Closure

5.1 Closure Method

Waste will continue to be placed as discussed in Section 4, Operating Procedures, until final grades are reached. Once the surface is at the appropriate elevation, the cover layer will be installed. This layer will consist of 6 inches of top soil and 12 inches of general fill soil capable of supporting vegetative growth. In addition, the sedimentation basins will be cleaned of sediment build-up within the basin as necessary, and this sediment, which will consist of the material eroded from the cover, will be blended into the vegetative layer.

5.2 Closure Schedule

LP will begin final closure activities within 30 days of the final receipt of wastes.

5.3 Post-Closure Care

LP will regularly perform the following maintenance activities for the duration of the period of post-closure care:

- **Final Cover**: The finished cap will periodically receive a walking inspection to check for and document evidence of settling, subsidence, erosion, and other potential failures of the final cover. These inspections will also encompass the perimeter berm, ditches, channels, and sedimentation basins to ensure stormwater run-on and run-off is being properly routed. These inspections, along with any repairs that were required, will be documented and kept in LP files.

  In addition, the landfill will be mowed, fertilized, and reseeded as needed. Any vegetation that poses a danger to the integrity of the final cover, such as trees and woody vegetation will be discouraged and removed.

5.4 Long-term Use

Once the landfill has been closed, it will not be used for any purpose or activity that would be detrimental to the integrity of the final cover or stormwater management system.

Appendix A
Synthetic Precipitation Leaching Procedure Laboratory Reports

METHOD SUMMARY

Client: RMT, Inc. Job Number: 680-27501-1

Description	Lab Location	Method	Preparation Method
Matrix: Solid			
SPLP Metals	STL SAV	SW846 6010B	
Synthetic Precipitation Leaching Procedure -East	STL SAV		SW846 1312
Acid Digestion of Aqueous Samples and Extracts	STL SAV		SW846 3010A
Matrix: Water			
Alkalinity, Titration Method	STL SAV	SM18 SM 2320B	
Total Dissolved Solids (Dried at 180 °C)	STL SAV	SM18 SM 2540C	
Fluoride (Ion-selective Electrode)	STL SAV	SM18 4500-F-C	
pH Electrometric Measurement	STL SAV	SW846 9040B	

LAB REFERENCES:

STL SAV = STL Savannah

METHOD REFERENCES:

SM18 - "Standard Methods For The Examination Of Water And Wastewater", 18th Edition, 1992.

SW846 - "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

DATA REPORTING QUALIFIERS

Client: RMT, Inc. Job Number: 680-27501-1

Lab Section	Qualifier	Description
Metals		
	U	Indicates the analyte was analyzed for but not detected.
General Chemistry		
	U	Indicates the analyte was analyzed for but not detected.

DATA REPORTING QUALIFIERS

Client: RMT, Inc. | Job Number: 680-27501-1

Lab Section	Qualifier	Description
Metals		
	U	Indicates the analyte was analyzed for but not detected.
General Chemistry		
	U	Indicates the analyte was analyzed for but not detected.

Client: RMT, Inc.

Job Number: 680-27501-1

TCLP SPLPE Leachate Blank - Batch: 680-77737

Method: 6010B
Preparation: 3010A
SPLP East

Lab Sample ID: LB 680-77553/2-AB
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 06/16/2007 1815
Date Prepared: 06/14/2007 0926
Date Leached: 06/12/2007 1446

Analysis Batch: 680-78023
Prep Batch: 680-77737
Units: ug/L
Leachate Batch: 680-77553

Instrument ID: ICP/AES
Lab File ID: N/A
Initial Weight/Volume: 50 mL
Final Weight/Volume: 50 mL

Analyte	Result	Qual	RL
Arsenic	10	U	10
Barium	10	U	10
Cadmium	5.0	U	5.0
Chromium	10	U	10
Lead	5.0	U	5.0
Selenium	10	U	10
Silver	10	U	10
Zinc	20	U	20

Lab Control Spike - Batch: 680-77737

Method: 6010B
Preparation: 3010A

Lab Sample ID: LCS 680-77737/3-AA
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 06/16/2007 1820
Date Prepared: 06/14/2007 0926

Analysis Batch: 680-78023
Prep Batch: 680-77737
Units: ug/L

Instrument ID: ICP/AES
Lab File ID: N/A
Initial Weight/Volume: 50 mL
Final Weight/Volume: 50 mL

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Arsenic	2000	2030	101	75 - 125	
Barium	2000	2180	109	75 - 125	
Cadmium	50.0	51.9	104	75 - 125	
Chromium	200	207	104	75 - 125	
Lead	500	503	101	75 - 125	
Selenium	2000	2010	100	75 - 125	
Silver	50.0	50.5	101	75 - 125	
Zinc	500	516	103	75 - 125	

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: RMT, Inc.

Job Number: 680-27501-1

Method Blank - Batch: 680-78184

Method: 4500-F-C
Preparation: N/A

Lab Sample ID:	MB 680-78184/1	Analysis Batch: 680-78184		Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch: N/A		Lab File ID:	N/A
Dilution:	1.0	Units: mg/L		Initial Weight/Volume:	50 mL
Date Analyzed:	06/19/2007 1100			Final Weight/Volume:	50 mL
Date Prepared:	N/A				

Analyte	Result	Qual	RL
Fluoride	0.20	U	0.20

Lab Control Spike - Batch: 680-78184

Method: 4500-F-C
Preparation: N/A

Lab Sample ID:	LCS 680-78184/2	Analysis Batch: 680-78184		Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch: N/A		Lab File ID:	N/A
Dilution:	1.0	Units: mg/L		Initial Weight/Volume:	50 mL
Date Analyzed:	06/19/2007 1100			Final Weight/Volume:	50 mL
Date Prepared:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Fluoride	5.66	5.69	100	85 - 115	

Duplicate - Batch: 680-78184

Method: 4500-F-C
Preparation: N/A

Lab Sample ID:	680-27501-2	Analysis Batch: 680-78184		Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch: N/A		Lab File ID:	N/A
Dilution:	1.0	Units: mg/L		Initial Weight/Volume:	50 mL
Date Analyzed:	06/19/2007 1100			Final Weight/Volume:	50 mL
Date Prepared:	N/A				

Analyte	Sample Result/Qual	Result	RPD	Limit	Qual
Fluoride	0.59	0.590	0	30	

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: RMT, Inc.

Job Number: 680-27501-1

Lab Control Spike/
Lab Control Spike Duplicate Recovery Report - Batch: 680-78261

Method: 9040B
Preparation: N/A

LCS Lab Sample ID: LCS 680-78261/1
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 06/19/2007 1437
Date Prepared: N/A

Analysis Batch: 680-78261
Prep Batch: N/A
Units: SU

Instrument ID: No Equipment Assigned
Lab File ID: N/A
Initial Weight/Volume: 50 mL
Final Weight/Volume: 50 mL

LCSD Lab Sample ID: LCSD 680-78261/2
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 06/19/2007 1437
Date Prepared: N/A

Analysis Batch: 680-78261
Prep Batch: N/A
Units: SU

Instrument ID: No Equipment Assigned
Lab File ID: N/A
Initial Weight/Volume: 50 mL
Final Weight/Volume: 50 mL

Analyte	% Rec. LCS	% Rec. LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
pH	100	101	63 - 158	1	40		

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: RMT, Inc. Job Number: 680-27501-1

Method Blank - Batch: 680-77800

Method: SM 2320B
Preparation: N/A

Lab Sample ID:	MB 680-77800/3	Analysis Batch:	680-77800	Instrument ID:	Titrator
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	1.0	Units:	mg/L	Initial Weight/Volume:	
Date Analyzed:	06/14/2007 1035			Final Weight/Volume:	25 mL
Date Prepared:	N/A				

Analyte	Result	Qual	RL
Alkalinity	1.0	U	1.0

Lab Control Spike - Batch: 680-77800

Method: SM 2320B
Preparation: N/A

Lab Sample ID:	LCS 680-77800/6	Analysis Batch:	680-77800	Instrument ID:	Titrator
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	1.0	Units:	mg/L	Initial Weight/Volume:	
Date Analyzed:	06/14/2007 1047			Final Weight/Volume:	25 mL
Date Prepared:	N/A				

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Alkalinity	352	306	87	80 - 120	

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: RMT, Inc. | Job Number: 680-27501-1

Method Blank - Batch: 680-78224

Method: SM 2540C
Preparation: N/A

Lab Sample ID: MB 680-78224/1
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 06/19/2007 1931
Date Prepared: N/A

Analysis Batch: 680-78224
Prep Batch: N/A
Units: mg/L

Instrument ID: No Equipment Assigned
Lab File ID: N/A
Initial Weight/Volume: 100 mL
Final Weight/Volume: 100 mL

Analyte	Result	Qual	RL
Total Dissolved Solids	5.0	U	5.0

Lab Control Spike - Batch: 680-78224

Method: SM 2540C
Preparation: N/A

Lab Sample ID: LCS 680-78224/2
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 06/19/2007 1931
Date Prepared: N/A

Analysis Batch: 680-78224
Prep Batch: N/A
Units: mg/L

Instrument ID: No Equipment Assigned
Lab File ID: N/A
Initial Weight/Volume: 100 mL
Final Weight/Volume: 100 mL

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Total Dissolved Solids	310	306	99	80 - 120	

Calculations are performed before rounding to avoid round-off errors in calculated results.

Appendix B
Groundwater Calculations

ANALYSIS OF BORON IN ZINC SLUDGE COMBINED WITH ASH

Projected boron concentration in wastewater based on LP calculations (mg/L)	30
Based on RMT North Carolina, Inc. (RMT) treatability testing, 100% of boron remains soluble in wastewater.	
Maximum zinc sludge generation (dry tons/day)	10
Dewatered zinc sludge solids concentration (%TS)	20
Maximum zinc sludge generation (total wet tons/day)	50
Ash generation (total tons/day)	16.7
Ash contains no water. Therefore, all water in sludge/ash blend is from wastewater.	
All water in the sludge/ash blend contains boron at this concentration (mg/L)	30
Sludge to ash ratio used for SPLP test (weight basis)	3
SPLP sample weight (g)	100
Zinc sludge weight in SPLP (g)	75
Water (wastewater) weight in zinc sludge portion of SPLP sample (g)	60
Density of water (wastewater) in zinc sludge portion of SPLP sample (g/mL)	1
Water (wastewater) volume in zinc sludge SPLP sample (mL)	60
Water (wastewater) volume in zinc sludge SPLP sample (L)	0.06
Boron concentration in water portion of SPLP sample (mg/L)	30
Mass of boron in water portion of SPLP sample (mg)	1.8
Mass of boron in total SPLP sample (mg)	1.8
Estimated amount of boron available for migration to groundwater via precipitation (%)	100
Estimated leachable mass of boron from SPLP sample (mg)	1.8
Volume of water added to in SPLP test (L)	2
Estimated boron concentration in SPLP leachate (mg/L)	0.90
Estimated amount of boron in leachate that would recharge to groundwater (%)	100
Class GA groundwater standard for boron (mg/L)	0.315

Site-Specific Dilution Factor Calculations

At the indicated dilution factor, the concentration of boron in groundwater would be: 0.094 mg/L (leachate concentration of 2.8125 mg/L)

Equations: Dilution Factor = 1 + [(Kid)/(IL)]

$d = [(0.0112*L^2)^{0.5}]+d_a\{1-\exp[(-LI)/(Kid_a)]\}$

	Landfill
Calculated Dilution Factor	9.6

Parameters for Dilution Factor Calculation

Abbreviation	Parameter	Units		Source of Data or Information
K	Hydraulic conductivity	ft/day	5.27	Joyce Engr report, p5
i	Hydraulic gradient	dimensionless	0.1	Joyce Engr report, p6
I	Infiltration rate	inches/year	10.1	80% of area recharge, defined in Heath, 1994 (see below)
L	Length of source parallel to GW flow	feet	400	Site map
d	Mixing zone depth (limited by d_a)	feet	44.0	Calculated using equation presented as indicated above

Additional Parameters for Mixing Zone Depth Calculation

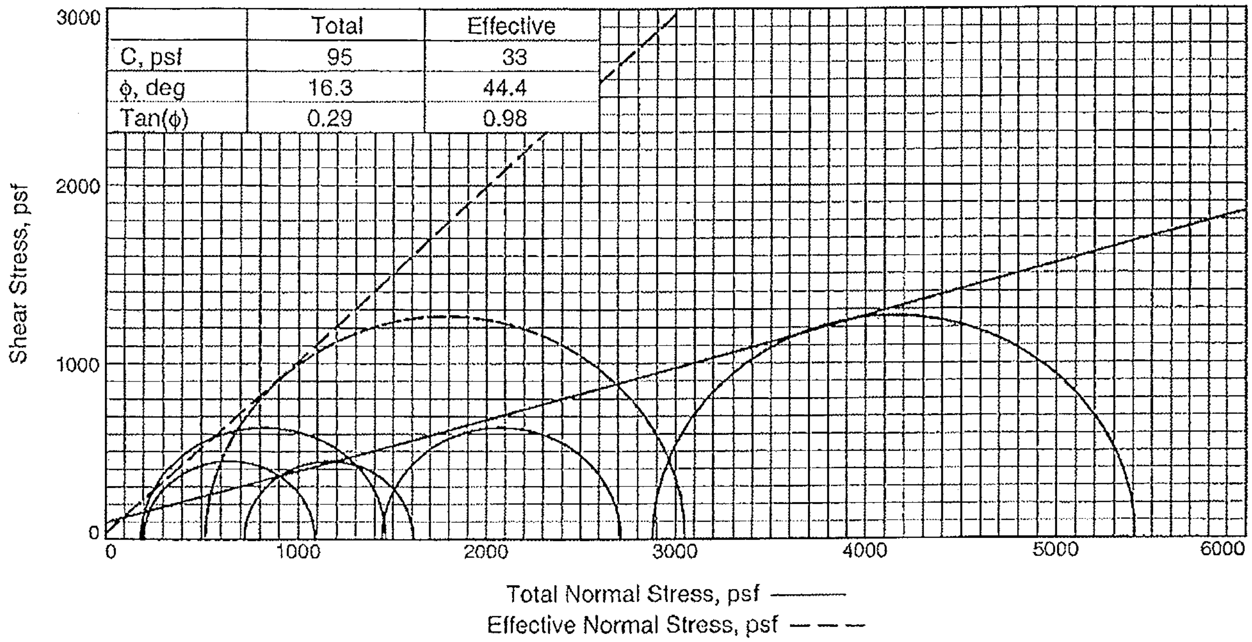
d_a	Aquifer depth	feet	15	Estimated overall saturated thickness

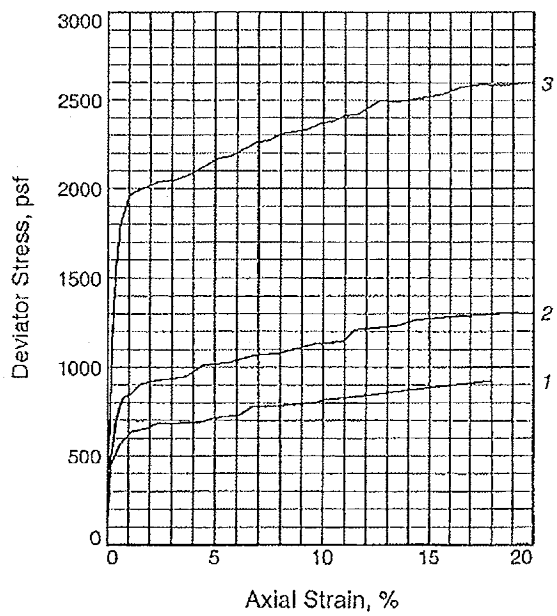
Heath, Ralph C. 1994. Ground-Water Recharge in North Carolina. Prepared for the Groundwater Section, Division of Environmental Management, North Carolina Department of Environment, Health, and Natural Resources. March 1994.

Appendix C
Triaxial Shear Test Report

√JRN

	Total	Effective
C, psf	95	33
φ, deg	16.3	44.4
Tan(φ)	0.29	0.98





Sample No.		1	2	3
Initial	Water Content, %	167.5	167.5	167.5
	Dry Density, pcf	28.7	28.6	28.7
	Saturation, %	98.1	97.7	97.8
	Void Ratio	3.6711	3.6863	3.6825
	Diameter, in.	2.75	2.75	2.75
	Height, in.	5.50	5.50	5.50
At Test	Water Content, %	140.9	130.5	124.6
	Dry Density, pcf	33.3	35.3	36.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	3.0295	2.8062	2.6782
	Diameter, in.	2.62	2.56	2.53
	Height, in.	5.24	5.14	5.09
Strain rate, %/min.		1.00	1.00	1.00
Eff. Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, psf		887	1275	2531
Total Pore Pr., psf		14198	14213	13882
Strain, %		15.1	15.4	15.5
Ult. Stress, psf				
Total Pore Pr., psf				
Strain, %				
$\bar{\sigma}_1$ Failure, psf		1088	1462	3050
$\bar{\sigma}_3$ Failure, psf		202	187	518

Type of Test:
CU with Pore Pressures

Sample Type: Remolded

Description: Sludge/Fly Ash Mix (3:1)

Specific Gravity= 2.15

Remarks:

Figure: ________

Client:

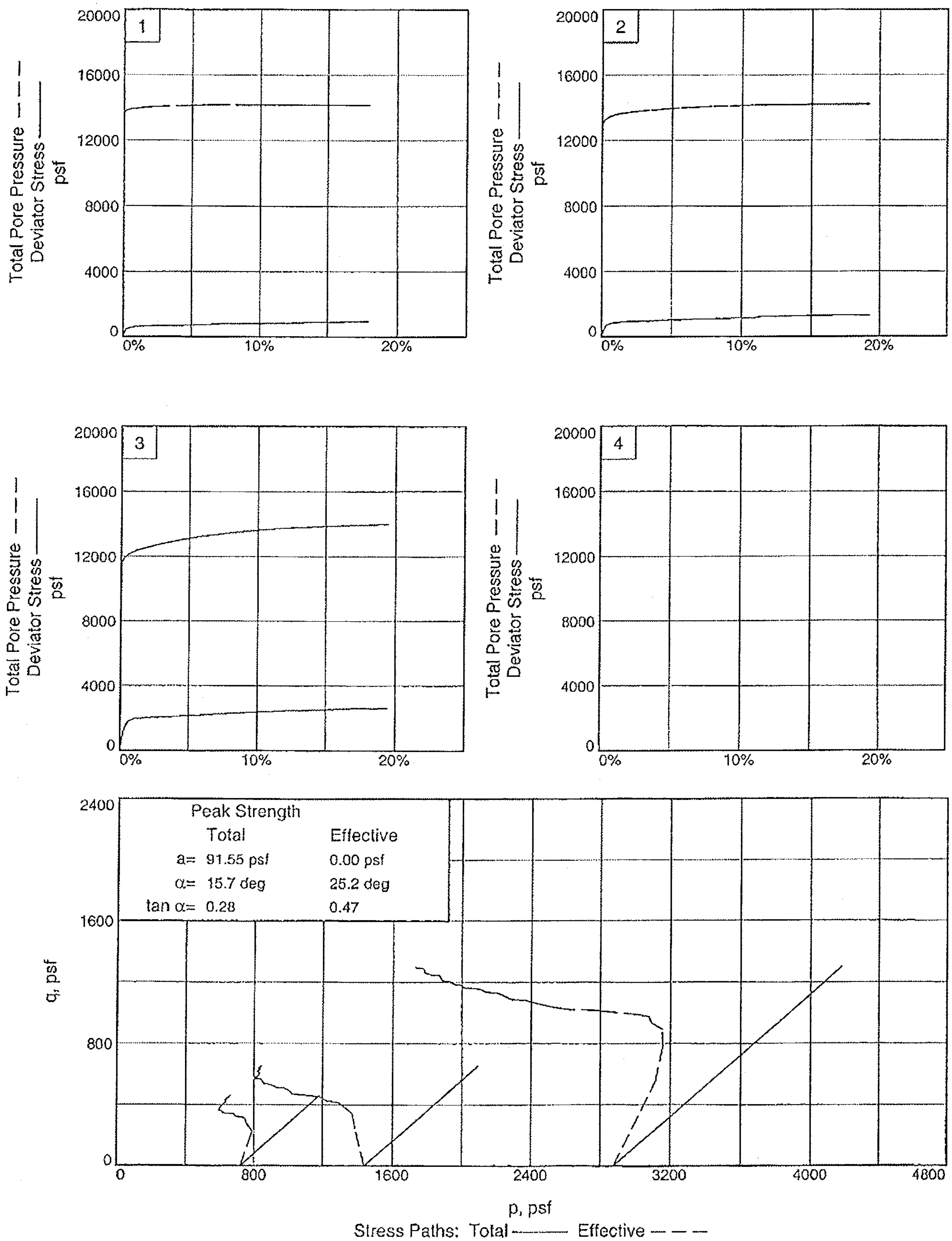
Project: LP: Landfill Permit Renewal

Sample Number: Sludge/Fly Ash Mix

Proj. No.: 71345.35 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

RMT, Inc.



Client:

Project: LP: Landfill Permit Renewal

Sample Number: Sludge/Fly Ash Mix

Project No.: 71345.35

Figure: ______

RMT, Inc.

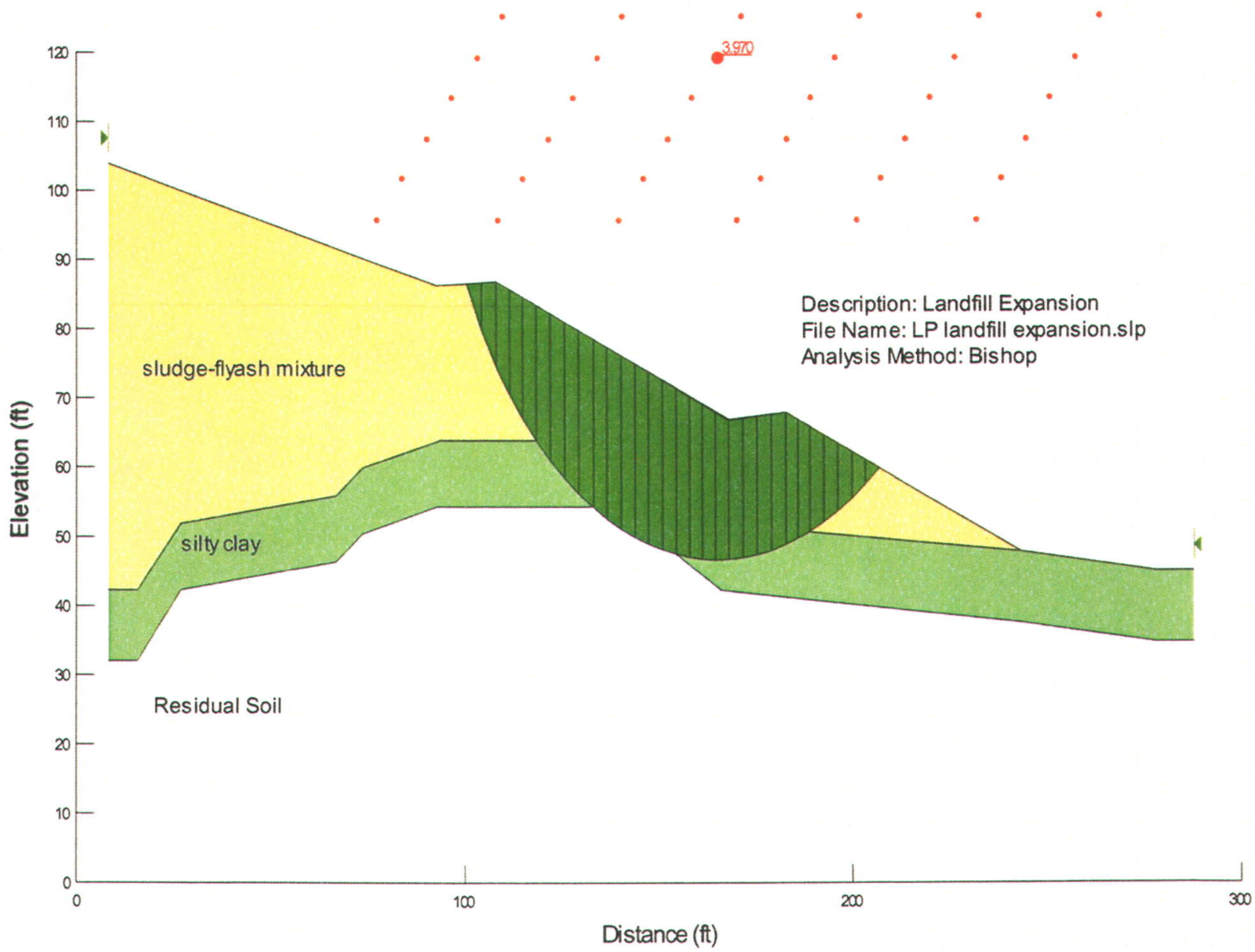
Appendix D
Slope Stability Modeling Data

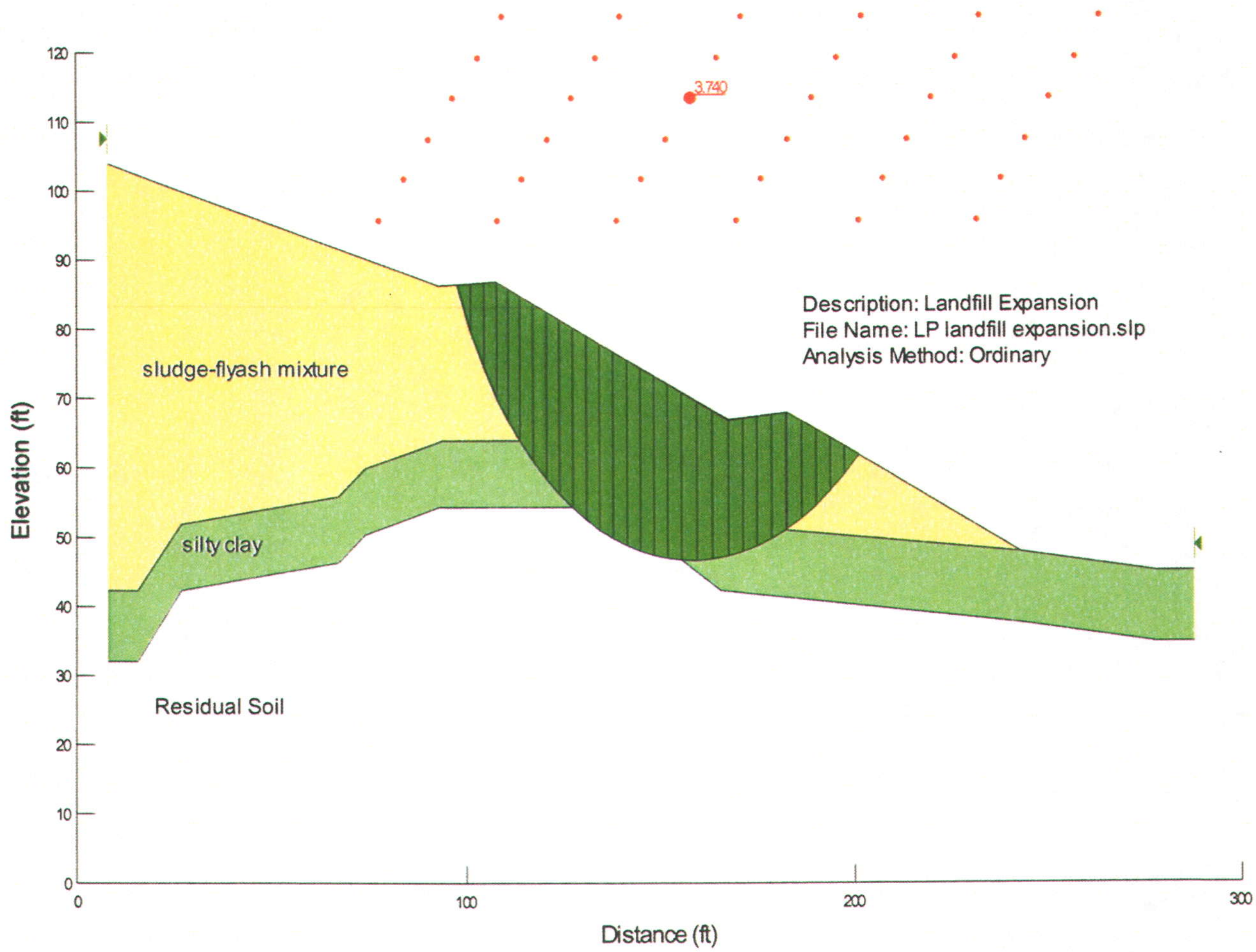
All Soils

Soil 1
sludge-flyash mixture
Soil Model Mohr-Coulomb
Unit Weight 48
Cohesion 95
Phi 16.3
Piezometric Line # 0
Pore-Air Pressure 0

Soil 2
silty clay
Soil Model Mohr-Coulomb
Unit Weight 115
Cohesion 800
Phi 16
Piezometric Line # 0
Pore-Air Pressure 0

Soil 3
Residual Soil
Soil Model Mohr-Coulomb
Unit Weight 120
Cohesion 300
Phi 28
Piezometric Line # 0
Pore-Air Pressure 0


3.970
Description: Landfill Expansion
File Name: LP landfill expansion.slp
Analysis Method: Bishop
sludge-flyash mixture
silty clay
Residual Soil
Elevation (ft)
Distance (ft)
0
10
20
30
40
50
60
70
80
90
100
110
120
0
100
200
300



3.740
120
110
100
90
80
70
60
50
40
30
20
10
0
Elevation (ft)
sludge-flyash mixture
silty clay
Residual Soil
Description: Landfill Expansion
File Name: LP landfill expansion.slp
Analysis Method: Ordinary
0
100
200
300
Distance (ft)

Appendix E
Hydrologic/Sediment Pond Calculations

Table of Contents

********************** MASTER SUMMARY **********************

S/N:
PondPack Ver: Compute Time: Date:

Type.... Master Network Summary Page 1.01
Name.... Watershed
File.... G:\HD Stuff\Projects\Martek\LP_LANDFILL_PREDEVELOPMENT.PPW

MASTER DESIGN STORM SUMMARY

Network Storm Collection: LP Landfill

Return Event	Total Depth in	Rainfall Type	RNF ID
2	3.4000	Synthetic Curve	TypeII 24hr
5	4.1000	Synthetic Curve	TypeII 24hr
10	4.8000	Synthetic Curve	TypeII 24hr
25	5.4000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10	JCT	2	.522		12.0500	6.78		
*OUT 10	JCT	5	.777		12.0500	10.61		
*OUT 10	JCT	10	1.058		12.0500	14.78		
*OUT 10	JCT	25	1.314		12.0500	18.56		
SUBAREA 10	AREA	2	.522		12.0500	6.78		
SUBAREA 10	AREA	5	.777		12.0500	10.61		
SUBAREA 10	AREA	10	1.058		12.0500	14.78		
SUBAREA 10	AREA	25	1.314		12.0500	18.56		

S/N: E2170120708C   RMT Inc
PondPack Ver: Compute Time: Date:

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Index of Starting Page Numbers for ID Names

S/N:
PondPack Ver: Compute Time: Date:

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********************** MASTER SUMMARY **********************

Watershed....... Master Network Summary 1.01

S/N:
PondPack Ver: Compute Time: Date:

Type.... Master Network Summary
Name.... Watershed Page 1.01
File.... G:\HD Stuff\Projects\Martek\LP_LANDFILL_POSTDEVELOPMENT.PPW

MASTER DESIGN STORM SUMMARY

Network Storm Collection: LP Landfill

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 2	3.4000	Synthetic Curve	TypeII 24hr
Dev 5	4.1000	Synthetic Curve	TypeII 24hr
Dev 10	4.8000	Synthetic Curve	TypeII 24hr
Dev 25	5.4000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID		Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*OUT 10		JCT	2	.688		14.3500	.49		
*OUT 10		JCT	5	.949		13.7500	.78		
*OUT 10		JCT	10	1.217		13.4000	1.13		
*OUT 10		JCT	25	1.451		12.6000	3.11		
POND 10	IN	POND	2	.838		12.0500	11.79		
POND 10	IN	POND	5	1.099		12.0500	15.40		
POND 10	IN	POND	10	1.367		12.0500	19.06		
POND 10	IN	POND	25	1.601		12.0500	22.20		

POND 10	OUT	POND	2	.688	14.3500	.49	1047.59	.583
POND 10	OUT	POND	5	.949	13.7500	.78	1048.36	.738
POND 10	OUT	POND	10	1.217	13.4000	1.13	1049.18	.895
POND 10	OUT	POND	25	1.451	12.6000	3.11	1049.63	.980

S/N: E2170120708C RMT Inc
PondPack Ver: Compute Time: Date:

Type.... Master Network Summary Page 1.02
Name.... Watershed
File.... G:\HD Stuff\Projects\Martek\LP_LANDFILL_POSTDEVELOPMENT.PPW

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
SUBAREA 10	AREA	2	.838		12.0500	12.07		
SUBAREA 10	AREA	5	1.099		12.0500	15.72		
SUBAREA 10	AREA	10	1.367		12.0500	19.40		
SUBAREA 10	AREA	25	1.601		12.0500	22.56		

S/N: E2170120708C RMT Inc
PondPack Ver: Compute Time: Date:

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S/N:
PondPack Ver: Compute Time: Date:

Drawings Under Seperate Cover