

Part III
Attachment III-D
Appendix III-D.5

GEOTECHNICAL ANALYSES REPORT

**Pescadito Environmental Resource Center
MSW No. 2374
Webb County, Texas**

PESCADITO
ENVIRONMENTAL RESOURCE CENTER

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**Part III
Attachment III-D
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GEOTECHNICAL ANALYSES REPORT

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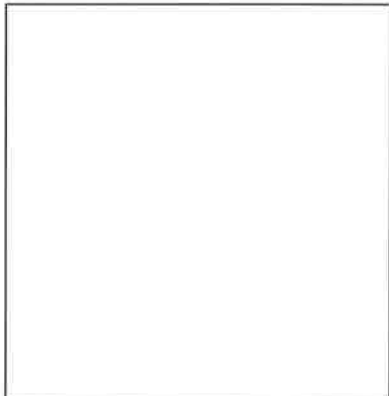
Appendix III-D.5-2 Slope Stability Analyses

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(with and without an Anchor Trench)



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APPENDIX III-D.5-1

SUMMARY OF GEOTECHNICAL DESIGN PARAMETERS

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CB&I Environmental & Infrastructure

Client Name: Rancho Viejo Waste Management, LLC		
Project Name: Pescadito Environmental Resource Center	Project No.: 148866	
Prepared by: P. Thomas	Date Prepared: 2/24/2015	
Reviewed by: Jesse P. Varsho, PE	Date Reviewed: 3/2/2015	

TITLE: SUMMARY OF GEOTECHNICAL DESIGN PARAMETERS

Assumptions

The landfill will include the following components as detailed below (**from top to bottom**):

- Final Cover System (4H:1V Slope)
 - 7-inch Vegetative Cover / Erosion Control Layer
 - 30-inch Infiltration Layer
 - 12-inch Intermediate Cover (Intermediate Cover is included as part of the Waste Layer for analysis purposes)
- Waste (maximum waste column thickness of approximately 380 feet occurring through peak final landform elevation of the North and South Unit Landfills)
- Leachate Collection / Liner System on 3H:1V Landfill Sideslopes (Reference No. 3)
 - *Protective Soil Layer (2-feet thick)*
 - *Geosynthetics - Option 1*
 - Geotextile Slip Layer
 - Double-Sided Drainage Geocomposite
 - 60-mil Textured HDPE Geomembrane
 - *Geosynthetics - Option 2*
 - Geotextile Slip Layer
 - Double-Sided Drainage Geocomposite
 - Bentonite Enhanced Textured FML (bentonite side faced down)
 - Bentonite Enhanced Textured FML (bentonite side faced up)
 - *Compacted Low Permeable Soil Liner ($k \leq 1 \times 10^{-7}$ cm/sec)*
 - MSW Cells (2-feet thick)
 - Class I Waste Cells (3-feet thick)
- Leachate Collection / Liner System on Landfill Base (Reference No. 3)
 - *Protective Soil Layer (2-feet thick)*
 - *Geosynthetics - Option 1*
 - Double-Sided Drainage Geocomposite
 - 60-mil Textured HDPE Geomembrane
 - *Geosynthetics - Option 2*
 - Double-Sided Drainage Geocomposite
 - Bentonite Enhanced Textured FML (bentonite side faced down)
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Table 3 Final Cover Unit Weights and Strength Parameters						
Layer	Moist Unit Weight γ_{moist}	Saturated Unit Weight γ_{sat}	Shear Strength Short-Term Conditions		Shear Strength Long-Term Conditions	
			Cohesion c	Friction Angle ϕ	Cohesion c'	Friction Angle ϕ'
Final Cover	129 pcf	132 pcf	720 psf	13.5°	720 psf	13.5°

Material Properties of Waste

Unit Weight and Shear Strength

The unit weight of the landfill waste varies widely because of differences in waste constituents, state of decomposition, degree of compaction, height of placement, amount of daily cover, etc. The total unit weight of waste has been reported in published technical literature to range from 55 pcf up to 95 pcf. A unit weight of 50 pcf (1,350 lbs/cy) has been reported for various sites permitted in Texas and agrees with published data reported for moderately compacted waste (**Reference No. 8**). Assuming that daily and intermediate soil cover will be applied at a ratio of 20% to 80% waste, a weighted average of the landfill waste / cover is calculated to be approximately 65 pcf using a unit weight of 129 pcf for the soil cover material (based on Stratum II-III-IV soils). The value of 65 pcf agrees with data published for the unit weight of waste with soil cover under typical compactive efforts (**Reference No. 9**).

The shear strength of waste that has been assumed is zero cohesion with a friction angle of 30 degrees. This assumed shear strength is based on the conservative assumption that the landfill will operate with continuous leachate recirculation throughout the landfill useful life (**Reference No. 10**). The assumed unit weights and shear strength parameters for waste are summarized below on **Table 4**.

Table 4 Landfill Waste Fill Unit Weights and Shear Strength Parameters				
Layer	Moist Unit Weight γ_{moist} (pcf)	Saturated Unit Weight γ_{sat} (pcf)	Shear Strength Short-Term & Long-Term Conditions	
			Cohesion c, c'	Friction Angle ϕ, ϕ'
Waste Fill <u>(includes daily and intermediate cover)</u>	65	65	0 psf	30°



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TITLE: SUMMARY OF GEOTECHNICAL DESIGN PARAMETERS

Summary of Material Unit Weights and Shear Strength

A summary of material unit weights and shear strength values for all landfill layers and geologic units directly beneath the landfill is presented on **Table 9** below.

Table 9 Summary of Material Unit Weights and Shear Strength						
Layer Description	Total Unit Weight γ_{moist}	Saturated Unit Weight γ_{sat}	Shear Strength Short-Term Conditions		Shear Strength Long-Term Conditions	
			Cohesion c	Friction Angle ϕ	Cohesion c'	Friction Angle ϕ'
Soil Stratum I:						
Beneath Landfill Sideslope Liner, and outside of Landfill footprint	125 pcf	126 pcf	1,000 psf	0°	250 psf	10°
Soil Stratum II, III & IV:						
Beneath Landfill Sideslope Liners, Base Liners, and areas outside Landfill footprint	129 pcf	132 pcf	2,500 psf	5°	720 psf	13.5°
Landfill Layers:						
Final Cover	129 pcf	132 pcf	720 psf	13.5°	720 psf	13.5°
Waste (includes daily and intermediate cover)	65 pcf	65 pcf	0 psf	30°	0 psf	30°
Protective Soil Cover Layer (2-ft) on Sideslopes and Base	129 pcf	132 pcf	720 psf	13.5°	720 psf	13.5°
Compacted Low Permeable Soil Liner on Sideslopes and Base	129 pcf	132 pcf	720 psf	13.5°	720 psf	13.5°
Critical Geosynthetic Interface along Sideslope Liner	129 pcf	132 pcf	0 psf	8°	0 psf	8°
Critical Geosynthetic Interface along Base Liner	129 pcf	132 pcf	0 psf	14°	0 psf	14°



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TITLE: SUMMARY OF GEOTECHNICAL DESIGN PARAMETERS

Summary of Material Consolidation Parameters

A summary of material consolidation parameters for all landfill layers and geologic units directly beneath the landfill is presented on **Table 10** below.

Table 10 Summary of Material Consolidation Parameters							
Layer Description	Void Ratio (e _o)	Liquid Limit	Effective Overburden Pressure p' _o	Pre-Consolidation Pressure p' _c	Compression Index C _c (C' _c)	Recompression Index C _r	Secondary Compression Index C _α (C' _α)
Final Cover	0.64	58	--	--	0.4204	0.0609	0.0136
Compacted Low Permeable Soil Liner at 100-ft.bgs ¹	0.64	58	6,960 psf (333.25 kPa)	125,847 psf (6,026 kPa)	0.0609	0.0609	0.0136
Stratum II-III-IV at 150-ft.bgs ²	0.64	58	10,440 psf (499.87 kPa)	114,763 psf (5,495 kPa)	0.4204	0.0609	0.0136
Waste Fill <u>(includes daily and intermediate cover)</u>	--	--	--	--	(0.25)	--	(0.051)
<p>Notes</p> <ol style="list-style-type: none"> 1. The referenced depth of 100-ft.bgs for the Compacted Low Permeable Soil Liner is relevant to the calculation of the effective overburden pressure and preconsolidation pressure. 2. The referenced depth of 150-ft.bgs for the Stratum II-III-IV soil is relevant to the calculation of the effective overburden pressure and preconsolidation pressure on the Stratum IV soil that lies 50-ft below the Compacted Soil Liner. 							