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SEEPAGE AND STABILITY STUDY FOR NORTH END OF EAST DIKE

PURPOSE

In March 2010, Tennessee Valley Authority (TVA) requested that Geosyntec Consultants (Geosyntec) perform a Seepage and Stability Study for the South End of the East Dike that is located adjacent to the Intake Channel for the TVA Kingston Fossil Plant (KIF). As shown in Figure 1, the East Dike is located on a portion of reclaimed land that is adjacent to the existing Sluice Channel and the Ballfield Site (Site) at the KIF. Geosyntec performed a geotechnical investigation, laboratory investigation and seepage and stability analyses on the South End of the Dike. These analyses were presented to TVA in June 2010 in the letter report titled "Summary of Stability Calculations for East Dike Haul Road Kingston Fossil Plant, Ballfield Site" [Geosyntec, 2010a] and the calculation package titled "Seepage and Stability Study for East Dike and Raised Dike" [Geosyntec, 2010a]. In these analyses, the North End of the East Dike was not considered since no seepage water was observed along the downstream slope of the North End of the East Dike. These previous analyses are collectively referred to as the "South End Study".

At the request of TVA, Geosyntec has performed a follow-up seepage and stability study focused on the North End of the East Dike (referred to as the "North End Study"). It is noted that the Raised Dike and Haul Road are not present in this area. This calculation package presents the results of additional geotechnical investigation, laboratory testing and slope stability analyses for the North End of the East Dike performed during the North End Study.

BACKGROUND

The KIF is located on the Watts Bar Reservoir, at the confluence of the Emory River and Clinch River in Harriman, Tennessee approximately 35 miles southwest of Knoxville, Tennessee. The East Dike is on the far eastern edge of a portion of land bounded by the Sluice Channel and the Intake Channel as shown on the attached aerial plan included as Figure 1.

The area of the East Dike investigated in the North End Study includes a relatively narrow driveway used for inspection of the perimeter slopes of the KIF Site and is at approximate elevation 746 feet, which is approximately 5 feet above the summer pool elevation (i.e., 741 feet) of Watts Bar Lake.

TVA has not historically reported seepage locations along the North End slopes of the East Dike.



GEOTECHNICAL INVESTIGATION PROGRAM

As a part of the North End Study, Geosyntec requested that MACTEC advance six Standard Penetration Testing (SPT) borings along two cross section locations (i.e., C-C and D-D) selected by Geosyntec. Due to accessibility issues with the adjacent wetlands, only four SPT borings were drilled by MACTEC as part of the North End Study. Cross sections C-C and D-D were selected based on visual observations of the site. Continuous split-spoon samples were obtained during drilling. The borings were advanced to auger refusal depths to investigate the general engineering characteristics and the subsurface conditions. After the completion of the borings, TVA personnel surveyed the boring locations and the local ground surface elevations adjacent to the borings. The cross-sections derived from these borings are shown on Figure 1. The North End Study boring logs prepared by MACTEC are included in Attachment 1. A summary of the location and depth of the borings is presented in Table 1.

MACTEC also installed six standpipe piezometers near the borings to monitor the water levels. Piezometer construction consisted of two-inch diameter, five-foot long, Schedule 40 PVC well screen at the bottom of the standpipes. A sand filter pack was used to backfill to some distance above the screened section followed by a minimum two-foot thick bentonite seal. Piezometer locations and tip elevations are summarized in Table 2. Water levels at these six locations were obtained on a daily basis. A summary of the water level readings observed as part of the North End Study through 13 October 2010 is shown in Figure 2. It is noted that in the future, the monitoring frequency is expected to be reduced to three times per week.

MACTEC performed laboratory testing on selected split-spoon samples and undisturbed (i.e., Shelby) tube samples. Because the previous South End Study included an extensive laboratory testing matrix, the North End Study testing matrix was intended to determine whether the subsurface materials encountered as part of the North End Study are similar to those previously encountered in the South End Study. The testing matrix for the North End Study has been broken into two phases. Phase I includes a large number of natural moisture content, Atterberg Limits, soil classification, and sieve analysis tests. Phase II uses three Shelby tube samples to perform consolidated-undrained (CU) triaxial tests. The results of these tests are included in Attachment 2. Table 3 summarizes the results of the Phase I tests.

SUBSURFACE STRATIGRAPHY & MATERIAL PROPERTIES

Based on Geosyntec's review of the results of the geotechnical investigation program, the subsurface materials along cross section C-C generally exhibit slightly higher blow counts than the subsurface materials along cross section D-D. Therefore, Geosyntec identified cross section

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D-D as a more critical cross section and subsequently used the stratigraphy along this cross section in the seepage and static stability analyses. The location of the cross section D-D is shown in Figure 1. The ground surface geometry and the interpreted subsurface stratigraphy used in SLIDE are presented in Figure 3. Previous geotechnical boring B-45 performed by MACTEC in early 2009 was also included in the preparation of the stratigraphy of cross section D-D. The boring locations are shown in Figure 3. The boring logs for these three previous borings are also included in Attachment 1.

Geosyntec reviewed the laboratory test results received as part of the North End Study laboratory testing matrix. The laboratory test results are similar to those received previously from the South End Study, with the exception of the "Upper Dike Fill" layer. Based on Geosyntec's understanding of site conditions and the SPT testing values, it appears that the dike was constructed in two stages. The dike was constructed initially and then a second layer of "Upper Dike Fill" was added on top in the South End of the East Dike to support additional ash disposal behind the East Dike. The North End of the East Dike does not appear to have this additional fill, therefore the entire East Dike section in the North End Study will be considered to be Lower Dike Fill.

Based on the similarity in laboratory test results between the North End Study and the South End Study, Geosyntec has used the same material properties previously assumed as part of the South End Study in the analyses herein. The material properties used in the seepage analyses are summarized in Table 5, and the properties used in the stability analyses are summarized in Table 6.

SEEPAGE ANALYSES

Methodology

Based on the interpreted subsurface stratigraphy, a seepage model for the entire cross section D-D was developed based on the interpreted subsurface stratigraphy. Calculations related to seepage were conducted using the computer program SLIDE (version 5.044) [Rocscience, 2010]. SLIDE is distributed by Rocscience of Toronto, Ontario, Canada and includes the capability of performing steady-state, saturated and unsaturated groundwater analysis using the finite element method. The program calculates pore-pressures, piezometric head, and discharge quantities using the site-specific geometry considered for the slope stability analysis. Calculated pore pressures at discrete points are integrated into the slope stability analysis.

Steady state seepage was assumed for these analyses, using static water levels in the rim ditch, the sluice channel, and the intake channel as boundary conditions. The water level in the

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rim ditch and sluice channel was assumed to be at elevation 765 feet based on recent topographic plan provided by Jacobs. On the downstream side, the water level in the intake channel was assumed to be at elevation 737 feet, corresponding to a normal winter pool elevation of the adjacent Watts Bar Lake.

Additional relevant boundary conditions for the SLIDE analysis are assumed as follows. Along the vertical upstream edge of the model, the hydraulic head at each node is constant with depth and equal to the rim ditch/sluice channel water level elevation. Along the vertical downstream edge of the model, the hydraulic head at each node is equal to the intake channel water level elevation at the location of the node. Other nodes along the ground surface are treated as potential seepage exit locations. The base of the model is assumed to be located on top of the shale bedrock and is modeled as a seepage barrier, where flow is not allowed to cross these boundary nodes.

Input Parameters

For the analyzed cross section D-D, the representative profile was compiled based on boring logs and available record drawings. The hydraulic conductivity for vertical seepage through saturated materials (k_v) was estimated using available laboratory data. Typical values for similar soils were obtained by Geosyntec using various public sources in cases when laboratory data were not available. The ratio of horizontal hydraulic conductivity (k_h) to vertical hydraulic conductivity (k_v) was estimated based on placement condition of the materials. Given the hydraulic placement condition of the materials, a typical value of $k_h/k_v=10$ was assumed for the ash, the clay dike material, the clayey foundation materials, and the sandy foundation material. It is noted that the input parameters used for the seepage analysis are similar to those previously assumed as part of the South End Study.

Critical Exit Gradient

A critical exit gradient is calculated as the gradient that causes seepage pressures in an upward direction to exceed the downward force of the soil. In this case, the calculated factor of safety (FS) with respect to the escape gradient (FS_G) can be defined as:

$$FS_{gradient} = i_c / i \tag{1}$$

where *i* is the escape gradient in the soil at the exit point. SLIDE computes values of the escape gradient. The hydraulic gradient associated with escape gradient near an unrestrained soil surface is termed the critical gradient, i_c , which can be computed as:

Geosyntec[▷] consultants Page 5 of 105 Written by: J. Sura / Y. Cao **Date:** 10/29/10 **Reviewed by:** Neil Davis **Date:** 10/29/10 **Project:** Dredge Cells Recovery GR4327 Task No.: 105 Client: TVA Project/ Proposal No.: $i_{\rm c} = (\gamma - \gamma_{\rm w}) / \gamma_{\rm w}$ (2)

where γ is the total unit weight of the soil and γ_w is the unit weight of water. For the clayey dike material such as the Upper Dike Fill and Lower Dike Fill, γ is approximately 120 pounds per cubic feet (pcf) and the γ_w is 62.4 pcf. Therefore, the calculated i_c is ≈ 0.9 .

According Section 1.7.1 of TVA's 7 December 2009 report titled "Facility Design and Construction Requirements, Volume 2, Rev 1.0", "selection of an acceptable minimum FS_{eg} against piping should be on a case by case basis at the discretion of an experienced engineer. Based on the literature, a FS_{eg} greater than or equal to 4 should provide reasonable guidance as an acceptable minimum factor of safety for the piping mode, providing it is used in conjunction with other factors and sound engineering judgment."

Other investigators have recommended ranges for FS_G from 1.5 to 15 according to US Army Corps of Engineers (USACE) Engineering Manual 1110-2-1901 [USACE 1986].

Contour plots of the vertical hydraulic gradient and the phreatic surface computed in SLIDE are shown in Figure 4. The negative value indicates the water flows downward and the positive value indicates the water flows upward. Due to the different hydraulic conductivities of different layers, the contour lines are discontinuous at the material boundaries. The results indicate that the calculated vertical hydraulic gradient along the East Dike Fill and the underlain Clayey Foundation Soil, *i*, ranges from 0 to 0.46. The calculated maximum *i* within the East Dike Fill is located at the toe of the East Dike Fill layer. Using Equation (1), the minimum FS_G is calculated as 1.96, which is less than the recommended FS of 4 as presented in the TVA Master Programmatic Document. Further discussion and recommendations are provided in the conclusion session of this calculation package.

STATIC STABILITY ANALYSES

Methodology

Static stability analyses were performed using Spencer's method [Spencer 1973], as implemented in SLIDE, the same program used in the previously referenced seepage analysis. Two failure modes were considered in the analyses: (i) rotational failure modes (i.e., circular slip surfaces); and (ii) translational failure modes (i.e., block slip surfaces). The purpose of the stability analyses is to evaluate the calculated factor of safety for these two potential relatively deep-seated failure modes.

Spencer's method is chosen to analyze the rotational failure modes and the translational failure modes. Spencer's method, which satisfies both vertical and horizontal force equilibrium

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and moment equilibrium, is considered to be more rigorous than other methods, including the simplified Janbu method [Janbu, 1973] and the simplified Bishop method [Bishop, 1955]. It should be noted that a minimum depth of 3 ft was used in the analysis to avoid calculation of shallow veneer slip (i.e., sloughing), as this slip mode is not considered to be as important as the overall global stability of the dike.

Input Parameters

Information required for the static stability analyses includes slope geometry, subsurface ash/soil stratigraphy, phreatic surface computed from the seepage analysis, and material properties of the subsurface soils along the selected cross section.

Target Factors of Safety

Target factor of safety (FS) values for these conditions are identified in Section 1.4.2 of TVA's 7 December 2009 report titled "*Facilities Design and Construction Requirements, Volume 2, Rev 1.0.*" In this document, the TVA requirement for post-closure slopes (i.e., long-term conditions) is 1.5. TVA allows a calculated factor of safety of 1.3 for "interim slopes." Geosyntec believes that the East Dike is a long-term condition and therefore a target FS of 1.5 is appropriate.

<u>Results</u>

The minimum FS values for the North End of the East Dike were calculated using Cross Section D-D and the results are summarized in Table 7. As shown in this table, the calculated FS values satisfy the target FS of 1.5 long-term loading conditions. The calculated critical failure surface for each potential failure mode is shown graphically in Figures 9 (rotational failure). SLIDE output files are included in Attachment 3.

SEISMIC STABILITY ANALYSES

Methodology

Seismic slope stability analyses were performed using a procedure consistent with a guidance document prepared by the U.S. Environmental Protection Agency [USEPA, 1995]. The procedure is as follows:

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- 1. Estimate the peak ground acceleration (PGA) at the site. Estimate the peak horizontal acceleration (a_{max}) of the potential critical slip surface based on PGA.
- 2. Perform pseudo-static slope stability analyses for the potential critical section to evaluate the yield acceleration. The yield acceleration is the horizontal acceleration at which a marginally stable condition is produced (i.e., factor of safety of 1.0) for the potential slip surface. A trial-and-error process was applied to evaluate the yield acceleration.
- 3. The yield acceleration (k_y) was compared to the peak horizontal acceleration (a_{max}) of the slide mass due to the design earthquake. If k_y is greater than a_{max} , the analysis is concluded, as the landfill will not likely undergo permanent displacement. If k_y is less than a_{max} , then the landfill will likely undergo permanent displacement and a displacement analysis is performed to evaluate the magnitude of the permanent displacement.
- 4. The seismic displacement, corresponding to the computed k_y/a_{max} ratio, is estimated using the results presented by Hynes and Franklin [1984] and the "modified mean + one standard deviation curve" developed by Geosyntec, as presented in Figure 7. The "modified mean + one standard deviation curve" considers data associated with only large earthquakes, and therefore, is more conservative to use. This procedure is consistent with those given in the USEPA guidance document [USEPA, 1995].

According to United States Geological Survey (USGS) seismic hazard map [2008], the PGA with a 2 percent probability of exceedence in 50 years (or 10 percent probability of exceedence in 250 years) is 0.20 g for the KIF site as presented in Figure 8. The peak horizontal acceleration (a_{max}) was assumed the same as the PGA because subsurface soil conditions were considered not to have the potential for amplification of the ground motion.

Deformation Performance Criteria

The criterion for seismic stability is based on calculated permanent deformation. According to Table 1.4.2-1 of the TVA's 7 December 2009 report titled "*Facilities Design and Construction Requirements, Volume 2, Rev 1.0.*", the embankment has an allowable calculated displacement of 1 meter.

Analysis Case and Shear Strength Selection

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Based on the static slope stability analyses results, both the circular slip mode and the block mode have similar calculated FSs with the circular mode being a little more conservative. Therefore, only the circular mode was analyzed for seismic slope stability analysis.

The seismic slope stability analyses were conducted using both drained and undrained shear strength values, and the smaller yield acceleration (k_y) (i.e., more conservative) was used to estimate the deformation.

Results

The minimum yield acceleration (k_y) using the undrained shear strength was computed for Section D-D and the results are summarized in Table 8. Per Figure 7, the calculated deformation is approximately 0.4 meter, which is considered as acceptable since it is less than the maximum allowable deformation of 1.0 meter. SLIDE output files are included in Attachment 3.

CONCLUSIONS

The minimum calculated FS of 1.96 from the seepage model for the slopes of the North End of the East Dike is less than the recommended FS of 4 as presented in the TVA Master Programmatic Document. It is noted that the water pool elevation in the model was conservatively modeled using winter pool elevation at 737 ft. However, the water level observation at well PZ-D1B was conducted during summer/fall season and the summer pool elevation was at approximately 741 ft. An additional seepage analysis was performed using a water pool elevation at 741 ft and the result is presented in Figure 10. According to the result, the maximum calculated vertical hydraulic gradient i = 0.275, therefore, the FS was calculated to be 3.27, which is greater than the previously calculated FS of 1.96. It should be noted that this FS corresponding to the summer pool elevation is still less than the recommended value of 4. If the water level at well PZ-D1B remains the same during winter season when the pool elevation drops to 737 ft, the FS against piping will be calculated as 1.96 again.

Due to the interim condition of the East Dike, Geosyntec recommends regular monitoring of water levels in the piezometers/wells on the North End of East Dike. In addition, one or more slope inclinometers are recommended to be installed on the North End of the East Dike. The purpose of the proposed slope inclinometers is to capture abnormal and sudden dike soil movement and provide early warning to potential piping failure. If a consistent trend of soil lateral movement is observed, remediation measures (such as lowering the water level behind the dike on the landside) shall be taken immediately at that time.

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The static stability analysis performed by Geosyntec indicates that the North End of the East Dike has adequate calculated factors of safety against a deep-seated failure mechanism in long term conditions.

The seismic stability analysis performed by Geosyntec indicates that the North End of the East Dike is anticipated to develop deformation during the design earthquake. However, the calculated deformation is less than the maximum allowable deformation, and is thus considered as acceptable.



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Tables

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Table 1. Summary of Borings

Boring No.	Northing	Easting	Ground Elevation (ft)	Boring Termination Depth (ft)	Boring Termination Elevation (ft)
C-1	553672.74	2440474.16	748.44	47.2	701.2
C-2	553640.67	2440489.71	743.90	43.4	700.5
D-1	553760.16	2440698.96	748.70	53.7	695.0
D-2	553727.81	2440708.45	743.30	44.9	698.4

Notes:

- 1. The northing, easting, and ground elevation at each boring location was provided by Jacobs.
- 2. The boring logs provided by MACTEC are included in Attachment 1.



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Piezometer No.	Piezometer Depths (ft)	Ground Elevation (ft)	Screen Depth (ft)	Layer Screened In
PZ-C1A	15.50	748.44	10.00 - 15.00	East Dike Fill
PZ-C1B	30.09	748.44	24.90 - 29.90	Sandy Foundation Soil
PZ-C2	17.50	743.90	11.93 – 16.93	Clayey Foundation Soil
PZ-D1A	20.50	748.70	14.86 – 19.86	Clayey Foundation Soil
PZ-D1B	39.50	748.70	34.00 - 39.00	Sandy Foundation Soil
PZ-D2	15.32	743.30	10.07 - 15.07	Clayey Foundation Soil

Table 2. Summary of Piezometers

Note:

1. The piezometer depth, ground surface elevation and screen depth at each piezometer location was provided by MACTEC in the piezometer logs.

2. Based on the boring results, the foundation soil layer may potentially be a confined/pressurized layer.

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Table 3. Summary of Phase I Testing (provided by MACTEC)

East Dike Stability Study, TVA Kingston, Harriman, TN MACTEC Project 3043101038

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					Index/	Table Classification	1 Test Summar	ry				
	Sample	Sampla	Natural	Atterberg Limits			Grain Size Distribution			USCS Classification		
Boring	Depth (Feet bgs)	Type/Number	Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Gravel, %	Sand, %	Fines – Silt & Clay, %	Group Symbol	Group Name	
C-1	8.5-10	SS-6	21.5					-				
C-1	7-8.5	SS-5		12	24	17			10.1			
C-1	10-11.5	SS-7	63.6	42	26	17	9.3	41.6	49.1	SC	Clayey Sand	
C-1	11.5-13	SS-8	23.9		20	16	12.0		22.0			
C-1	13-14.5	SS-9	29.6	44	28	10	12.0	54.1	33.9	SM	Silty Sand	
C-1	16-17.5	SS-11	25.2	21	20	10	0	26.0				
C-1	17.5-19	SS-12	22.3	51	20	10	0	26.8	13.2	CL	Lean Clay with Sand	
C-1	19-20.5	SS-13		22	20	12	2.0	24.1	77.0	a		
C-1	20.5-22	SS-14	22.7	35	20	13	2.0	24.1	73.9	CL	Lean Clay with Sand	
C-1	38.5-40	SS-26	20.5									
C-1	40-41.5	SS-27	16.5	200	2112							
C-1	41.5-43	SS-28	19.1	NP	NP	NP	0	66.9	33.1	SM	Silty Sand	
C-2	7.5-9	SS-5	17.0									
C-2	10.5-12	SS-7	26.3	40	25	14	25.4	44.5	30.1	SC	Clayey Sand with Grave	
C-2	12-13.5	SS-8	26.6	1.000	1 10000	1920			in the second first		and the set	
C-2	13.5-15	SS-9	22.7	29	20	10	7.2	27.8	65.0	CL	Sandy Lean Clay	
C-2	25.5-27	SS-17	19.8									
C-2	27-28.5	SS-18	16.2	NP	NP	NP	0.6	50.2	49.2	SM	Silty Sand	
C-2	28.5-30	SS-19	24.4									
D-1	12-13.5	SS-9					0.0488		1			
D-1	13.5-15	SS-10	19.4	40	23	17	11.9	54.1	34.0	SC	Clayey Sand	
D-1	15-16.5	SS-11	21.1				-					
D-1	16.5-18	SS-12	23.4	34	20	14	1.0	16.7	82.3	CL	Lean Clay with Sand	
D-1	18-19.5	SS-13	23.3			2.554		0.024702	0.000	C326.0725	2-48778987899	
D-2	5.5-7	SS-4				S						
D-2	7-8.5	SS-5	14.2	10	22	10					23	
D-2	8.5-10	SS-6	18.4	40	22	18	12.4	49.1	38.5	SC	Clayey Sand	
D-2	10-11.5	SS-7	17.4	20	10							
D-2	11.5-13	SS-8		30	19	11	0	15.9	84.1	CL	Lean Clay with Sand	

SS – standard penetration test/split spoon NP – non-plastic

Note:

1. These results were provided to Geosyntec by MACTEC.

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Table 4. Summary of Consolidated – Undrained Triaxial Shear Testing

Boring	Sample	Material	Matarial Zana	CU Triaxial Strength			
No.	Interval (ft)	Description	Material Zone	c' (psf)	þ' (°)		
$C^{2}[2]$	25.0.27.0	Silty Clayey	Sandy Foundation	1260	75 Q°		
C-2	23.0-27.0	Sand	Soil	1200	23.0		
ר ז	7595	Clayey Sand	Fast Dika Fill	80	33 10		
D-2	1.5-9.5	with Gravel	Last DIKE FIII	80	55.4		
D 2	15 0 17 0	Sandy Clay	Clayey	0	22 10		
D-2	13.0-17.0	Sality Clay	Foundation Soil	0	55.4		

Note:

- 1. Laboratory testing results provided by MACTEC in October 2010 (see Attachment 2).
- The cohesion value of 1,260 psf for boring C-2 is considered relatively large for a silty clayey sand material. This is likely caused by the large silt and clay percentage in the testing sample (i.e., 49.2% per Table 3). For slope stability analyses presented in this calculation package, the cohesion component will be conservatively ignored.

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	Permeat	Source	
Material Layers	Vertical k _v (cm/s)	k _h /k _v	Source
Crust Layer	3×10^{-5}	10	Note 1
East Dike Fill	1.7×10^{-7}	10	Note 2
Soft Pond Ash	$5.85 imes 10^{-5}$	10	Note 3
Clayey Foundation Soil	4.4×10^{-8}	10	Note 2
Sandy Foundation Soil	1×10^{-5}	10	Note 4

Table 5. Material Properties for Seepage Analysis

Notes:

- 1. Based on *Fly Ash, Bottom Ash and Scrubber Gypsum Study* performed by Law Engineering at KIF site in 1995.
- 2. Based on laboratory testing results provided by MACTEC during the South End Study.
- 3. Based on average values for Pond Ash presented in the aforementioned 1995 study.
- 4. Typical values for gravel and sands.



	Total Unit Weight	Drain Sti	ed Shear rength	Undrained Shear Strength		
Material Layers	(pcf)	c' (psf)	\$, (°)			
Crust Layer	120	500	10	N/A		
East Dike Fill	120	0	30	$Su/\sigma_v = 0.78^{[2]}$		
Soft Pond Ash	75	0	25	$Su/\sigma_v = 0.8$		
Clayey Foundation Soil	125	0	30	$Su/\sigma_v = 0.25$		
Sandy Foundation Soil	125	0	26 ^[3]	N/A		

 Table 6. Material Properties for Stability Analysis

Notes:

- 1. The shear strength values presented in this table are identical to those previously assumed in the South End Study [Geosyntec, 2010] except those discussed in the following notes. The laboratory investigation indicates that the materials encountered as part of the North End Study are similar to those encountered in the South End Study, therefore, the use of the previous material properties is considered acceptable. The "East Dike Fill" layer matches the "Lower Dike Fill" layer from the South End Study, as discussed in the package.
- 2. The Su/σ_v for the East Dike Fill is derived from the triaxial test results for sample D-2 at depth 7.9' to 9.5'. This triaxial test results are presented in Attachment 2 of this calculation package.
- 3. As previously discussed in Table 4, sample C-2 is located in the Sandy Foundation Soil layer. For slope stability analyses presented in this calculation package, the cohesion component based on the triaxial test results for C-2 will be conservatively ignored.

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Table 7. Results of Slope Stability Analysis for East Dike and Raised Dike(Long Term Condition)

Failure Mode	Analyzed Condition	Calculated FS	Target FS	Is FS OK?	Results Shown in Figure
Circular Slip	Long Term	1.80	1.50	Yes	5
Block Slip	Long Term	1.83	1.50	Yes	6

Notes:

1. Factors of safety presented in this table were calculated using Spencer's method for both the circular slip mode and the block slip mode.

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Table 8. Results of Seismic Slope Stability Analysis

Failure Mode	Peak Horizontal Accelerati on, a _{max} (g)	Minimum Yield Acceleration ky	Displacement Analysis Necessary?	Displacement (cm.)	Acceptable ?
Circular Slip	0.20	0.031	Yes	40 [2]	Yes

Notes:

1. The minimum yield acceleration (Ky) calculated for Section D using the drained shear strength values was 0.104g, which was not as critical when compared with the 0.031g obtained using undrained shear strength values.

2. $k_y / a_{max} = 0.031 / 0.2 = 0.156$, per Figure 7, the displacement corresponding to a k_y / a_{max} ratio of 0.031 is approximately 40 cm (0.4 m, or 15.8 inches)

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Figure 1. Site Location Note: Sections A-A and B-B were previously analyzed as part of the South End Study

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Figure 2. Summary of Piezometer Readings (updated to 13 October 2010)

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Figure 3. Surface Geometry and Subsurface Stratigraphy (Cross Section D-D)



Figure 4. Calculated Vertical Hydraulic Gradient along Cross Section D-D using Winter Pool Elevation of 737 ft

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Figure 5. Slope Stability Result: Rotational Failure Mode

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Figure 6. Slope Stability Result: Translational Failure Mode

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 Dredge Cells Recovery
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Figure 7. Selection of Calculated Displacement



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N 35.89472° W 84.50351°

> Figure 8. The Peak Ground Acceleration (PGA) with a 2 Percent Probability of Exceedence in 50 Years (or 10 Percent Probability of Exceedence in 250 Years) [USGS, 2008]



Figure 9. Seismic Slope Stability Result using Undrained Shear Strength

11-40



Figure 10. Calculated Vertical Hydraulic Gradient along Cross Section D-D using Summer Pool Elevation of 741 ft



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Attachment 1: Boring Logs

- C-1 field boring log
- PZ-C1A piezometer installation record
- PZ-C1B piezometer installation record
- C-2 field boring log
- C-2 UD offset boring log
- PZ-C2 piezometer installation record
- D-1 field boring log
- PZ-D1A piezometer installation record
- PZ-D1B piezometer installation record
- D-1 UD offset boring log
- D-2 field boring log
- D-2 UD offset boring log
- PZ-D2 piezometer installation record

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 J. Sura / Y. Cao
 Date:
 10/29/10
 Reviewed by:
 Neil Davis
 Date:
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Client: TVA Project: Dredge Cells Recovery Project/ Proposal No.: GR4327 Task No.: 105

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	BOF WA WA WA CAV CAS STA	RING TER RING REF TER TOB TER 24 H TER LOSS 'E-IN DEF ING: SIZE NDBY TII	MINAT USAL: _ DEPTH R DEPT SES: PTHS: ME:	TED:	A LA LEI A BC	30 2.8 1A JA NGTH DRING L	S Zg	5 1A 199x 51	POWER AL HAND SHO ROTARY DI DIAMOND CORE SIZE UNDISTUR BAG SAMP	THOD OF ADVANCING BORINGER P: W/MUD: W/WATER RILL: W/MUD: W/WATER CORE BED SAMPLES No SI	IG D 	ЕРТН ТО ТО ТО ТО 	<u>10.5</u>	
					Geos	yntec [▷]								
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					Page 37	of <u>105</u>								
Written by:	J. Sura / Y. Cao	Date: 10/29/10	Reviewed by:	Neil Davis	Date:	10/29/10								
Client: TV	A Project:	Dredge Cells Reco	overy	Project/ Proposal No.	: <u>GR4327</u> Ta	nsk No.: 105								
	JOB NAME TUA WELL NUMBER	PIEZOME KINGSTON-E PZ-C	TER INSTAL	LATION RECO	RD 3101039 8/27/10	9K/N5)								
			Ľ	DRILLED BY AISTA	TE (George F	AKINS)								
	BOREHOLE DIAME	TER	* *	MATERIAL Sche	dule 40 PVC	<u> </u>								
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TVA			Proj	ect:	Dredg	ge Cell	s Recov	very		Project/ Proposa	I No.: GR432	27	Tasł
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TVA			Proje	ect:	Dredg	e Cell	s Recov	very		Project/ Pro	posal No.:	GR432	27	Tasł	s No
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t: _]	VA			Proje	ect: _	Dredg	ge Cell	s Recov	very		Project/ Proposal No.:	GR432	<u>7</u> Tas	sk No.:
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Geosyntec[>] consultants Page 41 of 105 Written by: J. Sura / Y. Cao Date: 10/29/10 Reviewed by: Neil Davis Date: 10/29/10 Client: TVA Project: Dredge Cells Recovery Project/ Proposal No.: GR4327 Task No.: 105 - UD Offset MACTEC SOIL TEST BORING FIELD REPORT BORING NO. CZ PG. OF TRISTATE RIG TYPE CME-SSO TRACHAMMER TYPE AUTO JOB NO. THA 3043101038 DRILLER GEORGE AKINS HOURS DRILLING 3 GROUND SUBFACE ELEV. 743 JOB NAME TVA KINGSTON LOGGED BY PODNEY LIAGHTOURS MOVING O.25 DATE: 8/26/10/WEATHER: EAST DIKE STABILITY STUDY SAMPLING SOIL CLASSIFICATION "N" SCALE UD REC DEPTH No. SAMPLER 1ST 6" 2ND 6" 3RD 6" 1.25' Drilled from 0.0' to 10.0 w, UD-1 UD-1 10.0-12.0 NA NA NA NA 314"HSA's/ Charged augers W/ water at 5' \$ 10 prior to collection of UD. - Pushed UD1 tube via piston samp O.D. SPLIT - Wast appx 10 minutes prior to pulling tube from boring - Material is reddish brown I.D., 2" CLAY (CM) UD-2 25.0-27.0 NA A)A UD-Z -Drill to 25.0 Charge augers NA NA -3/8" at 5' intervals \$ prior to colle BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1 UD-2 POUND HAMMER FALLING 30 INCHES 2.0 -Push UD-Z via piston sampler -Wait appx 10 minutes prid to pulling tube from porte Terminate @ 27.0' 140 **RESISTANCE IS SUM OF** 0 STANDARD PENETRATION 27.0 METHOD OF ADVANCING BORING DEPTH BORING TERMINATED: NA 0.0 TO 22.0 BORING REFUSAL: POWER AUGER то ____ WATER TOB DEPTH: 2.5'645 HAND SHOP: W/MUD: W/WATER WATER 24 HR DEPTH: ROTARY DRILL: W/MUD: W/WATER TO DOM NA DIAMOND CORE TO WATER LOSSES: NA CAVE-IN DEPTHS: _ CORE SIZE TO UNDISTURBED SAMPLES No. 2 SIZE 2.5 tubes NA LENGTH NA CASING: SIZE STANDBY TIME: NA BORING LAYOUT 5' BAG SAMPLES No. NA SIZE NA of 6-2 F1024

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						Page	42	of	105
Written by:	J. Sura / Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis		Date:	10/29	/10
Client: TVA	Project:	Dredg	e Cells Recov	very	Project/ Proposal No.:	GR4327	Tas	k No.:	105
	JOB NAME WELL NUMBER BOREHOLE DIAME TOTAL DEPTH FIELD REPRESENT/ G.S.712. [G.S.712. [G.S.712. [G.S.712.] [7.12] [S.SO	P A KIN TER ATTIVE ATTIVE ATTIVE Const Sec V Actual Sec V	PIEZOME DISTON PZ- Rodne 17.5 Rodne 1.4 Rodn	ETER INSTA	ALLATION RECO	ORD $-10 \cdot 10$ 8/3 $4 \cdot 7 \cdot 6$ $2 \cdot 6 \cdot 6$ $2 \cdot 7 \cdot 7 \cdot 6$ $2 \cdot 7 \cdot 6$ $2 \cdot 7 \cdot 7 \cdot 7$ $2 \cdot 7 \cdot 7 \cdot 7 \cdot 7$ $2 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$ $2 \cdot 7 \cdot $	23 8 31/20 40 7 KING CO R EXPAN CONCE NTONITI SCH. 40 2010" S NND FILT SCH. 40 2010" S NND FILT SCH. 40 2010" S	VER IDING RETE PAD E GROUT PVC RIS INFE CAL SLOTTED TER PACK PVC TAL SLOTTED	ER Lips SCREEN

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	11	· R	50-160	INR	IN)OH	1	-	/	39	ile alt	+ i	nstea	CIAY/	EH) al south	10	11	ETRA	
				min	10011		-			sand	The	igh pla	sticity	- bastought	1055	10010	DEM	
		-								shale-	frag	ments	in upp	ermost		1	DAR	
	17	10	56-181	Yurt	IDOM	lint	-	-	1.2'	port s	UE	FIAH	Maista	prisoft		\checkmark	STAN	
	12	- 1.0	1.2 10.4	, cull	0001	F				easin	, 514		WOI SI II	Syst				
	BO	RIN	G TERM	MINAT	ED:	2	250	+ 6	as	M	ETHOD	OF ADVA	NCING BO	RING	DEP	TH	22	
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	WA	ATE	R LOSS	ES:	4	Noi	re			DIAMOND	CORE				-	TO		
	CA	SIN	G: SIZF	IHS:	JA	LEI	IGTH	R	A)	UNDISTUR	RBED SA	MPLES I	No. NA	SIZE NA	I		-	
	STA	AND	BY TIM	1E:	HRI	SMIRG	RINGL	AYOUT	DA East	BAG SAME	PLES		No. N	SIZE NA	_	,		
	Contrast.			R	AIN	DEL	AY	Dik	e Grace	1 Road	Ser.	* Begin'	charging	auger al	H.5	-		

										Ge	con	mte sultar	
										Page	44	of	105
Vritten by:	J. Sura / Y. C	ao	D	ate:	10/29	9/10	Review	ed by:	Neil Davis	C	Date:	- 10/29	9/10
'lient• TV	А	Proje	et. T	Dredge	Cells	Recove	rv		Project/ Proposal No •	GR432	7 Tas	k No •	105
							- 5		110 Jee w 110 P 05w11000				
	JOB NO. JOB NAM	ACT 304310 ETUAR EAS		DRI	LLER C	RING FIE	LD REPORT	BORING RIG TYPE HOURS	NO. D-1 PO <u>CMG -SEOATU</u> HAMMER DRILLING <u>H.S IKS</u> GROUND S MOVING <u>O.S IKS</u> DATE: <u>2</u>	SUBFACE EL	F <u>AUTO</u> EV. <u>74</u> ATHER: C	18.7 10°1 Rain	
	No. DEP		"N"		SCALE	UD	REC		SOIL CLASSIFICATION		REMARK	S MIT	
	12 12	IST 6"	2ND 6"	3RD 6"		58* ·	1.21	Isal to IN	lowers how for	CIA	Alle	White	
	13 1009	7,3 0001	WUH	worr		-	195	(CH)	moist very soft h	al plast	kite 1	E Starl	
	111 102	7/1 2	C	-			1 - 1 -	locu-	toughness little t	ne san	R.Y	BARR	
	14 19.5	61.0 Z		0			1.6	lean (AY w/sand, Chim	ast gui		SPLIT	
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	10 000		11	0			1111	fines	and, Very stiff	11 1		/E 1-3 S.	
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			-					highp	asticity, medium ta	ghosses		6" TC	
	17 24.0	-255 Z	5	5	/		1.5	same .	is about except	Firm		3RD	
	18 255-	270 1	3	5	1	/	1,5	Same	as above, vortical	striation		" AND	
	10 -		e	6	0		1 11'	Mott	ing	TALI		AMN	
	9 210-	05 3	· .	0			104	wet.	vallawish how in	wHraco		FOR	
								grace	small sitter SA	NO(SM)		0 POL	
	70285	1 1	4	2	~	-	1.0	lensi	nor tirm silles	AND	Ent	OF BL	
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	al (2) a		-7	-7	14		201	Vera	fine sand		2	CEIS	
	30	.5	6	6	_	-	0.0	Not	he ara -	what		STAN	
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	33	5						veri	bose lensing	wsilt	Y with	ATION	
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	WATER 24	4 HR DEP	TH:		t de		1	ROTARY	ORILL: W/MUD: W/WATER		TO	- /	-
	WATER LO	DSSES:		1.14							TO	- /	
	CAVE-IN L	IZE		LEN	IGTH		0	UNDISTU	RBED SAMPLES No.	IZE	I 10 _	7	
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Written bv:	J. Sura	/ Y. Ca	10		Date:	10/	/29/10	Revie	wed by:	Neil Davis		I age	Date:	01 10/29	<u> </u>
	7.4		D •		Б 1	0.1	1 D		<i>.</i>		1.51	CD 422	7 10		105
Client: <u>1</u> V	/A		Proj	ect:	Dred	ge Cel	is Reco	very		Project/ Pro	posal No.:	GR432	<u>./</u> Ta	ISK NO.:	105
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	21	MA	CT	EC	SOILT	EST BO	RING FI	ELD REPOR	T BORING N	0. <u>V</u> -	<u> </u>	3_01	3		
	JOB	NO. 30	4310	1038	DR	ILLER /	prod	Alen	RIG TYPE	ME-SSOAT	C HAMMER	TYPE <u>AU</u> JRFACE ELI	70 V. 74	8.7	
	JOB	NAME	TUA I	KING	3TONLO	GGED B	Y Rod	hey Clar	Le HOURS	MOVING 0.5	HES DATE: 8	Z/10 WE	ATHER:	10°4F	
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				"N"		SCALE	UD	REC		SOIL CLASSI	FICATION		REMARK	SM	
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		20.0	7						medi	in plas-	Ficitor	2		ARRE	
	25	36.5-	WOR	Woll	WOH			104 -	same	s a's at	olo	1.			
		515												S.	
	26	37.5 >	WOH	WOH	1	/	/	1.5'	gray	silty SAI	D(SM)wet		, 2" 0	
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		415	- Carrie					1.001				AIDEN	Alimin	RIVE CHES.	
	28	41.5-43.	p wor	WOH	1	-	_	1.5	up lour	sh brown ,	SIHO SH	TNUCM	A.107	10E	
	4. V.		States -	-		1.2.15			fine.	quarte	Sand AL	Will	V	RD 6"	
	29	18. 6-44	51	5	6	-	-	1.4	grayisi	brown gre	des to ye	llowisi	1	REALI	
		1990	Carlor and		1-38		· · ·	1. A	fice	most	SAND (5M) une	54-	AMEF	
			and in						ALL	UUIUM	y y war is	- sa et	TOPOF	R 2NI	
	30	445-4	805	15	23		-	1.5	darkg	Tag SIL	TMLU	EATHE	15HA	N N N	
			-						Mati	bedding	Friaba	a na	04	BLOV 140 P	
					10				Fiss	to that	d I	7 7	and states	M OF	(h)
	31	460 ->	10	15	19	-	/	1.5	darka	plating up	atherea	SHALL	aboth	ad /	
		112	-		1.000	4.51	1		Fissle	parop De	to off	riade	Shale	LU N	
	32	47.5	17	19	26	1	/	1.0	Same	as a tork	2	1. A.	-1-	ESIST/	
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	33	49.0-9	SIS	23	22	/	/	1.3	samo	as also	ve		- der	RATI	
	34	encla	201	17	9		/	05	Egya	o de al		1	1.27	ENEL	
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	BOR	RING TER	MINAT	"ED:	1 100	ne	unie	s Degre	M	ETHOD OF ADV	ANCING BORI	NG	DEPTH	- and	
	BOR	RING REF	USAL:		<u> </u>		1		POWER A	JGER	MATER	1	TO		
	WA	TER 24 H	IR DEPTH		SP.	cano	21)		ROTARY D	RILL: W/MUD: W/	WATER		TO	7	
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	CAV	E-IN DEF	PTHS: _	12	1.51	NCTU	/		CORE SIZE		No. CI	75	TO		
	STAI	NDBY TI	ME:		BC	DRING L	AYOUT		BAG SAMI	PLES	No. SI	SIZE	. 3 . 3		
							-	al Mar	and Line	ing the second					
		Sec. Sug												F1024	

						Geo	synte	CV
						(consultan	nts
						Page 4	6 of	105
Written by:	J. Sura / Y. Cao	Date:	10/29/10 Revi	ewed by:	Neil Davis	Da	te: 10/29/	/10
Client: T	VA Pr	oject: Dredge	Cells Recovery	I	Project/ Proposal No.:	GR4327	Task No.:	105
						0		
			PIEZOMETE	R INSTA	ALLATION RECO	ORD		
	JOB NA	ME TVA KIN	IGSTON - EAS	TDIKE	JOB NUMBER 300	1310103	38	
	WELL N	IUMBER	PZ-D	1A	INSTALLATION DATE	8/25	12010	
	3		0 "		DRILLED BY TRI	STATE-	George Ak	INS
	BOREH	OLE DIAMETER	6"		RISER/SCREEN	dule 40	PUC	
	TOTAL	DEPTH	20.5 bgs	s ()	DIAMETER	2"		
	FIELD I	REPRESENTATIVE _	Kodneys !	M. Jark	SLOT SIZE (0.010"		
	7			NH	4			
					(4)	- STEEL LOCKI	NG COVER	
						- PVC/RUBBER	EXPANDING	
			3,45'ags			PLUG	,	
				121.12		_Z'XZ	CONCRETE PAD)
			0.5					
			1.03'			- CEMENT/BEN	TONITE GROUT	
		15.11	7			– <u>Z</u> " dia. s	CH. 40 PVC RIS	ER
		1950	To of Seal					
	20.50 20.05		T. S.C. A	0.2		- BENTONITE A	NNULAR SEAL	
		Top of S	Creen 14.86			- 2" DIA 0	010" SLOTTED	SCREEN
		Actual	? Screened			2 010.0	.010 3201120	JERLEN
		Sec	1 l			- No. <u>2</u> SAN	ND FILTER PACK	
		Bottom	of screen	10.74		DIA. S (IF A	CH. 40 PVC TAI	LPIPE
				(NOT TO	SCALE)	FVC ENDCAP	0.17)	
					No. 1. Parent Barran and Parent Street St			

						Ge	OSy con	mte sultar	C [▷] nts
						Page	47	of	105
Written by: <u>J.</u>	Sura / Y. Cao	Date:	10/29/10	_ Reviewed by:	Neil Davis]	Date:	10/29	/10
Client: TVA	Project:	Dredge	Cells Recov	ery	Project/ Proposal No.:	GR4327	Tas	k No.:	105
	Proventiere		R	zuision					
		Pl	EZOME	TER INST	ALLATION RECO	DRD	70		
	JOB NAME(U	P	Z-D1	R Offert	JOB NUMBER 304	8/22	56		
					DRILLED BY Triste	ater	Seon	ze A	leins)
	BOREHOLE DIAME	TER	8		RISER/SCREEN	adula.	40	PIC	
	TOTAL DEPTH	ATIVE	39.0	50	DIAMETER	2"	10	1 1	
	FIELD REFRESENT	A/IVE	NOAME	7 aug	SLOT SIZE	0.0	10"	/	
	39.19 39.50 Botto Botto	32.5) 32.5) 32.5) Top of s Top of sc tom of sc tom of sc	3:49' ags 2:5' 3' apol Seal of Sand agguesed tron	CONCRETI STEEL PO	CALE DELICED TO 41.5 DELICED TO 41.5	STEEL LOCK PVC/RUBBEI PLUG 2×2 CEMENT/BEI 2×2 CEMENT/BEI 2×2 CEMENT/BEI 2×2 DIA. BENTONITE 2×0 2×2 DIA. (IF) PVC ENDCAP 2×2 2×2	CONCR R EXPAN CONCR NTONITE SCH. 40 annte. ANNULA D.010" S ND FILTI SCH. 40 APPLICA (0, 19) (0, 39, 0) (0, 19)	VER DING ETE PAD GROUT PVC RISE R SEAL LOTTED S ER PACK PVC TAIL BLE) SC C 2 ¹ /N AC AUGER	ER SCREEN PIPE- Treen

				G	eosyntec ⁽
				Page	e <u>48</u> of <u>105</u>
Vritten by:	J. Sura / Y. Cao	Date: 10/29/10	Reviewed by:	Neil Davis	Date: 10/29/10
lient: TV	A Project:	Dredge Cells Reco	overy	Project/ Proposal No.: GR43	327 Task No.: 10.
		C SOIL TEST BORING F	REC 1.2.5' Dall to War water Prior to Name of the second Name	D. PZ-DIB PG. 1 C CMESSOTERE HAMMERTYPE AL RILLING 1.0 GROUND SURFACE EN MOVING 0.25 DATE: 3/25/10 WE SOIL CLASSIFICATION 300/314"HSAS, push tube Sompler after charging borning of wait opp 10 minutes pulling tube Material adding tube Material adding augers 1 bgc encanter adding augers 1 bgc encanter toction "large cobble refusal Offset to location	PENELTATION RESISTANCE IS SUM OF BLOWS FOR ZND 6" AND 3RD 6" TO DRIVE 1-3/8" LD, 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.
					TANDARI
	BORING TERMINATED: BORING REFUSAL: WATER TOB DEPTH: WATER 24 HR DEPTH: WATER LOSSES: CAVE-IN DEPTHS: CASING: SIZE STANDBY TIME:	HIS 6 HIS 6 MA NA NA LENGTH BORING LAYOUT	M POWER AU HAND SHC ROTARY D DIAMOND CORE SIZE UNDISTUR 6 South BAG SAMF	ETHOD OF ADVANCING BORING JGER IP: W/MUD: W/WATER RILL: W/MUD: W/WATER CORE BED SAMPLES No. <u>MA</u> SIZE <u>MA</u> PLES No. <u>MA</u> SIZE <u>M</u> A	DEPTH 20 TO 2.0 TO TO TO TO TO TO TO TO TO TO

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												Page	40	of	105
N	I Cumo				Datas	10/	0/10	Darita	J h	Nail Davia		1 age	 Defet	01	
vritten by:	J. Sula	/ 1.0	a0	1	Date:	10/2	29/10	Kevie	wea by:	Nell Davis			Date:	10/25	9/10
lient: TV	'A		_ Proje	ect: _	Dredg	ge Cells	s Recov	ery		Project/ Pro	posal No.:	GR432	7 Ta	sk No.:	105
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	2	IN	ACT	FC	SOIL 1	TEST BO	RING FIE	LD REPOR	BORING	10. D-2	PG.	OF	4		
	ior		21421	NINZ	8 00		Concert	Aleine	RIG TYPE	CMESSOTRE	GROWNDS	TYPE <u>AU</u>	TO'	177	
	JOI		TUA	KINGS	STONP	GGED B	Y Roc	Ineg Clo	HOURS		DATE: 8/	1/10 WEA	THER S	MANY	-
	1.1		Eas	+ 0:	ke	- -		0	1	STATUS LINES, AND WHERE WERE ADDRESS	1	/		-	
	0	1	SAMPL	ING "N"		SCALE	UD	REC		SOIL CLASS	IFICATION		REMARK	SMITH	
	No	DEP	TH 1ST 6'	2ND 6	" 3RD 6'	- ist	B						7	PLER	
	it was a start of the start of	0.5-	1.0 1	VA NA	NA	NA	NA	NA	-Remo	ved 0.0'-	1.0 0FW	el grader	4	SAM	
	1	1.0	1 1	1	2	NA	NA	0.5	- 1.0-1.	S acavel F	dry Very	0052 To 100	se	Annu	
		24	ST		1		in .		1.5'-2	.5 yellani	is brown	tograys			
						10	186 1		brock	in Fat a	AY (CH).	soff.	-	- C.	
								5.900	- trogi	vents, trac	e organiz	6		2 0	
	2	2.	57 1	Z	1	NA	NA	0.5'	same	as above	fat cu	TY) trace	Fi	10.1	
	-	4.	21	7	3	ALA	NA	1.3'	- boxes	~ fet al	AY(CH).m	oist.	146	TEA/	
		5.	5			104		1.0	firm.	Some grad	slegravel)sizod		HES.	1
	4	-							angula	ar fragment	to of shale	weathe	al	10 D	
	L	1 55-	7.0 i	3	2	NA	NA	1.4'	-bro so	ne as about	R anove	Ilen fat		SD 6"	
		-							CLAYC	(CH) Firm	moist, so	1. granu	e.	ND 31	
									sized	Fgravelsize	PT Sula	nts of	ta	AMER	
									angul	ar			4	R 2NI	
	*	7.0-	851	Z	3	NA	NA	1.3'	- Grow	nfat CLAY u	/gravel (C	H) some		VS FO	
									trac	e roots	as above	F		BLOV 140 P	
	6	85-	0.01	1	1	NA	NA	1.0	· brown	to gay ta	+ CLAY (C	H), mois	4.L. UZ	Aö v	
	-								Very	frankaste	angular	Form	1	IS SU	
						-			mois	+ to ust	quartes		110.0'	ANCE	
	Ŧ	10.0:	- WOI	H WOH	41	NA	NA	1.2'	light	yellowith the	own, chast	ic SILT,	Begi	1SIST 1	
		110	3				-		Sard	ino struct	race to II	F/10 +160	Albrid	ANO.	
	8	115-	13.5' 1	2	3	NA	NA	1.5'	light on	Maishbrow	n mottled	u reddist	1 148	TRAT	
	-		-						60un	SILL W/ SON	Sand 6	wet:	HID		
	9	13.0-	14.51.0	50	3	NA	NA	1.0	reddisj.	to orangish the	ain mottleda	Vyellows		ARD	
		-	_			-	-	1 4 1	Grocen: 6	elastic SICT	u/osand, n	noist que	×, V	IVNE	
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	ВО	RING T	ERMINA	TED:	4	4.0	1 Cadi	SPT)	ZI AO	IETHOD OF ADV	ANCING BORI	NG	DEPTH		
	BO	RING R	EFUSAL:		4	3.7	Lac	aholp wh	POWER A	UGER	WATER		0 TO _	43.7	
	WA	ATER 24	HR DEP	TH:	R	3.81	6g-3	* see	ROTARY	DRILL: W/MUD: \	W/WATER		TO		
	WA	ATER LO	SSES:		No	A	1 Ton	no Das	DIAMONI	D CORE			TO	_	
	CA	VE-IN D	IZE	NA	LE LE	NGTH	N	A	UNDISTU	E RBED SAMPLES	No. NAS	IZE NA		-	
	ST	ANDBY	TIME:	NA	кВ	ORING L	AYOUT	IN GRAVEL	BAG SAM	PLES	No. NA	SIZE NA	6.16	ornio	
			* 16	ste?	Blizh	0,008	sos W	Lo=0.4	along	pround suffc	an in a	gers/	SET TH	51024	

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V. • 44 1	L Come / S	V C-	_		Dete	10	20/10	Dest		N-1 D	Page	<u>50</u>	of	<u>105</u>
vritten by:	J. Sura /	1. Ca	0		Date:	10/	29/10	Kevi	ewed by:	Nell Davis		Date	10/2	9/10
lient: TV	'A		Proj	ect:	Dred	ge Cel	ls Reco	very		Project/ Proposal No.:	GR43	27 T	ask No.:	105
	JOB NG JOB NG JOB NG No. D IO IO III IG IS IS	VIA D. 32 SI SI SI SI SI SI SI SI SI SI			SOIL T	SCALE		ELD REPOR	I BORING NC RIG TYPE <u>C</u> HOURS DF HOURS DF REHOURS DF REHOURS DF REHOURS DF REAL SALT U VERY FINE OTATOLS OTA	D. D. Z. PG. <u>ME-SSOTRAC</u> (HAMMER T RILLING <u>G</u> GROUND SU MOVING <u>H</u> DATE: <u>A</u> SOIL CLASSIFICATION Moving <u>H</u> DATE: <u>A</u> SOIL CLASSIFICATION Monthed w/ danges, box <u>Jand</u> , moist, some for <u>Sound</u> , <u>Monthed</u> w/ for <u>Infl gray</u> , clayer <u>Sound</u> , <u>Idose</u> , <u>Jannin</u> <u>Sound</u> , <u>Jannin</u> , <u>Idose</u> , <u>Jannin</u> <u>Sound</u> , <u>Jannin</u> , <u>Idose</u> , <u>Jannin</u> <u>Sound</u> , <u>Jannin</u> , <u>Jannin</u> <u>Jannin</u> <u>Sound</u> , <u>Jannin</u> <u>Sound</u> , <u>Jannin</u> <u>Sou</u>	2 of TYPE AD IRFACE ELE IL/OWEA TOM HAL NO TOM TOM TOM TOM TOM TOM TOM TO	ATHER: 20	ENETRATION RESISTANCE IS SUM OF BLOWS FOR ZND 6" AND 3RD 6#TO DRIVE 1.3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLINGSO INCHES.	
									SANE	(Sc) wet very	soft	mong	DARD	
	18 20	55-20	70th bp	WOR	Warf	NA	NA	1.6'	Saino.	as about	V		STAN	
	BORING BORING WATER WATER CAVE-II CASING	G TERN G REFU TOB E 24 HR LOSSE N DEPT G: SIZE	MINATE JSAL: DEPTH: R DEPTI ES: FHS:	ED:					ME POWER AUG HAND SHOF ROTARY DR DIAMOND C CORE SIZE UNDISTURB	THOD OF ADVANCING BORIN SER 2: W/MUD: W/WATER ILL: W/MUD: W/WATER CORE ED SAMPLES No SIZ	G	DEPTH TO TO TO TO		

										G	eosy	mte	C ¹
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				_	10	100 110				Page		_ Of	103
ritten by:	J. Sura / Y. C	ao		Date:	10	/29/10	Revie	ewed by:	Neil Davis		Date:	10/29)/10
ient: TV	'A	Proj	ect:	Dred	ge Cel	ls Reco	overy		Project/ Proposal No.:	GR43	27 Tas	k No.:	10
									2.2		1. 3	. I	
	#MA	CT	EC	SOIL T	EST BO	RING FIE		BORING NO	D. D.C PG	B OF	4	1	
	JOB NO. 3	04311 WA K	0103		LLER <u>4</u> GGED B	Grane	Mathres Edney Ch	HOURS DE		SURFACE ELE	N. 743	ろ花	
	E	SAMPLIN	NG	E							2	1	
	No. DEPTH		"N"		SCALE	UD	REC		SOIL CLASSIFICATION		REMARKS		
	19 780-2	1ST 6"	2ND 6"	3RD 6"	NA	NA	1.5'	aran	ebstic SILTW/S	and	HUMIDA .		
				19071				MH	wet very sof	+ They	ACHER		
	20195-31	5 un	e 11/08	UDR	NA	NA	0.0'	A w	recorder catche	s intact			
			- ques	-		10	1.11		5 Sounded	1	Color		
	21 310-7	WOH	WOH		NA	Wat	104	gray C	losse Franksland	wartz		5	
				,				Sand	The star	1.0.0	- AG	2	
	22 325-3	to with		1	NA	NH	1.4	gravito	Lack gran Silt # S	nasized	GILTESAL	a de la de	
	27 2415/20	1-100	,	5	120	AIA	,,,	Very	Soft Sitt	IL SAN	th analysis	CHES.	
	43 344 53	> ach		6-	ANT	1017	101	SM.	wet vern los	se Al		30 IN	
	24 3353	woh	11	1	NA	NA	1.2'	darlig	my States	itty SAI	VD de	SNITH	
	.37:0						and	Sand	RASE W/ organics	sticks		IER FA	
		1	a	p	45			ilogd Allenti	O.1 9 observed	J 36.8	Beai	AMM	
	25 37.0	-8	6	is	NA	NA	1.3	Thate g	rainel from 37.0"	-37-5	SU	And I	
	38.5	1						37.5'- SILAL	38.5 dark gran	WEATHE	Din	40 PO	
				1. 2.				Severe	weathering mag	ative H	al exn		
	26 38.5	19	9	9	NA	NA:	lat	38-5 W	leathered Sha	le			
	70.0						1 and	bedd.	a planes dipping	Dappx 4	150 100	HINC	
	27 40.0	-9	19	16	NR	NA	105	Friot	a platy bed	dirog	DECICT		
	28 41.9	5					1.1	Child in	easapt.				
	43.	Bre	T	3	8	NA	1.5	darte of	ang grades to appen	task d		LINA	
	XX	1	1					Fissle	friable moderat	- to	7		
	29 43.8	1 c	-41	46	47.	Na	Talk	52100	ely weathered	-		NAUN	
	afel.	\$	1.	100	10	100	17	43.7	Auger Refusa	4	CTA	AIC .	
	BORING TEF	MINAT	ED:					·	THOD OF ADVANCING BOR	ING	DEPTH		
	BORING REI	USAL:					1	POWER AU	IGER		TO		
	WATER TOE WATER 24 F	R DEPTH	1: [H: 4	60	ep	392		HAND SHO	P: W/MUD: W/WATER RILL: W/MUD: W/WATER	1. 1.	TO	-	
	WATER LOS	SES:						DIAMOND	CORE		TO		
	CAVE-IN DE CASING: SIZ	PTHS: E		LEN	NGTH			UNDISTUR	BED SAMPLES No.	SIZE	10		
	CTAND DV T	1.1				AVOUT						1.11	

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					Page 52 of 1
itten by:	J. Sura / Y. Cao	Date: 10/29/1	0 Reviewed by:	Neil Davis	Date: 10/29/10
ent: TVA	A Projec	t: Dredge Cells R	ecoverv	Project/ Proposal No.:	GR4327 Task No.:
	JOB NO. <u>3043 IC</u> JOB NAME <u>7/4 K</u>	C SOIL TEST BORING	FIELD REPORT BORING NO RIG TYPE <u>(</u> GR AKINS HOURS DE CALLY (ALLY HOURS DE	DPG ME-SSD TRACHAMMER TYPI RILLING GROUND SURF. MOVING DATE: 6/4/	4_ of 4_ E_AUTO_7433 ACE ELEV WEATHER: Sunny
	SAMPLING				E
	No. DEPTH	"N" SCALE UI	D REC	SOIL CLASSIFICATION	REMARKS
	30 44.5'7 59 0. 44.9	640 640	O.z'-Driller ina materi	licated refusal on "very a/" at 43.7/Indicat	hard the terms
			to dri	11 to collect SPT D 4	HAP
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	BORING TERMINATED):		THOD OF ADVANCING BORING	ТО
	WATER TOB DEPTH: WATER 24 HR DEPTH:	Seepe	HAND SHO ROTARY DE	P: W/MUD: W/WATER RILL: W/MUD: W/WATER	то то
	WATER LOSSES:		DIAMOND	CORE	TO
	CASING: SIZE	LENGTH BORING LAYOU	UNDISTURI T BAG SAMP	BED SAMPLES No SIZE _ LES No SIZE	
			[5:00 8:000		F1024

													Ge	eosy cor	/nte	EC ⁽
													Page	53	of	10
ritten by:	J. S	ura /	Y. Ca	D	1	Date:	10/2	29/10	Revie	wed by:	Neil Davis		-	Date:	10/2	9/10
ent: TV	νA			Proje	ct:	Dredg	ge Cell	s Recov	very		Project/ Proj	posal No.:	GR432	27 Tas	sk No.:	10
		JOB JOB No.	MA NO3 NAME S DEPTH	CT TVA AST AMPLIN 1ST 6"	EC KING VG INT 2ND 6	SOIL T	SCALE	RING FIE Gentine Y Redae	Abins Abins y Gall REC	Hard 1	0. D-2 CME:550 AT RILLING MOVING SOIL CLASSIN MATERIAL ENCOR	UD Off-BG. L HAMMER T _ GROUND SU _ DATE: 8/ FICATION MAGENT OF	1 OF YPE <u>A</u> RFACE ELE BAD WEA	270 20. <u>7473</u> ATHER: <u>(</u> REMARKS	L SAMPLER WITH	
		00-1	75' 9.S	NA NA	NA	NA		19-1.	1.3	-Instruct prior to P-Ayae w/ wo	t dillers to collecting to r to 7.5 tc/puch pist	avaer past 10 Sample 8 charge 10 10 sample	costruce 2 2 2 2 2 2 2 2 0	kien ,	" O.D. SPLIT BARRE	
	/							*		+ubie is Charge	Auger/Pus	S/Mater 2.11 Libevise	piston c	anpler	RRIVE 1-3/8" I.D., 2 CHES.	
		<u>UD-2</u>	155-1"	7.0 NA	NA	NA		00-2	Z.O.	pullin	appk Boyn g tube/1	utes pri Vatorial	15		" AND 3RD 6" TO I IER FALLING 30 IN	
		103 103	25:0 25.0 27.0	NA	NĄ	NA		00-3	2.0	Charge Pieton Prior -	auge complete sumple complete to pulling	eushtube Wait app tube/Ma	2.0 mi Komu Jerra J	r wtas	0F BLOWS FOR 2ND 6 140 POUND HAMN	
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									the second se						D PENETRATION R	
		POP				6.05	7	7.0	2-	E E			16	рертн	STANDA	
		BOR WAT WAT WAT CAV CASI STAI	ING TER ING REF TER TOB TER 24 H TER LOSS E-IN DEF ING: SIZI NDBY TII	USAL: DEPTH IR DEPT SES: PTHS: ME:	: :H: :H: N/	LE BC		A A A A A A A YOUT	D-2- ade	POWER A HAND SHO ROTARY D DIAMONE CORE SIZE UNDISTUF BAG SAM	UGER OP: W/MUD: W/N ORILL: W/MUD: W/N O CORE E RBED SAMPLES PLES	NATER //WATER No. 3 SI No. 14 S	ze <u>2,5</u> ize <u>NA</u>	0.0 TO 2 		

				Geo	synte	ec ^D
				Page 54	l of	105
Written by: J. Sura / Y. Cao	Date: 10/29/10	_ Reviewed by:	Neil Davis	Da	te: <u>10/29</u>	/10
Client: <u>TVA</u> Project:	Dredge Cells Recover	ery	Project/ Proposal No.:	GR4327	Task No.:	105
	-			DYJIAG		
17-	PIEZOME	TER INSTA	ALLATION RECO	RD		
IOD NAME IN	A KINGSTON)	EAST DIVE	100 NUMBER 20	43101	138	
WELL NUMBER	PZ-D-2	wanter	INSTALLATION DATE	8/18	1.10	
			DRILLED BY TRISTA	TE/Georg	ne Akin	S
BOREHOLE DIAME	eter 8''		RISER/SCREEN	ele		
TOTAL DEPTH	15.32		MATERIAL	106		
FIELD REPRESENT	TATIVE RODNEY M	A. CLARK	SLOT SIZE	010		
1947 Sector Constants	·					<u></u>
15.32 15.32	3.02'ags 3.02'ags 5.98' 5.98' 5.98' Top of seal Top of sand Top of sand Top of sand Top of sere of Actual screened ctron 10.32'-14.71' Bottom of screen actual cap actual cap			- STEEL LOCKIN - PVC/RUBBER E - $2' \times 2' c$ - CEMENT/BENT - $2'' DIA. SC - 2'' DIA. 0.0- 2'' DIA. 0.0- NO. 2 SANT- MA'' DIA. SC (IF AF - PVC ENDCAP$	G COVER EXPANDING ONCRETE PAD ONITE GROUT H. 40 PVC RIS Ver pellel INULAR SEAL DIO" SLOTTED D FILTER PACK H. 40 PVC TAI	SER SCREEN C ILPIPE
)

consultants

							Page	55	of	105
Written	by: J. Sura / Y. Ca	10	Date:	10/29/10	Reviewed by:	Neil Davis		Date:	10/29/	/10
Client:	TVA	Project:	Dredge	e Cells Recove	ery	Project/ Proposal No.:	GR432	7 Tasl	x No.:	105

Attachment 2: Laboratory Test Results (provided by MACTEC)

consultants

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Written	by: J. Sura / Y.	Cao	Date:	10/29/10	Reviewed by:	Neil Davis		Date:	10/29/	/10
Client:	TVA	Project:	Dredge	e Cells Recove	ery	Project/ Proposal No.:	GR432	7 Tasl	k No.:	105

Phase I Test Results

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Written	by: J. Sura	Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis	:	Date:	10/29/	/10
Client:	TVA	Project:	Dredge	e Cells Recove	ery	Project/ Proposal No.:	GR4327	Tasl	k No.:	105

East Dike Stability Study, TVA Kingston, Harriman, TN MACTEC Project 3043101038

September 24, 2010

					Index/	Table Classification	1 Test Summa	ry			
	Sample	Sample	Natural	A	tterberg Li	mits	Gra	in Size Dist	ribution	1	USCS Classification
Boring	Depth (Feet bgs)	Type/Number	Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Gravel, %	Sand, %	Fines – Silt & Clay, %	Group Symbol	Group Name
C-1	8.5-10	SS-6	21.5								
C-1	7-8.5	SS-5		12	24	1.7			10.1		
C-1	10-11.5	SS-7	63.6	42	26	17	9.5	41.6	49.1	SC	Clayey Sand
C-1	11.5-13	SS-8	23.9		20	12	12.0		22.0		
C-1	13-14.5	SS-9	29.6	44	28	10	12.0	54.1	33.9	SM	Silty Sand
C-1	16-17.5	SS-11	25.2	21	20	10		26.0			
C-1	17.5-19	SS-12	22.3	51	20	10	0	26.8	73.2	CL	Lean Clay with Sand
C-1	19-20.5	SS-13		22	20	12	2.0				
C-1	20.5-22	SS-14	22.7	33	20	13	2.0	24.1	73.9	CL	Lean Clay with Sand
C-1	38.5-40	SS-26	20.5								
C-1	40-41.5	SS-27	16.5	NID	NID	ND					
C-1	41.5-43	SS-28	19.1	NP	NP	NP	0	66.9	33.1	SM	Silty Sand
C-2	7.5-9	SS-5	17.0	40				0.000		1000	
C-2	10.5-12	SS-7	26.3	40	25	14	25.4	44.5	30.1	SC	Clayey Sand with Gravel
C-2	12-13.5	SS-8	26.6								
C-2	13.5-15	SS-9	22.7	29	20	10	7.2	27.8	65.0	CL	Sandy Lean Clay
C-2	25.5-27	SS-17	19.8								
C-2	27-28.5	SS-18	16.2	NP	NP	NP	0.6	50.2	49.2	SM	Silty Sand
C-2	28.5-30	SS-19	24.4			·					
D-1	12-13.5	SS-9		10							
D-1	13.5-15	SS-10	19.4	40	23	17	11.9	54.1	34.0	SC	Clayey Sand
D-1	15-16.5	SS-11	21.1								
D-1	16.5-18	SS-12	23.4	34	20	14	1.0	16.7	82.3	CL	Lean Clay with Sand
D-1	18-19.5	SS-13	23.3								
D-2	5.5-7	SS-4				1					
D-2	7-8.5	SS-5	14.2	10	22	10	10.1				
D-2	8.5-10	SS-6	18.4	40	22	18	12.4	49.1	38.5	SC	Clayey Sand
D-2	10-11.5	SS-7	17.4	20	10		0	150	(m) (
D-2	11.5-13	SS-8		30	19	11	0	15.9	84.1	CL	Lean Clay with Sand

bgs – below ground surface SS – standard penetration test/split spoon NP – non-plastic

Prepared by/Date: Tin Zan ene 7/24/2010 Checked by/Date:



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Written by:	J. Sura / Y. Ca	0	Date:	10/29/10	Reviewed by:	Neil Davis	Da	nte: 10/29/	/10
Client: T	VA	Project:	Dredge	Cells Recover	ry	Project/ Proposal No.:	GR4327	Task No.:	105



1070 West Main Street Suite : Abingdon, Va. 24210 (276) 676-0426 (276) 676-0761

Moisture Content, %

ASTM D-2216-98
Project Name: TVA Kingston East Dike Stability Study
Project Number: 3043-10-1038
Date: 9/21/2010

	C-1	C-1	C-1	C-1	C-1	C-1	C-1	C-1
Sample #	SS-6	SS-7	SS-8	SS-9	SS-11	SS-12	SS-14	SS-26
Depth	8.5'-10.0'	10.0'-11.5'	11.5'-13.0'	13.0'-14.5'	16.0'-17.5'	17.5'-19.0'	20.5'-22.0'	38.5'-40.0
Tare + Wet	129.59	106.63	120.58	100.53	81.98	79.25	118.55	113.1
Tare + Dry	112.26	77.53	103.35	84.56	71.78	70.50	102.55	99.2
Water (w/w)	17.33	29.10	17.23	15.97	10.20	8.75	16.00	13.8
Tare	31.68	31.74	31.29	30.65	31.23	31.27	31,91	31.7
Dry Soil (w/s)	80.58	45.79	72.06	53.91	40.55	39.23	70.64	67.5
Moisture, %	21.5	63.6	23.9	29.6	25.2	22.3	22.7	20.
Boring #	C-1	C-1	C-2	C-2	C-2	C-2	C-2	C-2
Sample #	SS-27	SS-28	SS-5	SS-7	SS-8	SS-9	SS-17	SS-18
Depth	40.0'-41.5'	41.5'-43.0'	7.5'-9.0'	10.5'-12.0'	12.0'-13.5'	13 5'-15 0'	25 5'-27 0'	27 0'-28 5
Tare + Wet	117.66	106.95	101.96	114.07	110.25	115 78	113.95	110 3
Tare + Dry	105.39	94.89	91.65	96.81	93.69	100 16	100.20	107.00
Water (w/w)	12.27	12.06	10.31	17.26	16.56	15.62	13.75	12.0
Tare	31.19	31,72	31.18	31,21	31.51	31.48	30.85	31 5
Dry Soil (w/s)	74.20	63.17	60.47	65.60	62.18	68 68	69.35	75.5
Moisture, %	16.5	19.1	17.0	26.3	26.6	22.7	19.8	16.3
Poring #	<u> </u>	DI	5.4	5.4				
Somela #	52 40	0-1	D-1	D-1	D-1	0-2	D-2	D-2
Sample #	00-19	35-10	55-11	55-12	SS-13	55-5	SS-6	SS-7
Tere L Mat	20.0-30.0	13.5-15.0	15.0-16.5	10.5-18.0	18.0-19.5	7.0-8.5	8.5'-10.0'	10.0'-11.5
Tare + Wet	157.81	101.36	97.94	117.82	125.54	106.91	98.89	95.28
Tare + Dry	133.08	89.97	86.29	101.46	107.71	97.45	88.37	85.90
Maker bules	04.70		11 001	16.361	17.83	9.46	10.52	9.38
Water (w/w)	24.73	11.39	11.00					
Water (w/w) Tare	24.73 31.71	11.39 31.31	31.10	31.50	31.27	30.80	31.14	31.89
Water (w/w) Tare Dry Soil (w/s) Moisture %	24.73 31.71 101.37 24.4	11.39 31.31 58.66	31.10 55.19 21.1	31.50 69.96	31.27 76.44	30.80 66.65	31.14 57.23	31.89 54.01
Water (w/w) Tare Dry Soil (w/s) Moisture, %	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23.4	31.27 76.44 23.3	30.80 66.65 14.2	31.14 57.23 18.4	31.89 54.01 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring #	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23.4	31.27 76.44 23.3	30.80 66,65 14.2	31.14 57.23 18.4	31.89 54.01 17. 4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample #	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23,4	31.27 76.44 23.3	30.80 66.65 14.2	31.14 57.23 18.4	31.89 54.01 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample # Depth	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23.4	31.27 76.44 23.3	30.80 66,65 14.2	31.14 57.23 18.4	31.89 54.01 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample # Depth Tare + Wet	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23.4	31.27 76.44 23.3	30.80 66.65 14.2	31.14 57.23 18.4	31.89 54.01 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample # Depth Tare + Wet Tare + Dry	24.73 31.71 101.37 24,4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23.4	31.27 76.44 23.3	30.80 66,65 14.2	31.14 57.23 18.4	31.80 54.0 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample # Depth Tare + Wet Tare + Dry Water (w/w)	24.73 31.71 101.37 24,4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23.4	31.27 76.44 23.3	30.80 66.65 14.2	31.14 57.23 18.4	31.89 54.0 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample #, Depth Tare + Wet Tare + Dry Water (w/w) Tare	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23,4	31.27 76.44 23.3	30.80 66,65 14.2	31.14 57.23 18.4	31.89 54.0 17.4
Water (w/w) Tare Dry Soil (w/s) Moisture, % Boring # Sample # Depth Tare + Wet Tare + Dry Water (w/w) Tare Dry Soil (w/s)	24.73 31.71 101.37 24.4	11.39 31.31 58.66 19.4	31.10 55.19 21.1	31.50 69.96 23,4	31.27 76.44 23.3	30.80 66,65 14.2	31.14 57.23 18.4	31.89 54.01 17.4



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Written by:	J. Sura / Y	. Cao	Date:	10/29/10	Reviewed by	Neil Davis	·	Date:	10/29	/10
Client: TVA		Project:	Dredg	ge Cells Reco	very	_ Project/ Proposal No.:	GR4327	Tas	k No.:	105
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				Station -						
	0		u j	2 N	VIAC	TEC				
				-	1070 West Main Stre	et Suite 5			and a second	
	8			Telephone:	Abingdon, Virginia 276-676-0426 ~ Fac	24210 simile: 276-676-0761				
		Project Name:		TVA East Dik	e Stability Study					
		Project Number	:	3043-10-1038						
		Report Date.		09/23/10	Soil	Description: Dark Brown Claye	y SAND (SC)			
	50			Atterb	erg Limits AASHTC	(10YR 3/3)) T90-00 (2004)				
		Sample Number		C-1 \$5-5/\$5-7	(Three Point	s)				
	0	Depth (ft):	•	7.0'-8.5'/10.0'-1	11.5'				. 1	
					Blows % Mo	isture				
	÷.,				<u>36 39</u> 24 42	9.5 9.7				
					16 45	.5				
			Liqui	d Limit	Plastic Limit	Plasticity Index				
				42	26	- 17			ţ	
	8.				Liquid Limit (ASTM D 4	318)]		
					Three Points	y = -7.	411in(x) + 66.133			
		47 1	**************************************							
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ritten by: J. Sura	/ Y. Cao	Date:	10/29/10	Reviewed I	oy: Neil Dav	is	D	ate: 10/2	9/10
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			1	1070 West Main S	Street Suite 5				į.
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	Desired Mener	101		0. 1					93 82
	Project Number	. 30	VA East Dike 43-10-1038	e Stability Study	с° т. т.				
	Report Date:	09	/23/10	c	oil Description D	arle Gravith Drow	- Cilter CAND		
Table 4				2	(SN	ark Grayish Brow (1) (2.5Y 4/2)	n Siity SAND		
			Atterbe	erg Limits AASE	ITO T90-00 (2004))			
	Sample Number	r: C-	1 SS-8/SS-9	(Infecto	intsj				1
	Depth (ft):	11	.5'-14.5'						
			1	Blows %	Moisture				1
		18		25	42.2				80
				14	47.6				
	20 20	Liquid L	imit	Plastic Li	mit Plas	ticity Index			
		44		28		16			
				Liquid Limit (ASTM Three Point	D 4318) s	v = -5	74210(2) + 62 703		
	49	un en	-	Na Alaka Milaka kuta da Manara kana akata a		y0.	(42iii(x) · 02.785		
-	48	•							
;	47								
1	2 45								
	Introduction			×					
	* 43						a a 1		
1	42		5 9.						
	41								
	39								
	10			Blows		100			
	Perfo	rmed by:	uca		Checked I	ov: am			
	. on o				Children of the second s			-	



								Page	61	of	105
Written by:J. Sura / Y	. Cao	Date:	10/29/10	Revie	wed by:	Neil Davis			Date:	10/29	/10
Client: TVA	Project:	Dredg	ge Cells Rec	overy		Project/ Proj	posal No.:	GR4327	Tasl	k No.:	105
										1	
			111141-			Sheer Street and Street State					
				\mathbf{M}	<i>AC</i>	TE	C .				
				1070 West	Main Street	Suite 5					
			Telephone	Abingdoi e: 276-676-04	n, Virginia 2 126 ~ Facsi	4210 nile: 276-676-07	61			1	
	Project Name:		TVA East Di	ike Stability S	Study					j	
	Project Numbe	r: ·	3043-10-103	8	, and y					20 - 2	
	Report Date:		09/23/10	21	Soil De	scription: Olive I	Brown Lean Cl	LAY (CL) wi	ith	1	
			Atter	berg Limits	AASHTO	T90-00 (2004)	(2.51 4/4)				
	Sample Numbe	r:	C-1 SS-11/SS	(Th S-12	ree Points)						
	Depth (ft):		16.0'-19.0'								
-				Blows	% Mois	ture					
				25 15	30.9	2) }				1	
		Liqui	id Limit	Pla	stic Limit	Plastici	ty Index			1	
			31		20	1	0		•	1	
				Linual Linu	LACTH D 404	100	y = -3.9	03ln(x) + 43.373	7		
				Thre	e Points	10)				-	
	³⁵										
	34										
4 .	32										
	en 31 -										
	NO 30				2					-	
1	* 29									÷	
	20				+.						
	26										
	25				1					1	
	10			Blow	s		100				
	Perfe	ormed by:	Nett			Checked by	arm]		
1	, and				-	Tila.	Ale se le	9/24/20	10	3	
						in Sur	unce	1-1/-0			









					Page 64	of	105
Written by: J. Sura /	Y. Cao	Date: 10/29/10	Reviewed by:	Neil Davis	Dat	te: <u>10/29</u>	9/10
Client: TVA	Project:	Dredge Cells Recov	very	Project/ Proposal No.:	GR4327	Task No.:	105
L							
		it do se					
			ЛАС	TEC			
		-	1070 West Main Street				
		0.13	Abingdon, Virginia 24	4210			
		Telephone:	276-676-0426 ~ Facsir	nile: 276-676-0761		8	
	Project Name:	TVA East Dike	e Stability Study			. The second sec	
	Report Date:						
			Soil De	scription:Dark Grayish Brown (SC) with Gravel (2.5Y 4	Clayey SAND		
		Atterbe	erg Limits AASHTO	F90-00 (2004)	,		
	Sample Number	r: C-2 SS-5/SS-7	(Three Points)				
	Depth (ft):	7.5'-9.0' / 10.5'-	12.0'				
			Blows % Mois	ture			
			33 38.1 22 40.3				
		I	14 42.6			8	
		Liquid Limit	Plastic Limit	Plasticity Index			
		40	25	14			
			Liquid Limit (ASTM D 431 Three Points	8) V=-5	259lp(x) + 56 474		
	45			,	nooning - ooini -	1	
	44					24	
	43 42	~					
	물 41						
	tsi 40	~ ~					
	* 39	1					
	38		B				
	36					1	
1	35					1	
	10		Blows	100		1	
	Perfo	rmed by: <u>MCH</u>		Checked by: Irm			
		Altino or construction and the second s		Tim Laurence	9/24/2010		
1							











									Page	67	of	105
Written by:	J. Sura / Y	. Cao	Date:	10/29/10	Review	ed by:	Neil Davis		I	Date: 10		0/10
Client: <u>TV</u>	'A	Project:	Dredge Cells Recovery				Project/ Pr	oposal No.:	GR4327	Task No.:		105
				Ľ١	MA		ΤE	С				
					1070 West M	lain Street S	Suite 5					
				~	Abingdon,	Virginia 242	210				:	
			l elephone:	2/6-6/6-042	6 ~ Facsim	lle: 2/6-6/6-0	0761			i		
	Project Name: Project Number Report Date:	r:	TVA East Dik 3043-10-1038 09/23/10	e Stability St	udy							
				Å téorb	our Timita A	Soil De	scription: Oli (ve Brown Clay 2.5Y 4/4)	ey SAND (SC)			
		2 		Atterb	erg Limits A (Thro	ee Points)	90-00 (2004)				1	
		Sample Numbe Depth (ft):	r:	D-1 SS-9/SS-1 12.0'-15.0'	0							
	1				Blows 35 25	% Moist 37.6	ure				÷	
					14	43.9						
	-		Liqui	d Limit	Plast	ic Limit	Plasti	city Index			1	
				40		23		17				
		47			Liquid Limit (Three	ASTM D 4318 Points)					
		46						y ≈ -6	865ln(x) + 62.135			
		44							2			
		Woist 42										
		× 41			~							
		40			1							
		38										
	12	37				<u>}</u>						
		10			Blows			100				
		Perfe	ormed by:	<u> 1114</u>		-	Checked by	y gem		-		
							Tim X	annene	e 9/24/	2010		
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					Page <u>68</u> of <u>1</u>	105					
Written by: J. Sura / Y.	Cao	Date: 10/29/10	Reviewed by:	Neil Davis	Date: 10/29/10	0					
Client: TVA	Project:	Dredge Cells Recov	very	Project/ Proposal No.:	GR4327 Task No.:	105					
T				· *	ĩ						
	98										
		11.11 1			<i></i>						
			MAC	TEC							
			1070 West Main Street	Suite 5							
		Telephone:	276-676-0426 ~ Facsi	4210 mile: 276-676-0761							
	Project Name:	TVA East Dik	e Stability Study								
	Project Number Report Date:	: 3043-10-1038 09/23/10									
			Soil	Description: Light Olive Brown (CL) with Sand (2.5V.5/3	Lean CLAY						
l		Atterb	erg Limits AASHTO	T90-00 (2004)							
	Sample Number	D-1 SS-11/SS-	(Three Points) 12/SS-13	×	. Joseph and the second se						
-	Depth (ft):	15.0'-19.5'									
			Blows % Mois	sture							
			25 33.5	5							
1	*		15 57.3								
		34	Plastic Limit 20	Plasticity Index 14	1						
			87) -								
		Liquid Limit (ASTM D 4318) Three Points									
	40			v=-6.5	05ln(x) + 54.549						
	39										
	37				a a						
	en 36				e e						
	W 34										
	33				1						
	32				1						
	30 L				8						
			Blows	100							
- And a second set of	Perfo	rmed by: <u>AICH</u>		Checked by: 9cm							
				Tim Zaurence	2 9/24/2010						









									Ut	cor	/ I ILE	nts
									Page	71	of	105
Written by:	J. Sura / Y.	Cao	Date:	10/29/10	Reviewed	by: N	eil Davis			Date:	10/29	9/10
Client: T	VA	Project:	Dredg	ge Cells Recover	у	Pro	ject/ Prop	osal No.:	GR432	7 Ta	sk No.:	105
		2						э				
			[A(CTEC	MACTEC F 1070 West M Abingdon, Vi (276) 676-042	ENGINEER ain StreetSui rginia 24210 6	ING AND CO te 5	ONSULTING,	INC			
				Project Name: Project Number: Report Date:	TVA East I 3043-10-10 09/22/10	Dike Stabili 38	ty Study					
		e R		Washed Part Sample Number Percent Finer	ticle Size/Grad ASTM D1140/ : SS-5/SS-7 Depth: than No. 200:	lation Test I D422 7.0'-8.5'/ 49.1	Location: 10.0'-11.5']% (from w	C-1 (ashing)				
	12			Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
				1 in. 3/4 in	0.00	0.00	100.0	100.0				
	6			3/8 in.	0.80	0.80	98.8	99.4				
		3		# 4	11.63	10.83	81.9	90.7				
				# 20	39.60	13.76	60.5	79.8 68.5				
				# 40	48.24	8.64	25.0	61.6				
		340		# 60	53.47	5.23	16.9	57.4				
				#200	63.93	5.54	0.6	49.1				
				PAN	64.33	0.40						
				Wt. of Soil, g	125.55							
			3"	3/4" No. 4	Particle S U.S. Standar No. 40 No	Size Analysi d Sieve Size 200	s	• /				
		10					10011111	IIIIIIII	1			
	е е 8	Percent Flaer by Weight		10.000	00 0.11 Grain Siz	00 0 0 e (mm)						
		Performed By: N	4			Checked Bu	YM		4	0.000	• .	
		-,- <u>,</u> ,,			×.	CHOUNCU BY	Tinto	înline	- 9/23	s-5,55-7 /2010		

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							Geo	DSY cons	nte sultar	ec ^{>}
							Page	72	of	105
Written by: J. Sura / Y. Cao	Date:	10/29/10	Reviewed	by: N	Jeil Davis		E	Date:	10/29	/10
Client: TVA Project:	Dredg	e Cells Recovery	1	Pre	oject/ Prop	osal No.:	GR4327	Tasl	k No.:	105
					л ^{- 4}					
	AC	CTEC	MACTEC I 1070 West M Abingdon, Vi (276) 676-042	ENGINEER ain StreetSu rginia 24210 26	RING AND CO ite 5	ONSULTING,	INC			
а. На 1911	1	Project Name: Project Number: Report Date:	TVA East I 3043-10-10	Dike Stabil 38	ity Study					
		Washed Paul	09/22/10					5		
х.		A Sample Number: Percent Finer t	STM D1140 / SS-8/SS-9 Depth: han No. 200:	11.5 11.5 33.9	Location: 5'-14.5' % (from w	C-1 vashing)				
	- -	Sieve Size	Cumulative (g)	Wt. Retained Each Sieve	1 Cumulative % Passing	Cumulative % Passing				
	þ	1 in.	0.00	0.00	100.0	100.0				
	E	3/4 m. 3/8 in.	0.00	0.00	93.2	100.0 95.5	1.1		а •	
	-	# 4	15.60	9.68	82.1	88.0				
	E	# 20	50.87	24.35	41.7	79.7 61.0				
	F	# 40	65.75	14.88	24.7	49.6				
2. 851 S	. L	# 100	79.67	6.09	8.7	43.6				
	-	#200 PAN	86.27	6.60	1.1	33.9				
	F	Wt of Soil a	120.52	0.99						
	L .	WL 01 3011; g	130.52							
	3"	3/4" No. 4	Particle S U.S. Standar No. 40 No	Size Analysi d Sieve Size 200	is es	25				
100							٦			
90										
80							-			
- He 70		-					-			
× 60		N								
			N							
tu tu	1 M M M M						1			
2 40 2							1			
30							-			
20										
10							-			
0	0.000	10.000 1.00	00 0.10	00 0	 0.010 0.	.001 0.	000	8. s		
5 (1)			Grain Size	e (mm)						
Performed By: <u>NO</u>	<u>#</u>			Checked By	4cm		C-1 SS-8,	55-9		
				-	Tin Law	reme	9/23/2010			
		e.								
							Geo)SY cons	nte sultai	
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							Page _	73	of	105
Written by: J. Sura /	Y. Cao Date	e: <u>10/29/10</u>	Reviewed	by: Ne	il Davis		D	ate:	10/29	9/10
Client: TVA	Project: Dre	dge Cells Recover	у	Proj	ect/ Prop	osal No.:	GR4327	Task	No.:	105
		02					13			
	MA	CTEC	MACTEC 1 1070 West M Abingdon, V (276) 676-042	ENGINEERI (ain StreetSuite irginia 24210 26	NG AND CC	ONSULTING,	INC	*3 2	14	
		Project Name: Project Number: Report Date:	TVA East 1 3043-10-10 09/22/10	Dike Stability 138	y Study					
		Washed Par Sample Number Percent Finer	ticle Size/Grad ASTM D1140 :: SS-11/SS-12 Depth: than No. 200:	dation Test R / D422 2 16.0'- 73.2	eport Location: 19.0']% (from w	C-1 ashing)				
9		Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
		1 in.	0.00	0.00	100.0	100.0	1			
		3/4 in.	0.00	0.00	100.0	100.0	-			
	and the state of the state	# 4	0.00	0.00	100.0	100.0	1			
		# 10	0.10	0.10	99.7	99.9	· · · · ·			
		# 40	8.05	3.24	74.5	93.0				
		# 60	11.55	3.50	63.5	90.0				
		# 100	18.25	6.70	42.3	84.2				
		PAN	31.61	0.64	2.0	13.2				
	5.* C	We of Soil a	115.60				1 1910			
		WE OF SOLL, g	Particle	Size Analysis					8	
		3" 3/4" No. 4	U.S. Standa No. 40 N	rd Sieve Size: o. 200	s					
	100						7			
	90									
	80									
	1 Fig 70						-			
	M 60						_			
	1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-								8	
	nt Fd									
	au 40						-			
	30						_			
	20									
1	. 20									
	10						-			
	0	10.000 1.	.000 0.	100 0.	ļ	0.001	0.000			
9	27 Day	9.5° -	Grain Si	ize (mm)						
	Performed By: NCK		<i>8</i>	Checked By:	4cm	1.4	C-1 SS-11,5	S-12		
					Tinz	annene	e 9/23/2	010		
1			112				(/			

								Ge	OSy con	/ nte Isultar	ec
								Page	74	of	105
ritten by: J. Sura / Y.	Cao	Date:	10/29/10	Reviewed	by: N	leil Davis			Date:	10/29	9/10
ent: <u>TVA</u>	Project:	Dredg	ge Cells Recover	у	Pro	oject/ Prop	osal No.:	GR4327	Tas	k No.:	105
	ŹМ	A	CTEC	MACTEC E 1070 West M Abingdon, Vi (276) 676-042	ENGINEER ain StreetSui rginia 24210 6	ING AND CO ite 5	ONSULTING,	INC.			
			Project Name:	TVA East I	Dike Stabili	ty Study					
			Project Number: Report Date:	3043-10-10 09/22/10	38						
			Washed Part	icle Size/Grad	lation Test	Report					
			A Sample Number	STM D1140	D422	Teentleur	C 1				
			Sample Number	: 55-13/55-14 Depth:	19.0)'-22.0'			•		
			Percent Finer	than No. 200:	73.9	% (from w	ashing)				
			Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
			1 in.	0.00	0.00	100.0	100.0				
			3/4 in. 3/8 in.	0.00	0.00	93.5	100.0 98.3				
		1	# 4	2.71	0.43	92.3	98.0				
			# 10	4.66	1.95	86.7	96.5				
			# 20	8.97	4.31	67.2	93.2				
			# 60	15.34	3.84	56.3	88.4				
		[# 100	22.26	6.92	36.6	83.2				
			#200	34.58	12.32	1.5	73.9				
			PAN	35.09	0.51					đ	
		l	Wt. of Soil, g	132.69							
				Particle	Size Analys	is					
	8	3"	3/4" No. 4	No. 40 No.	o. 200	es			$\overline{a} \in \mathcal{O}$		
	i.							7			
	9	0						-			
	8	0									
	ч.				NII						
	/cigh							1			
	M 6	0						-		32	
	ner										
	it B										
e	ana 4	0						-			
	e 3										
	2	0									
	1	0						-			
		0]			
		100.000	10.000 1.	Grain Si	100 ze (mm)	0.010 . (0.001 0	.000			
	Performed By: //	rH	м. С	18	Checked P	1 Arm					
		- 1/			Checked B	T. J.		C-1 SS-13	s,SS-14		
,						maan	unel	10/2	., 0		
<u>\$</u>											

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							Page	75	of	105
Written by: J. Sura / Y. Cao	Date:	10/29/10	Reviewed	by: <u>N</u>	Neil Davis			Date:	10/29	9/10
Client: <u>TVA</u> Project:	Dredg	ge Cells Recover	у	Pr	oject/ Prop	osal No.:	GR432	7 Tas	k No.:	105
			~							
	[A(CTEC	MACTEC I 1070 West M Abingdon, Vi (276) 676-042	ENGINEER ain StreetSu rginia 24210 26	LING AND CO	ONSULTING, I	ΫC			
		Project Name:	TVA East I	Dike Stabili	ity Study					
		Project Number:	3043-10-10	38						
		Report Date:	09/22/10			•				
		Washed Part	icle Size/Grad	lation Test	Report					
		A Sample Number:	STM D1140 /	D422	Location:	C-1			54	
		Percent Finer f	Depth:	40.0	0'-43.0'					
		rercent Filler (inan 190. 200:	33.1	% (irom w	ashing)				
		Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				0
	ł	1 in. 3/4 in.	0.00	0.00	100.0	100.0				
	t	3/8 in.	0.00	0.00	100.0	100.0				
40. 40	ŀ	# 4	0.00	0.00	100.0	100.0				
<u> </u>	ł	# 20	0.00	0.00	99.9	100.0				
	F	# 40	0.61	0.53	99.6	99.7				
		# 60	22.72	22.11	83.4	88.6			•	
	t	#200	132.94	47.99	2.6	33.1				
	Ĺ	PAN	136.50	3.56	2.0	55.1				
	ł	Wt. of Soil, g	198.58							
			Particle	Size Analys	is					
	3"	3/4" No. 4	No. 40 No.	d Sieve Siz	es					
. 10										
	0									
61 ^{/2}	10									
Veig										
r vd	50									
i i i i i i i i i i i i i i i i i i i	0									
cent	u IIII									
Per				N						
1	0									
:	0									
	0									
	×									
5.	0 HELLI									
	100.000	10.000 1.0	00 0.1 Grain Siz	00 (e (mm)	0.010 0	.001 0.00	0			
<i>I</i> I	14									
Performed By: //	L []			Checked By	· 4cm		C-1 SS-2	7,SS-28		
					Tink	aurence	9/23	12010	25	

								Ge	eosy	nte	ec^{\diamond}
								Daga	76	of	105
Written by: I Sura / Y	Сао	Date	10/29/10	Reviewed	bv∙ Ne	vil Davis		I age	Date	- ⁰¹	9/10
	<u> </u>	Dute.		Revieweu	n <u>n</u>			CD 422	7 T	<u> </u>	105
Chent: <u>IVA</u>				MACTEC F	Proj	JECU/ Prop	OSAL NO.: DNSULTING,	GR432	<u>/ 1as</u>	K NO.:	
	1V]			1070 West M Abingdon, Vi (276) 676-042	ain StreetSuit rginia 24210 6	e 5					
			Project Name:	TVA East I	Dike Stabilit	y Study					
			Project Number:	3043-10-10	38	2 - 2 - 3	* 0		18 C)		
			Report Date:	09/22/10	•						
			Washed Part	icle Size/Grad	ation Test R	eport		38			
			A Sample Number	STM D1140 / SS-5/SS-7	D422	Location:	C-2				
(4)			Demonst 72'	Depth:	7.5'-9.0'/1	0.5'-12.0'	·				
			Percent Finer	than No. 200:	30.1	」% (from w	ashing)				
			Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
			1 in. 3/4 in	0.00	0.00	100.0	100.0		\sim		
			3/8 in.	18.33	8.14	76.3	83.3			til	
		1	# 4 # 10	27.99 39.29	9.66	63.8	74.6				
			# 20	53.12	13.83	31.4	51.7				
			# 40	67.32	8.79	20.0	43.8				
			# 100	71.90	4.58	7.1	34.7				
		-	#200 PAN	76.91	5.01	0.7	30.1				
			THIS	11.42					12		
		1	Wt. of Soil, g	110.07							
	•	• 2		Particle	izo Anolucie				2.3		
				U.S. Standar	d Sieve Size	s					
,	10	3" 00 mm	3/4" No. 4	No. 40 No	. 200						
	- 0										
								1			
	8	50.						-			
	cight 2	70						-			
	hy W	50 						-			
	iner 1	io						1			
	cent							ſ			
	Per							1			
	3							1			
	2	20						1			
	1	0						-			
		0						1			
		100.000	10.000 1.0	000 0.1 Grain Siz	00 0. ze (mm)	. 010 . 0	0.001 0.	000			
	Performed By: _/	CH			Checked By:	4cm		C-2 S	S-5,SS-7		
						Timz	aurence	9/23/	2010		

								Ge	con	mte sultai	ec ^D
								Page	77	of	105
Written by: J. Sura / Y	. Cao	Date:	10/29/10	Reviewed	by: No	eil Davis			Date:	10/29	0/10
Client: TVA	Project:	Dredg	ge Cells Recovery	у	Pro	ject/ Prop	osal No.:	GR4327	7 Tas	k No.:	105
			17								
	100-										
		IA(J TEC	1070 West M Abingdon, Vi (276) 676-042	ain StreetSuit irginia 24210 26	nG AND CC e 5	JNSULTING,	INC			
÷			Project Name:	TVA East 1	Dike Stabilit	y Study					
			Project Number: Report Date:	3043-10-10 09/22/10	38						
			Washed Part	icle Size/Grad	lation Test R	eport					
			Sample Number:	SIMD1140 SS-8/SS-9 Depth:	12.0 ⁴	Location:	C-2				
			Percent Finer t	than No. 200:	65.0]% (from w	vashing)				
			Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
			1 in. 3/4 in.	0.00 J 9.10	0.00 9.10	100.0 79.8	100.0 92.8				
			3/8 in. # 4	9.10	0.00	79.8 79.8	92.8 92.8				
			# 10 # 20	9.26 13.30	0.16	79.4	92.7 89.5				
			# 40 # 60	17.33	4.03	61.5	86.3				
		ļ	# 100	29.88	7.73	33.6	76.3				
		-	#200 PAN	44.15 44.98	0.83	1.8	65.0				
		ŀ	Wt. of Soil, g	126.29			+:				
5.											
				U.S. Standar	size Analysis d Sieve Size	s					
	10	3" 00 [[]]]]]	3/4" No. 4	No. 40 No	. 200			-			
	9	0									
	8	30									
	glit	70									
	y Wei	50									
	ner b	50									
	ent P							1			
	Perc							1			
								1			
	2	20						1			
	1	0						1			
	2	100.000	10.000 1.0	00 0.1 Grain Siz	00 0.0	010 0	0.001 0.	-1 000			
	Performed By: /	CH			Checked By:	arm			0.00 0		
					7	in ha	nence	9/23/	2010		
	411 1				/	- 1		, ,			

								Ge	cor	/nte	C⊳ nts
								Page	78	of	105
Written by: J. Sura / Y.	Cao	Date:	10/29/10	Reviewed by	: <u>N</u>	eil Davis			Date:	10/29	/10
Client: TVA	Project:	Dredg	ge Cells Recover	у	Pro	ject/ Prop	osal No.:	GR432	7 Ta :	sk No.:	105
	11111-			MACTEC EN	ומשוחי	NC AND CO	NOTI TING	DIC			
	21 M	A	CTEC	1070 West Main Abingdon, Virgin (276) 676-0426	StreetSuit	e5	JNSOLILING	INC			
			Project Name:	TVA East Dik	e Stabilit	y Study	8		s		
			Project Number: Report Date:	3043-10-1038 09/22/10				ę.			
	4		Washed Part	icle Size/Gradati	on Test R	leport		5 - 4			
		a G	A Sample Number:	STM D1140 / D4 SS-17/SS-18 Depth:	122 25.5	Location: -28.5'	C-2				
		4	Percent Finer t	than No. 200:	49.2	% (from w	vashing)				
			Sieve Size	Cumulative (g) W	t. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
			1 in. 3/4 in.	0.00	0.00	100.0 ·	100.0	1			
			3/8 in.	0.00	0.00	100.0	100.0				
	4		# 10	1.68	0.66	98.8	99.4 99.0		÷.	5	
	12		# 20 # 40	2.05	0.37	97.6	98.7				
			# 60	8.86	5.71	89.4	94.5				
*			# 100 -	41.05	32.19	51.1	74.5				
			PAN	83.95	2.21	2.0	49.2				
5		ł	Wt. of Soil, g	160.81			1000				
				Particle Size	Analysis	5					
	0 700	3"	3/4" No. 4	U.S. Standard S No. 40 No. 20	lieve Size	S		122			
	100 90 80 110 100 100 100 100 100 100 100 100									4 10 11	
				Grain Size (n	am)						

Performed By: <u>NCIT</u> Checked By: <u>ACM</u> C-2 SS-17, SS-18 Tin Lawrence 9/23/2010

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									Page	79	of	105
Written by: J.S.	Sura / Y.	Cao	Date:	10/29/10	Reviewed	by: Ne	eil Davis			Date:	10/29	0/10
Client: TVA		Project:	Dredg	ge Cells Recover	у	Pro	ject/ Prop	osal No.:	GR432	7 Tas	k No.:	105
	14	<i>≝</i> N	IAC	CTEC	MACTEC 1 1070 West M Abingdon, Vi	ENGINEERI ain StreetSuite irginia 24210	NG AND CC	ONSULTING,	INC			
				Desired M	(270) 070-042				*			
				Project Number: Report Date:	3043-10-10 09/22/10	38	y Study				S2	
				Washed Part	icle Size/Grad	lation Test R	eport					
				A Sample Number:	STM D1140 . SS-9/SS-10	/ D422	Location:	D-1			٢	
		ं		Percent Finer	Depth: than No. 200:	12.0'- 34.0	15.0' % (from w	ashing)				
				Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
				1 in. 3/4 in	0.00	0.00	100.0	100.0				
				3/8 in.	5.27	5.27	93.4	95.6				
				# 4 # 10	14.30 28.62	9.03	82.2 64.3	· 88.1 76.3				
				# 20	47.89	19.27	40.3	60.3				
	1			# 40 # 60	60.39	7.20	24.7	50.0				
				# 100	73.46	5.87	8.4	39.1				
			ł	#200 PAN	79.63	6.17	0.7	34.0				
				We of Cold of	100.07	0.00						
			L	wt. of Soll, g	120.67						50	
				123	Particle	Size Analysis					a.	
			3"	3/4" No. 4	No. 40 No.	d Sieve Size:	5			200 - D		
		1	00						٦			
			90						-			
			80						4			
		ght	70									
		Wei	60									
		ter hy			NI				1			
		nt Fir	50						1			
		crce	40						-			
		-	30						-			
			20									
			10									
									1			
			100.000	10.000 1.0	00 0.1	00 0.0	010 0	.001 0.	4 000			
					Grain Siz	te (mm)						
		Performed By:	VCH			Checked By:	Acm		D-1 \$\$-	9,SS-10		
							Tima	annence	2 9/23	12010		

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									Page	80	of	105
Written by	J. Sura / Y.	Cao	Date:	10/29/10	Reviewed	bv: No	eil Davis			Date:	10/29	/10
Client:	TVA	Project:	Dredg	ge Cells Recover	у	Pro	ject/ Prop	osal No.:	GR4327	Tasl	k No.:	105
									5			
	6 1		[AC	CTEC	MACTEC E 1070 West Ma Abingdon, Vir (276) 676-0420	NGINEERI in StreetSuit ginia 24210 5	NG AND CO e 5	ONSULTING,	INC			
	×	*		Project Name: Project Number: Report Date:	TVA East D 3043-10-103 09/22/10	ike Stabilit 8	y Study					
				Washed Part A Sample Number	icle Size/Grad STM D1140 / : SS-11/SS-12/	ation Test R D422 SS-13	Location:	D-1				
				Percent Finer	than No. 200:	82.3	% (from w	vashing)				
				Sieve Size	Cumulative (g)	Wt. Retained Each Sieve (g)	Cumulative % Passing	Cumulative % Passing w/ Wash 200				
				1 in. 3/4 in.	0.00	0.00	100.0	100.0				
				3/8 in. # 4	1.05	1.05	97.6	99.6				
				# 10	2.77	0.30	93.6	99.0				
				# 20 # 40	5.16	2.39	88.1 82.2	97.8 96.8				
				# 60	11.91	4.22	72.5	95.0				
				#200	42.40	9.22	2.0	91.2 82.3				
				PAN	43.26	0.86						
				Wt. of Soil, g	239.88							
			1									
					Particle S	ize Analysis	5					
			3"	3/4" No. 4	U.S. Standard No. 40 No.	Sieve Size	s					
		10					1111111		T			
		nt Finer by Weight	20						-			
		Lerce							-	2	it Al	
			100.000	10.000 1.0	000 0.10 Grain Size	0 0. e (mm)	010 0	0.001 0.	000			
		Performed By: <u>//</u>	<u>'cĦ</u>			Checked By:	-qcm Tim Ka	wrenze	D-1 55-11,55-12,5 9/23/20	55-13 070		

										Geo	DSY con	mte sultar	C [▷]
										Page	81	of	105
Written	by:	J. Sura / Y.	Cao	Date:	10/29/10	Reviewed	by: <u>N</u>	Neil Davis		D	ate:	10/29	/10
Client:	ΤV	/A	Project:	Dredg	ge Cells Recover	у	Pr	oject/ Prop	oosal No.:	GR4327	Tas	k No.:	105
			≝ M	A	CTEC	MACTEC 1 1070 West M Abingdon, Vi (276) 676-042	ENGINEER ain StreetSui rginia 24210 :6	ING AND CO	ONSULTING,	INC	с. С.		
					Project Name:	TVA East I	Dike Stabili	ity Study					
					Project Number: Report Date:	3043-10-10 09/22/10	38						
					Washed Part A Sample Number:	icle Size/Grad STM D1140 / : SS-5/SS-6	lation Test] / D422	Report	D.2				
					Percent Finer (Depth: than No. 200:	7.0 38.5	'-10.0'	(ashing)				
				[Sieve Size	Cumulative (g)	Wt. Retained Each Sieve	I Cumulative % Passing	Cumulative % Passing				
		+			l in.	0.00	0.00	100.0	100.0				
				ŀ	3/4 m. 3/8 in.	8.14	0.00 8.14	92.5	100.0 95.3				
				F	# 4	21.68	13.54	79.9	87.6				
				ŀ	# 10	65.85	27.31	64.3	62.3				
					# 40	82.58	16.73	23.6	52.7				
				ŀ	# 60	91.85	9.27	15.0	47.4				
				t	#200	107.45	7.95	0.6	43.1 38.5				
				F	PAN	108.06	0.61						
				E	Wt. of Soil, g	174.73							
					0	Particle	Size Analys	is					
				3"	3/4" No. 4	U.S. Standar No. 40 No.	d Sieve Siz	es					
			10							7			
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		<i>t</i> 0	8										
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							-	Tin Ia.	N9- 0	9/23/255-5.5	0		
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										con	sultar	nts
Waitton had	I Suro / V	Cao	Data	10/20/10	Domorrod	h \	Joil Davia		Page _	82	of	105
written by:	J. Sula / 1	. Ca0	Date:	10/29/10	Kevleweu	ыу: <u>г</u>			L	ale:	10/29	105
Client: <u>TV</u>	'A	Project:	Dredg	e Cells Recover	У	Pr	oject/ Prop	osal No.:	GR4327	Tas	k No.:	105
		*			,							
		M	[AC	CTEC	MACTEC E 1070 West Ma Abingdon, Vin (276) 676-042	NGINEER ain StreetSu rginia 24210 6	ING AND CO ite 5	ONSULTING,	INC .	t		
			I	Project Name:	TVA East D)ike Stabili	ity Study					
			I	roject Number:	3043-10-103	38						
			H	Report Date:	09/22/10							
				Washed Part A Sample Number Percent Finer	ticle Size/Grad ASTM D1140 / : SS-7/SS-8 Depth: than No. 200:[ation Test D422 10.0 84.1	Report Location:)'-13.0' % (from y	D-2 vashing)				
			Г		Cumulative	Wt. Retained	i Cumulative	Cumulative	1			
				Sieve Size	(g)	Each Sieve (g)	% Passing	% Passing w/ Wash 200				
			F	1 in.	0.00	0.00	100.0	100.0				
			H	3/4 in. 3/8 in.	0.00	0.00	100.0	100.0			0	
			E	# 4	0.00	0.00	100.0	100.0				
				# 10	0.00	0.00	100.0	100.0				
			H	# 20	0.19	0.19	99.1	99.9				
				# 60	2.29	1.65	89.3	99.5				
			E	# 100	7.50	5.21	65.0	94.3	5			
			F	#200	20.85	13.35	2.7	84.1				
			F	PAN	21.43	0.58						
			E	Wt. of Soil, g	130.84			2				
			5.4			··· ·						
					U.S. Standar	d Sieve Siz	1S es					
		12	3"	3/4" No. 4	No. 40 No.	. 200		,				
		10							7			
		5	0						_			
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			100.000	10.000 1.	Grain Siz	ze (mm)	0.010	0.001 (.000			
		Performed By: N	CH-		12) 	Checked B	y: SCM		D.2 86 7	CC.8		
						1	1		173/201	00-0		
						In	- Jane	mee	10/0/0	-		
	i.											

consultants

							Page	83	of	105
Written	by: J. Sura / Y	Y. Cao	Date:	10/29/10	_ Reviewed by:	Neil Davis		Date:	10/29/	/10
Client:	TVA	Project:	Dredge	e Cells Recov	ery	Project/ Proposal No.:	GR432	7 Tas	k No.:	105

Phase II Test Results

<page-header> Pig g _ 0 _ 00 Writen brit J.Sura Y, Y.co Date: Dorder Date: Date:</page-header>				
Writen by: 1. Sura / Y. Czo Dei: 10/2012 Reviewed by: Neil Davis Davis Davis Tota / Y. Czo Chent: TVA Project: Decige Cells Recovery Project/Proposal No: GR432 Task No: 10 (10/2014) Will down a bins, bin Decige Cells Recovery Project / Proposal No: GR432 Task No: 10 (10/2014) (10/2014) Decige Cells Recovery Project / Proposal No: GR432 Task No: 10 (10/2014) Decige Cells Recovery Project / Proposal No: GR432 Task No: 10 (10/2014) Decige Cells Recovery Project / Proposal No: GR432 Task No: 10 Unit of the colspane down a bins, bin (10/2014) Decige Cells Recovery Total Normal Stress, bin Decige Colspane"2">Normal Stress, bin Unit of the colspane"2" Total Normal Stress, bin Decige Colspane"2"				Page <u>84</u> of <u>105</u>
Term: Ye Yeiger,	Written by: J. Sura / Y	7. Cao Date: 10/29/10 R e	eviewed by: Neil Davis	Date: 10/29/10
Image: State of the s	Client: TVA	Project: Dredge Cells Recovery	Project/ Proposal No.:	<u>3R4327 Task No.: 105</u>
Tested By: FBChecked By: Kelly ManhallChecked By: Kelly ManhallTested By: FBChecked By: Kelly Manhall				
Image: space of the space				
Image: space of the second		9 <u>Total</u> Effer C, ksf 1.81 1.2	ctive	
Image: state of the second		φ, deg 20.7 25. Tan(φ) 0.38 0.4	8	
99 0		5 6		
Image: set of the set of		Stress		
Image: set of the set of		3 3 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
Image: state in the second				
Total Normal Stress, kaf				
Product Normal Stress, kst 10			9 12 15	18
15 1 2 3 10 1 2 3 10 1 1 2 3 10 1 1 2 3 10 1		Effec	tive Normal Stress, ksf	
12.5 10 1 <td></td> <td>15</td> <td>Samala No.</td> <td></td>		15	Samala No.	
Type of Test: Club Pressure, pai 65.00 5.24 5.33 Club Pressure, pai 65.00 5.00 5.00 5.24 5.33 Type of Test: Club Pressure, pai 65.00 5.00 5.00 5.00 5.00 Subartition: Club Pressure, pai 65.00 5.00 5.00 5.00 5.00 Type of Test: Club Pressure, pai 65.00 7.00 80.00 7.2 9.0 9.6 Tube of Test: Club Pressure, pai 65.00 7.00 8.00 7.2 9.0 9.6 Tube of Test: Club with Proc Pressures 5.38 2.6 2.8 2.8 2.6 Sample Type: UD Description: Gray silty clayey SAND Failure, kst 9.7 12.9 12.2 Piel A: 48.0 Piel A: 48.0 Piel A: 48.0 Piel A: 48.0 Piel A: A8.0		12.5	Water Content, % 23.9 22.	6 22.3
2 10 10 2.86 2.86 2.86 2.87 Height, in. 5.26 5.25 5.34 102.7 105.5 103.7 5 5 10 100.0 100.0 100.0 100.0 100.0 2.6 2.87 102.7 105.5 103.7 105.5 103.7 2.6 2.87 100.0 100.0 100.0 100.0 100.0 2.6 2.85 2.86 2.85 2.86 100.0 100.0 100.0 2.6 2.85 2.85 2.86 100.0 100.0 100.0 100.0 100.0 2.6 10 2.0 4.46 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10.8 10.0			Image: Solution of the second secon	2 95.7 9 0.6206
65 7.5 7.5 Water Content, % 23.3 21.7 22.7 90 90 90 102.7 102.7 102.7 102.7 102.7 10 100 100.0 100.0 100.0 100.0 100.0 2.5 2.6 2.5 2.8 2.8 2.8 2.8 2.8 2.5 0 10 2.0 30 30 30 30 30 30 30 30.0 10.0 <td< td=""><td></td><td></td><td>2 Diameter, in. 2.86 2.8 Height, in. 5.26 5.2</td><td>6 2.87 5 5.34</td></td<>			2 Diameter, in. 2.86 2.8 Height, in. 5.26 5.2	6 2.87 5 5.34
Image: Second Strain Second Strain Second Strain Table Stability 100.0 100.0 100.0 100.0 Image: Second Strain Second Strain Second Strain Table Strain Strain Table Strain Strai		7.5 7.5	1 Water Content, % 23.3 21. 1 1 Dry Density, pcf 102.7 105. 9 Solution % 100.0 100.0 105.	7 22.7 5 103.7
2.5 10 2.		6 Cerviat	Ze Saturation, % 100.0 100. Void Ratio 0.6208 0.578 Diameter, in. 2.86 2.8	0 100.0 1 0.6052
2.5 30 30 40 0 10 20 30 40 Axial Strain, % Axial Strain, % 7.2 9.0 9.6 Type of Test: 7.4 9.0 6.2 8.9 CU with Pore Pressures 3.8 2.5 8.9 Sample Type: UD Description: Gray silty clayey SAND 7.12.9 12.2 Failure, ksf 2.5 3.8 2.6 Client: Tennessee Valley Authority Project: TVA KIF East Dike Stability Study Source of Sample: Boring C-2 Depth: 25.0'-27.0' Sample Number: UD Proj. No.: 3043-10-1038 Date Sampled: TRIAXIAL SHEAR TEST REPORT MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MACT			Height, in. 5.25 5.2 Strain rate, in./min. 0.01 0.0	4 5.33
0 10 20 30 40 Axial Strain, % 7.2 9.0 9.6 Type of Test: 6.1 5.0 6.2 8.9 CU with Pore Pressures 0 7.1 12.9 12.2 Sample Type: UD 0 2.5 3.8 2.6 Description: Gray silty clayey SAND Client: Tennessee Valley Authority Project: TVA KIF East Dike Stability Study Specific Gravity= 2.666 Source of Sample: Boring C-2 Depth: 25.0-27.0' Remarks: Percent passing No. 200 sieve: Pill B: 39.3 Date Sampled: Pill C: 42.1 TRIAXIAL SHEAR TEST REPORT Figure MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MAMM		2.5	Back Pressure, psi 50.00 50.00 Cell Pressure, psi 50.00 50.00	0 50.00
Axial Strain, % Total Pore Pr., ksf 6.9 6.2 8.9 Ult. Stress, ksf Total Pore Pr., ksf 0 7 12.9 12.2 Type of Test: CU with Pore Pressures 5 3.8 2.6 2.5 3.8 2.6 Sample Type: UD Description: Gray silty clayey SAND Client: Tennessee Valley Authority Project: TVA KIF East Dike Stability Study Specific Gravity= 2.666 Source of Sample: Boring C-2 Depth: 25.0'-27.0' Remarks: Percent passing No. 200 sieve: Pill A: 48.0 Proj. No.: 3043-10-1038 Date Sampled: Proj. No.: 3043-10-1038 Date Sampled: TRIAXIAL SHEAR TEST REPORT MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MAMM		0 10 20 20 00	Fail. Stress, ksf 7.2 9.1	0 80.00 0 9.6
Total Pore Pr., ksf Gr, Failure, ksf 9.7 12.9 12.2 CU with Pore Pressures Gr, Failure, ksf 2.5 3.8 2.6 Sample Type: UD Description: Gray silty clayey SAND Project: TVA KIF East Dike Stability Study Specific Gravity= 2.666 Source of Sample: Boring C-2 Depth: 25.0'-27.0' Remarks: Percent passing No. 200 sieve: Source of Sample: Boring C-2 Depth: 25.0'-27.0' Pill A: 48.0 Pill B: 39.3 Pill C: 42.1 Proj. No.: 3043-10-1038 Date Sampled: Figure MACTEC ENGINEERING AND CONSULTING, INC. TRIAXIAL SHEAR TEST REPORT MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MAMM		Axial Strain, %	Total Pore Pr., ksf 6.9 6.1 Ult. Stress, ksf	2 8.9
Type of rest: 12.9 12.2 CU with Pore Pressures 5, Failure, ksf 2.5 3.8 2.6 Sample Type: UD Description: Gray silty clayey SAND Project: TVA KIF East Dike Stability Study Specific Gravity= 2.666 Source of Sample: Boring C-2 Depth: 25.0'-27.0' Remarks: Percent passing No. 200 sieve: Pill A: 48.0 Proj. No.: 3043-10-1038 Date Sampled: Pill B: 39.3 TRIAXIAL SHEAR TEST REPORT MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MAMM		Town of Test.	Total Pore Pr., ksf	0 122
Sample Type: UD Client: Tennessee Valley Authority Description: Gray silty clayey SAND Project: TVA KIF East Dike Stability Study Specific Gravity= 2.666 Source of Sample: Boring C-2 Depth: 25.0'-27.0' Remarks: Percent passing No. 200 sieve: Sample Number: UD Proj. No.: 3043-10-1038 Date Sampled: Pill A: 48.0 Proj. No.: 3043-10-1038 Date Sampled: TRIAXIAL SHEAR TEST REPORT Pill C: 42.1 MACTEC ENGINEERING AND CONSULTING, INC. MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MACMU		CU with Pore Pressures	$\overline{\sigma}_3$ Failure, ksf 2.5 3.0	3 12.2 8 2.6
Project: TVA KIF East Dike Stability Study Specific Gravity= 2.666 Remarks: Percent passing No. 200 sieve: Pill A: 48.0 Pill B: 39.3 Pill C: 42.1 Figure Tested By: FB Checked By: Kelly Marshall		Sample Type: UD	Client: Tennessee Valley Authority	
Specific Gravity= 2.666 Source of Sample: Boring C-2 Depth: 25.0'-27.0' Remarks: Percent passing No. 200 sieve: Pill A: 48.0 Proj. No.: 3043-10-1038 Date Sampled: Pill B: 39.3 Pill C: 42.1 TRIAXIAL SHEAR TEST REPORT MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MACH		Coordination. Gray sinty crayey SAND	Project: TVA KIF East Dike Stability Study	
Remarks: Percent passing No. 200 sieve: Pill A: 48.0 Pill A: 48.0 Pill B: 39.3 Pill C: 42.1 Proj. No.: 3043-10-1038 Date Sampled: Figure MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall MACT		Specific Gravity= 2.666	Source of Sample: Boring C-2 Depth: 25	0' 22 0'
Pill A: 48.0 Proj. No.: 3043-10-1038 Date Sampled: Pill B: 39.3 TRIAXIAL SHEAR TEST REPORT Pill C: 42.1 MACTEC ENGINEERING AND CONSULTING, INC. Figure Checked By: Kelly Marshall MACH Tested By: FB Checked By: Kelly Marshall MACH		Remarks: Percent passing No. 200 sieve:	Sample Number: UD	v-21.0
Pill C: 42.1 TRIAXIAL SHEAR TEST REPORT Figure MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall Checked By: Kelly Marshall MACTEC		Pill A: 48.0 Pill B: 39.3	Proj. No.: 3043-10-1038 Date Sample	:d:
Figure MACTEC ENGINEERING AND CONSULTING, INC. Tested By: FB Checked By: Kelly Marshall Mull		Pill C: 42.1		RT
Tested By: FB Checked By: Kelly Marshall A Mell		Figure	WAGTEG ENGINEERING AND CONS	ULTING, INC.
- 1 0 10/7/10		Tested By: FB Cho	ecked By: Kelly Marshall My Mill	2
			E. 1. 0 10/7/10	



				Ge	OSy con	mte sultar	
				Page	86	of	105
Written by:J. Sura / Y	7. Cao Date: <u>10/29/10</u> R	eviewed by:	Neil Davis]	Date:	10/29	0/10
Client: TVA	Project: Dredge Cells Recovery		Project/ Proposal No.:	GR4327	Tas	k No.:	105
Client: <u>TVA</u>	Project: Dredge Cells Recovery	ffective 0.08 33.4 0.66 0.66 0.06 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.09 0.08 0.09 0.09 0.08 0.09 0.09 0.08 0.09 0.08 0.09 0.09 0.08 0.09 0.09 0.08 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.09 0.08 0.	Project/ Proposal No.: Project/ Proposal No.: 2.8 2.8 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 2.82 3.1 3.8 3.8 3.8 3.8 3.8 3.8 3.8 3.8	GR4327 GR4327 2 19.9 110.9 99.6 0.5522 2.87 5.56 18.7 113.7 100.0 0.5148 2.85 5.52 0.01 60.00 70.00 70.00 2.25	_ Tas	k No.:	
	Type of Test:	0 Total Pore Ult. Stress, k Total Pore σ ₁ Failure, k	Pr., ksf 8.88 sf Pr., ksf 8.88 sf 97., ksf 1.95	2.25 9.29 3.05			
	CU with Pore Pressures Sample Type: UD	G ₃ Failure, ks	sf 0.48	0.79		_	
	Description: Gray clayey SAND with gravel	Project: TV	A KIF East Dike Stability Stud	у			
	Specific Gravity= 2.758	Source of S	Sample: Boring D-2 De	pth: 7.5'-9.5'			
	Remarks: Percent passing No. 200 sieve: Pill A: 42.5	Proj No 12	043 10 1039	Comelect			
	Pill B: 41.9	PT0J. NO.: 3	TRIAXIAL SHEAR TEST	Sampled:		_	
	Figure	MACTEO	ENGINEERING AND	CONSULTIN	IG, INC	c.	
	Tested By: FB Cl	hecked By: <u>Kell</u>	y Marshall hy /1 Frizansene	2/10 3/10 10/15/2010			





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			Page <u>88</u> of <u>105</u>
Written by: J. Sura / Y. Cao	Date: <u>10/29/10</u> Reviewed	by: Neil Davis	Date: 10/29/10
Client: <u>TVA</u> Project:	Dredge Cells Recovery	Project/ Proposal No.:	GR4327 Task No.: 105
	5.7 Total Effective		
a k	C, ksf 1.89 0 \$\phi\$, deg 18.3 33.4		
	Tan(\$\phi\$) 0.33 0.66 3.8		



Tested By: FB

Checked By: Kelly Marshall M Mll



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							Page	90	of	105
Written	by: J. Sura / Y. Ca	10	Date:	10/29/10	Reviewed by:	Neil Davis		Date:	10/29/	/10
Client:	TVA	Project:	Dredge	Cells Recove	ry	Project/ Proposal No.:	GR432	7 Tasl	x No.:	105

Attachment 3:

SLIDE Output Files (Static and Seismic)

Note: The error messages in the output files are a result of invalid slip surfaces generated by the SLIDE program during the automatic search for the most critical slip surface. The invalid slip surfaces include surfaces that are beyond the defined model boundaries, surfaces that are kinematically not feasible, and surfaces that mathematically do not converge to a solution. The invalid slip surfaces do not affect the valid slip surfaces from which the critical slip surface is identified.

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Written	by: J. Sura / Y	Y. Cao	Date:	10/29/10	_ Reviewed by:	Neil Davis		Date:	10/29/	/10
Client:	TVA	Project:	Dredge	e Cells Recov	ery	Project/ Proposal No.:	GR432	7 Tasl	k No.:	105

Circular Mode of Section D-D

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Page 92 of 105 Written by: J. Sura / Y. Cao **Date:** 10/29/10 **Reviewed by:** Neil Davis 10/29/10 Date: Project/ Proposal No.: GR4327 Task No.: 105 Client: TVA **Project:** Dredge Cells Recovery Material: Clayey Foundation Soil Slide Analysis Information Strength Type: Mohr-Coulomb Unit Weight: 125 lb/ft3 **Document Name** Cohesion: 0 psf Friction Angle: 30 degrees Unsaturated Shear Strength Angle: 0 degrees File Name: Section D Circular Fan.slw Air Entry Value: 0 psf Ks: 1.4e-009 Project Settings K2/K1: 10 K Angle: 90 Project Title: SLIDE - An Interactive Slope Stability Program Model: Simple Failure Direction: Left to Right Units of Measurement: Imperial Units Material: Sandy Foundation Soil Pore Fluid Unit Weight: 62.4 lb/ft3 Strength Type: Mohr-Coulomb Groundwater Method: Finite Element Analysis Unit Weight: 125 lb/ft3 Tolerance (groundwater): 1e-006 Cohesion: 0 psf Maximum number of iterations (groundwater): 500 Friction Angle: 26 degrees Data Output: Standard Unsaturated Shear Strength Angle: 0 degrees Calculate Excess Pore Pressure: Off Air Entry Value: 0 psf Allow Ru with Water Surfaces or Grids: Off Ks: 3.3e-007 Random Numbers: Pseudo-random Seed K2/K1: 10 Random Number Seed: 10116 K Angle: 90 Random Number Generation Method: Park and Miller v.3 Model: Simple Analysis Methods Material: Pond Ash Analysis Methods used: Strength Type: Mohr-Coulomb Spencer Unit Weight: 75 lb/ft3 Cohesion: 0 psf Number of slices: 25 Friction Angle: 25 degrees Tolerance: 0.005 Unsaturated Shear Strength Angle: 0 degrees Maximum number of iterations: 50 Air Entry Value: 0 psf Ks: 1.92e-006

Surface Options

Surface Type: Circular Search Method: Grid Search Radius increment: 10 Composite Surfaces: Disabled Reverse Curvature: Create Tension Crack Minimum Elevation: Not Defined Minimum Depth: 3

Groundwater Analysis

Maximum Number of Iterations: 500 Iteration Tolerance: 1e-006 Mesh Element Type: 3 noded triangles Number of Elements: 2411 Number of Nodes: 1367

Material Properties

Model: Simple

K2/K1: 10

K Angle: 90

Material: Lower Dike Fill Strength Type: Mohr-Coulomb Unit Weight: 120 lb/ft3 Cohesion: 0 psf Friction Angle: 30 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 5.6e-009 K2/K1: 10 K Angle: 90

Model: Simple

Material: Crust Layer Strength Type: Mohr-Coulomb Unit Weight: 120 lb/ft3

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								Page	93	01	105
Written	ı by:	J. Sura / Y. Cao		Date:	10/29/10	Reviewed by:	Neil Davis		Date:	10/2	9/10
Client:	TV	A P	roject:	Dredge	Cells Recov	very	Project/ Proposal No.:	GR432	<u>7</u> Τε	ask No.:	105
С	ohesio	on: 500 psf				or if hig	h external or anchor lo	ads are ap	plied		
F	riction	Angle: 10 degree	es			against	the failure direction.				
U	nsatu	rated Shear Strer	ngth Ang	gle: 0 de	grees						
A	ir Entr	y Value: 0 psf				-108 =	Total driving moment				
K	s: 1e-(006				or total	driving force < 0.1. Thi	s is to			
K	2/K1:	10				limit the	e calculation of extreme	ely high sat	ety		
K	Angle	e: 90				factors	if the driving force is ve	ery small			
		o				(0.1 is a	an arbitrary number).				
IV	lodel:	Simple				-111 =	safety factor equation of	did not con	verge		
G	loh	al Minimume	:				, ,		0		
U MECRLRLRDRD	lethod S: 1.80 enter: adius: eft Slip ight S eft Slo ight S esistir riving esistir riving	<u>spencer</u> 02600 1143.143, 773.7 40.242 o Surface Endpoi lip Surface Endpoi pe Intercept: 112 lope Intercept: 112 lope Intercept: 11306 Moment=72485. Ig Horizontal Force	42 nt: 1120 pint: 115 0.044 7 55.101 63 lb-ft 7 lb-ft ce=3136 =1740.1	0.044, 74 55.101, 7 40.790 737.000 5.73 lb 1 lb	0.790 '35.318	-112 = cos(alpha < 0.2 fc This scre some s of the an particul negative slices in -115 = -1000 = at a grid	The coefficient M-Alpha a)(1+tan(alpha)tan(phi) or the final iteration of the eens out lip surfaces which may alysis, in ar, deep seated slip su base angle in the passive zone. Surface too shallow, be No valid slip surfaces d center. Unable to dra	a = /F) ne safety fa not be val rfaces with elow the m are genera w a surfac	actor ca id in th i many inimun ated e.	alculatic ne conte r high n depth.	on. xt
<u>v</u>	alid	/ Invalid Su	rtaces	<u>s</u>							
Μ	lethod	: spencer				<u>List c</u>	of All Coordinate	<u>es</u>			
N	umbe	r of Valid Surface	s: 6840								
N	umbe	r of Invalid Surfac	ces: 143	02		<u>Materia</u>	<u>al Boundary</u>				
E	rror Co	odes:				1000					
E	rror Co	ode -103 reporte	d for 879	99 surfac	ces	1080	000 709.200				
E	rror Co	ode -107 reporte	d for 148	32 surfac	ces	1000					
E	rror C	ode -108 reporte	d for 769	surface	es	1000	000 730 500				
	rrar C	odo 111 roporto	d for 1 of	urfooo		1000	.000 100.000				

Error Code -111 reported for 4 surfaces Error Code -112 reported for 323 surfaces Error Code -115 reported for 131 surfaces Error Code -1000 reported for 2794 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified,

Material Boundary

1080.000

1113.000	700.000
1113.000	714.500
1113.000	727.980
1113.000	731.000
1113.000	741.376

746.000

Material Boundary

1080.000	730.500
1113.000	731.000
1178.955	731.000

Material Boundary

1080.000	714.500
1113.000	714.500

Material Boundary

1113.000 714.500

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Writte	n by: J. S	bura / Y. Cao	Date:	10/29/10	Reviewed by:	Neil	Davis	Da	ate:	10/29	/10
Client:	TVA	Project:	Dredge	e Cells Recove	ry	Projec	t/ Proposal No.:	GR4327	Task	No.:	105
	1270 000	714 500			707 /	Q1	748 000				
	1270.000	7 14.500			797.4		751 728				
N	Antorial Bou	Indany			790.0	00	751.720				
<u>IV</u>	700 000	748 000			782 6	32	755.000				
	700.000	748.000			702.0	68	756.000				
	191.401	740.000			775 9	00	756,800				
N	Antorial Bou	Indany			773.3	135	757 857				
<u>IV</u>		731 00/			768.6	202	758 810				
	700.000	730 866			765.0	57	758 062				
	1031 098	730,757			700.3	32	758 654				
	1080.000	730 500			754 1	84	758 686				
	1000.000	100.000			748 6	81	758 844				
N	Aaterial Bou	Indary			745.2	96	759 000				
<u></u>	700 000	724 000			733.3	169	759 000				
	1080.000	714 500			700.0	203	759 710				
	1000.000	714.000			718 1	06	760.000				
N	Aaterial Rou	Indary			710.1	80	760.000				
<u></u>	1031 098	730 757			715.8	241	759 689				
	1073 819	744 998			7137	'04	759.000				
	1070.010	711.000			710.7	267	759 000				
N	Aaterial Bou	Indary			7064	57	759 474				
<u></u>	0.000	724 000			704 (26	759 670				
	700 000	724 000			701.0	00	759 881				
	100.000	724.000			696.0	137	759 952				
N	Aaterial Bou	Indary			670.8	22	760.000				
<u></u>	700 000	700 000			667 0	03	761.000				
	700.000	724 000			651.1	05	762 000				
	700.000	730 866			643 7	19	764 000				
	700.000	748 000			423 8	103	765.000				
	700.000	759 881			408.8	03	758 000				
	100.000	100.001			308.8	03	758 000				
N	Aaterial Bou	Indary			298.6	21	765.000				
<u></u>	0.000	748.000			294.9	84	767.500				
	700 000	748 000			192 (90	767 500				
					187.5	590	766.000				
F	xternal Bo	undary			184.5	590	765.000				
-	1178,955	731.000			157.5	590	756.000				
	1145.812	737.000			147.5	590	756.000				
	1140.289	738.000			120.5	590	765.000				
	1134.765	739.000			117.5	590	766.000				
	1129.123	739.995			115.0	94	767.000				
	1127.112	740.202			112.1	95	770.000				
	1117.516	741.000			109.6	647	773.000				
	1113.000	741.376			65.72	9	773.282				
	1105.491	742.000			36.90	0	773.381				
	1101.027	743.000			28.53	84	773.062				
	1095.938	746.000			20.40	3	772.993				
	1080.000	746.000			19.86	9	772.834				
	1076.826	746.000			18.94	0	771.904				
	1073.819	744.998			12.97	7	767.877				
	1052.469	744.887			9.507	,	765.000				
	1026.854	745.000			7.712	2	764.000				
	1019.909	746.000			5.056	5	763.000				
	877.234	746.000			3.208	}	762.994				
	872.145	747.000			0.000)	762.759				

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Written by: J. Su	ra / Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis]	Date:	10/29	/10
Client: TVA	Project:	Dredg	e Cells Recov	very	Project/ Proposal No.:	GR4327	_ Tas	k No.:	105
0.000	748.000								
0.000	732.500								
0.000	731.094								
0.000	724.000								
0.000	700.000								
700.000	700.000								
1080.000	700.000								
1113.000	700.000								
1113.019	700.000								
1270.000	700.000								
1270.000	714.500								
1270.000	727.190								
1270.000	731.000								

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Written by:	J. Sura / Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis		Date:	10/29	/10
Client: TV	A Project :	Dredge	Cells Recove	ery	Project/ Proposal No.:	GR432	27 Tas	sk No.:	105

Block Mode of Section D-D



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Written by:	J. Sura / Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis	Date:	10/29/10

Client: TVA Project: Dredge Cells Recovery

Slide Analysis Information

Document Name

File Name: Section D_Block_Fan.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program

Failure Direction: Left to Right Units of Measurement: Imperial Units Pore Fluid Unit Weight: 62.4 lb/ft3 Groundwater Method: Finite Element Analysis Tolerance (groundwater): 1e-006 Maximum number of iterations (groundwater): 500 Data Output: Standard Calculate Excess Pore Pressure: Off Allow Ru with Water Surfaces or Grids: Off Random Numbers: Pseudo-random Seed Random Number Seed: 10116 Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used: Spencer

Number of slices: 25 Tolerance: 0.005 Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search Number of Surfaces: 16000 Pseudo-Random Surfaces: Enabled Convex Surfaces Only: Disabled Left Projection Angle (Start Angle): 115 Left Projection Angle (End Angle): 155 Right Projection Angle (Start Angle): 25 Right Projection Angle (End Angle): 65 Minimum Elevation: Not Defined Minimum Depth: 3

Groundwater Analysis

Maximum Number of Iterations: 500 Iteration Tolerance: 1e-006 Mesh Element Type: 3 noded triangles Number of Elements: 2411 Number of Nodes: 1367

Material Properties

Material: Clayey Foundation Soil Strength Type: Mohr-Coulomb Unit Weight: 125 lb/ft3 Cohesion: 0 psf Friction Angle: 30 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 1.4e-009 K2/K1: 10 K Angle: 90

Project/ Proposal No.: GR4327 Task No.: 105

Model: Simple

Material: Sandy Foundation Soil Strength Type: Mohr-Coulomb Unit Weight: 125 lb/ft3 Cohesion: 0 psf Friction Angle: 26 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 3.3e-007 K2/K1: 10 K Angle: 90

Model: Simple

Material: Pond Ash Strength Type: Mohr-Coulomb Unit Weight: 75 lb/ft3 Cohesion: 0 psf Friction Angle: 25 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 1.92e-006 K2/K1: 10 K Angle: 90

Model: Simple

Material: Lower Dike Fill Strength Type: Mohr-Coulomb Unit Weight: 120 lb/ft3 Cohesion: 0 psf Friction Angle: 30 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 5.6e-007 K2/K1: 10 K Angle: 90

Model: Simple

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										Page	98	of	105
Writter	ı by:	J. Sura /	Y. Cao	Date:	10/29/10	Reviewed b	y:	Neil Da	ivis		Date:	10/2	9/10
Client:	T	VA	Project:	Dredge	e Cells Recove	ry		Project/	Proposal No.:	GR432	7 Tas	k No.:	105
						li	mit	the calcu	lation of extrem	nelv hiah	safetv		
	Mate	rial [.] Crust	Laver			fa	acto	ors if the c	triving force is	verv sma	ll		
	Stren	ath Type:	Mohr-Coulomb			(().1	is an arbi	trarv number).	vory onno			
	Unit \	Weight: 12	0 lb/ft3			, ,			,				
	Cohe	sion: 500	psf				111	= safety	factor equatior	n did not (converge	Э	
	Fricti	on Angle:	10 degrees										
	Unsa	turated Sh	near Strength A	ngle: 0 c	legrees	-'	112	= The co	efficient M-Alp	ha =			
	Air E	ntry Value	: 0 psf			COS	s(al	pha)(1+ta	in(alpha)tan(pl	ni)/F)			
	Ks: 1	e-006				<	0.2	2 for the fi	nal iteration of	the safe	ty factor		
	K2/K	1:10 ala:00				cai	CUI	ation. I nis	s screens out		مناطنه	the	
	r Ang	gie: 90				S		e siip sun	aces which ma	ay not be	valid in	ine	
	Mode	al· Simple				00	arti	cular dee	n seated slin (surfaces	with mar	w hiah	
	wout					ne	nati	ve hase a	anale	Sunaces	with mar	iy nigi	
	<u>Glo</u>	bal Min	imums			S	lice	s in the p	assive zone.				
	Meth	od: spence	<u>er</u>				ic	+ ~f ^II	Coordina	tac			
	F5: 1	.833330	1101 510 750 7	15		<u> </u>	.13		Coordina	163			
	L off Q	Lucation. Slin Surfac	- Endnoint: 100	10 027 1	746 000	F	00	is/Block	Search Window	W			
	Right	Slin Surfa	ace Endpoint: 1	107 735	741 813	<u>1</u>	10	44 324	727 160	<u>v</u>			
	Resis	sting Mom	ent=24291.1 lb-	ft	, / 11.010		10	98.457	727.160				
	Drivir	ng Momen	t=13249.8 lb-ft				10	96.053	745.460				
	Resis	sting Horiz	ontal Force=124	48.29 lb			10	43.467	742.592				
	Drivir	ng Horizon	tal Force=680.8	889 lb									
						<u>F</u>	οςι	us/Block S	Search Windov	<u>v</u>			
	Vali	id / Inva	alid Surface	es			11	00.370	728.721				
							11	76.738	731.000				
	Meth	od: spence	<u>er</u>				11	17.557	740.473				
	Numl	ber of Vali	d Surfaces: 987	8			10	97.192	742.341				
	Numl	ber of Inva	ilid Surfaces: 61	22		N	late	erial Boun	darv				
	Error	Codes:	E reported for 1			<u></u>	10	80.000	700.000				
	Error	Code - 10	7 reported for 7		es		10	80.000	709.200				
	Error		8 reported for 5	191 sund			10	80.000	714.500				
	Error	Code -11	1 reported for 1	72 surfa	Ces		10	80.000	728.200				
	Error	Code -11	2 reported for 1	2 surfac	es		10	80.000	730.500				
							10	80.000	746.000				
	Erro	or Code	s				10+-	vial Davia	don				
						<u>IV</u>	11	13 000					
	The f	ollowing e	rrors were enco	untered	during the		11	13.000	714,500				
co	ompu	tation:			-		11	13.000	727.980				
							11	13.000	731.000				
	-105	= More that	an two surface /	slope			11	13.000	741.376				
	inters	sections wi	th no valid slip	surface.									
						N	late	rial Roun	darv				

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to

Material Boundary

730.500
731.000
731.000

Material Boundary

1080.000	714.500
1113.000	714.500

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Writter	n by: J. Sura	a / Y. Cao	Date:	10/29/10	Reviewed by:	Neil D	Davis	D	ate:	10/29	/10
Client:	TVA	Project:	Dredge	e Cells Recov	ery	Project	/ Proposal No.:	GR4327	Task N	No.:	105
	Matarial Davis				0-	77 00 4	740.000				
	Material Bour				87	7.234	746.000				
	1113.000	/14.500			8/	2.145	747.000				
	1270.000	/14.500			75	97.481	748.000				
					79	90.090	751.728				
	Material Bour	<u>ndary</u>			78	34.400	754.278				
	700.000	748.000			78	32.532	755.000				
	797.481	748.000			77	79.168	756.000				
					77	75.893	756.899				
	Material Bour	ndarv			77	73.335	757.857				
	0.000	731.094			76	38.603	758.819				
	700 000	730 866			76	5 957	758 962				
	1031 008	730 757			74	58 332	758 654				
	1091.090	730.757			75	5/ 10/	758 686				
	1000.000	730.500			7	10 604	750.000				
					74	+0.001	700.044				
	Material Bour				74	15.296	759.000				
	700.000	724.000			13	33.369	759.000				
	1080.000	714.500			72	21.203	759.710				
					71	18.106	760.000				
	Material Bour	ndary_			71	17.580	760.000				
	1031.098	730.757			71	15.841	759.689				
	1073.819	744.998			71	13.704	759.000				
					71	10.267	759.000				
	Material Bour	ndarv			70)6.457	759.474				
	0.000	724.000			70)4.026	759.670				
	700.000	724,000			70	00.000	759.881				
					69	96 937	759 952				
	Material Bour	ndarv			67	70 822	760.000				
	700 000	700 000			67 67	37 003	761.000				
	700.000	700.000			64	51 105	762.000				
	700.000	720.866			6/	12 710	764.000				
	700.000	730.000			0 <u>-</u>	+J.7 19	765.000				
	700.000	740.000			42	23.003	765.000				
	700.000	759.881			40	18.803	758.000				
					30	18.803	758.000				
	Material Bour	<u>ndary</u>			29	98.621	765.000				
	0.000	748.000			29	94.984	767.500				
	700.000	748.000			19	92.090	767.500				
					18	37.590	766.000				
	External Bour	ndary_			18	34.590	765.000				
	1178.955	731.000			15	57.590	756.000				
	1145.812	737.000			14	17.590	756.000				
	1140.289	738.000			12	20.590	765.000				
	1134.765	739.000			11	17.590	766.000				
	1129.123	739.995			11	15.094	767.000				
	1127.112	740.202			11	2.195	770.000				
	1117,516	741,000			1()9.647	773.000				
	1113 000	741.376			65	5 729	773 282				
	1105 491	742 000			36	3 900	773 381				
	1100.401	743.000			29	2 531	773.062				
	1005.020	745.000			20	0.004	773.002				
	1095.936	746.000			20	0.403	772.993				
	1000.000	740.000				7.009 0.40	112.034				
	10/6.826	746.000			18	3.940	//1.904				
	1073.819	/44.998			12	2.977	/6/.877				
	1052.469	/44.887			9.	507	765.000				
	1026.854	745.000			7.	712	764.000				
	1019.909	746.000			5.	056	763.000				

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Written	by: J. Sura	a / Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis]	Date:	10/29	/10
Client:	TVA	Project:	Dredge	e Cells Recov	/ery	Project/ Proposal No.:	GR4327	Tas	k No.:	105
	3.208	762.994								
	0.000	762.759								
	0.000	748.000								
	0.000	732.500								
	0.000	731.094								
	0.000	724.000								
	0.000	700.000								
	700.000	700.000								
	1080.000	700.000								
	1113.000	700.000								
	1113.019	700.000								
	1270.000	700.000								
	1270.000	714.500								
	1270.000	727.190								
	1270.000	731.000								

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Circular Mode of Section D-D



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Client: TV	A Project:	Dredge	Cells Recover	ry	Project/ Proposal No.:	GR4327	Task No	.: 105

Slide Analysis Information

Document Name

File Name: Section D_Circular_Seis_UD_Fan.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program Failure Direction: Left to Right Units of Measurement: Imperial Units Pore Fluid Unit Weight: 62.4 lb/ft3 Groundwater Method: Finite Element Analysis Tolerance (groundwater): 1e-006 Maximum number of iterations (groundwater): 500 Data Output: Standard Calculate Excess Pore Pressure: Off Allow Ru with Water Surfaces or Grids: Off Random Numbers: Pseudo-random Seed Random Number Seed: 10116 Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used: Spencer

Number of slices: 25 Tolerance: 0.005 Maximum number of iterations: 50

Surface Options

Surface Type: Circular Search Method: Grid Search Radius increment: 10 Composite Surfaces: Disabled Reverse Curvature: Create Tension Crack Minimum Elevation: Not Defined Minimum Depth: 3

Loading

Seismic Load Coefficient (Horizontal): 0.031

Groundwater Analysis

Maximum Number of Iterations: 500 Iteration Tolerance: 1e-006 Mesh Element Type: 3 noded triangles Number of Elements: 2411 Number of Nodes: 1367

Material Properties

Material: Clayey Foundation Soil Strength Type: Strength=F(overburden) Unit Weight: 125 lb/ft3 Tau/Sigma Ratio: 0.25 Minimum Shear Strength: 0 psf Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 1.4e-009 K2/K1: 10 K Angle: 90

Model: Simple

Material: Sandy Foundation Soil Strength Type: Mohr-Coulomb Unit Weight: 125 lb/ft3 Cohesion: 0 psf Friction Angle: 26 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 3.3e-007 K2/K1: 10 K Angle: 90

Model: Simple

Material: Pond Ash Strength Type: Strength=F(overburden) Unit Weight: 75 lb/ft3 Tau/Sigma Ratio: 0.8 Minimum Shear Strength: 0 psf Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 1.92e-006 K2/K1: 10 K Angle: 90

Model: Simple

Material: Lower Dike Fill Strength Type: Strength=F(overburden) Unit Weight: 120 lb/ft3 Tau/Sigma Ratio: 0.78 Minimum Shear Strength: 0 psf Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 5.6e-009 K2/K1: 10 K Angle: 90

Model: Simple

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Written by:	J. Sura / Y. Cao	Date:	10/29/10	Reviewed by:	Neil Davis]	Date: 10/29	/10
Client: T	VA Project:	Dredge	e Cells Recove	erv	Project/ Proposal No.:	GR4327	Task No.:	105

Project: Dredge Cells Recovery Project/ Proposal No.: GR4327 Task No.: 105

Material: Crust Layer Strength Type: Mohr-Coulomb Unit Weight: 120 lb/ft3 Cohesion: 500 psf Friction Angle: 10 degrees Unsaturated Shear Strength Angle: 0 degrees Air Entry Value: 0 psf Ks: 1e-006 K2/K1: 10 K Angle: 90

Model: Simple

Global Minimums

Method: spencer FS: 1.001620 Center: 1153.143, 783.742 Radius: 63.428 Left Slip Surface Endpoint: 1105.360, 742.029 Right Slip Surface Endpoint: 1188.376, 731.000 Left Slope Intercept: 1105.360 742.029 Right Slope Intercept: 1188.376 737.000 Resisting Moment=833734 lb-ft Driving Moment=832389 lb-ft Resisting Horizontal Force=11826 lb Driving Horizontal Force=11806.9 lb

Valid / Invalid Surfaces

Method: spencer Number of Valid Surfaces: 7766 Number of Invalid Surfaces: 13376 Error Codes: Error Code -103 reported for 1788 surfaces Error Code -107 reported for 721 surfaces Error Code -108 reported for 817 surfaces Error Code -111 reported for 145 surfaces Error Code -113 reported for 63 surfaces Error Code -115 reported for 63 surfaces Error Code -1000 reported for 9779 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-115 = Surface too shallow, below the minimum depth.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Material Boundary

1080.000	700.000
1080.000	709.200
1080.000	714.500
1080.000	728.200
1080.000	730.500
1080.000	746.000

Material Boundary

700.000
714.500
727.980
731.000
741.376

Material Boundary

1080.000	730.500
1113.000	731.000
1178.955	731.000

Material Boundary

1080.000	714.500
1113.000	714.500

Material Boundary

1113.000	714.500
1270.000	714.500

Material Boundary

748.000 700.000

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	797.481	748.000			779.1	68	756.000			
					775.8	393	756.899			
Μ	laterial Boun	dary			773.3	335	757.857			
	0.000	731.094			768.6	603	758.819			
	700.000	730.866			765.9	957	758.962			
	1031.098	730.757			758.3	332	758.654			
	1080.000	730.500			754.1	84	758.686			
					748.6	581	758.844			
Μ	laterial Boun	dary			745.2	296	759.000			
	700.000	724.000			733.3	369	759.000			
	1080.000	714.500			721.2	203	759.710			
					718.1	06	760.000			
Μ	laterial Boun	idary			717.5	580	760.000			
	1031.098	730.757			715.8	341	759.689			
	1073.819	744.998			713.7	704	759.000			
					710.2	267	759.000			
M	laterial Boun	idary_			706.4	157	759.474			
	0.000	724.000			704.0)26	759.670			
	700.000	724.000			700.0	000	759.881			
					696.9	937	759.952			
M	laterial Boun	idary_			670.8	322	760.000			
	700.000	700.000			667.0	003	761.000			
	700.000	724.000			651.1	05	762.000			
	700.000	730.866			643.7	719	764.000			
	700.000	748.000			423.8	303	765.000			
	700.000	759.881			408.8	303	758.000			
					308.8	303	758.000			
M	laterial Boun	idary_			298.6	621	765.000			
	0.000	748.000			294.9	984	767.500			
	700.000	748.000			192.0	090	767.500			
					187.5	590	766.000			
<u>E</u>	xternal Bour	ndary_			184.5	590	765.000			
	1178.955	731.000			157.5	590	756.000			
	1145.812	737.000			147.5	590	756.000			
	1140.289	738.000			120.5	590	765.000			
	1134.765	739.000			117.5	590	766.000			
	1129.123	739.995			115.0)94	767.000			
	1127.112	740.202			112.1	95	770.000			
	1117.516	741.000			109.6	647	773.000			
	1113.000	741.376			65.72	29	773.282			
	1105.491	742.000			36.90	00	773.381			
	1101.027	743.000			28.53	34	773.062			
	1095.938	746.000			20.40)3	772.993			
	1080.000	746.000			19.86	69	772.834			
	1076.826	746.000			18.94	10	771.904			
	1073.819	744.998			12.97	77	767.877			
	1052.469	744.887			9.507	7	765.000			
	1026.854	745.000			7.712	2	764.000			
	1019.909	746.000			5.056	6	763.000			
	877.234	746.000			3.208	3	762.994			
	872.145	747.000			0.000)	762.759			
	797.481	748.000			0.000)	748.000			
	790.090	751.728			0.000)	732.500			
	784.400	754.278			0.000)	731.094			
	782.532	755.000			0.000)	724.000			

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Client:	TVA	Project:	Dredge	e Cells Recover	ry	Project/ Proposal No.:	GR4327	Task	No.:	105
	0.000 700.000 1080.000 1113.000 1113.019 1270.000 1270.000 1270.000 1270.000	700.000 700.000 700.000 700.000 700.000 714.500 727.190 731.000								