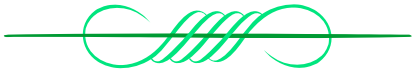
SAVANNAH HARBOR EXPANSION
BANK STABILITY REPORT



ANALYSES & REEVALUATION SUMMARY

w/Updates and Comments

28 July 2010

Savannah Harbor Expansion General Bank Stability Report

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Appendices

CESAS-EN-GS 15 APRIL 2003
W/Comments 28 JULY 2010

SUMMARY
SAVANNAH RIVER SIDE SLOPE STABILITIES
SAVANNAH HARBOR EXPANSION PROJECT

1. Introduction

The Savannah District Soils Section (EN-GS) has completed computations, sketches and preliminary drawings regarding channel side slopes for use in preparation of plans and specifications. Computations are based on drilling data, test results from soil samples taken at drilling locations, the 2002 Annual Survey data, hill survey data as requested for specific locations, observation/review of channel side slopes resulting from previous harbor widening and deepening projects, and other information from previous dredging works regarding channel side slope performance. NOTE: References to mean low water (mlw) used herein have since been revised to mean lower low water reference (mllw) for later work. The difference is minor, 0.2 tenths of an inch. Such references have not been changed herein to maintain consistency between drilling logs, survey data, and other information used during analyses.

2..General

a. Channel side slopes historically average approximately 1 vertical on 3 horizontal (1V on 3H) for the Savannah River Inner Harbor and are generally considered the norm within the inner harbor. Areas where possible exceptions might occur have been identified by borings taken during the subsurface investigation program. Other areas of concern have been identified by the Savannah District Planning Division. Addressed in these analyses are the known locations or reaches of problem areas regarding channel side slopes, sloughing of materials, and/or real estate acquisition requirements. Each is discussed separately in the following paragraphs. Areas that are not specifically addressed herein were also reviewed in detail using the proposed channel geometries and the most recent survey/sounding information. Review of these areas indicates the proposed expansion will not have a direct effect on lands above mean low water (mlw) and/or structures located on the river.

b. Specifically not addressed are the effects of time, tide, erosion, wind, rain, ships wake, earthquake, structural deterioration, or any other natural or unnatural forces not directly related to the removal of material by dredging as proposed. Exceptions to this occur only at Federally owned facilities, i.e. the Corps of Engineers (COE) Engineer Yard or other Federally recognized areas or facilities of historical interest. With regard to time, tide, erosion, etc. as stated above, all other real estate properties are considered the responsibility of respective owners, which historically has always been the case.

c. Inspections were performed as a part of obtaining riverbank and structural information within the limits of this project. The data obtained is described and discussed in the trip report written as a Memorandum for Record and dated 06 December 2001. A copy of the report, photographs, and descriptions are included as Appendix G, Inspection Summary.

3. Subsurface Investigation

The U.S. Army Corps of Engineers, Savannah District, has performed a number of subsurface investigations within the project area. Recently, borings have also been performed using contract drillers. Several hundred borings have been drilled within and adjacent to the Savannah Harbor. The majority of these borings were drilled along the north side of the channel for the Savannah Harbor Widening and the Savannah Harbor Deepening projects. These borings were drilled to obtain information necessary for evaluating the in-situ materials within specific areas of the channel for harbor modification projects. The majority of the borings were water-borne. The land-based borings were completed to identify soil materials within the channel side slopes to help determine the most probable channel side slopes resulting for each proposed harbor modification. The investigations have used a variety of methods to obtain subsurface data, including Vibracore, splitspooning, coring, cone penetration tests, and other methods. Standard penetration sampling using a split-barrel sampler was the method most often used. Using this method, a 1-3/8 inch inner diameter standard split barrel sampler was driven through the material using a 140-pound hammer with a 30-inch fall. The sampler was retrieved and the material was described in accordance with the Unified Soil Classification System. Subsurface investigations were performed at selected locations based on the early-proposed revisions to the channel limits. Drilling Logs are located in Appendix A. Standard penetration test borings were performed at the locations indicated on the included maps. See Appendix F. Soil samples were obtained from each boring and selected samples were tested for moisture content, plasticity, soil grain-size distribution, and strength characteristics.

4. Analyses Overview

All slope analyses for the turning basin were performed using the Modified Slope Stability Package with Kansas City Analysis (DGSLOPE) and the computer program UTEXAS3. Both programs were used for original analyses and for the checking and verification of results. Final input data sets and the results are provided separately. Illustrations of cross-sections, slip circles and/or wedge location(s) are provided separately.

5.0. Channel Summaries by Stations

5.1. Channel Stations 101+250 through 102+000 (Argyle Island).

Review and analysis indicate that side slopes after widening should closely match side slopes before dredging. The cross-section sketches indicate expected side slopes after the dredging has been performed. See Appendix C for Maps and Appendix D for Cross Section Drawings. Indications are that the proposed widening will result in the existing top of slope being relocated landward. Specifically, approximately 2.5 acres is expected to be taken above the mean low water (mlw) line. Of the 2.5 acres, approximately 0.3 acre occurs above elevation plus 8.0 mlw. Coordinates of the line that describe the taking limit are shown on the map and do not include any provision for rights-of-way or construction limits. The maps and cross-sections have been reviewed by Coastal Hydraulics Section and appropriate areas were provided to Real Estate for acquisition purposes. Coastal Hydraulics Section can also use for planning and computation of dredge volumes.

5.2 Channel Stations 97+500 through 101+250 (Kings Island Turning Basin).

a. Existing Conditions. Analysis indicates a global or overall factor of safety (FS) against slope failure of 2.2 for the riverbank and dike adjacent to Kings Island Turning Basin. However, for the softer soils located generally within the tidal zone, the calculated factor of safety is approximately 1.1. While the lower FS does not necessarily indicate a local failure problem, the fact that soft soil material occurs in the tidal zone could indicate an ongoing erosion problem due mainly to tidal and wave action. The analyses also indicate that the calculated slope exposed to the river should remain stable on an approximate 1 vertical on 3.2 horizontal slope (1V on 3H). The measured distance from the top of the riverbank to the toe of the Disposal Area 2A dike is approximately 110 feet.

b. Proposed Conditions. In accordance with the proposed widening studies, analyses were performed assuming a new bottom depth for the turning basin of -55 mlw. Assuming the final side slope would be 1V on 3H, the analysis indicates results similar to existing conditions. The overall FS against slope and dike failure was calculated at 1.9. The local factor of safety for the soft area within the tidal zone was calculated at 1.1. The calculated distance remaining from the top of the riverbank measured to the toe of the existing dike is approximately 45 feet. Please note that depending on how the turning basin is dredged and whether or not the slopes are dredged, the bank side slopes could stand somewhat steeper for a short time. However, any materials remaining steeper than the 1V on 3H will likely collapse and fall into the turning basin. Erosion within the tidal zone (soft marsh material) will likely involve the loss of approximately 20 additional feet of riverbank within a short time. Such erosion would leave approximately 25 feet between the top of slope and the toe of the existing disposal area dike.

c. Summary. Calculations indicate that dredging within the Kings Island Turning Basin to an elevation of -60 mlw will not adversely affect the embankment stability nor the stability of the Disposal Area 2A dike. The material within a 1V on 3H slope measured from the bottom of the turning basin limits should be included in dredge quantities. Approximately 60 to 80 feet of channel bank measured landward from the top of the existing river slope will likely be lost as a result of dredging to -60 mlw. Coordinates of the line that describe the taking limit are shown on the map and do not include any provision for rights-of-way or construction limits. The map should be reviewed and provided to Real Estate for acquisition purposes prior to beginning the proposed work. Cross-sections will be provided to Coastal Hydraulics Section for their use in planning and computation of dredge volumes.

5.3 Channel Stations 92+500 through 97+500.

The sketch for Station 96+500 indicates a recommended side slope of 1V on 3H. The recommendation is based on review of previously obtained subsurface data, existing side slopes, test results, and comparison with similar channel soil profiles for which DGSLOPE was performed. Cross Section 96+500 was chosen to represent the worst case for the reach suspected as a possible problem area with regard to sloughing of materials. The currently proposed expansion maintains the existing side slope to the new depths to elevation -58 mlw. Provided over-swing of the dredge cutterhead (beyond the channel toe) can be tightly controlled, real estate acquisition should not be required.

5.4 Channel Stations 89+500 through 91+500. Georgia Side Only.

Analysis indicates that a normal channel side slope of 1V on 3H should be used for the reach between 89+500 through 91+500. The currently proposed expansion maintains the existing side slope to the new proposed depth. Provided over-swing of the dredge cutterhead (beyond the channel toe) can be tightly controlled, real estate acquisition should not be required.

5.5 Channel Stations 87+250 through 88+750.

Analysis indicates that a channel side slope of 1V on 3H should be used from the channel bottom to approximately elevation 0 mlw. Above 0 mlw, a side slope of 1V on 4H should be used. The currently proposed expansion maintains the existing channel toe to the new proposed depth. The estimated top of slope occurs at approximately 0 mlw. However, variations in the shoreline may require real estate acquisition. Coordinates for the estimated top of slope are given on the map for this reach.

5.6 Channel Stations 86+000 through 87+500.

Analysis indicates that a channel side slope of 1V on 3H should be used for the reach between 86+000 through 87+500. The currently proposed expansion maintains the existing side slope the to new depths of study defined as elevations -44, -45, -46, -47, and -48 and considers 2 feet of overdepth and 2 feet of squat for each depth. Provided over-swing of the dredge cutterhead (beyond the channel toe) can be tightly controlled, real estate should not be directly impacted. However, variations in the shoreline may require real estate acquisition. Coordinates for the estimated top of slope are given on the map for this reach.

5.7 Channel Stations 77+500 through 79+000, Northeast Side.

Review and analysis indicate that side slopes after deepening should closely match side slopes before dredging. The cross-section sketches indicate expected side slopes after the expansion dredging has been performed. See Appendix D, Cross Section Drawings for sketches. This area was previously within a proposed widener, which was deleted from the WES channel model. However, subsurface information was obtained and a cross-section was setup for analysis if needed, as may be decided later. If a widener does occur in this reach, preliminary analysis indicates the existing Savannah Marine bulkhead may be at risk.

5.8 Channel Stations 75+000 through 76+200.

Review and analysis indicate that side slopes after deepening should closely match side slopes before dredging. The cross-section sketch indicates expected side slope after the expansion dredging has been performed. This area was previously within a proposed widener, which was deleted from the WES channel model. However, subsurface information was obtained and a cross-section was setup for analysis if needed, as may be decided later. If a widener does occur in this reach, preliminary analysis indicates the existing T.I.C. bulkhead may be at risk.

5.9 Channel Stations 72+750 through 73+750, Upstream of the COE Engineer Yard.

Review and analysis indicate that side slopes after deepening should closely match side slopes before dredging. The cross-section sketch indicates expected side slope after the expansion dredging has been performed. This area is not within a proposed widener, however the bank materials are known to contain artifacts of historical interest. Over-swinging of the proposed channel toe could expose such artifacts. Caution is advised through this particular reach with regard to dredging operations.

5.10 Channel Stations 69+700 through 71+200, North Side.

Review and analysis indicate that side slopes after deepening should closely match side slopes before dredging. The cross-section sketch indicates expected side slope after the expansion dredging has been performed. This area was previously within a proposed widener, which was deleted from the WES channel model. However, subsurface information was obtained and a cross-section was setup for analysis if needed, as may be decided later. If a widener does occur in this reach, preliminary analysis indicates a real estate taking of approximately 1.5 acres above 0 mlw, of which 0.7 acre is located above elevation +8.0 mlw. An access easement of approximately 30 feet in width may also be required.

5.11 Channel Stations 58+000 to 59+000 (Fort Jackson / CSS Georgia location.)

a. This reach has typically been excluded from dredging over the past several years to avoid either (1) disturbing the CSS Georgia and/or (2) affecting the structure located at Old Fort Jackson. A review of previous and present channel soundings indicates that where a short section is left higher than the adjacent bottom depths, the higher area will eventually scour to the elevation of the adjacent depths at either end. The CSS Georgia appears to be 'perched' on a stiff layer located near the north toe of the river channel. Disposition of the CSS Georgia is currently being addressed by Planning Division.

b. Plans have been completed for the extended protection of Old Fort Jackson. However, at the present time, protection of Old Fort Jackson is considered an issue separate from the Savannah Harbor Expansion project.

5.12 Channel Stations 49+500 through 52+800, South Channel Training Wall & Southern LNG Pipe Crossing.

a. The proposed widener and new channel toe through this reach is approximately 156 feet southeast of the existing channel toe. It is expected that dredging operations will encounter both rock and timber and/or remnants of the rock and timber cribbing placed during construction of the South Channel Training Wall. Dredging in this area may require special consideration with regard to equipment, i.e. clamshell dredging may be more appropriate than hydraulic cutterhead methods.

b. The LNG pipeline crossing the river bottom at approximate Station 51+000 will need to be addressed before dredging begins. Location will need to be established and relocation may be required.

5.13 Channel Stations 34+500 through 41+900, LNG Turning Basin.

A review of the proposed expansion through the recently completed LNG turning basin indicates minimal impact. Top of slope occurs generally between -42 and -46 mlw elevations and well within the turning basin boundaries.

5.14 Channel Stations 34+500 through -85+500 (all below 34+500).

Top of slope occurs at elevations well below mlw and away from real estate and shorelines. By inspection, taking will not be required.

6. Additional Geotechnical Requirements.

Changes in channel geometry due to deepening, widening, realignment, slope stability, or feature avoidance require re-evaluation of existing data. As channel geometry continues to change, older geotechnical data is no longer adequate to evaluate these changes for a number a reasons. One concern is that there may be an insufficient number of borings located in areas that involve real estate taking or acquisition. Another concern is that older borings, drilled for a much shallower project, were completed at depths that are shallower than proposed project depths. Also, as channels become deeper to accommodate larger vessels, bend wideners are often added in areas that have not been previously investigated. These concerns were considered prior to the performance of the investigations conducted for the re-evaluation of this project. However, as additional changes in channel geometry are identified, these concerns will be re-evaluated and additional subsurface investigations will be required.

APPENDIX A

BORING LOGS

BORING LOGS

CS-7
SH-34
SH-102
SH-112
SH-122
SH-127
SH-128
SH-138
SH-149
SH-150
SH-218
SH-373
SH-374
SH-384
SH-385
SH-386
SH-400
SH-401
SH-402
SH-403
SH-404
SH-405
SH-406
SH-406-UD
SH-407
SH-407-UD
SH-408
SH-410
SH-410A
SH-411
SH-412

Hole No. CS-7

DRILLING LOG

DIVISION: SOUTH ATLANTIC

INSTALLATION: SAVANNAH RIVER & HARBOR

SHEET 1 OF 2 SHEETS

1. PROJECT: KINGS ISLAND TURNING BASIN
2. LOCATION (Coordinates or Station) SEE PLAN: OPPOSITE STA. 92+500 AT WATERS EDGE
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): CS 7
5. NAME OF DRILLER: L. McDONALD
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 45.5' BELOW MLW
10. SIZE AND TYPE OF BIT: 1 3/8" ID SPLITSPOON
11. DATUM FOR ELEVATION SHOWN (USGS or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FALLING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 27 APRIL 1973; COMPLETED 27 APRIL 1973
17. ELEVATION TOP OF HOLE: 0.0' = MLW
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR: Carlos D. Griffin

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	BLOWS
-0.8			WATER DEPTH 0.8' AT MLW				
	5		ML - GRAY INORGANIC SILT W/SILTY SAND LAYERS		1		1 1 1 1 1 1 1 1
	10						
	15		CH - GRAY FAT CLAY W/GRAVEL		2		7 8
			SM - GRAY SILTY FINE MEDIUM SAND,				13 12 19
	20				3		32 34 36
	25						41 44 46
	30		GREEN, SLIGHTLY MICACEOUS		4		49

CONTINUED ON SHEET NO 2

DRILLING LOG (Cont Sheet,) LOCATION TOP OF HOLE O.B BELOW MLW Hole No. CS 7

PROJECT KINGS ISLAND TURNING BASIN INSTALLATION SAVANNAH RIVER HARBOR SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH 30	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g BLOWS
						51
			SM- GREEN SILTY FINE SAND, SLIGHTLY MICACEOUS			54
	35					62
						64
						59
						61
	40					62
						60
						58
-45.5	45				5	51

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

BLOWS PER FOOT: Number required to drive 1⅜" ID splitspoon w/140 lb hammer falling 30".

Hole No. SH-34

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Savannah, GA

SHEET 1 OF 2 SHEETS

1. PROJECT: Savannah Harbor
2. LOCATION (Coordinates or Station): Sta 70+000N, R="26" (X-838665 Y-758100)
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): SH-34
5. NAME OF DRILLER: Perry Rountree
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 55.0
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: -55.0' MLW
10. SIZE AND TYPE OF BIT: 1 3/8" ID splitspoon
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: Sprague and Henwood
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 31 Oct 77; COMPLETED 2 Nov 77
17. ELEVATION TOP OF HOLE: 0.0 MLW
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: CHARLES D. GRIFFIN

ELEVATION 0.0 MLW a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Water			
-4.0			Bottom of river -4.0'		JAR	BLOWS
	5'		SM - Gray silty fine sand		1	7
						5
-8.5			MH - Gray soft clayey silt			7
	10'				2	1
-10.5			SM - Gray silty fine and medium sand			4
					3	8
						15
	15'		With some soft silt pockets		4	35
						30
			Gray and brown			33
	20'					31
						31
						25
	25'		Gray fine silty sand		5	21
						20
						24
			Gray fine sand with soft silt pockets		6	25
-30.0	30'		Continued on sheet 2			

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

BLOWS PER FOOT: Number required to drive 1 3/8" ID splitspoon w/ 140 lb hammer falling 30'

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 0.0 MLW | Hole No. SH-34

PROJECT Savannah Harbor | INSTALLATION Savannah, GA | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH 38'	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g BLOWS
	35'		SM - Gray fine silty sand with soft silt pockets			19 18 12
-38.5	40'		SP - Light tan poorly graded sand		7	20 28 34 30 18
-41.5			MH - Dark gray soft clayey silt		8	3 5
-45.0	45'		SP - Tan poorly graded sand		9	19 20
-48.0	50'		SM - Dark green very fine cemented silty sand, hard slightly clayey		10	68 87 79
-55.0	55'		Bottom of hole -55.0' MLW		11	93 90

Hole No. SH-102

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Savannah, GA	SHEET 1 OF 2 SHEETS

1. PROJECT: Savannah Harbor Widening
2. LOCATION (Coordinates or Station): X-838175 Y-758052
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): SH-102
5. NAME OF DRILLER: E. Maulden
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 50.0' includes water
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 50.0'
10. SIZE AND TYPE OF BIT: 1 3/8" ID splitspoon
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 0.0 MLW
16. DATE HOLE: STARTED 30 Sep 83; COMPLETED 30 Sep 83
17. ELEVATION TOP OF HOLE: 0.0 MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: James E. Bolen, Geologist — James E. Bolen

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			Sea Water 0.0'-2.0'			Blows
			Bottom of Harbor 2.0'			
-2.0	5		MH-Dark gray fat clayey silt with 15% medium grained sand		1	Note: Weight of tools 2.0'-7.4'
-7.4	10		SM-Gray silty coarse medium sand, moderate silt content		2	Note: At 10.4' cleaned ou to 10.5' Next drive was 10.5'-12.0. 7
					3	At 13.5' set 6" diameter steel casing to 13.5' 34
	15				4	9 Weight of tools 16.5'-17.2' 15 Next drive 17.2'-18.7' 9 Weight of tools 19.0-20.0' 9
	20		With lenses of clay 10%		5	Weight of tools 24.5'-26.5' 33 W/T
-24.5	25		SC-Alternating layers of fat clay and gray silty medium fine sand		6	Sample Lab No. Class LL PL PI 32 1 CH 86 34 52 4 SP-SM NP NP NP 17 6 SM NP NP NP 7 MH 80 40 40 11 9 MH 70 35 35 10 SP-SM NP NP NP W/T
-26.5			CH-Dark gray silty fat clay with some black wood chips		7	Weight of tools 28.0'-29.1' 7
-30.0	30		Continued on Sheet 2			W/T

Note: Soils field classified in accordance with the Unified Soil Classification System.

Blows Per Foot: Number required to drive 1 3/8 ID splitpoon w/140 lb. hammer falling 30".

Note: W/T=Weight of tool.

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE: 0.0 MLW | HOLE NO.

PROJECT: Savannah Harbor Widening | INSTALLATION: Savannah, GA | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	Blows
		c	d	e	JAR	g	
-30.0	30		CH-Dark gray silty fat clay-with some black wood chips		8	Weight of tool 29.1'-30.6'.	6 W/T
						Weight of tool 30.5'-31.7'.	5
	35				9	Weight of tool 33.2'-35.7'	W/T
-37.7						Weight of tool 37.2'-37.7'.	18 W/T
			SM-Gray silty coarse, medium sand with some small clay lenses (moderate silt content)		10	Note: At 40.7' cleaned out to 41.0' Next drive is 41.0'-42.5'.	28
	40						36
							36
							60
	45				11		40
							51
							77
							97
-50.0	50		Bottom of Hole: 50.0'			Note: 6" diameter casing must be advanced 1.5' after every drive. Note: W/T = Weight of tools including 140 lb. hammer.	

Hole No. SH-112

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Savannah District

SHEET 1 OF 1 SHEETS

1. PROJECT: Savannah Harbor Widening
2. LOCATION (Coordinates or Station): X-824512, Y-767695
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): SH-112
5. NAME OF DRILLER: Tommy Scott
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 27.0'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 48.0'
10. SIZE AND TYPE OF BIT: 1 3/8" ID Splitspoon
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 31 Oct 83; COMPLETED 31 Oct 83
17. ELEVATION TOP OF HOLE: 0.0 MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Ted Zielonka — Ted Zielonka

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) Blows
0.0	0		River Water 0.0' to 21.0'			Note: Scale change at 20.0'.
	20					
-21.0			Bottom of Harbor 21.0'			
			SM-Tan fine to medium grained silty sand.		1	16
			Color change to gray at 22.2'		2	17
	25		Contains organic material from 22.2' to 24.0'.			18
			Color change to dark gray at 28.0'. 28.5'			55
-28.5					3	36
	30		No Recovery 31.5'			100/0.9
-31.5						Note: 28.5' to 31.5' cuttings appear to be from gray fine to medium silty sand. Tried new plastic spring and plastic in spoon. 72
-33.0			SC-Dark gray fine to medium grained clayey sand. 33.0'		4	23
			SM-Gray fine to medium grained silty sand.		5	20
	35					20
			Fine to coarse grained with gravel below 37.5'. 40.5'			20
-40.5	40				6	Note: 40.5' to 43.5' Cuttings appear to be from gray fine to coarse silty sand. 60
-43.5			No Recovery. 43.5'			29
			SP-Tan fine to coarse grained poorly graded sand with gravel.		7	32
	45		Gravel absent below 46.5'.			40
-48.0					8	39
			Bottom of boring at 48.0'			40
			Note: Soils field classified in accordance with the Unified Soil Classification System			

SAMPLE LAB

No.	Class	LL	PL	PI
2	SP	NP	NP	NP
4	SM	-	-	-
7	SP	NP	NP	NP

BLOWS PER FOOT

Number required to drive 1 3/8" ID splitspoon w/140 hammer falling 30".

Hole No. SH-122

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Savannah District

SHEET 1 OF 2 SHEETS

1. PROJECT: Savannah Harbor Widening
2. LOCATION (Coordinates or Station): X-835410 Y-758830
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): SH-122
5. NAME OF DRILLER: P. Rowtree
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 65.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 65.0
10. SIZE AND TYPE OF BIT: 1 3/8" ID Splitspoon
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 550
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 2 Nov 83; COMPLETED 3 Nov 83
17. ELEVATION TOP OF HOLE: 15.1
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: James E. Bolen

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS
15.1	0		CL-Dark brown lean clay with some silt and fine sand. 3.0'		1		21
12.1					-	W.T. 7.0' Date 2 Nov. 83 Depth to water during drilling	10
	5		SM-Dark brown silty medium fine sand with some clay. 9.0'		2		10
					3		11
6.1						W.T. 6.3' Water table reading 24 hrs. after hole completed.	11
	10		SC-Gray clayey coarse-medium sand.		4		4
			With wood chips and fibers.				4
						Note: Fill material 0.0'-4.0'. Mixed mud at 7.5'.	6
0.1	15		MH- Dark green fat clayey silt with a trace of wood chips and fibers. 19.0'		5		6
							2
-3.9					6	Note: W/T=Weight of Tools.	W/T
	20		SM-Dark green silty coarse medium sand.(moderate silt content). 23.5'		7	SAMPLE LAB: No 1 Class CL LL 37 PL 18 PI 19; No 4 SC-M LL 56 PL 25 PI 31; No 6 MH LL 93 PL 44 PI 49; No 8 SM-M LL 58 PL 31 PI 27; No 9 CH LL 130 PL 44 PI 86; No 11 SP SM NP NP NP; No 12 SP-SM NP NP NP	16
-8.4							13
	25		SC-Alternating layers of dark green fat clay and medium grained silty sand.				11
			MH- Dark green fat clayey silt with 25% medium sand.		8		14
-14.4							14
-14.9	30		Continued on sheet 2		9		11
			Note: Soils field classified in accordance with the Unified Soil Classification System.			BLOWS PER FOOT: Number required to drive 1 3/8" ID splitspoon w/140 lb. hammer falling 30".	

DRILLING LOG (Cont Sheet) | ION TOP OF HOLE 15.1' | Hole No. SH-122

PROJECT: Savannah Harbor Widening | INSTALLATION: Savannah District | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV. ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
-14.9	30 b	c	d	e	JAR	g BLOWS
			MH- Dark green fat clayey silt with 25% medium sand.		9	5
						7
-18.9			34.0'			24
	35		SM- Gray/green silty medium fine sand. (Moderate silt content).		10	27
						21
						20
	40					19
					11	20
						20
	45		Silty coarse-medium sand.		12	21
						37
						34
	50				13	42
						44
						50
						59
	55				14	94
			Gray/brown silty coarse medium sand.			74
						25
	60				15	47
						65
						60
-50.4	65				16	66
						97
			Bottom of Boring 65.5'			
			Note: Soils field classified in accordance with the Unified Soil Classification System.			

BLOWS PER FOOT: Number required to drive 1 3/8" ID splitspoon w/140 lb. hammer falling 30".

Hole No. SH-127

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Savannah River	SHEET 1 OF 2 SHEETS
1. PROJECT: Savannah Harbor Widening		10. SIZE AND TYPE OF BIT: 1 3/8" split spoon & 5 1/2"	
2. LOCATION (Coordinates or Station): X-324881 Y-767364		11. DATUM FOR ELEVATION SHOWN (MSL or MLW): MLW	Ushant II
3. DRILLING AGENCY: Savannah District		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-550	
4. HOLE NO. (As shown on drawing title and file number): SH-127		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 14 / UNDISTURBED 0	
5. NAME OF DRILLER: P. Rountree		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 5-13-84 / COMPLETED 5-14-84	
7. THICKNESS OF OVERBURDEN: 58.5'		17. ELEVATION TOP OF HOLE: 8.4	
8. DEPTH DRILLED INTO ROCK: 0.0'		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
9. TOTAL DEPTH OF HOLE: 58.5'		19. SIGNATURE OF INSPECTOR: Larry Benjamin, Larry Benjamin	

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	BLOWS
8.4	0						
			SM-Black & white fine silty sand.		1		5
			Brown		2		4
5.4							
			MH-Grey fine silty fat clay w/roots.		3		1
	5					W.T. 2.5' Date 5-13-84 Depth to water during drilling.	2 weight of hammer
0.6							2
	10		SP-Grey med. to coarse poorly graded sand.		4	W.T. 2.0' Water table reading 24 hrs. after hole completed.	5
			Coarse grained				13
							13
					5		10
	15						
							14
							13
						At 9.0' mixed Zeogel mud & continuously drove 1.5'(18") & fish-tailed 1.5'(18") to a depth of 58.5'.	16
	20				6		15
							15
							15
	25				7		22
							25
							25
-2.6	30						23

Continued on sht 2

NOTE Soils field classified in accordance with the Unified Soil Classification System.

BLOWS PER FOOT:

Number required to drive 1 3/8"ID splitspoon w/ 140 lb. hammer falling 30".

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 8.4' | **Hole No.** SH-127

PROJECT: Savannah Harbor Widening | INSTALLATION: Savannah River | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS
-21.6'	30'	c	d	e	JAR	g	
			SP-Grey coarse poorly graded sand.		8		27
							31
							29
	35				9		26
							24
							23
	40				10		23
							27
							28
					11		27
	45						29
			Trace of coarse river gravel.				30
							28
	50				12		26
			Tan no river gravel.				32
			Trace of clay		13		37
							34
	55		No clay.				30
					14		29
-50.1			Bottom of Boring 58.5'				

NOTE· Soils field classified in accordance with the Unified Soil Classification System.

BLOWS PER FOOT:

Number required to drive 1 3/8"ID splitspoon w/ 140 lb. hammer falling 30".

DRILLING LOG

DIVISION: South Atlantic

INSTALLATION: Savannah River

SHEET 1 OF 2 SHEETS

1. PROJECT: Savannah Harbor Widening
2. LOCATION (Coordinates or Station): X-831931 Y-760221
3. DRILLING AGENCY: Savannah District
4. HOLE NO. (As shown on drawing title and file number): SH-128
5. NAME OF DRILLER: C.D. Justiss
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 64.5'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 64.5'
10. SIZE AND TYPE OF BIT: 1 3/8" splitsspoon
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 15 May 1984; COMPLETED 17 May 1984
17. ELEVATION TOP OF HOLE: 12.6'
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Lou Archambault

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS
12.6'	0'	c	d	e	JAR	g	
			SM-Tan & brown, fine to med. grained, dry, silty sand w/scattered gravel, twigs & grasses.		1		28
							9
							7
	5						5
6.6'							
			Brown with shell fragments.		2	W.T. 6' Date 15 May 1984 Depth to water during drilling.	2
							1
	10						0
							0
						W.T. 6' Water table reading 72 hrs. after hole completed.	8
-0.9'							
	15		CH-Grey fat clay w/organics.		3		3
-3.4'							14
			SP-SM-Grey, green med.-poorly graded silty sand w/scattered mica.		4		32
							40
	20						20
							23
					5		17
	25						10
							16
-15.9'							10
			SW-SM-Grey green fine to coarse grained silty sand w/mica.		6		23
	30						

(Con't. on sht. 2)

NOTE: Soils field classified in in accordance with the Unified Soil Classification System.

BLOWS PER FOOT: Number required to drive 1 3/8" ID splitspoon w/140 lb. hammer falling 30".

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 12.6' | **Hole No.** SH-128

PROJECT: Savannah Harbor Widening | INSTALLATION: Savannah River | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH 30 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	BLOWS
			W/wood fragments				16
-20.4'			SP-SM-Grey green med. grained, silty sand w/mica throughout.		7		22
-21.9'	35		SW-SM-fine to med.grained silty sand w/mica.				35
			Occassional gravel.		8		33
	40				9		31
	45		Tan coarse - med.		10		37
-36.9'	50		SP-SM-Light grey coarse grained silty sand.		11		22
	55		Tan		12		20
			Medium grained.				37
-47.4'	60		SW-SM-Grey green well graded silty sand.		13		25
-48.9'			CH-Grey fat clay.		14		27
-50.4'			SW-SM-Grey green well graded silty sand.		15		37
-51.4'			CH-Green fat clay.		16		44
-51.9'	65		Bottom of Hole 64.5'				40
							26
							21
							37
							43
							31
							36
							10
							1
							31

Hole No. SH-138

DRILLING LOG	DIVISION South Atlantic	INSTALLATION Savannah, Ga.	SHEET 1 OF 2 SHEETS

1. PROJECT	Savannah Harbor Widening
2. LOCATION (Coordinates or Station)	X=831848 Y=760405
3. DRILLING AGENCY	Savannah District
4. HOLE NO. (As shown on drawing title and file number)	SH-138
5. NAME OF DRILLER	J. Butts
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	63.0'
8. DEPTH DRILLED INTO ROCK	0.0'
9. TOTAL DEPTH OF HOLE	63.0'
10. SIZE AND TYPE OF BIT	1 3/8"splitspoon,6" spiral auger & fishtail
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MLW
12. MANUFACTURER'S DESIGNATION OF DRILL	Failing 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 18 UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	See Remarks
16. DATE HOLE	STARTED 12 Mar 1987 COMPLETED 14 Mar 1987
17. ELEVATION TOP OF HOLE	13.0'
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	T. Nicholson(0-24') J. Arthur(24-63')

ELEVATION 13.0'	DEPTH 0 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	BLOWS
			CH-Dark brown fat clay,some roots,brick fragments & sand, dry.		1	Water level 4.8' depth to water during drilling.	3
9.5'			SP-Tan poorly graded fine sand,some brick fragments, dry.		2		10
8.5'	5				3	No 24 hour water level taken. Backfilled hole/w grout aftet com-pletion of boring.	11
7.0'			Dark brown,fine to med. grained,trace of clay,damp.				5
5.5'			Trace of roots & fine gravel, wet.		4		13
4.0'							5
2.5'	10		CH-Brown fat clay,trace of fine to coarse gravel & roots,wet.			12.0'-Began using Revert mud.	2
1.0'			Some roots,no gravel.			Undisturbed sample taken from 24.0' to 26.0' w/5"shelby tube.Recovered 1.8'. Jar sample from 24.0' to 24.1' & 25.7' to 25.8' from shelby tube.	2
-0.5'			Greenish grey,no roots,3" piece of wood @ 11.0'.		5		2
-2.0'	15						11
-3.5'			Trace of fine to med.sand.		6		16
			Trace of fine to coarse gravel.				7
-6.5'			SM-Greyish green silty fine sand,trace of fine to coarse gravel,wet.				3
	20				7		14
			Some fine to coarse gravel, trace of clay in thin layers.				25
-11.0'			No clay.				9
-12.5'	25		CH-Greenish grey fat clay, trace of fine to coarse gravel,fine sand & mica, damp.		8		4
					9		10
-15.5'			SC-Greenish grey clayey fine to med.sand,trace of mica, wet.				15
-17.0'	30				10		21
			SM-Greenish grey silty fine to med. sand,trace of mica, wet.				
			Continued on sht 2				

LAB CLASSIFICATION

No.	Class	LL	PL	PI
1	SM	NP	NP	NP
6	SP-SM	NP	NP	NP
8	CH	126	37	39
9	SC	40	24	16
11	SP	NP	NP	NP
14	SP	NP	NP	NP
16	SW	NP	NP	NP

BLOWS PER FOOT: Number required to drive 1 3/8" ID splitspoon w/140 lb. hammer falling 30".

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

DRILLING LOG (Cont Sheet) | ELEV. TOP OF HOLE 13.0' MLW | **Hole No.** SH-138

PROJECT: Savannah Harbor Widening | INSTALLATION: Savannah, Ga. | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS
-17.0'	30'	c	d	e	JA R	g	
			SM-Greenish grey silty fine to med.sand,trace of mica, wet.				24
-20.0'			Med. to coarse grained.		11		19
-21.5'	35		Fine to med. grained.				28
					12		28
	40		Grey,some light brown & tan streaks.				31
-29.0'			SP-Greyish brown poorly graded med.to coarse sand,trace of silt & mica,wet.		13		29
-30.5'					14		30
-32.0'	45		Light brown,few grayish brown streaks.				25
-33.5'			Very thin layer of decayed wood at approx. 47.0'.				33
-35.0'					15		21
-36.5'			Few grey streaks,trace of fine gravel.				26
	50						21
-38.0'			No gravel.				26
-39.5'			Light greyish tan,fine to med.grained,trace of fine gravel.		16		38
-41.0'							32
	55		Greyish tan,med.to coarse grained.				24
-44.0'					17		22
-45.5'			Coarse grained.				25
	60		Some fine gravel.				17
			Few thin grey silty layers.		18		20
-50.0'			Bottom of Boring 63.0'				20
	65						22

Hole No. SH-149

DRILLING LOG

DIVISION: SOUTH ATLANTIC

INSTALLATION: SAVANNAH, GA.

SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING
2. LOCATION (Coordinates or Station): X= 817840 ; Y= 778530 (GA EAST)
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-149
5. NAME OF DRILLER: D. JUSTISS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 60.0'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 60.0'
10. SIZE AND TYPE OF BIT: 3/8" I.D. SPLITSPOON, 4" SPIRAL AUGER, 5 1/2" FISHTAIL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: SEE REMARKS
16. DATE HOLE: STARTED 18 Oct 91; COMPLETED 18 Oct 91
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: J. Justiss, P.G.

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	Blows
	0		(SM) BROWN, SILTY FINE TO MEDIUM SAND, TRACE OF ROOTS, SLIGHTLY DAMP.		1	CLEANED OUT HOLE WITH 4" SPIRAL AUGER FROM 1.5' TO 4.5' & 6.0' TO 9.0'.	7
			(SP) LIGHT BROWN TO TAN, POORLY GRADED FINE TO MEDIUM SAND, TRACE OF SILT, SLIGHTLY DAMP.		2	JAR SAMPLE #2 TAKEN FROM AUGER FROM 1.5' TO 4.5'.	
	5		(SM) BROWN, SILTY, FINE TO MEDIUM SAND, DAMP.		3	BEGAN USING 5 1/2" FISHTAIL & ZEOGEL DRILLING MUD AT 10.5'.	15
			MEDIUM SAND, WET.				
			MEDIUM TO COARSE SAND, SOME FINE TO MEDIUM, SAND FROM 10.3' TO 10.5'.		4	SPLITSPOON DRIVES TAKEN AT 4.5' INTERVALS.	4
	10		WASH				
			(SC) GREENISH GRAY, CLAYEY, FINE TO MEDIUM SAND, SOME SILT, TRACE OF MICA, WET.		5	WATER LEVEL 6.5' DEPTH TO WATER DURING DRILLING.	4
	15		WASH			WATER LEVEL NOT ENCOUNTERED 21 Oct 91. TAPED HOLE TO 5.0'.	
			(SM) TANNISH GRAY, SILTY, MEDIUM TO COARSE SAND, TRACE OF CLAY, WET.		6		18
	20		WASH				
			(SP) TANNISH GRAY, POORLY GRADED MEDIUM TO COARSE SAND, TRACE OF SILT, WET.		7		15
	25		WASH				
			SAME AS 22.5' TO 24.0'.		8		13
			WASH				
	30		CONTINUED ON SHEET #2				
			NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.			BLOWS PER FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" I.D. SPLIT-SPOON WITH 140 LB. HAMMER FALLING 30".	

DRILLING LOG (Cont. Sheet) | ELEVATION TOP OF HOLE | Hole No. SH-149

PROJECT: SAVANNAH HARBOR DEEPENING | INSTALLATION: SAVANNAH, GA. | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH 30 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g BLOWS
			Wash.			
			(SM) Grey, fine to med. silty SAND. Trace of mica, wet.		9	24
	35		Wash.			
			(SP) Grey, med. to coarse, poorly graded SAND. Trace of silt & mica, wet.		10	39
	40		Wash.			
			Same as 36.0' to 37.5' but coarse sand, Trace of fine gravel.		11	46
			Wash.			
	45		Same as 40.5' to 42.0'.		12	33
			Wash.			
	50		(GP) Greenish-grey, fine, poorly graded GRAVEL. Trace of silt & coarse sand, wet.		13	17
			Wash. NOTE: Wash return contained some sand and clay.			
	55		(CL) Greyish-green, silty, lean CLAY. Trace of mica & fine sand, slightly damp.		14	36
			Wash			
			Same as 54.0' to 55.5' but dry.		15	45
	60		Bottom of Boring 60.0'			

Hole No. SH-150

DRILLING LOG	VISION SOUTH ATLANTIC	INSTALLATION SAVANNAH, GA.	SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING
2. LOCATION (Coordinates or Station): X-817555 Y-779145 GA. EAST
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-150
5. NAME OF DRILLER: DAVID JUSTISS
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 64.5'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 64.5'
10. SIZE AND TYPE OF BIT: 1⅜"splitspoon, 4"spiral auger, 5½"fishtail
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: SEE REMARKS
16. DATE HOLE: STARTED 16 OCT 91; COMPLETED 17 OCT 91
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: JAMES ARTHUR, P.G.

ELEVATION a	DEPTH 0 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc. If significant) g	BLOWS
			(SP) Tan, coarse, poorly graded SAND. Damp.		1		4
			(SC) Olive, fine clayey SAND. Some silt, damp.		2	Cleaned out hole with spiral auger to 4.5'. Jar #2 taken from auger from 1.5' to 4.5'. Splitspoon drive taken at each 4.5' interval to 55.5'. Began using 5½" fishtail & Zeogel drilling mud at 6.0'.	
	5		Fine to med. sand, trace of fine gravel, wet.		3	Water level 2.0' depth to water during drilling.	0
			Wash. NOTE: Wash return contained large amount of clay.			Water level 1.7' depth to water on 21 Oct 91. Taped hole to 19.8' depth.	
			Same as 4.5' to 6.0'.		4		15
	10		Wash				
			(SP) Olive grey, med., poorly graded SAND. Trace of silt, wet.		5		30
	15		Wash.				
			(SM) Olive-grey, med., silty SAND, wet.		6		21
	20		Wash. Note: Traces of wood in wash.				
			(SP) Light brown, med. to coarse, poorly graded SAND. Trace of silt, wet.		7		16
	25		Wash.				
			Same as 22.5' to 24.0', but with traces of fine gravel.		8		26
			Wash.				
	30		Continued on sheet #2			BLOWS PER FOOT: Number required to drive 1⅜" I.D. splitspoon w/140 lb. hammer falling 30".	

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

DRILLING LOG (Cont.Sheet) | ELEVATION TOP OF HOLE | Hole No. SH-150

PROJECT: SAVANNAH HARBOR DEEPENING | INSTALLATION: SAVANNAH, GA. | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH 30 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g BLOWS
			Wash.			
			(SP) Light brown, fine to med poorly graded SAND. Trace of silt, wet.		9	33
	35		Wash.			
			Same as 31.5' to 33.0' but med. to coarse sand.		10	30
			Wash.			
	40		Same as 36.0' to 37.5' but with some wood.		11	26
			Wash.			
	45		(SP) Greyish-brown, coarse, poorly graded SAND. Trace of fine gravel & silt, wet.		12	27
			Wash.			
	50		(CL) Greyish-green, silty lean CLAY. Trace of Mica & fine sand, dry.		13	31
			Wash			
			Same as 49.5' to 51.0' but greyish-green.		14	54
	55		Wash.			Began continuous splitspoon drives at 58.5'.
			(SM) Grey & greenish-grey, fine silty SAND. Trace of Mica, dry.		15	100/0.8
	60				16	78
			(SC) Greyish-green, fine clayey SAND. Some silt, dry.		17	42
					18	43
	65		Bottom of Boring 64.5'			

Hole No. SH-218

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: SAVANNAH, GA.	SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING		10. SIZE AND TYPE OF BIT: 1⅜"SPLITSPOON, 5½" FISHTAIL	
2. LOCATION (Coordinates or Station): X-843032 Y-758229 GA. EAST		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW	
3. DRILLING AGENCY: SAVANNAH DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 314	
4. HOLE NO. (As shown on drawing title and file number): SH-218		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 6	UNDISTURBED 0
5. NAME OF DRILLER: DAVID JUSTISS		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: N/A	
		16. DATE HOLE: STARTED 16 JAN 92	COMPLETED 16 JAN 92
7. THICKNESS OF OVERBURDEN: 50.0' (Water 41.0')		17. ELEVATION TOP OF HOLE: 0.0'	
8. DEPTH DRILLED INTO ROCK: 0.0'		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
9. TOTAL DEPTH OF HOLE: 50.0'		19. SIGNATURE OF INSPECTOR: JAMES ARTHUR, P.G.	

ELEVATION (0.0)	DEPTH (0_b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. UAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) BLOWS
			Water			Scale change at 40.0'. Set 6" diameter casing by own weight to 44.4'.
	40		Bottom of Harbor ~~42.8~~ 41.0			
-41.0'			(MH) Dark grey to black clayey SILT.		1	0
-42.5'			(SM) Dark grey to black, medium to coarse silty SAND. Some clay.		2	4
-44.0'			(SC) Dark grey to black, medium to coarse clayey SAND. Some silt.		3	15
-45.0'	45		(SM) Dark grey, fine to medium, silty SAND. Some clay.		4	
-45.5'			(SP) Tannish-light grey, coarse, poorly graded SAND. Trace of silt.		5	16
			With some fine gravel.		6	22
-50.0'	50		Bottom of Boring 50.0'			56
			NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			BLOWS PER FOOT: Number required to drive 1⅜" I.D. SPLITSPOON W/140 LB HAMMER FALLING 30", FOR THE LAST FOOT OF EACH DRIVE. splitspoon w/140 lb. hammer falling 30".

Hole No. SH- 373

DRILLING LOG	DIVI South Atlantic	INSTALLATION Savannah, Ga.	SHEET 1 OF 1 SHEETS

1. PROJECT: Savannah Harbor Deepening	10. SIZE AND TYPE OF BIT: 1 3/8" I.D. Splitspoon.
2. LOCATION (Coordinates or Station): UTM, X- 523009.46, Y- 3538226.61	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW; 5½ "Fishtail
3. DRILLING AGENCY: Savannah District	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing-314
4. HOLE NO. (As shown on drawing title and file number): SH- 373	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 6; UNDISTURBED 0
5. NAME OF DRILLER: D. Justiss	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: 60.8' (Water 44.3')	16. DATE HOLE: STARTED MAR 7 1992; COMPLETED MAR 7 1992
8. DEPTH DRILLED INTO ROCK: 0.0'	17. ELEVATION TOP OF HOLE: 0.0'
9. TOTAL DEPTH OF HOLE: 60.8	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: P.G. J. ARTHUR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	Blows
			WATER			SCALE CHANGE AT 40.0'. SET 6" DIAMETER CASING BY OWN WEIGHT TO 47.1'.	
	40						
-44.3'			BOTTOM OF HARBOR 44.3'		JARS		Blows
	45		(SP) GRAYISH BROWN MEDIUM TO COARSE POORLY GRADED SAND, SOME SMALL SHELL FRAGMENTS, TRACE OF FINE GRAVEL & SILT.		1	WEIGHT OF RODS DRIVE SPLITSPOON FROM 44.3' TO 44.8'.	6
-45.8'			(SM) DARK GRAY FINE TO MEDIUM SILTY SAND, TRACE OF SMALL SHELL FRAGMENTS.		2	BEGAN USING ZEOGEL DRILLING MUD AT 47.3'.	38
-48.8'							24
	50		(GP) GRAY FINE POORLY GRADED QUARTZ GRAVEL, SHELLY, SOME FINE TO COARSE SAND, TRACE OF SILT.		3	NO SPLITSPOON RECOVERY ON FIRST DRIVE FROM 48.8 TO 50.3'. RE-DROVE TO 50.3' THEN CONT'D WITH DRIVE TO 51.8'. JAR SAMPLE #3 FROM 48.8' TO 51.8'.	11
-51.8'			(CH) GRAY FAT CLAY.		4		13
	55				5		31
							13
							16
							14
-59.3'			(SC) OLIVE FINE CLAYEY SAND, SOME SILT.				14
-60.8'	60				6		15
			BOTTOM OF BORING 60.8'				

NOTE: Soils field classified in accordance with the Unified Soil Classification System

BLOWS PER FOOT: Number required to drive 1 3/8" ID splitspoon w/140 lb hammer falling 30".

Hole No. SH-374

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION SAVANNAH, GA.	SHEET 1 OF 1 SHEETS

1. PROJECT SAVANNAH HARBOR DEEPENING	10. SIZE AND TYPE OF BIT 1⅜" SPLITSPOON, 5½" FISHTAIL
2. LOCATION (Coordinates or Station) X-938464 Y-723217 GA. EAST	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLW
3. DRILLING AGENCY SAVANNAH DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 314
4. HOLE NO. (As shown on drawing title and file number) SH-374	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 6; UNDISTURBED 0
5. NAME OF DRILLER DAVID JUSTISS	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER N/A
7. THICKNESS OF OVERBURDEN 60.7' (Water 42.7')	16. DATE HOLE STARTED 20 FEB 92 COMPLETED 20 FEB 92
8. DEPTH DRILLED INTO ROCK 0.0'	17. ELEVATION TOP OF HOLE 0.0'
9. TOTAL DEPTH OF HOLE 60.7'	18. TOTAL CORE RECOVERY FOR BORING N/A %
	19. SIGNATURE OF INSPECTOR JAMES ARTHUR, P.G.

ELEVATION 0_a0	DEPTH 0_b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. UAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	BLOWS
			Water			Scale change at 40.0'. Set 6" diameter casing by own weight to 43.7'.	
	40		Bottom of Harbor 42.7'				
-42.7'			(SM) Dark grey, fine, silty SAND.		1	No recovery on first splitspoon drive. Redrove first drive to 44.2' then continued drive to 45.7'.	11
	45						12
-45.7'			Fine to medium sand, trace of small to large shell fragments.				19
-47.2'			(GP) Grey, fine poorly graded GRAVEL. Trace of silt, fine sand & small to large shell fragments.		2		8
-48.7'			(SM) Grey, fine to medium, silty SAND. Trace of small shell fragments.		3		25
	50						6
-51.7'			(CH) Dark grey, fat CLAY. Trace of silt.		4		27
							13
	55				5		14
							15
							19
	60				6		17
-60.7'			Bottom of Boring 60.7'			BLOWS PER FOOT:	
			NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			Number required to drive 1⅜" I.D. splitspoon w/140 lb. hammer falling 30".	

Hole No. SH-384

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION SAVANNAH, GA.	SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING	10. SIZE AND TYPE OF BIT: 1⅜"splitspoon, 5½"fishtail
2. LOCATION (Coordinates or Station): x-849850 Y-759106 GA. EAST	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
3. DRILLING AGENCY: SAVANNAH DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 314
4. HOLE NO. (As shown on drawing title and file number): SH-384	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 9; UNDISTURBED 0
5. NAME OF DRILLER: DAVID JUSTISS	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: 60.0' (WATER 30.4')	16. DATE HOLE: STARTED 26 NOV 91; COMPLETED 26 NOV 91
8. DEPTH DRILLED INTO ROCK: 0.0'	17. ELEVATION TOP OF HOLE: 0.0'
9. TOTAL DEPTH OF HOLE: 60.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: JAMES ARTHUR, P.G.

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY JAR	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	BLOWS
			Water			Scale change at 30.0'. Set 6"diameter casing by own weight to 35.4'.	
	30		Bottom of Harbor 30.4'				
-30.4'			(CH) Dark olive grey, fat CLAY. Very soft & wet.		1		0
-34.5'	35		Dark grey, some coarse sand, wood particles & glass fragment at 35.8'.				1
-36.0'			(SC) Dark grey, coarse clayey SAND. Trace of glass fragments.		2		3
-37.5'			(SP) Greyish-tan, coarse, poorly graded SAND. Some fine to coarse gravel, glass & rock fragments.		3	Weight of rods drove splitspoon from 30.4' to 34.5'.	18
-39.0'	40		Tan, some fine gravel, trace of glass fragments.				15
-43.5'			No glass.				13
-45.0'	45		Trace of silt & glass fragments.		4		18
-46.5'			(SM) Olive-grey, fine silty SAND.		5		20
-48.0'			(CL) Olive-grey, silty, lean CLAY. Some fine sand.		6		26
	50						25
-52.5'			(SC) Olive-grey, fine clayey SAND. Some silt.		7		17
	55				8		20
							19
							26
							31
							11
							26
					9		17
-60.0'	60		Bottom of Boring 60.0'			BLOWS PER FOOT:	
			NOTE: Soils visualy field classified in accordance with the Unified Soil Classification System.			Number required to drive 1⅜" I.D. splitspoon w/140 lb. hammer falling 30".	

Hole No. SH-385

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION SAVANNAH, GA.	SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING	10. SIZE AND TYPE OF BIT: 1⅜"SPLITSPOON, 5½" FISHTAIL
2. LOCATION (Coordinates or Station): X-849451 Y-759522 GA. EAST	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
3. DRILLING AGENCY: SAVANNAH DISTRICT	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 314
4. HOLE NO. (As shown on drawing title and file number): SH-385	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 8 6; UNDISTURBED 0
5. NAME OF DRILLER: DAVID JUSTISS	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: N/A
7. THICKNESS OF OVERBURDEN: 60.8' (Water 42.8')	16. DATE HOLE: STARTED 18 DEC 91; COMPLETED 18 DEC 91
8. DEPTH DRILLED INTO ROCK: 0.0'	17. ELEVATION TOP OF HOLE: 0.0'
9. TOTAL DEPTH OF HOLE: 60.8'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: JAMES ARTHUR, P.G.

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO. UAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS
0.0	0		Water			Scale change at 40.0'. Set 6" diameter casing by own weight to 44.9'.	
	40						
-42.8'			Bottom of Harbor 42.8'		--		
			(SP) Tan, coarse poorly graded SAND.		1		3
-44.3'	45		(CL) Olive, silty lean CLAY. Trace of fine sand.		2		30
-45.8'					3		
			(SC) Olive, fine clayey SAND.				100/0.6'
							58
	50						70
					4		
							33
							32
	55						24
					5		
							26
							25
							26
	60				6		
-60.8'			Bottom of Boring 60.8'				22

NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.

BLOWS PER FOOT:

Number required to drive 1⅜" I.D. splitspoon w/140 lb. hammer falling 30".

Hole No. SH-386

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION SAVANNAH, GA.	SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING
2. LOCATION (Coordinates or Station): X-849665 Y-759846 GA. EAST
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-386
5. NAME OF DRILLER: DAVID JUSTISS
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 60.8' (Water 29.3')
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 60.8'
10. SIZE AND TYPE OF BIT: 1⅜"splitspoon, 5½" fishtail
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 10; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 17 DEC 91; COMPLETED 17 DEC 91
17. ELEVATION TOP OF HOLE: 0.0'
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: JAMES ARTHUR, P.G.

ELEVATION 0a0	DEPTH 0b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO UAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	BLOWS
	25		Water			Scale change at 25.0'. Set 6" diameter casing by own weight to 29.5'.	
-29.3'			Bottom of Harbor 29.3'				
	30		(SM) Olive grey, fine silty SAND. Some clay, trace of shell fragments & mica		1	Weight of rods drove splitspoon to 30.5',cont'd. drive to 30.8' with four blows.	4
-30.8'			No shell fragments.		2		46
	35						52
-36.8'			(SC) Olive-grey, fine clayey SAND. Some silt, trace of mica.		3		43
	40						57
					4		52
-44.3'							52
	45		(SM) Olive, fine silty SAND. Trace of clay.		5		49
							52
					6		36
							67
-50.3'	50		(SC) Olive-grey, fine clayey SAND. Some silt, trace of mica.		7		71
-51.8'			(CL) Olive-grey, silty lean CLAY. Some fine sand, trace of mica.				100/0.8'
					8		79
							32
							44
-55.0'	55		Continued on sheet #2			BLOWS PER FOOT:	25
			NOTE: Soils visually field classified in accordance with the Unified Soil Classification System.			Number required to drive 1⅜" I.D. splitspoon w/140 lb. hammer falling 30".	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 0.0' MLW

Hole No. SH-386

PROJECT: SAVANNAH HARBOR DEEPENING

INSTALLATION: SAVANNAH, GA.

SHEET 2 OF 2 SHEETS

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. JAR (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
-55.0'	55		(CL) Olive grey, silty lean CLAY. Some fine sand, trace of mica.			34
					9	27
						24
	60				10	21
-60.8'			Bottom of Boring 60.8'			

Hole No. SH-400

DRILLING LOG

DIVISION: SOUTH ATLANTIC
INSTALLATION: SAVANNAH, GA.
SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): LAT: 31°59'44.2169", LON: 80°42'41.0623"
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-400
5. NAME OF DRILLER: P. MOUNTREE
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 60.4' (IND. 52.9' WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 60.4'
10. SIZE AND TYPE OF BIT: 1 3/8" I.D. SPLITSPOON, 5 1/2"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW IFISHATAIL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 6; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 30 SEP 97; COMPLETED 30 SEP 97
17. ELEVATION TOP OF HOLE: 0.0' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: J. [illegible], P.G.

ELEVATION MLW (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	BLOWS
	0		WATER			SCALE CHANGE AT 50.0'	
	50		BOTTOM OF OCEAN 52.9'			SET 6" DIAMETER STEEL CASING TO 56.6'.	
-52.9'			(SP) GRAY FINE POORLY GRADED QUARTZ SAND, TRACE OF FINES TO COARSE SAND SIZE SHELL FRAGMENTS CALCAREOUS. (SEE REMARKS) 54.4'		1	NO RECOVERY ON FIRST DRIVE, REDRIVE 52.9' TO 54.4' THEN CONT'D DRIVE TO 55.9'. RECOVERED BOTH DRIVES.	3 2
-54.4'					2		1 8 11
-55.9'	55		(SM) GRAY FINE TO MEDIUM SILTY QUARTZ SAND, 15% FINE TO COARSE SAND SIZE SHELL FRAGMENTS, TRACE OF FINE GRAVEL SIZE SHELL FRAGMENTS, CALCAREOUS. 55.9'		3		9 12 12
-57.0'					4		
-58.2'			(SP) GRAY COARSE POORLY GRADED QUARTZ SAND, 40% FINE GRAVEL SIZE SHELL FRAGMENTS, CALCAREOUS. 57.0'		5	BEGAN USING ZOOGEL DRILLING MUD AT 55.9'.	10 11 14
-60.4'	60		(SM) OLIVE GRAY FINE SILTY QUARTZ SAND, SLIGHTLY CALCAREOUS. 58.9'		6		11 15 15
			DARK OLIVE GRAY, TRACE OF CLAY. BOTTOM OF BORING 60.4'				

STA -65+000 R300
N 716 730.2 E 1107 482.0

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

BLOWS PER 1/2 FOOT
NUMBER REQUIRED TO DRIVE 1 3/8" I.D. SPLITSPOON W/140 LB HAMMER FALLING 30".

Hole No. SH-401

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	SOUTH ATLANTIC	SAVANNAH, GA	1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): LAT: 31°57'15.7138", LON: 80°41'57.4161"
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-401
5. NAME OF DRILLER: P. DOUNTREE
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 60.4' (INCL. 49.9' WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 60.4'
10. SIZE AND TYPE OF BIT: 1 3/8" I.D. SPLIT SPOON, 5 1/2"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW (FISHTAIL)
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 7; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 30 SEP 93; COMPLETED 30 SEP 93
17. ELEVATION TOP OF HOLE: 0.0' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: J. [illegible], P.G.

ELEVATION MLW (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (f) Blows
			WATER			SCALE CHANGE AT 45.0'.
	45		BOTTOM OF OCEAN 49.9'			SET 6" DIAMETER STEEL CASING TO 53.2'.
			(SP) GRAY MEDIUM TO COARSE POORLY GRADED QUARTZ SAND, TRACE OF FINE QUARTZ GRAVEL, 20% SHELL FRAGMENTS, CALCAREOUS.			BEGAN USING ZEOGEL DRILLING MUD AT 49.9'.
-49.9'	50		51.4			
-51.4'			FINE TO MEDIUM GRAINED, TRACE OF SHELL FRAGMENTS. 52.9'		1	CASING BEGAN DROPPING WITH CLEANOUT BEGINNING AT 57.4'. 2 7 10
-52.9'			NO GRAVEL. 54.4'		2	15 20 34
-54.4'	55		FINE GRAINED. 55.9'		3	14 34 21
-55.9'			COARSE GRAINED, SOME FINE QUARTZ GRAVEL AND SHELL FRAGMENTS. 58.9'		4	19 16 36
					5	5 10 15
-58.9'			(SC) VERY DARK OLIVE GRAY FINE CLAYEY SAND, SOME SILT, SLIGHTLY CALCAREOUS		6	33 59 29
-60.4'	60		BOTTOM OF BORING 60.4'		7	13 12 9
	65					

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

Blows per 1/2 foot: Number required to drive 1 3/8" I.D. split spoon w/140 lb hammer falling 30".

STA-69+965, L-05
E: 1 111 794.8
N: 714 170.3

Hole No. CH-402

DRILLING LOG

DIVISION: SOUTH ATLANTIC

INSTALLATION: SAVANNAH, GA.

SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): LAT: 31° 56' 52.4254" LON: 80° 41' 1.9911"
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-402
5. NAME OF DRILLER: C. ROBBINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 60.3' (INCL. 48.3' WATER)
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 60.3'
10. SIZE AND TYPE OF BIT: 1 3/8" I.D. SPLITSPOON 5'6"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): FISHTAIL MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FALING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 6 OCT 97; COMPLETED 6 OCT 97
17. ELEVATION TOP OF HOLE: 0.0' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: P.G.

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. SPT	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	Blows
	0		WATER			SCALE CHANGE AT 45.0'. SET 6" DIAMETER STEEL CASING TO 53.1'. BEGAN USING ZEOGEL, DRILLING MUD AT 51.3'.	
	45		BOTTOM OF OCEAN 48.3'				
-48.3'			(SP) GRAY MEDIUM TO COARSE POORLY GRADED SAND, TRACE OF FINE QUARTZ GRAVEL AND SHELL FRAGMENTS, SLIGHTLY CALCAREOUS. 49.8'				
-49.5'	50		GRAY TO LIGHT GRAY, FINE TO MEDIUM GRAINED, NO GRAVEL, CALCAREOUS. 52.8'		1		0 5 6
-51.3'					2		10 13 23
-52.8'			LIGHT GRAY / MEDIUM GRAINED SLIGHTLY CALCAREOUS. 54.3'		3		12 36 55
-54.3'	55		GRAY, MEDIUM TO COARSE GRAINED, TRACE OF FINE QUARTZ GRAVEL. 57.1'		4	NO SPLITSPOON RECOVERY ON FIRST ATTEMPT FROM 54.3' TO 55.5'. RE-DRIVE TO 55.5' THEN CONTIO DRIVE TO 57.3', CHANGE OF MATERIAL AT 57.1'.	12 16 13
-57.1'			(SC) DARK OLIVE GRAY FINE CLAYEY SAND, SLIGHTLY CALCAREOUS.		5		10 13 9
-60.3'	60		BOTTOM OF BORING 60.3'		6		8 18 22
					7		8 10 11
	65				8		6 9 11

STA -74+980.4
N: 711,612.0 E 1,116,089.2

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

Blows per 1/2 foot

Number required to drive 1 3/8" I.D. splitspoon w/ 140 lb hammer falling 30".

Hole No. SH-403

DRILLING LOG

DIVISION: SOUTH ATLANTIC
INSTALLATION: SAVANNAH, GA.
SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR DEEPENING FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): LAT: 31°56'31.6649" LON: 80°40'8.9228"
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-403
5. NAME OF DRILLER: C. ROBBINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 60.1' (INCL. 49.6' WATER)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 60.1'
10. SIZE AND TYPE OF BIT: 1 3/8" I.D. SPLITSPOON 5/2"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW FISH TAIL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 314
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 7; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 14 OCT 97; COMPLETED 14 OCT 97
17. ELEVATION TOP OF HOLE: 0.0' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: [signature], P.G.

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	BLOWS
			WATER			SCALE CHANGE AT 45.0'. SET 6" DIAMETER STEEL CASING TO 53.6'.	
	45		BOTTOM OF OCEAN 49.6'				
-49.6'			(SP) BROWN MEDIUM TO COARSE POORLY GRADED SAND, TRACE OF SHELL FRAGMENTS AND FINE QUARTZ GRAVEL, CALCAREOUS.				
	50		51.1'		1	NO RECOVERY ON FIRST DRIVE. REDRIVE 49.6' TO 51.1' THEN CONTINUED DRIVE TO 52.6'. RECOVERED BOTH DRIVES. BEGAN USING ZEOGEL DRILLING MUD AT 52.6'.	3 6 10
-51.1'			GRAY, FINE TO MEDIUM GRAINED, TRACE OF SILT, NO GRAVEL.		2		20 28 50
			54.1'		3		30 29 29
-54.1'	55		TRACE OF FINE QUARTZ GRAVEL, NO SILT, SLIGHTLY CALCAREOUS.		4		4 5 8
-55.6'			55.6' COARSE GRAINED. 58.6'		5		6 9 8
			(CL) DARK OLIVE GRAY SILTY LEAN CLAY, SOME FINE QUARTZ SAND, SLIGHTLY CALCAREOUS.		6		12 11 18
-58.6'							
-60.1'	60		BOTTOM OF BORING 60.1'		7		6 9 12
	65						

N: 709,576.9 E 1,120,691.0 STA -80+005, ℄

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

BLOWS PER ½ FOOT
Number required to drive 1 3/8" ID Splitspoon w/140lb hammer falling 30".

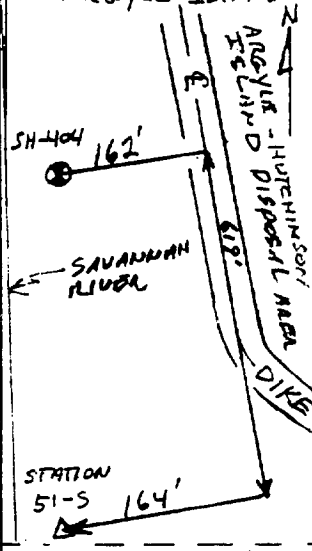
Hole No. SH-404

DRILLING LOG | DIVISION: SOUTH ATLANTIC | INSTALLATION: SAVANNAH, GA. | SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): SEE REMARKS — X 973 878, Y 779 250
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-404
5. NAME OF DRILLER: C. ROBBINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 64.5'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 64.5'
10. SIZE AND TYPE OF BIT: 13/8" I.D. SPLITSPOON 5½"
11. DATUM FOR ELEVATION SHOWN (MSL or MLW): MLW — FISHTAIL, 3" DIAMETER SHELBY TUBE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-550
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 20 — UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 20 NOV 97 — COMPLETED 21 NOV 97
17. ELEVATION TOP OF HOLE: 10.4' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: J. Clinton, P.G.

ELEVATION MLW (a)	DEPTH FT. (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	Blows
10.4'	0						
8.9'			(SM) BROWN AND GRAY FINE TO MEDIUM SILTY QUARTZ SAND, SOME ROOTS. 1.5'		1	BEGAN USING DRILLING MUD AT 0.0'.	1 2 2
7.4'			WASH 3.0'				
5.9'			(SP) LIGHT BROWN FINE TO MEDIUM POORLY GRADED QUARTZ SAND. 4.5'		2	SPLITSPOONED ON 2' CENTERS.	2 3 4
4.4'	5		WASH 6.0'			NOTE: NO RECOVERY ON FIRST ATTEMPT FROM 6.0' TO 7.5'. REDRIVE TO 7.5' THEN CONTINUED DRIVE TO 9.0'. JAR SAMPLE #3 FROM 6.0' TO 9.0'.	
			(SC) GRAY MEDIUM TO COARSE CLAYEY QUARTZ SAND. 9.0'		3		1 1 0
1.4'			(SP) LIGHT BROWN MEDIUM TO COARSE POORLY GRADED QUARTZ SAND, TRACE OF SILT. 10.5'				1 2 6
−0.1'	10		WASH 12.0'		4		4 4 6
−1.6'			(SM) GRAY FINE TO MEDIUM SILTY QUARTZ SAND. 13.5'		5	UNDISTURBED UD-1, 6.0'-7.8'	4 12 13
−3.1'			WASH 15.0'				
−4.6'	15		(SM) SAME AS 12.0-13.5' BUT WITH TRACE OF CLAY. 16.5'		6		2 8 6
−6.1'			WASH 18.0'				
−7.6'			(SP) GRAY MEDIUM TO COARSE POORLY GRADED QUARTZ SAND, TRACE OF WOOD. 19.5'		7		6 10 5
−9.1'	20		WASH 21.0'				
−10.6'			(SP) GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND, TRACE OF SILT. 22.5'		8		17 13 15
−12.1'			WASH 24.0'				
−13.6'			(SP) GRAY MEDIUM TO COARSE POORLY GRADED QUARTZ SAND, TRACE OF WOOD. 25.5'		9		9 6 7
−15.1'	25		WASH 27.0'				
−16.6'			(SP) SAME AS 24.0'-25.5' BUT WITH TRACE OF FINE QUARTZ GRAVEL. 28.5'		10		5 8 11
−18.1'			WASH				
−19.6'	30		CONTINUED ON SHEET # 2				

LOCATION



Blows per ½ foot

Number required to drive 1 3/8" I.D. splitspoon w/140 lb Hammer falling 30"

NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 10.4' MLW | **Hole No.** SH-404

PROJECT SAVANNAH HARBOR EXPANSION FEASIBILITY STUDY | INSTALLATION SAVANNAH, GEORGIA | SHEET 2 OF 2 SHEETS

ELEVATION MLW (a)	DEPTH FT. (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
19.6'	30					
			(SP) GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND, TRACE OF SILT AND FINE QUARTZ GRAVEL. 31.5'		11	6 13 13
-21.1'			WASH 33.0'			
-22.6'			(SP) LIGHT GRAY MEDIUM TO COARSE POORLY GRADED QUARTZ SAND, TRACE OF FINE QUARTZ GRAVEL. 34.5'		12	5 6 8
-24.1'	35		WASH 36.0'			
-25.6'			(SM) GRAY AND BROWN FINE TO MEDIUM SILTY QUARTZ SAND. 37.5'		13	12 13 12
-27.1'			WASH 39.0'			
-28.6'			(SP) GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND, TRACE OF SILT. 40.5'		14	9 19 18
-30.1'	40		WASH 42.0'			
-31.6'			(SP) SAME AS 39.0'-40.5' BUT WITH SOME WOOD. 43.5'		15	8 5 6
-33.1'			WASH 45.0'			
-34.6'	45		(CH) GRAY FAT CLAY, TRACE OF MEDIUM TO COARSE QUARTZ SAND AND WOOD. 46.5'		16	0 2 5
-36.1'			WASH 48.0'			
-37.6'			(SP) LIGHT GRAY MEDIUM TO COARSE POORLY GRADED QUARTZ SAND. 49.5'		17	BEGAN 5' CENTERS AT 49.5'. 16 24 25
-39.1'	50		WASH 53.0'			
-42.6'			(CL) OLIVE GRAY SILTY LEAN CLAY, SOME FINE QUARTZ SAND, TRACE OF MICA. 54.5'		18	15 22 27
-44.1'	55		WASH 58.0'			
-47.6'			(CL) SAME AS 53.0'-54.5' BUT WITH TRACE OF SAND AND MICA. 59.5'		19	14 22 28
-49.1'	60		WASH 63.0'			
-52.6'			(CL) SAME AS 58.0'-59.5'.		20	15 27 36
-54.1'	65		BOTTOM OF BORING 64.5'			

Hole No. SH-405

DRILLING LOG

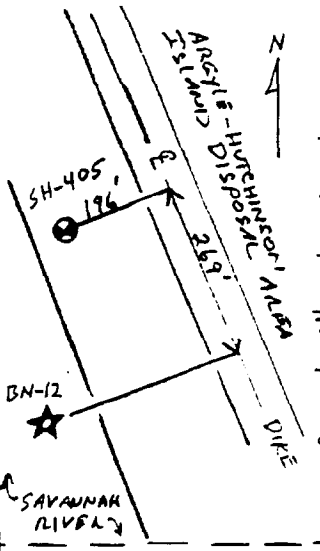
DIVISION: SOUTH ATLANTIC

INSTALLATION: SAVANNAH, GA.

SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): X 975641 Y 777213
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-405
5. NAME OF DRILLER: C. ROBBINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 75.5'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 75.5'
10. SIZE AND TYPE OF BIT: 1 3/8" I.D. SPLITSPOON 5/8" FISHTAIL, 3" SHELBY TUBE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-550
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 22NOV97; COMPLETED 24NOV97
17. ELEVATION TOP OF HOLE: 18.3' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: [signature], PG.

ELEVATION MLW (a)	DEPTH FT. (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. JAR	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	BLOWS
16.8'	0		(SM) BROWN FINE TO MEDIUM SILTY QUARTZ SAND, TRACE OF GRASS ROOTS. 1.5'		1	BEGAN USING DRILLING MUD AT 0.0'. SPLITSPOONED ON 3' CENTERS	2 5 8 — 13
15.3'			WASH 3.0'				
13.8'			(SP) LIGHT BROWN FINE TO MEDIUM POORLY GRADED QUARTZ SAND. 4.5'		2		2 5 4 — 9
12.3'	5		WASH 6.0'			UNDISTURBED	
10.5'			(SP) SAME AS 3.0'-4.5' 7.5'		3	UD-1, 15.0'-16.8' UD-2, 17.0'-18.7'	10 13 12 — 25
9.3'			WASH 9.0'				
7.8'	10		(SP) SAME AS 6.0'-7.5' BUT LIGHT BROWN AND ORANGE, TRACE OF SILT. 10.5'		4		4 6 7 — 13
6.3'			WASH 12.0'				
4.8'			(SM) GRAY FINE TO MEDIUM SILTY QUARTZ SAND, TRACE OF WOOD. 13.5'		5		2 3 3 — 6
3.3'	15		WASH 15.0'			LOCATION	
1.8'			(CH) GRAY FAT CLAY, TRACE OF SILT, ROOTS AND ORGANIC FIBERS. 16.5'		6	ARGYLE ISLAND	2 1 1 — 2
0.3'			WASH 18.0'				
-1.2'			(CH) SAME AS 15.0'-16.5' 19.5'		7		0 1 1 — 2
-2.7'	20		WASH 21.0'				
-4.2'			(SC) GRAY FINE TO MEDIUM CLAYEY QUARTZ SAND, SOME SAND AND SILT LAYERS 22.5'		8		2 9 13 — 22
-5.7'			WASH 24.0'				
-7.2'	25		(SP) GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND, TRACE OF CLAYEY LAYERS 25.5'		9		3 7 9 — 16
-8.7'			WASH 27.0'				
-10.2'			(SP) SAME AS 24.0'-25.5' BUT MEDIUM TO COARSE GRAINED. 28.5'		10		9 7 9 — 16
-11.7'			WASH				
	30		CONTINUED ON SHEET #2				



BLOWS PER 1/2 FOOT

NUMBER REQUIRED TO DRIVE 1 3/8" I.D. SPLITSAOON W/140 lb HAMMER FALLING 30".

NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 18.3' MLW | **Hole No.** SH-40S

PROJECT SAVANNAH HARBOR EXPANSION FEASIBILITY STUDY | INSTALLATION SAVANNAH, GA | SHEET 2 OF 2 SHEETS

ELEVATION MLW 11.7[a]	DEPTH FT. 3[b]	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	~~BOX OR~~ SAMPLE NO. SAV	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	Blows
13.2'			(SP) GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND, TRACE OF WOOD. 31.5'		11		6 13 14 — 27
14.7'			WASH 33.0'				
16.2'			(SP) SAME AS 30.0'-31.5' BUT NO WOOD. 34.5'		12		13 23 23 — 46
	35		WASH 36.0'				
17.7'			(SP) SAME AS 33.0-34.5' 37.5'		13		12 17 19 — 36
19.2'			WASH 39.0'				
20.7'			(SP) SAME AS 33.0-34.5' BUT WITH TRACE OF SILT. 40.5'		14		9 10 16 — 26
22.2'	40		WASH 44.0'			BEGAN 5' CENTERS AT 40.5'.	
25.7'			(SP) GRAY MEDIUM POORLY GRADED QTZ SAND. 45.5'		15		13 20 21 — 41
27.2'	45		WASH 49.0'				
30.7'			(SP) SAME AS 44.0'-45.5' BUT WITH TRACE OF SILT. 50.5'		16		8 16 19 — 35
32.2'	50		WASH 54.0'				
35.7'			(SM) DARK GRAY MEDIUM TO COARSE SILTY QUARTZ SAND TRACE OF FINE QUARTZ GRAVEL. 55.5'		17		7 5 5 — 10
37.2'	55		WASH 59.0'				
40.7'			(CL) OLIVE GRAY LEAN CLAY, TRACE OF FINE QUARTZ SAND AND MICA. 60.5'		18		8 14 18 — 32
42.2'	60		WASH 64.0'				
45.7'			(CL) SAME AS 59.0' BUT WITH SOME SILT AND FINE QUARTZ SAND 65.5'		19		13 31 27 — 58
47.2'	65		WASH 69.0'				
50.7'			(CL) OLIVE GRAY SANDY LEAN CLAY, FINE GRAINED QUARTZ AND MICA. 70.5'		20		14 25 24 — 49
52.2'	70		WASH 74.0'				
55.7'			(CL) SAME AS 69.0-70.5'		21		19 30 45 — 75
57.2	75		BOTTOM OF BORING 75.5'				

Hole No. SH-406

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: HUTCHINSON ISLAND	SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION, SLOPE STABILITY
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-406
5. NAME OF DRILLER: P. ROUNTREE
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: >71.5'
8. DEPTH DRILLED INTO ROCK: -
9. TOTAL DEPTH OF HOLE: 71.5'
10. SIZE AND TYPE OF BIT: 1 3/8" ID SPLITSPOON, 6" FISH-TAIL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: NONE
15. ELEVATION GROUND WATER: NOT DETERMINED
16. DATE HOLE: STARTED 24 NOV 97; COMPLETED 25 NOV 97
17. ELEVATION TOP OF HOLE: 9.94
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: G. ANDERSON / James A Biddy GEOLOGIST

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS/FT
9.9 a	0' b	c	BROWN d	e	f		
			(SM) FINE TO MEDIUM SILTY SAND W/ SOME ROOTLETS/WOOD		1	WATER LEVEL NOT DETERMINED DURING DRILLING. ZEOGEL DRILLING FLUID USED FROM SURFACE. 24 HOUR WATER LEVEL WAS NOT DETERMINED	12
			LOG, WOOD				
			TAN, GREEN, GRAY, TRACE OF GRAVEL		2	SEE COMPANION LOG SH-406-UD FOR UN-DISTURBED SAMPLE DESCRIPTIONS, LOCATIONS	8
	5'						
			GREEN AND GRAY W/ LAYERS OF HARD SILT		3		6
0.9	9'						
	10'		(MH) GREEN AND GRAY, HIGH LIQUID LIMIT SILT		4		3
-2.1	12'						
			(SM) TAN FINE TO MEDIUM SILTY SAND		5		3
	15'		GRAY WITH LARGE PIECE OF GRAVEL		6	N	19
						30'	
	20'				7		13
					8		21
	25'				9		23
			GRAY, FINE TO MEDIUM WITH A TRACE OF GRAVEL		10	HARBOR WATER-LINE AT LOW TIDE	6
-20.1	30'						
			CONTINUED ON SHEET No. 2				

NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 9.94 MLW | Hole No. SH-406

PROJECT: SAVANNAH HARBOR EXPANSION, SLOPE STABILITY | INSTALLATION: HUTCHINSON ISLAND, SAVANNAH, GA | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
-20.1	30'	c	d	e	f	g	
			(ML) GRAY, LOW LIQUID LIMIT SILT, MICACEOUS TRACE OF WOOD		11	WEIGHT OF HAMMER PUSHED TOOLS FROM 30.0' TO 31.0'	1
-24.1	34'				12	WEIGHT OF HAMMER PUSHED TOOLS FROM 33.0' TO 33.5'	8
	35'		(SM) GRAY, FINE TO MEDIUM SILTY SAND, MICACEOUS		13		20
-28.1	39'						
	40'		(SP) GRAY, FINE, POORLY GRADED SAND WITH A TRACE OF MICA		14		32
-32.1	42'		(SM) GRAY, FINE, SILTY SAND WITH A TRACE OF MICA.		15		24
-35.1	45'		(SP) GRAY AND TAN, FINE TO MEDIUM POORLY GRADED SAND WITH ONE COARSE PIECE OF GRAVEL		16		35
			WITH FINE GRAVEL		17		35
	50'						
			FINE TO COARSE, WITH SOME SILT		18		15
	55'						
			FINE TO MEDIUM, POORLY GRADED SAND		19		36
	60'						
			(ML) GREEN, LOW LIQUID LIMIT SILT, VERY DENSE, FINE		20		79
	65'						
-58.8					21		100/0.7'
			BOTTOM OF BORING: 68.7'				

Hole No. SH-406-UD

DRILLING LOG

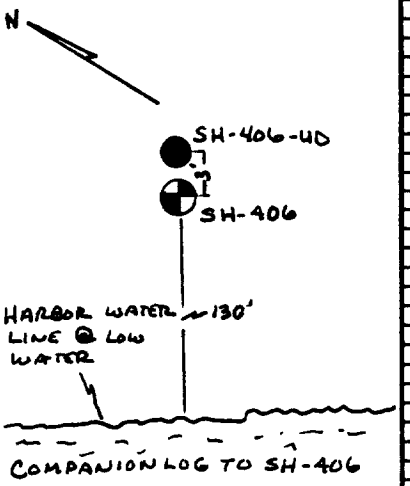
DIVISION: SOUTH ATLANTIC

INSTALLATION: HUTCHINSON ISLAND, GA

SHEET 1 OF 1 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION, SLOPE STABILITY
2. LOCATION (Coordinates or Station): See Boring Plan, SH-406, REMARKS
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-406-UD
5. NAME OF DRILLER: D. ROUNTREE
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: >32.5'
8. DEPTH DRILLED INTO ROCK: –
9. TOTAL DEPTH OF HOLE: 32.5'
10. SIZE AND TYPE OF BIT: 3" ID SHELBY TUBE, 6½" FISH-TAIL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: NONE; UNDISTURBED: 2
14. TOTAL NUMBER CORE BOXES: NONE
15. ELEVATION GROUND WATER: NOT DETERMINED
16. DATE HOLE: STARTED 24 NOV 97; COMPLETED 24 NOV 97
17. ELEVATION TOP OF HOLE: 9.94
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: James A Biddle GEOLOGIST

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						WAITED 15 MINUTES AFTER EACH PUSH BEFORE REMOVING TUBE.
	10'		GREEN & GRAY HIGH LIQUID LIMIT SILT. FINE		UD-1	
	20'					
	30'		GRAY, LOW LIQUID LIMIT SILT, FINE, MICACEOUS.		UD-2	
			BOTTOM OF BORING: 32.5'			



NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

Hole No. SH-407

DRILLING LOG

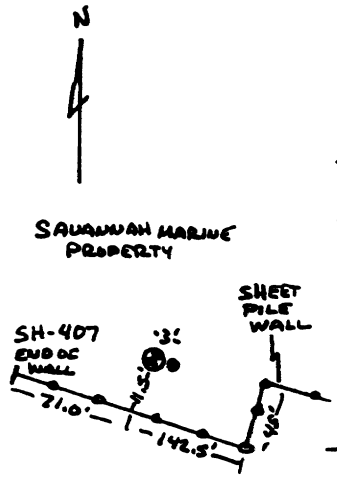
DIVISION: SOUTH ATLANTIC

INSTALLATION: HUTCHINSON ISLAND

SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION, SLOPE STABILITY
2. LOCATION (Coordinates or Station): SEE BORING PLAN, REMARKS
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-407
5. NAME OF DRILLER: P. ROUNTREE
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 71.5
8. DEPTH DRILLED INTO ROCK: –
9. TOTAL DEPTH OF HOLE: 71.5'
10. SIZE AND TYPE OF BIT: 1 3/8" ID SPLITSPOON, 6½" FISH-TAIL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES: NONE
15. ELEVATION GROUND WATER: NOT DETERMINED
16. DATE HOLE: STARTED 24 NOV 97; COMPLETED 25 NOV 97
17. ELEVATION TOP OF HOLE: 14.8
18. TOTAL CORE RECOVERY FOR BORING: NA %
19. SIGNATURE OF INSPECTOR: James aB iddle — GEOLOGIST

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	BLOWS/FT
14.8	0'						
			(SC) DARK GREENISH-GRAY AND REDDISH-BROWN FINE TO MEDIUM CLAYEY SAND, TRACE OF COARSE SAND		1	ZEOGEL-DRILLING FLUID USED FROM SURFACE. NOT POSSIBLE TO DETERMINE WATER LEVEL DURING DRILLING. 24 HOUR WATER LEVEL WAS NOT DETERMINED DUE TO REQUIREMENT OF PROPERTY OWNER TO BACKFILL HOLES ON COMPLETION OF BORING	14
	4.2'						
	5'		(SP) BROWNISH-TAN, FINE TO MEDIUM POORLY GRADED SAND		2		20
			SP/SC) POORLY GRADED SAND ABOVE W/ GRAY, FINE TO MEDIUM CLAYEY SAND		3	SEE COMPANION LOG SH-407-40 FOR LOG OF UNDISTURBED SAMPLES	4
	9.0'						
	10'		(SC) GRAYISH-BROWN, FINE, CLAYEY SAND W/ FINE GRAVEL		4		2
			LOST SAMPLE, TRACES OF FINE TO COARSE SATURATED SAND AND FINE GRAVEL		5		2
	13.5'						
-0.2	15'		(CL) GRAYISH-GREEN SANDY LEAN CLAY WITH FINE TO COARSE GRAVEL, SOFT SLIGHTLY ORGANIC APPEARANCE AND FEEL		6		5
			(MH) DARK GRAYISH-GREEN, HIGH LIQUID LIMIT SILT WITH FINE GRAVEL AND ORGANIC MATERIAL				2
			W/ 20% FINE SAND		7		2
	20'						
	21.9'		(SP) LIGHT GREENISH-GRAY FINE TO MEDIUM, POORLY GRADED SAND		8		12
			WITH 15% CLAY				
	25'				9		14
			TRACES OF SATURATED FINE SAND IN SPLIT SPOON		10	LOST SAMPLE	6
						NO SAMPLE RECOVERY	
-15.2	30'						2
			CONTINUED ON SHEET NO. 2				



NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

BLOWS PER FOOT

NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON W/ 140 LB HAMMER FALLING 30" FOR THE LAST 12" OF EACH DRIVE

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 14.8 MLW | Hole No SH-407

PROJECT: SAVANNAH HARBOR EXPANSION, SLOPE STABILITY | INSTALLATION: SAVANNAH HARBOR, HUTCHINSON ISLAND, GA | SHEET 2 OF 2 SHEETS

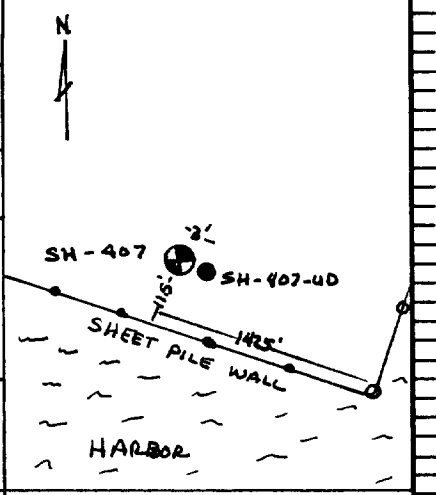
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
-15.2a	30'b	c	d	e	f	g Blows/FT
			(SP) CONTINUED FROM SHEET No. 1 · OLIVE GREEN, FINE TO MEDIUM POORLY GRADED SAND		11	24
			FINE TO 33.8'		12	25
	35'		CLAY LAYERS			
			FINE - TO MEDIUM, NO CLAY		13	34
			SLIGHT SULFUR ODOR		14	18
	40'		ONE FINE GRAVEL SIZED PIECE OF LIMESTONE		15	30
			TRACE OF COARSE SAND		16	26
	45'					
			FINE TO COARSE		17	37
	50'					
			TRACE OF FINE GRAVEL		18	44
	55'					
			FINE TO COARSE W/15% SILT, NO GRAVEL		19	22
	60'					
	65'					
-51.2	66'		(ML) DARK GRAVISH-GREEN ORGANIC SILT, HARD, DENSE		20	30
	70'					
-56.8					21	58
			BOTTOM OF BORING: 71.5'			

Hole No. SH-407-UD

DRILLING LOG	DIVISION	INSTALLATION	SHEET) OF 1 SHEETS
	SOUTH ATLANTIC	HUTCHINSON ISLAND	

1. PROJECT	SAVANNAH HARBOR EXPANSION
2. LOCATION (Coordinates or Station)	SEE BORING PLAN, SH-407, REMARKS
3. DRILLING AGENCY	SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	SH 407-UD
5. NAME OF DRILLER	P. ROUNTREE
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	> 20.9
8. DEPTH DRILLED INTO ROCK	–
9. TOTAL DEPTH OF HOLE	20.9
10. SIZE AND TYPE OF BIT	3" ID SHELBY TUBE, 6½" FISH-TAIL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MLW
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: NONE; UNDISTURBED: 2
14. TOTAL NUMBER CORE BOXES	NONE
15. ELEVATION GROUND WATER	NOT DETERMINED
16. DATE HOLE	STARTED: 24 NOV 97; COMPLETED: 24 NOV 97
17. ELEVATION TOP OF HOLE	14.8
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	James A Biddle, GEOLOGIST

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
14.8	0'					COMPANION LOG TO SH-407 SAMPLES ALLOWED TO SIT 30 MINUTES AFTER EACH PUSH BEFORE PULLING TUBE ATTEMPTED SAMPLES FROM 14.0-15.8 AND 16.0-17.8. LOST BOTH SAMPLES AT SURFACE WHEN PULLING TUBES
	5'					
6.8	8'		(SC) GRAYISH-GREENISH BROWN FINE TO MEDIUM CLAYEY SAND WITH GRAVEL		UD-1	
5.0	10'					
2.8	12'		(SP/SC) FINE TO COARSE SATURATED SAND AND FINE GRAVEL, SOME CLAY WITH GRAYISH-BROWN FINE CLAYEY SAND		UD-2	
1.0	13.8					
	15'					
-3.0	18'		(ML) DARK GREENISH-GRAY, LOW LIQUID LIMIT SILT WITH SOME CLAY, SAND		UD-3	
-6.1	20'					
			BOTTOM OF BORING: 20.9'			



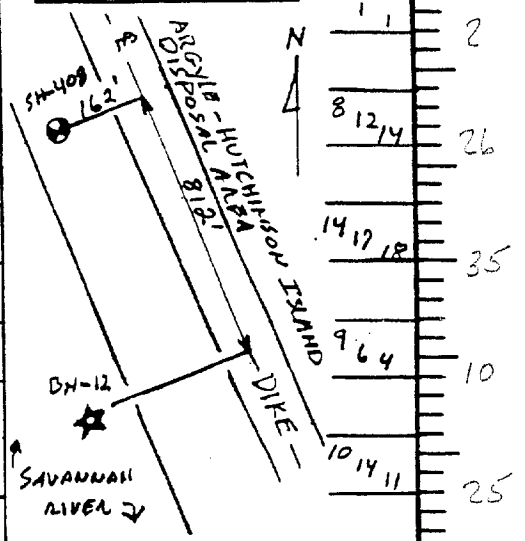
NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

Hole No. SH-408

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: SAVANNAH, GA.	SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION FEASIBILITY STUDY
2. LOCATION (Coordinates or Station): X 975329 Y 777666
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-408
5. NAME OF DRILLER: C. ROBBINS
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 55.5'
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 55.5'
10. SIZE AND TYPE OF BIT: 1 3/8" I.D. SPLITSPOON, 5 1/2" FISHTAIL, 3" SHELBY TUBE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55-D
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 25 NOV 97; COMPLETED 26 NOV 97
17. ELEVATION TOP OF HOLE: 15.7' MLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: J. Cushing P.G.

ELEVATION MLW (15.7)	DEPTH Ft (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (SA)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	Blows
	0		(SM) LIGHT BROWN FINE TO MEDIUM SILTY QUARTZ SAND. 1.5'		1	BEGAN USING DRILLING MUD AT 0.0'.	1 4 6
14.2'			WASH 3.0'				10
12.7'			(SP) LIGHT GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND, TRACE OF FINE GRAVEL. 4.5'		2	SPLITSPOON ON 3' CENTERS.	3 9 9
11.2'	5		WASH 6.0'				18
9.7'			(SC) GRAY MEDIUM TO COARSE CLAYEY QUARTZ SAND, SOME FINE QUARTZ GRAVEL. 7.5'		3	NOTE: WASH RETURN FROM 7.5' TO 9.0' CONTAINED LARGE PIECES OF WOOD; FISHTAIL HAD LARGE AMOUNT OF FAT CLAY, COBBLE AND GRAVEL.	4 4 4
8.2'			WASH - SEE REMARKS 9.0'				8
6.7'			(SM) GRAY FINE TO MEDIUM SILTY QUARTZ SAND, SOME CLAY. 10.5'		4		1 1 1
5.2'	10		WASH 12.0'				2
3.7'			(SC) GRAY FINE TO MEDIUM CLAYEY QUARTZ SAND. 13.5'		5	UNDISTURBED UD-1, 12.0'-13.8' UD-2, 14.7'-16.5'	1 2 3
2.2'			WASH 15.0'				5
0.7'	15		(CH) GRAY AND BROWN FAT CLAY, TRACE OF DECAYED WOOD AND FINE TO MEDIUM QUARTZ SAND. 16.5'		6	LOCATION	1 1 1
-0.8'			WASH 18.0'				2
-2.3'			(SP) LIGHT GRAY FINE POORLY GRADED QUARTZ SAND. 19.5'		7		8 12 14
-3.8'	20		WASH 21.0'				26
-5.3'			(SP) SAME AS 18.0'-19.5' BUT FINE TO MEDIUM GRAINED 22.5'		8		14 17 18
-6.8'			WASH 24.0'				35
-8.3'			(SP) SAME AS 21.0'-22.5'. 25.5'		9		9 6 4
-9.8'	25		WASH 27.0				10
-11.3'			(SP) SAME AS 21.0'-22.5'. 28.5'		10		10 14 11
-12.8'			WASH				25
-14.3'	30		CONTINUED ON SHEET #2				



NOTE: SOILS VISUALLY FIELD CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM.

BLOWS PER 1/2 FOOT
NUMBER REQUIRED TO DRIVE 1 3/8" I.D. SPLITSPOON W/ 140 LB HAMMER FALLING 30".

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 15.7' MLW | **Hole No.** SH-408

PROJECT SAVANNAH HARBOR EXPANSION FEASIBILITY STUDY | INSTALLATION SAVANNAH, GA. | SHEET 2 OF 2 SHEETS

ELEVATION MLW (a)	DEPTH FT. (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	Blows
14.3'	30						
-15.8'			(SP) LIGHT GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND. 31.5'		11		8 17 18 — 35
-17.3'			WASH 33.0'				
-18.8'			(SM) GRAY MEDIUM SILTY QUARTZ SAND. 34.5'		12		7 14 16 — 30
-20.3'	35		WASH 36.0'				
-21.8'			(SP) LIGHT GRAY FINE TO MEDIUM POORLY GRADED QUARTZ SAND. 37.5'		13	NOTE: INADVERTANTLY WASHED FROM 39.0' TO 41.0'.	12 12 15 — 27
			WASH (SEE REMARKS) 41.0'				
-25.3'	40		(SP) SAME AS 36.0'-37.5'. 42.5'		14		10 5 10 — 15
-26.8'			WASH 44.0'				
-28.3'			(SP) SAME AS 36.0'-37.5' BUT WITH TRACE OF SILT. 45.5'		15		15 19 21 — 40
-29.8'	45		WASH 49.0'			DRIVEN 5' CENTERS AT 45.5'.	
-33.3'			(SP) GRAY MEDIUM TO COARSE POORLY GRADED QUARTZ SAND. 50.5'		16		13 26 26 — 52
-34.8'	50		WASH 54.0'				
-38.3'			(SP) GRAY COARSE POORLY GRADED QUARTZ SAND, PIECE OF WOOD FROM 55.2' TO 55.3'.		17		14 13 13 — 26
-39.8'	55		BOTTOM OF BORING 55.5'				
	60						

Hole No. SH-410

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: SAVANNAH, GEORGIA	SHEET 1 OF 1 SHEETS

1. PROJECT	SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR
2. LOCATION	GA NAD83 E 989278.56 N 759851.67
3. DRILLING AGENCY	SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	SH-410
5. NAME OF DRILLER	H. FULCHER
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEGREES FROM VERTICAL
7. THICKNESS OF OVERBURDEN	> 7.0'
8. DEPTH DRILLED INTO ROCK	0.0
9. TOTAL DEPTH OF HOLE	7.0'
10. SIZE AND TYPE OF BIT	4" AUGER, 5 7/8" ROCK BIT, 5.5" FISHTAIL
11. DATUM FOR ELEVATION SHOWN (MSL or MLW)	MLW
12. MANUFACTURER'S DESIGNATION OF DRILL	PETERBUILT - FAILING 1500
13. TOTAL NUMBER OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 2 / UNDISTURBED: 0
14. TOTAL NUMBER OF CORE BOXES	0
15. ELEVATION GROUNDWATER	SEE REMARKS
16. DATE HOLE	STARTED: 21 AUG 2002 / COMPLETED: 22 AUG 2002
17. ELEVATION TOP OF HOLE	12.0'
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	DANA POLACSEK

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling time/water loss/etc.) BLOWS/1ft INCHES g "N" VALUE
	0		(SW) SILTY SAND, DK BROWN, FINE W/5-10% ROCK FRAGMENTS & FINE TO COARSE GRAVEL, & OCCASIONAL ASPHALT PIECES TO 1" ACROSS (FILL) WOOD AT 2.5 FEET.			HAND AUGERED TO 3.0 FEET
					1	4" O.D. AUGER, LARGE ROCK AT 3', 5 7/8" ROCK BIT TO ABOUT 3.5', LOST MUD
			LT. GRAY			SET 10' CASING TO DEPTH OF 2 FT BELOW GROUND SURFACE
	5		YELLOWISH RED W/CLAYEY ZONES AND LITTLE MED SAND, OCCASIONAL SHELLS TO 3/4", WOOD FRAGMENTS.		2	4/3/3 6
			BORING TERMINATED AT 7 FEET DUE TO CONTINUED WATER LOSS			WATER LEVEL NOT ENCOUNTERED
	10					
	15					
	20					
	25					
	30					

Hole No. SH-410A

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: SAVANNAH, GEORGIA	SHEET 1 OF 2 SHEETS

1. PROJECT	SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR
2. LOCATION	GA NAD83 E 989247.95 N 759814.98
3. DRILLING AGENCY	SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number)	SH-410A
5. NAME OF DRILLER	H. FULCHER
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEGREES FROM VERTICAL
7. THICKNESS OF OVERBURDEN	> 73.0'
8. DEPTH DRILLED INTO ROCK	0.0
9. TOTAL DEPTH OF HOLE	73.0'
10. SIZE AND TYPE OF BIT	4" SPIRAL AUGER, 5.5" FISHTAIL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MLW
12. MANUFACTURER'S DESIGNATION OF DRILL	PETERBUILT - FAILING 1500
13. TOTAL NUMBER OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 17 / UNDISTURBED: 0
14. TOTAL NUMBER OF CORE BOXES	0
15. ELEVATION GROUNDWATER	5.2'
16. DATE HOLE	STARTED: 22 AUG 2002 / COMPLETED: 28 AUG 2002
17. ELEVATION TOP OF HOLE	12.0'
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	DANA POLACSEK

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling time/water loss, etc.) BLOWS/15 INCHES g	"N" VALUE
12.0	0		(SM) SILTY SAND, BROWN & GRAY, FINE, W/5-10% COARSE SAND & FINE GRAVEL, OCCAS. ROCK FRAGMENTS, ASPHALT FRAGMENTS, TRACE IRON STAINING (FILL)			4" SPIRAL AUGER	
					1	51/100-8"/STOP	100
						WATER MEASURED AT 5.2' DEPTH @ 0920, 29 AUG 02.	
	5		AT 4.5' - PLASTIC SHEETING		2	6/5/4	9
			4.5-6.0' - DK BRN TO DK GRAY W/TRACE ROCK FRAGMENTS TO 1 CM DIAM, BRICK FRAGMENTS, OCCAS. SILTY ZONES & COARSE GRAVEL, SLIGHTLY MOIST.			WATER LEVEL TAGGED @ 5.9' DEPTH @ 1245 ON 29 AUG 02.	
			6.0-8.0', CLAYEY ZONES IN CUTTINGS, WET AT 7.0'		3	7/15/5	20
	10		8.0-9.5', DK GRAY TO GRAY, FINE TO MED W/10-15% SILT AND COARSE SAND TO 8.5', TRACE SHELL FRAGMENTS, OCCAS. FINE GRAVEL AND WOOD FRAGMENTS.			MIX MUD, SWITCH TO FISHTAIL	
					4	1/1/1	2
			(CL) LEAN CLAY, OLIVE GRAY W/ TRACE SILT & OCCAS. ROCK FRAGS. TO 1/2" DIAM.				
	15				5	1/1/2	3
			(SM) SILTY SAND, DK GRAY, FINE, W/FREQUENT FINE LAMINATED CLAY LENSES, MOIST				
			(CL) LEAN CLAY, OLIVE GRAY, 5OFT		6	1/7/11	18
	20		(SM) SILTY SAND, FINE TO MED, W/5ILT, MOIST TO WET			OILY SHEEN ON DRILLING FLUID	
			(CL) LEAN CLAY, OLIVE GRAY, W/ TRACE SILT, SOFT, WET		7	WR/WR/1	1
	25		BECOMMING MORE STIFF W/OCCAS. PARTING OF FINE TO MED SAND		8	4/6/9	15
			(SP) POORLY GRADED SAND, GRAY TO LT BRN, FINE, W/TRACE SILT				
	30		GRAY, MOSTLY FINE SAND, LAMINATED W/DK GRAY FINE SAND, W/TRACE MICA		9	6/8/10	19
			2-3MM LENSES AND LAMINATIONS OF CLAY AT 33-33.5', W/OCCAS, ROCK & SHELL FRAGS TO 1.5 CM DIAM.		10	10/15/16	31
	35						

CONTINUED ON SHEET #2

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 12.0'	Hole No. SH-410A
PROJECT SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR	INSTALLATION SAVANNAH, GEORGIA	SHEET 2 OF 2 SHEETS

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling time/rate, loss/depth of water/mud, etc., if significant) BLOWS/18 INCHES g	"N" VALUE
2.07	35		(SP) POORLY GRADED SAND, GRAY			CAVING 37'-39', THICKEN MUD	
			WOOD FRAGMENTS IN DRILLING MUD		11	WOOD FRAGMENTS	
	40		(NR) NO RECOVERY		NR	10/8/2	10
			(SC) CLAYEY SAND, OLIVE GRAY, FINE TO MED SAND, SOFT, MOIST, W/FREQ (3-4%) WOOD FRAGMENTS TO 1.5" LONG & 1" THICK.		12	WR/1/4	5
	45					WOOD FRAGMENTS IN CUTTINGS	
			(SM) SILTY SAND, OLIVE GRAY, FINE, W/LITTLE TO SOME CLAY, MOIST TO WET, W/FREQ ZONES OF CLAY TO CLAYEY SAND AND WOOD FRAGMENTS TO 1" THICK.		13	2/3/4	7
	50				14	2/20/20	40
	55		(SP) POORLY GRADED SAND, GRAY TO LT GRAY, MED, W/LITTLE TO SOME SILT, CLAY DECREASING TO FREQ PARTINGS/SEAMS, MOIST, MICACEOUS.				
			W/TRACE TO LITTLE FINE SAND AND TRACE COARSE SAND TO FINE GRAVEL FRAGMENTS, ANGULAR		15	22/19/23	42
	60						
			(CH) FAT CLAY, OLIVE GRAY, W/1" LAYER OF FINE GRAVEL FRAGMENTS				
	65		(ML) CLAYEY SILT, OLIVE GRAY, DAMP, FINELY LAMINATED, MIOCENE		16	8/12/17	29
	70		GREENISH GRAY, W/TRACE CLAY, FREQ SEAMS & LAYERS OF SILTY SAND IN UPPER 0.5', W/OCCAS FINE GRAVEL FRAGS, ALSO IN UPPER 0.5', SLIGHTLY MOIST MIOCENE		17	12/16/23	39
	75		BOTTOM OF BORING AT 73.0'				

Hole No. SH-411

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: SAVANNAH, GEORGIA	SHEET 1 OF 2 SHEETS
1. PROJECT: SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR		10. SIZE AND TYPE OF BIT: 4" ROTARY ROCK BIT	
2. LOCATION: GA NAD83 E 998735.3 N 758126.7		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW	
3. DRILLING AGENCY: SAVANNAH DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: CME 55, USING AUTOMATIC HAMMER	
4. HOLE NO. (As shown on drawing title and file number): SH-411		13. TOTAL NUMBER OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16	UNDISTURBED 0
5. NAME OF DRILLER: JOEY W. & NICK A. - GEC		14. TOTAL NUMBER OF CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒VERTICAL ☐INCLINED ____ DEGREES FROM VERTICAL		15. ELEVATION GROUNDWATER: APPROX. 5'	
7. THICKNESS OF OVERBURDEN: >73.0'		16. DATE HOLE: STARTED 22 OCT 2002	COMPLETED 28 OCT 2002
8. DEPTH DRILLED INTO ROCK: 0.0		17. ELEVATION TOP OF HOLE: 12.0'	
9. TOTAL DEPTH OF HOLE: 73.0'		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
		19. SIGNATURE OF INSPECTOR: JOEY W.	

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling time/water loss, etc.) BLOWS/1ft INCHES g	"N" VALUE
12.0	0		(SM) SILTY SAND, BLACK, FINE, W/ORGANICS			MIX & USING MUD	
					1	2/2/2	4
						WATER LEVEL ESTIMATED AT 5' DEPTH DURING DRILLING	
	5				2	1/2/2	4
			BROWN, VERY LOOSE			WOOD FRAGMENTS	
			(CL) LEAN CLAY, GRAY, TRACE FINE SILT WITH ORGANICS		3	1/0/1	1
	10						
					4	WEIGHT OF HAMMER	0
	15				5	WEIGHT OF HAMMER	0
			GRAY, VERY SOFT, WET		6	WEIGHT OF HAMMER	0
	20						
			GRAY, W/TRACE SILT, SOFT, WET, WITH ORGANICS		7	1/1/1	2
	25				8	WEIGHT OF HAMMER	0
					9	WEIGHT OF HAMMER	0
	30						
					10	WEIGHT OF HAMMER	0
	35						

CONTINUED ON SHEET #2

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 12.0′	Hole No. SH-411
PROJECT SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR	INSTALLATION SAVANNAH, GEORGIA	SHEET 2 OF 2 SHEETS

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling rate/time, loss/gain of water/grout, etc., if significant) BLOWS/18 INCHES g	'N' VALUE
−22.0	35		(CL) LEAN CLAY, GRAY, TRACE FINE SILT WITH ORGANICS			WOOD FRAGMENTS	
	40		(NR) NO RECOVERY		11	WEIGHT OF HAMMER	0
			(SC) CLAYEY SAND, OLIVE GRAY, FINE TO MED SAND, SOFT, MOIST, W/FREQ (3-4%) WOOD FRAGMENTS TO 1.5" LONG & 1" THICK.			WOOD FRAGMENTS IN CUTTINGS	
	45		(SM) SILTY SAND, OLIVE GRAY, FINE, W/LITTLE TO SOME CLAY, MOIST TO WET, W/FREQ ZONES OF CLAY TO CLAYEY SAND AND WOOD FRAGMENTS TO 1" THICK.		12	WEIGHT OF HAMMER	0
	50						
	55		(SP) POORLY GRADED SAND, GRAY TO LT GRAY, MED, W/LITTLE TO SOME SILT, CLAY DECREASING TO FREQ PARTINGS/SEAMS, MOIST, MICACEOUS.		13	6/9/10	19
	60				14	4/7/7	14
	65				15	4/7/9	16
	70				16	6/7/9	16
	75		BOTTOM OF BORING AT 73.0′				

Hole No. SH-412

DRILLING LOG	DIVISION: SOUTH ATLANTIC	INSTALLATION: SAVANNAH, GEORGIA	SHEET 1 OF 2 SHEETS

1. PROJECT: SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR
2. LOCATION: GA NAD83 E 991671.84 N 759038.80
3. DRILLING AGENCY: SAVANNAH DISTRICT
4. HOLE NO. (As shown on drawing title and file number): SH-412
5. NAME OF DRILLER: H. FULCHER
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEGREES FROM VERTICAL
7. THICKNESS OF OVERBURDEN: >73.0 FT
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 73.0 FT
10. SIZE AND TYPE OF BIT: 4" SPIRAL AUGER, 5.5" & 7.5" FISHTAIL, 9" ROCK BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MLW
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NUMBER OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 1
14. TOTAL NUMBER OF CORE BOXES: 0
15. ELEVATION GROUNDWATER: SEE REMARKS
16. DATE HOLE: STARTED 29 AUG 2002; COMPLETED 06 SEP 2002
17. ELEVATION TOP OF HOLE: 12.0'
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: DANA POLACSEK

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling time, water loss, etc.) BLOWS/18 INCHES g	'N' VALUE
19.39	0		(SM) SILTY SAND, FINE W/5-10% MED SAND & SILT, DK BRN TO BRN, W/TRACE COARSE SAND, OCCAS. CLAYEY/SILTY NODULES, DRY TO DAMP			4" SPIRAL AUGER	
					1	4/12/17	29
						WATER ENCOUNTERED AT 4.55' DURING DRILLING	
	5		SLIGHT INCREASE IN SILT & MED SAND, CLAY/SILT NODULES BECOME SEAMS OF DARK GRAY CLAY		2	2/2/2	4
			(SP) POORLY GRADED SAND, OLIVE GRAY W/TRACE SILT, TRACE COARSE SAND & ROCK FRAGS OF COARSE SAND SIZE TO OCCAS. FINE GRAVEL SIZE, WET		3	1/1/1	2
9.39	10					MIX MUD - SWITCHED TO 5.5" FISHTAIL	
			(CH) FAT CLAY, OLIVE GRAY W/ TRACE SILT, OCCAS. PARTING OF SILTY FINE SAND, VERY SOFT, WET		4	UD-1 UNDISTURBED 1/1/1	2
	15		W/FINE SAND, FINELY LAMINATED IN LAYERS, W/WOOD FRAGMENTS IN SHOE & CORE BARREL LIKE A CORE ADJACENT TO CLAY		5	1/2/2	4
			NO RECOVERY - WOOD IN SHOE		6	WOOD IN SHOE 2/15/3	18
	20						
			(SP) POORLY GRADED SAND, OLIVE GRAY, FINE TO MED, W/TRACE OF SILT, WET, MICACEOUS		7	SWITCH TO 7.5" FISHTAIL 4/5/4	9
	25		DK GRAY, W/OCCAS. ZONES W/TRACE CLAY, WOOD FRAGMENTS & TRACE MICA		8	USING 9" ROCK BIT 2/3/7	10
						USING 7.5" FISHTAIL	
	30				9	4/6/12	18
						PUMP/RODS CLOGGED WITH SAND & WOOD, CLEAN OUT PUMP, MIX NEW MUD	
			TRACE COARSE SAND, FINE GRAVEL, OCCAS, ROCK FRAGMENTS, ROUNDED, UP TO 1 CM DIAMETER		10	3/17/26	43
	35						

CONTINUED ON SHEET #2

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 12.0′	Hole No. SH-412
PROJECT SAVANNAH HARBOR EXPANSION, SAVANNAH HARBOR	INSTALLATION SAVANNAH, GEORGIA	SHEET 2 OF 2 SHEETS

ELEVATION (FEET) a	DEPTH (FEET) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	MOISTURE CONTENT (%) e	JAR OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g BLOWS/1ft INCHES	"N" VALUE
	35		(SP) POORLY GRADED SAND, OLIVE GRAY, FINE TO MED, W/TRACE OF SILT, WET, MICAEOUS				
	40		FINELY LAMINATED W/CLAYEY ZONES, FINE GRAVEL, ROCK FRAGMENTS, WOOD, DECREASING		11	9/17/19	36
	45		LAMINATIONS ABSENT, W/FEW SEAMS OF DARK GRAY TO BLACK SILT		12	7/14/13	27
	50		GRAY TO LT GRAY W/DARK GRAY CLAY LAYER ABOUT 0.4 FT THICK FROM 52.0 TO 52.4 FT		13	10/15/15	30
	55						
	60		BROWN & GRAY, MOSTLY COARSE SAND, TRACE FINE TO MED SAND & FINE GRAVEL, W/LAYER OF FINE LAMINATED GRAY FINE TO MED SAND ABOUT 59.0 TO 59.5 AND TRACE SILT, WOOD ABSENT		14	12/23/28	51
	65		63′ TO 64′ DRILLER REPORTS SOFT SOIL BASED ON DRILLING RESPONSE		15	15/25/40	65
	70		(ML) LEAN SILT, GREENISH GRAY, W/TRACE FINE SAND, VERY STIFF, DRY TO SLIGHTLY MOIST, MIOCENE				
			W/LITTLE FINE SAND, BECOMING OLIVE GRAY TO DK GRAY W/TRACE TO NO FINE SAND FROM 72.5 TO 73′, VERY FINELY LAMINATED		16	6/14/18	32
	75		BOTTOM OF BORING AT 73.0′				

APPENDIX B

LABORATORY DATA

(Click for Test Results)

LABORATORY DATA

Liquid and Plastic Limits

SH 410A	Sample	4	Depth	11.5	to	13.0	CH		
SH 410A	Sample	4	Depth	11.5	to	13.0	CH	Lab Work Sheet	
SH 410A	Sample	6	Depth	18.5	to	20.0	SC		
SH 410A	Sample	16	Depth	65.0	to	66.5	GM		
SH 411	Sample	2	Depth	4.5	to	6.0	SM		
SH 411	Sample	5	Depth	15.0	to	16.5	CH		
SH 411	Sample	8	Depth	25.5	to	27.0	MH		
SH 411	Sample	12	Depth	45.5	to	47.0	CH		
SH 412	Sample	5	Depth	15.0	to	16.5	CH		

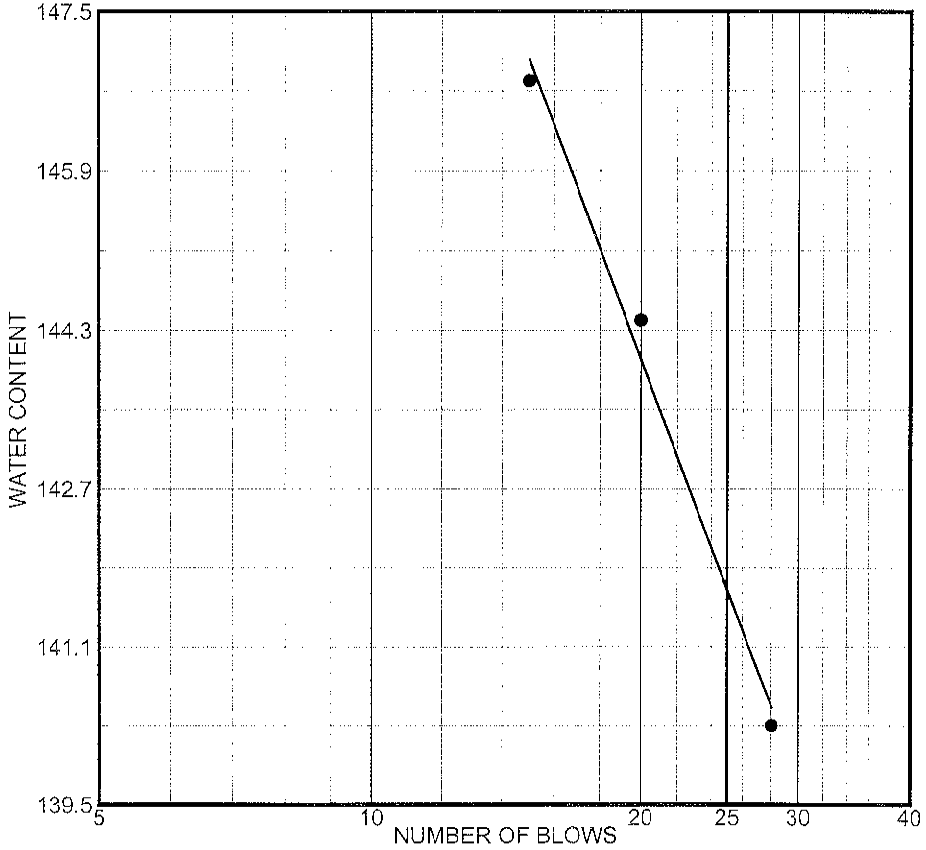
Grain Size Distribution

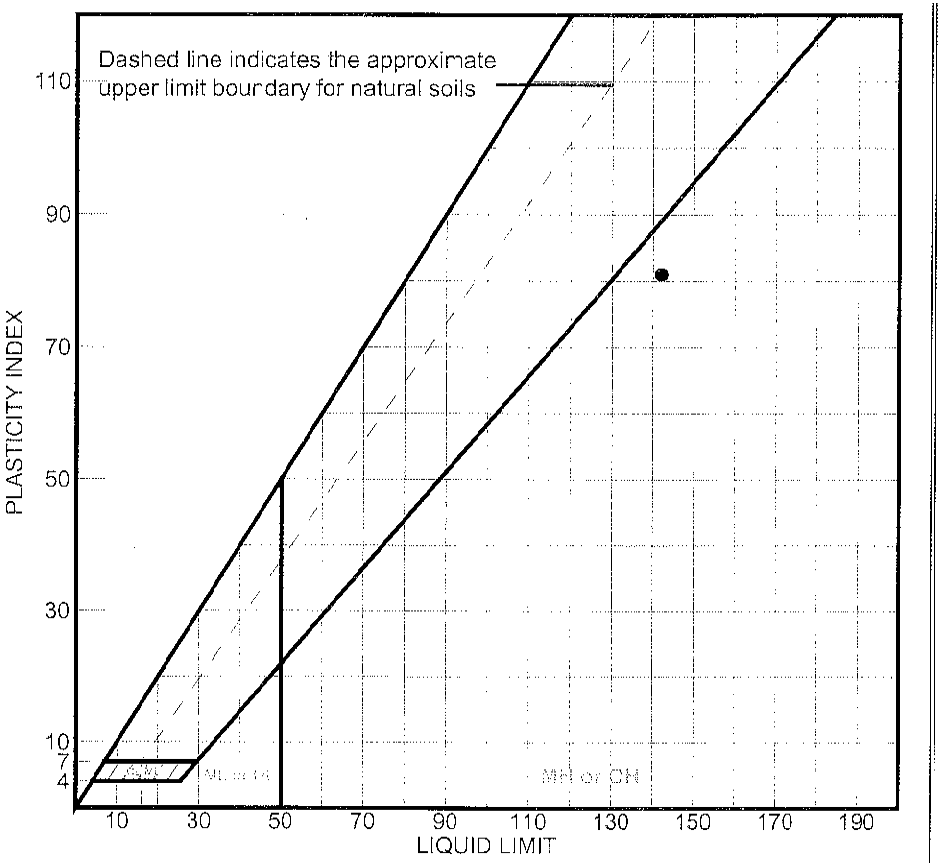
SH 410	Sample	2	Depth	4.5	to	6.0	SC	
SH 410	Sample	2	Depth	4.5	to	6.0	SC	Lab Work Sheet
SH 410A	Sample	3	Depth	8.0	to	9.5	SM	
SH 410A	Sample	3	Depth	8.0	to	9.5	SM	Lab Work Sheet
SH 410A	Sample	4	Depth	11.5	to	13.0	CH	
SH 410A	Sample	4	Depth	11.5	to	13.0	CH	Lab Work Sheet
SH 410A	Sample	6	Depth	18.0	to	20.0	SC	
SH 410A	Sample	6	Depth	18.0	to	20.0	SC	Lab Work Sheet
SH 410A	Sample	6	Depth	18.0	to	20.0	SC	
SH 410A	Sample	6	Depth	18.0	to	20.0	SC	Lab Work Sheet
SH 411	Sample	2	Depth	4.5	to	6.0	SM	
SH 411	Sample	2	Depth	4.5	to	6.0	SM	Lab Work Sheet
SH 411	Sample	5	Depth	15.0	to	16.5	CH	
SH 411	Sample	8	Depth	25.5	to	27.0	MH	
SH 411	Sample	12	Depth	45.5	to	47.0	CH	
SH 411	Sample	14	Depth	58.5	to	60.0	SM	
SH 412	Sample	5	Depth	15.0	to	16.5	CH	

Triaxial Shear Test

SH 412	Sample	UD1	Depth	11.5	to	13.3	CH	R w/pore pressures
SH 412	Sample	Jar	Depth	11.5	to	11.7	SM	
SH 412	Sample	UD1	Depth	11.5	to	13.3	CH	Sieve Analysis
SH 412	Sample	UD1	Depth	11.5	to	13.3	CH	Atterberg Limits

Moisture Contents Summary **Table 410, 411 & 412**





	SOURCE	SAMPLE #	DEPTH/E_EV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-410A	16	65.0'- 66.5'		GM	Olive-Brown Very Silty Fine SAND w/ rock fragments	34.7	142	81

Client US Army Corps of Engineers

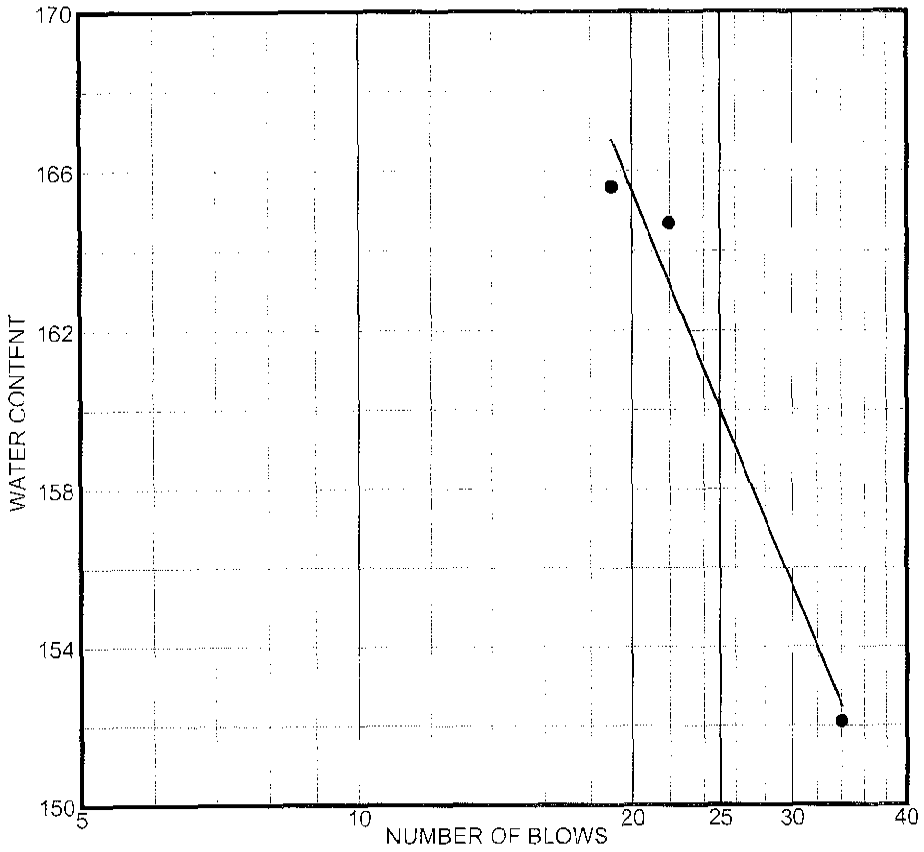
Project Savannah Harbor Expansion

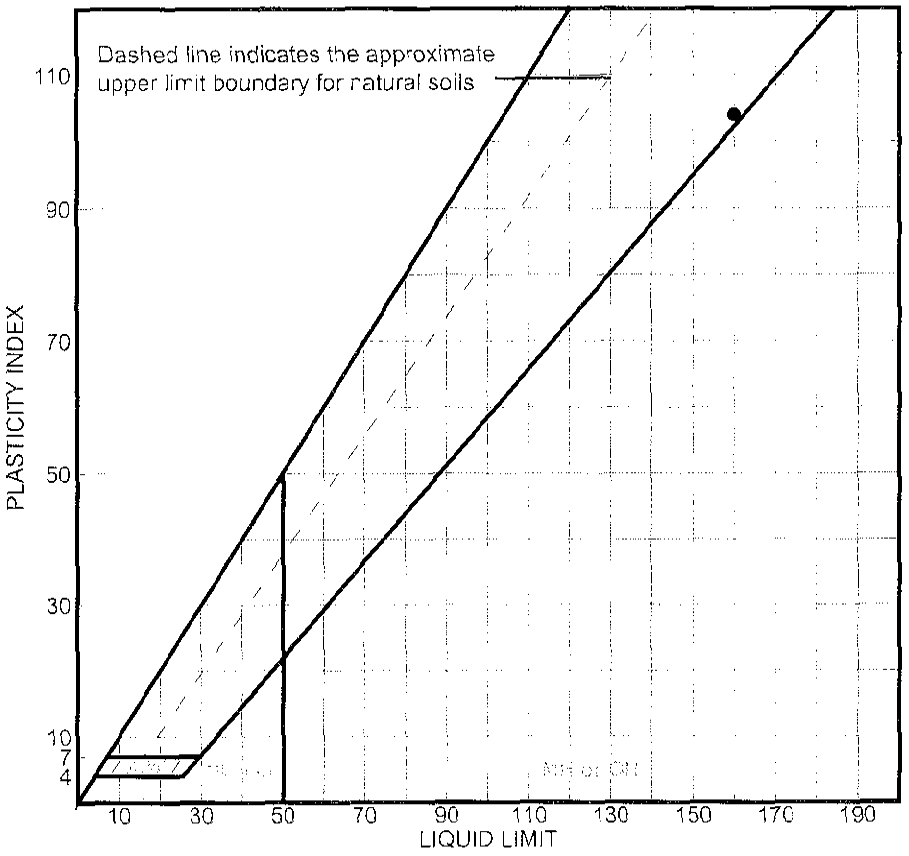
Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-410A	4	11.5'- 13.0'		CH	Brown Sandy CLAY w/ some rock fragments	107.3	160	104

Client US Army Corps of Engineers

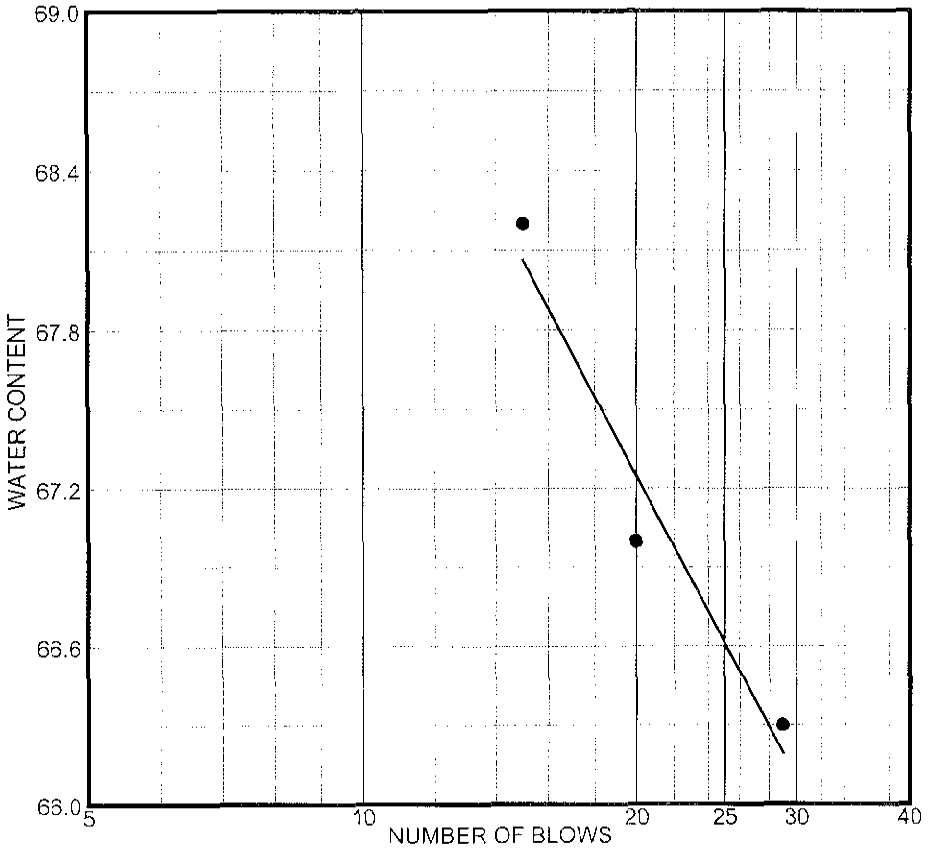
Project Savannah Harbor Expansion

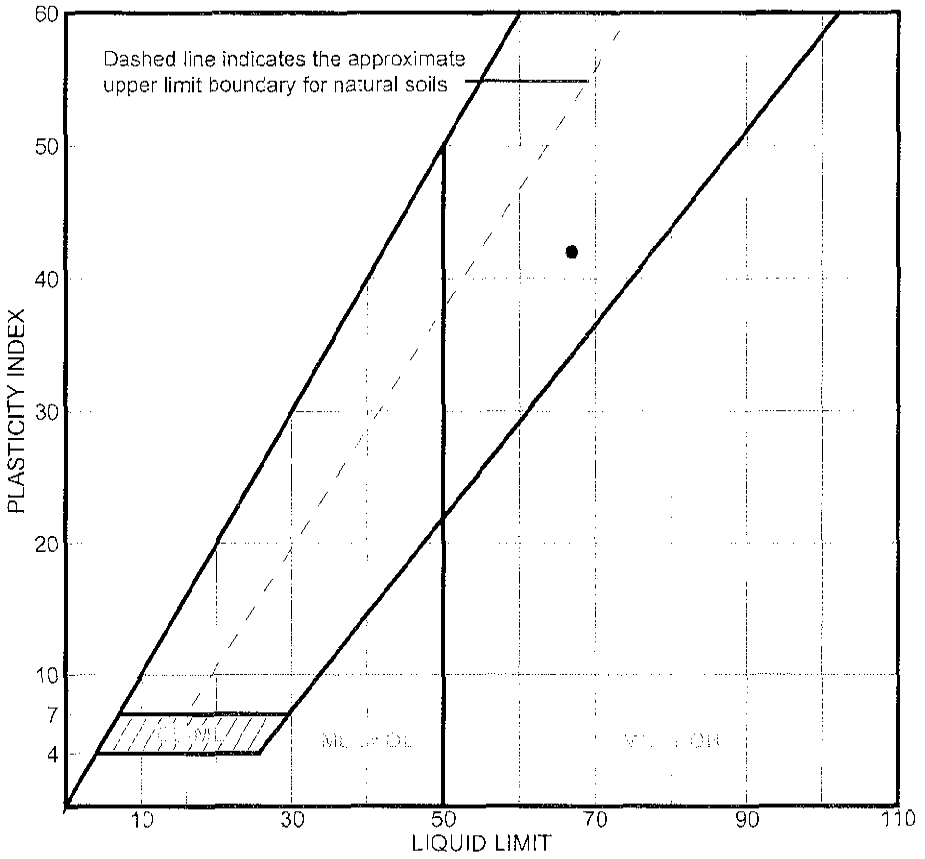
Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV. DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-410A	6	18.5'- 20.0'	SC	Brown Clayey Fine SAND w/ some rock fragments and organics	52.5	67	42

Client US Army Corps of Engineers

Project Savannah Harbor Expansion

Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●

LIQUID AND PLASTIC LIMIT TEST DATA

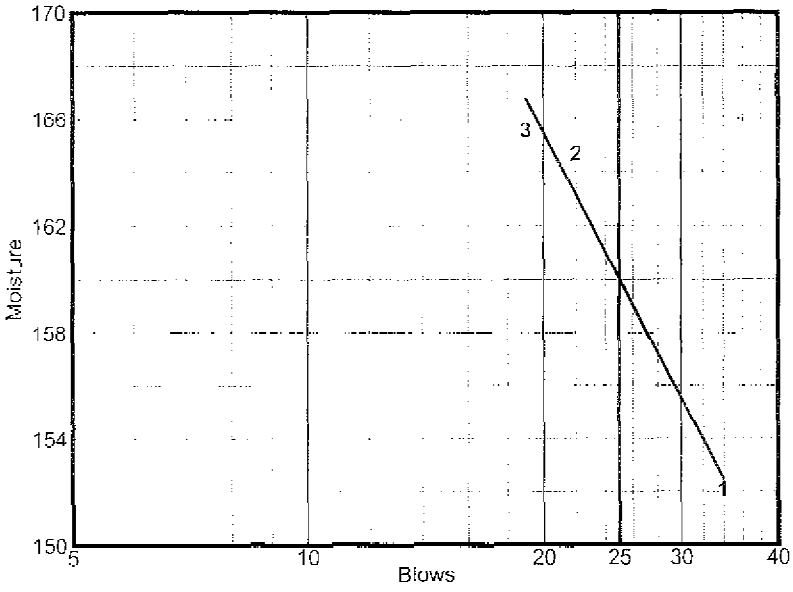
Client: US Army Corps of Engineers
Project: Savannah Harbor Expansion
Project Number: 1452-01-40

Sample Data

Source: Boring No. SH-410A
Sample No.: 4
Elev. or Depth: 11.5'- 13.0' **Sample Length (in./cm.):**
Location:
Description: Brown Sandy CLAY w/ some rock fragments
Date: **Natural Moisture:** 107.3
USCS Class.: CH **AASHTO Class.:** A-7-5(101)
Testing Remarks:

Liquid Limit Data

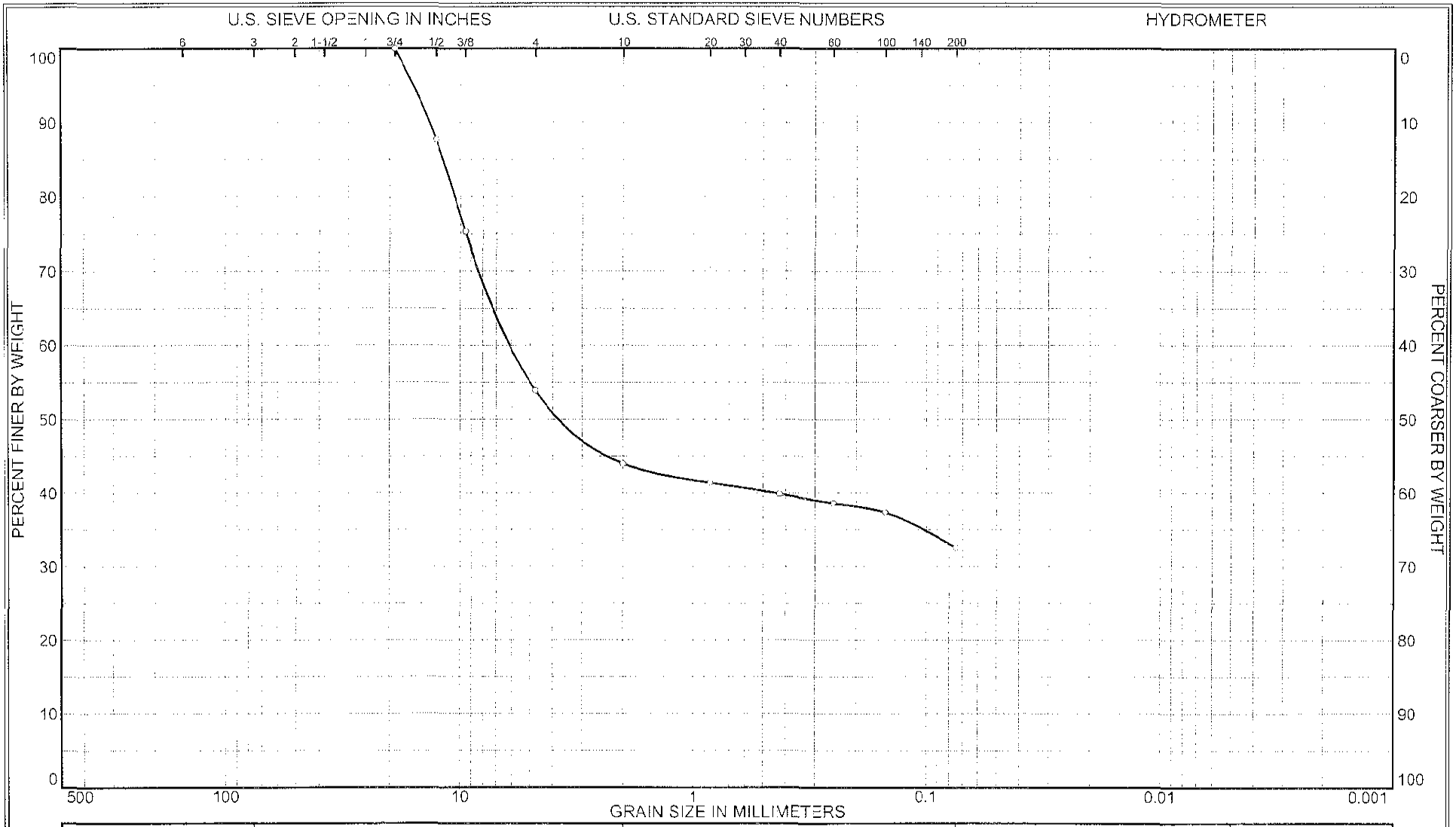
Run No.	1	2	3	4	5	6
Wet+Tare	35.26	35.56	34.95			
Dry+Tare	32.31	32.48	32.40			
Tare	30.37	30.61	30.86			
# Blows	34	22	19			
Moisture	152.1	164.7	165.6			



Liquid Limit= 160
Plastic Limit= 56
Plasticity Index= 104

Plastic Limit Data

Run No.	1	2	3	4
Wet+Tare	9.65			
Dry+Tare	7.48			
Tare	3.61			
Moisture	56.1			



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
16	65.0'- 66.5'	Olive-Brown Very Silty Fine SAND w/ rock fragments	34.7	142	61	81

Project Savannah Harbor Expansion

Area

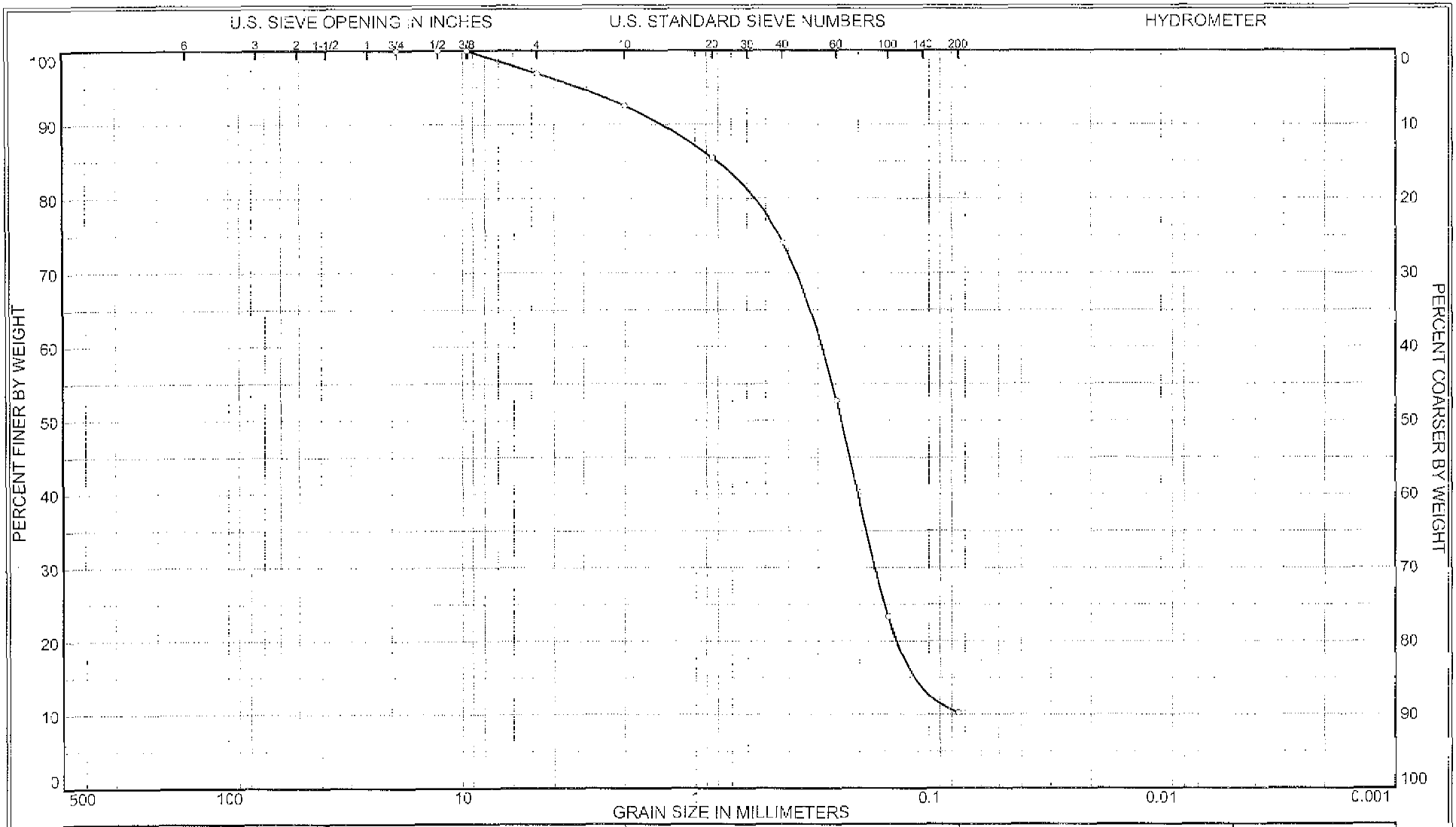
Boring No. Boring No. SH-410A

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Grain Size Distribution Report

ENG FORM 1 MAY 63 2087



	Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
○	3	8.0' - 9.5'	Gray Slightly Silty Fine SAND w/ rock fragments	23.8		NP	NP

Project Savannah Harbor Expansion

Area

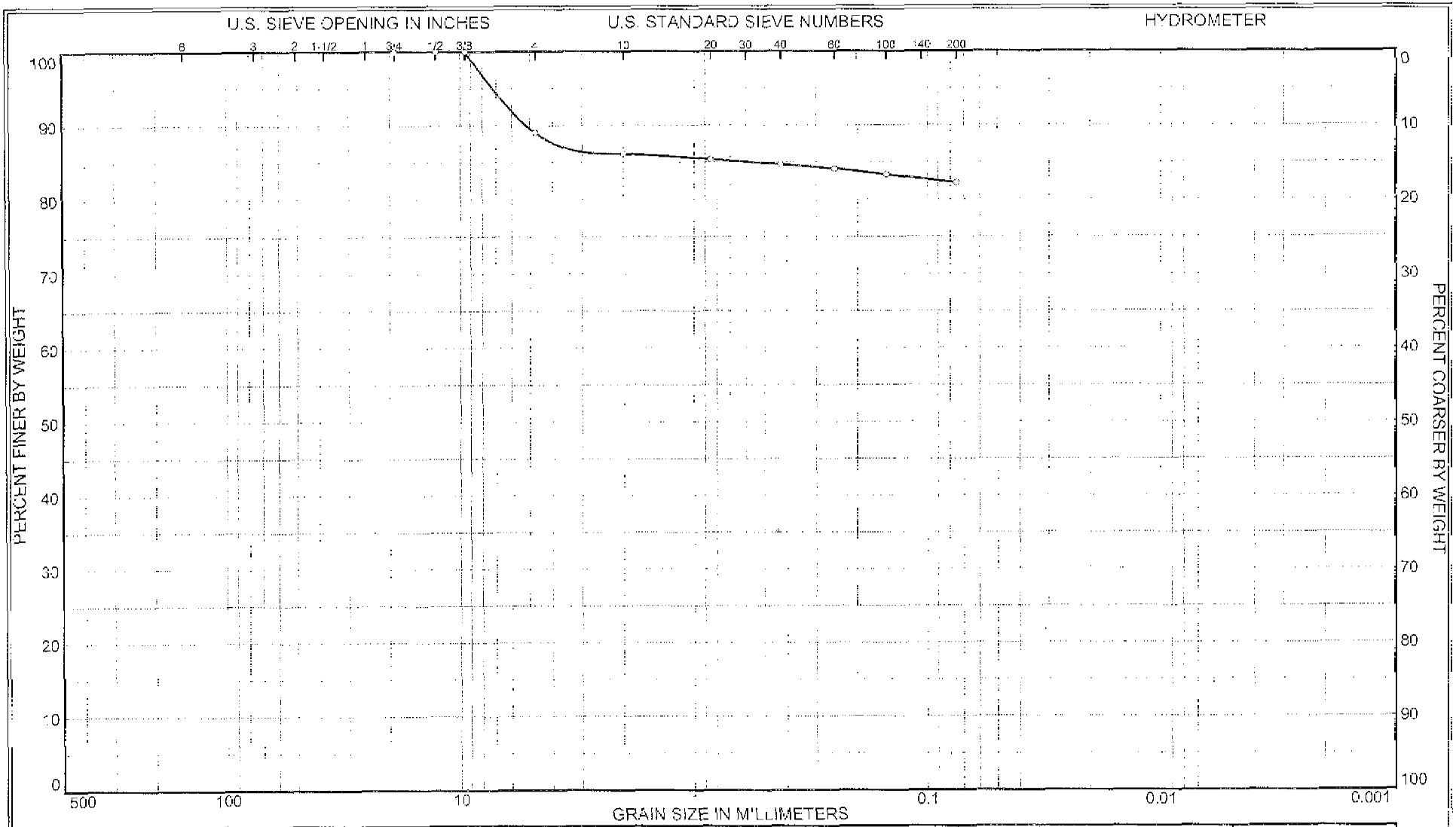
Boring No. Boring No. SH-410A

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Grain Size Distribution Report

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
4	11.5'- 13.0'	Brown Sandy CLAY w/ some rock fragments	107.3	160	56	104

Project Savannah Harbor Expansion

Area

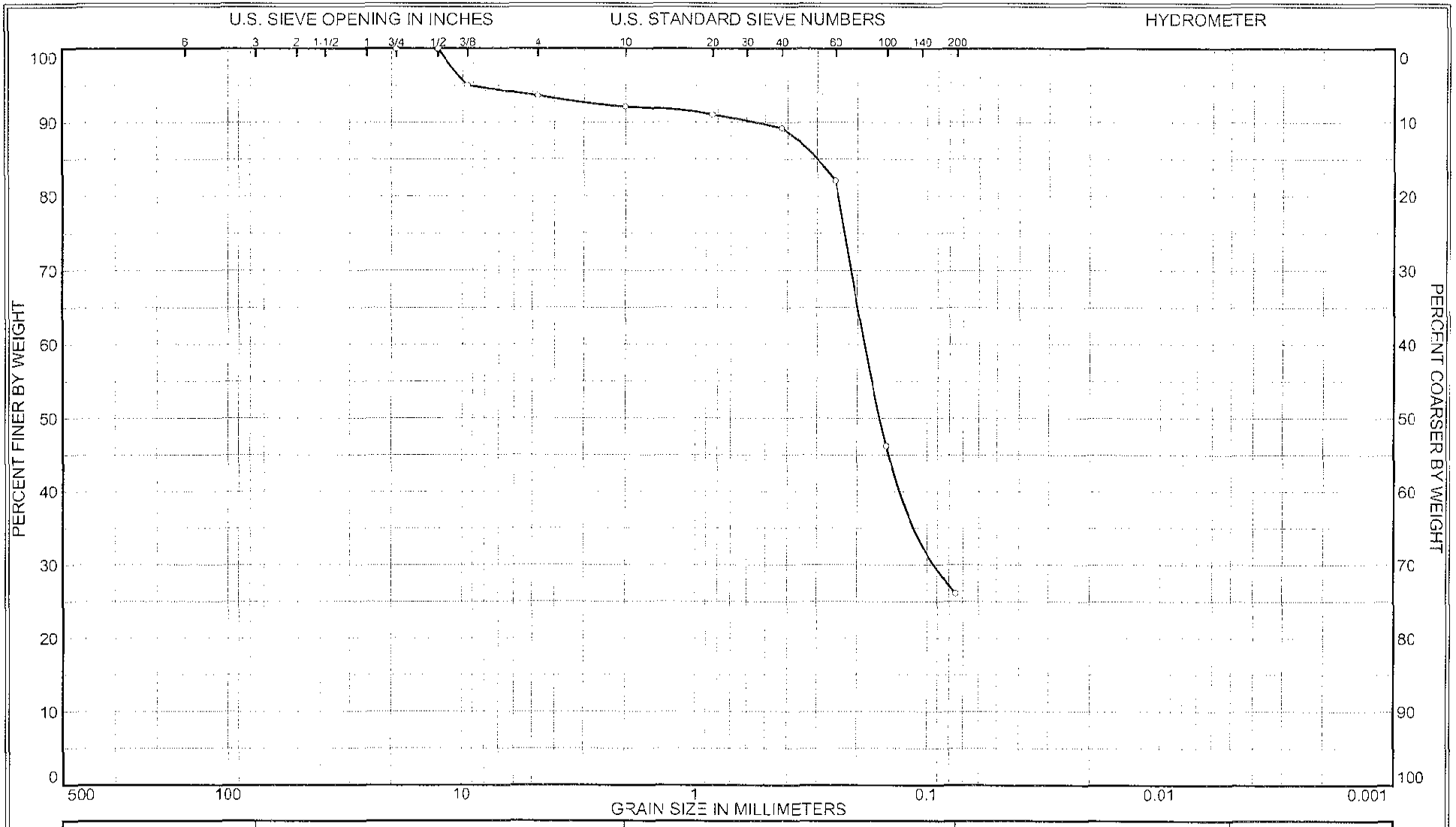
Boring No. Boring No. SH-410A

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Grain Size Distribution Report

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
6	18.5'- 20.0'	Brown Clayey Fine SAND w/ some rock fragments and organics	52.5	67	25	42

Project Savannah Harbor Expansion

Area

Boring No. Boring No. SH-410A

Grain Size Distribution Report

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

ENG FORM 1 MAY 53 2087

GRAIN SIZE DISTRIBUTION TEST DATA

Project: Savannah Harbor Expansion

Sample Data

Source: Boring No. SH-410A
Sample No.: 16
Elev. or Depth: 65.0'- 66.5' **Sample Length (in./cm.):**
Location:
Description: Olive-Brown Very Silty Fine SAND w/ rock fragments
PL: 61 **LL:** 142
PI: 81 **Nat W.%:** 34.7

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	109.77	90.48
Tare =	50.06	50.06
Dry sample weight =	59.71	40.42

Minus #200 from wash= 32.3 %
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
.75 inch	0.00	100.0
.50 inch	7.32	87.7
.375 inch	14.75	75.3
# 4	27.53	53.9
# 10	33.46	44.0
# 20	35.01	41.4
# 40	35.91	39.9
# 60	36.64	38.6
# 100	37.45	37.3
# 200	40.32	32.5

Fractional Components

Gravel/Sand based on #10
Sand/Fines based on #200
% COBBLES = **% GRAVEL =** 56.0 **% SAND =** 11.5
% FINES = 32.5

D_{85}= 11.88 D_{60}= 6.14 D_{50}= 3.80

GRAIN SIZE DISTRIBUTION TEST DATA

Project: Savannah Harbor Expansion

Sample Data

Source: Boring No. SH-410A
Sample No.: 3
Elev. or Depth: 8.0'- 9.5' **Sample Length (in./cm.):**
Location:
Description: Gray Slightly Silty Fine SAND w/ rock fragments
PL: NP **LL:**
PI: NP **Nat W.%:** 23.8

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	142.84	134.01
Tare =	49.94	49.94
Dry sample weight =	92.90	84.07

Minus #200 from wash= 9.5 %
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
.75 inch	0.00	100.0
.50 inch	0.00	100.0
.375 inch	0.00	100.0
# 4	2.90	96.9
# 10	6.98	92.5
# 20	13.50	85.5
# 40	24.11	74.1
# 60	43.92	52.7
# 100	71.23	23.3
# 200	83.40	10.2

Fractional Components

Gravel/Sand based on #10
Sand/Fines based on #200
% COBBLES = **% GRAVEL** = 7.5 **% SAND** = 82.3
% FINES = 10.2

D_{85}= 0.81 D_{60}= 0.29 D_{50}= 0.24
D_{30}= 0.17 D_{15}= 0.12

GRAIN SIZE DISTRIBUTION TEST DATA

Project: Savannah Harbor Expansion

Sample Data

Source: Boring No. SH-410A
Sample No.: 4
Elev. or Depth: 11.5'- 13.0' **Sample Length (in./cm.):**
Location:
Description: Brown Sandy CLAY w/ some rock fragments
PL: 56 **LL:** 160
PI: 104 **Nat W.%:** 107.3

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	90.23	57.49
Tare =	50.52	50.52
Dry sample weight =	39.71	6.97

Minus #200 from wash= 82.4 %
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
.75 inch	0.00	100.0
.50 inch	0.00	100.0
.375 inch	0.00	100.0
# 4	4.36	89.0
# 10	5.53	86.1
# 20	5.80	85.4
# 40	6.07	84.7
# 60	6.31	84.1
# 100	6.63	83.3
# 200	7.06	82.2

Fractional Components

Gravel/Sand based on #10
Sand/Fines based on #200
% COBBLES = **% GRAVEL =** 13.9 **% SAND =** 3.9
% FINES = 82.2

D_{85}= 0.57

GRAIN SIZE DISTRIBUTION TEST DATA

Project: Savannah Harbor Expansion

Sample Data

Source: Boring No. SH-410A
Sample No.: 6
Elev. or Depth: 18.5'- 20.0' **Sample Length (in./cm.):**
Location:
Description: Brown Clayey Fine SAND w/ some rock fragments and organics
PL: 25 **LL:** 67
PI: 42 **Nat W.%:** 52.5

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	106.85	92.51
Tare =	50.76	50.76
Dry sample weight =	56.09	41.75

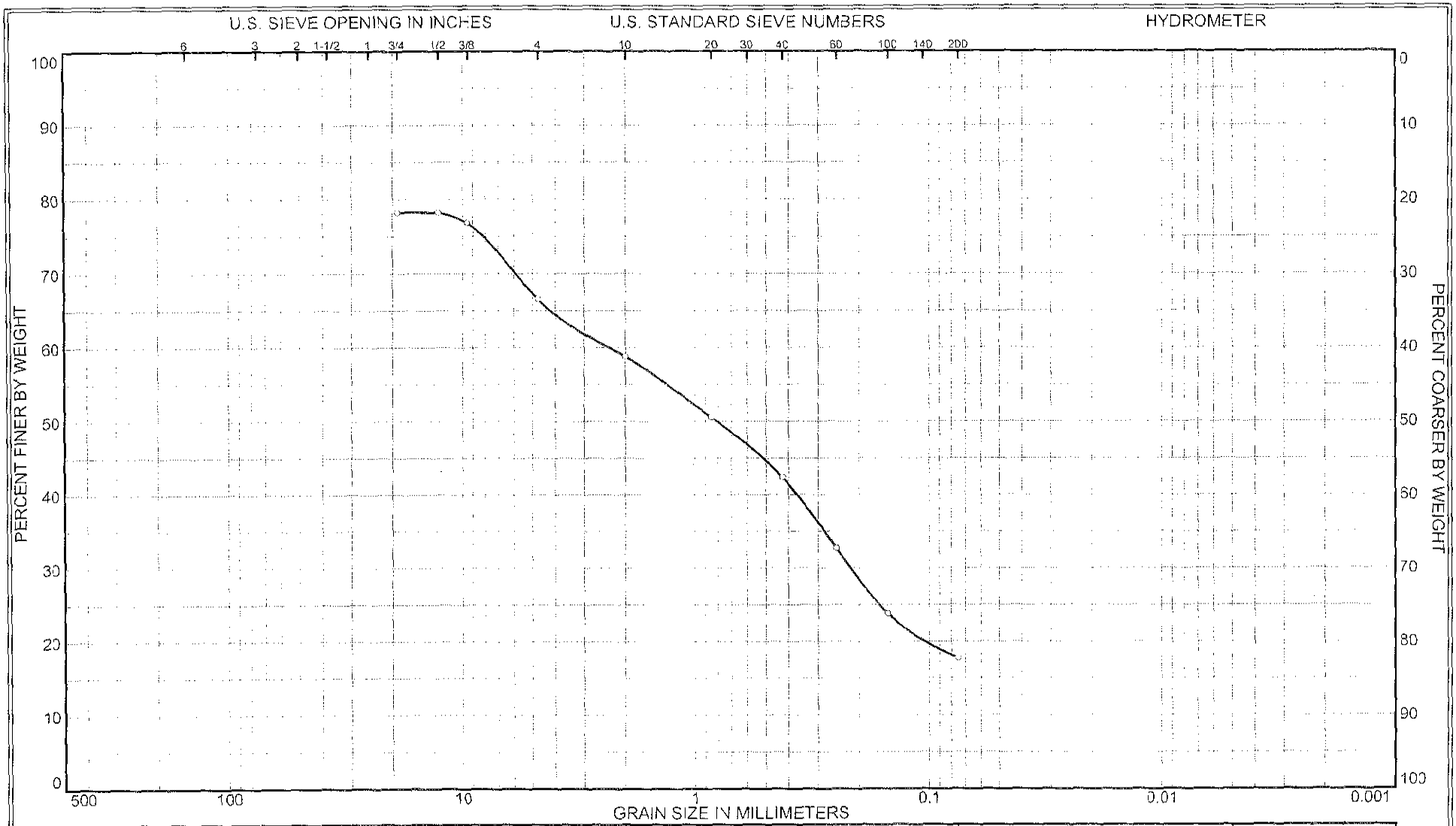
Minus #200 from wash= 25.6 %
Tare for cumulative weight retained= .00

Sieve	Cumul. Wt. retained	Percent finer
.75 inch	0.00	100.0
.50 inch	0.00	100.0
.375 inch	2.83	95.0
# 4	3.62	93.6
# 10	4.46	92.1
# 20	5.06	91.0
# 40	6.04	89.2
# 60	10.04	82.1
# 100	30.16	46.2
# 200	41.46	26.1

Fractional Components

Gravel/Sand based on #10
Sand/Fines based on #200
% COBBLES = % GRAVEL = 7.9 % SAND = 66.0
% FINES = 26.1

D_{85}= 0.30 D_{60}= 0.19 D_{50}= 0.16
D_{30}= 0.09



COBBLES	GRAVEL	SAND	SILT	CLAY

Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
2	4.5'- 6.0'	Brown Slightly Clayey Fine SAND w/ some rock fragments and organics (SC)	30.6			

Project Savannah Harbor Expansion

Area

Boring No. Boring No. SH-410

Grain Size Distribution Report

Date: 1/17/2003 **WOLF TECHNOLOGIES, INC.**

ENG , FORM 1 MAY 63 2087

GRAIN SIZE DISTRIBUTION TEST DATA

Project: Savannah Harbor Expansion

Sample Data

Source: Boring No. SH 410
Sample No.: 2
Elev. or Depth: 4.5'- 6.0' **Sample Length (in./cm.):**
Location:
Description: Brown Slightly Clayey Fine SAND w/ some rock fragments and organics (SC)
PL: **LL:**
PI: **Nat W.%:**

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	132.96	118.88
Tare =	50.54	50.54
Dry sample weight =	82.42	68.34

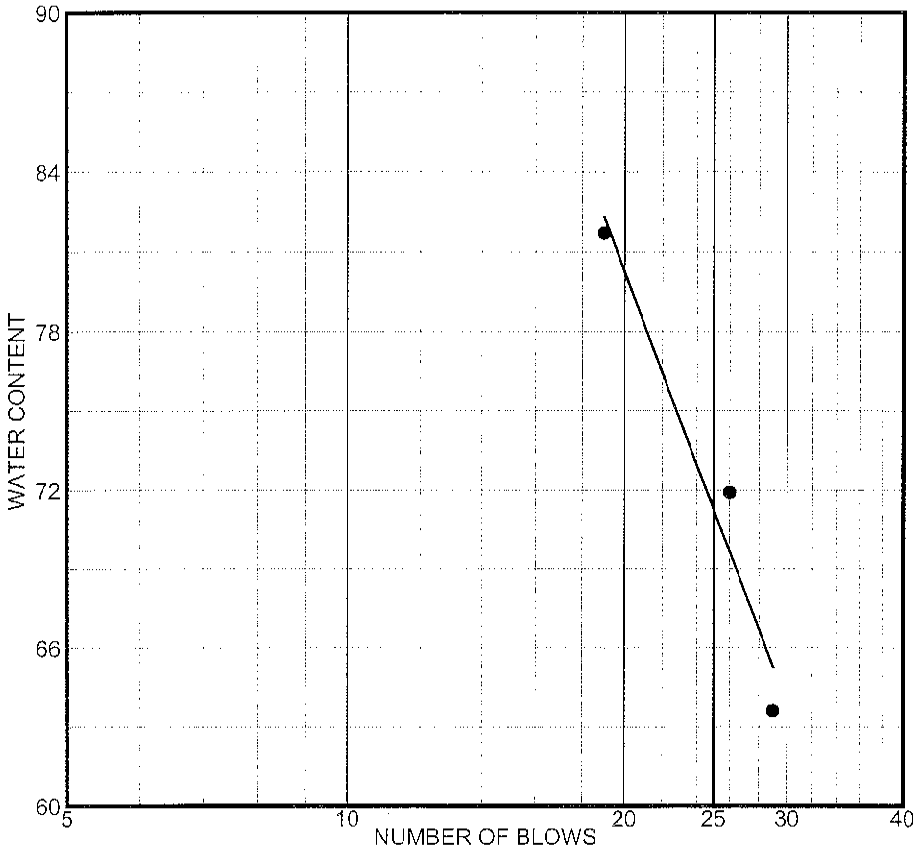
Minus #200 from wash= 17.1 %
Tare for cumulative weight retained= .00

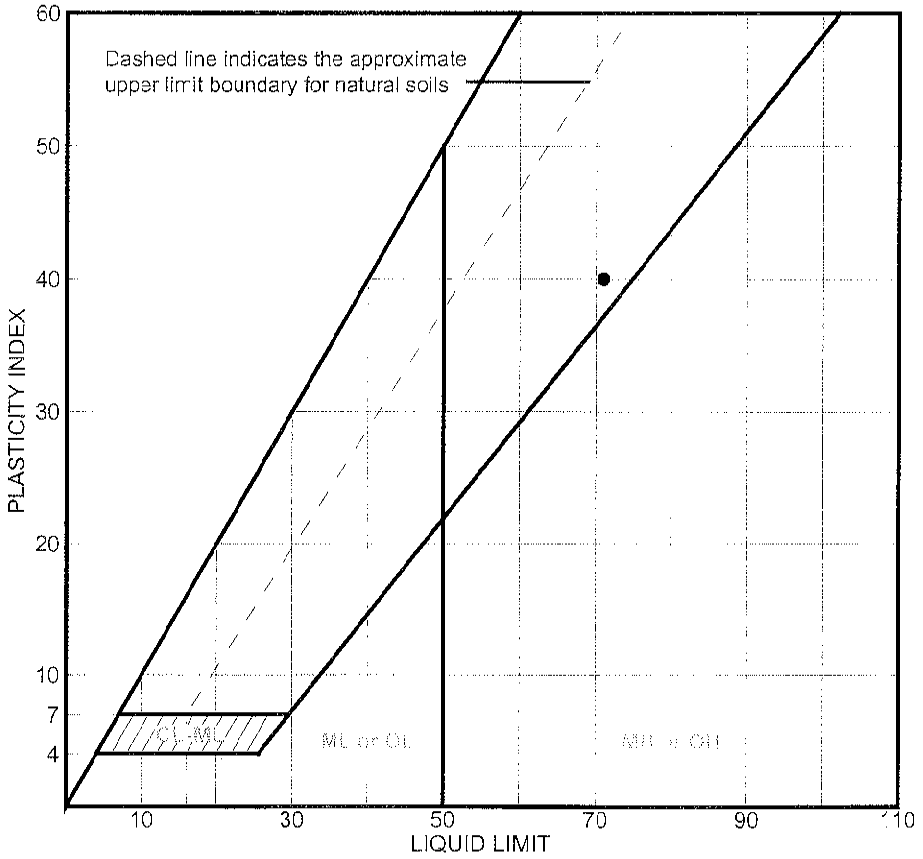
Sieve	Cumul. Wt. retained	Percent finer
.75 inch	17.97	78.2
.50 inch	17.97	78.2
.375 inch	19.15	76.8
# 4	27.54	66.6
# 10	33.95	58.8
# 20	40.80	50.5
# 40	47.50	42.4
# 60	55.50	32.7
# 100	62.83	23.8
# 200	67.83	17.7

Fractional Components

Gravel/Sand based on #10
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 41.1
% FINES = 17.7

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/E_EV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-411	12	45.5'- 47.0'		CH	Yellow-Brown CLAY	50.5	71	40

Client US Army Corps of Engineers

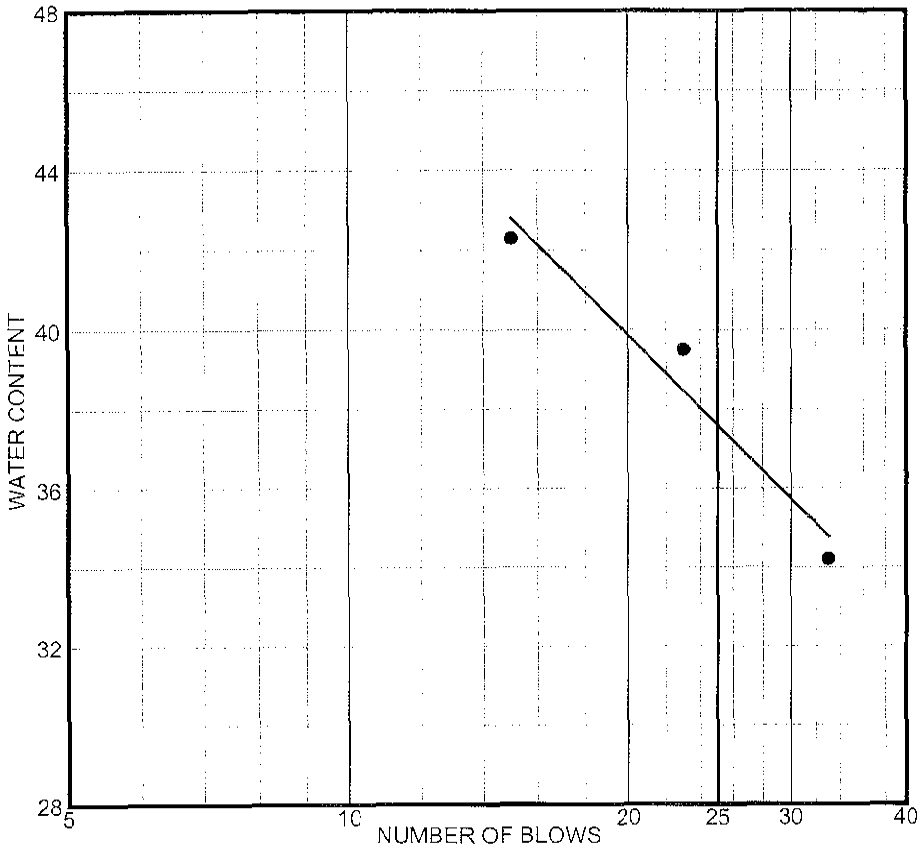
Project Savannah Harbor Expansion

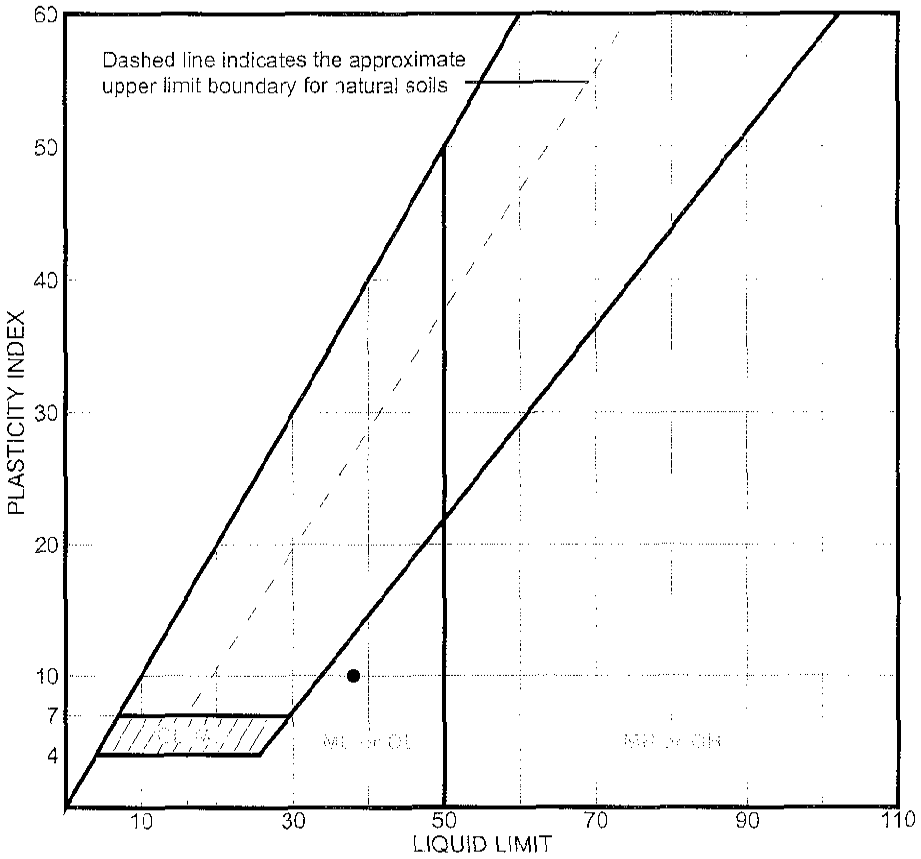
Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-411	2	4.5'- 6.0'		SM	Dark Gray-Brown Silty Fine SAND w/ some rock fragments and wood	89.2	38	10

Client US Army Corps of Engineers

Project Savannah Harbor Expansion

Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

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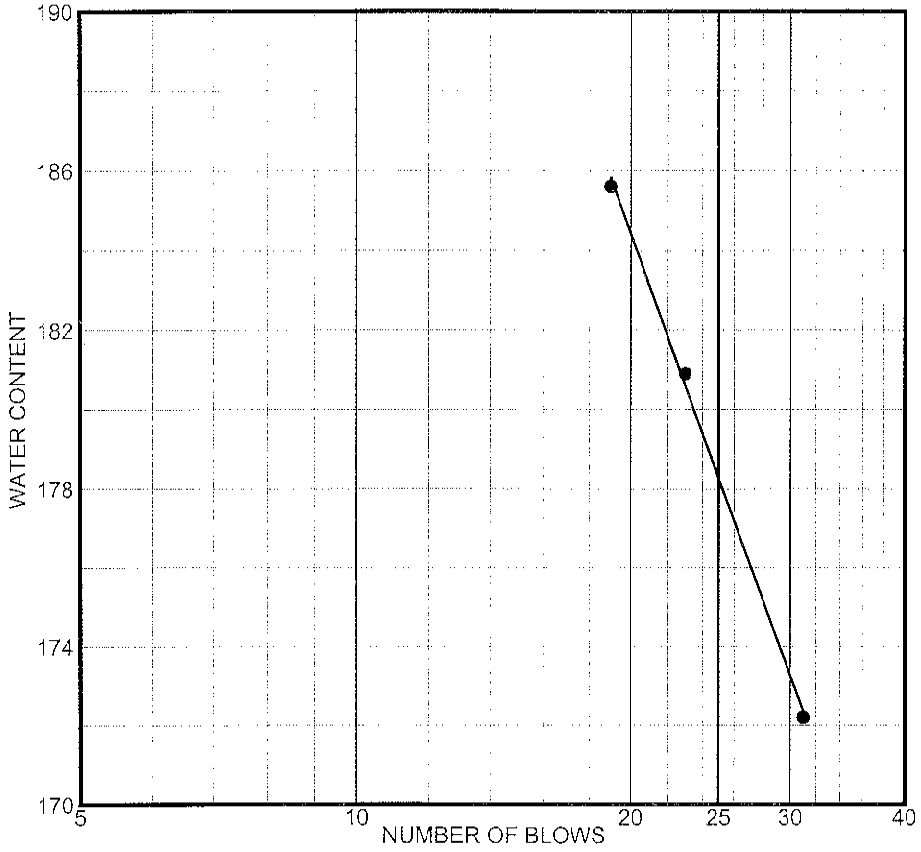
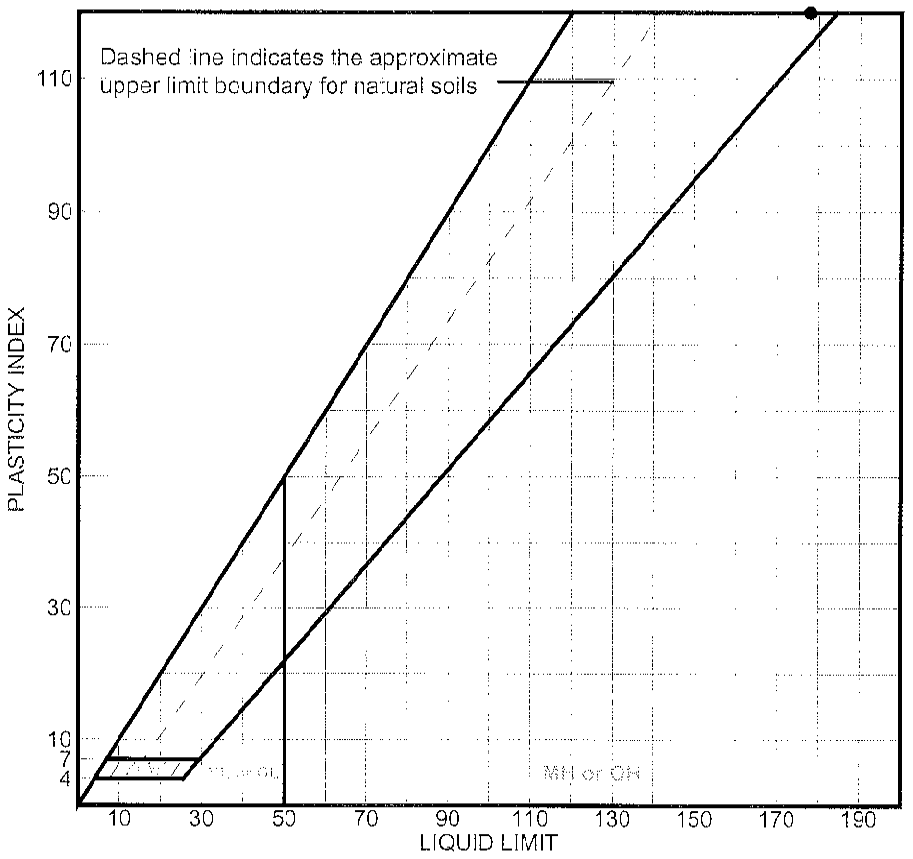
LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-411	5	15.0'- 16.5'		CH	Yellow-Brown CLAY w/ a trace of fine sand	133.2	178	120

Client US Army Corps of Engineers

Project Savannah Harbor Expansion

Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

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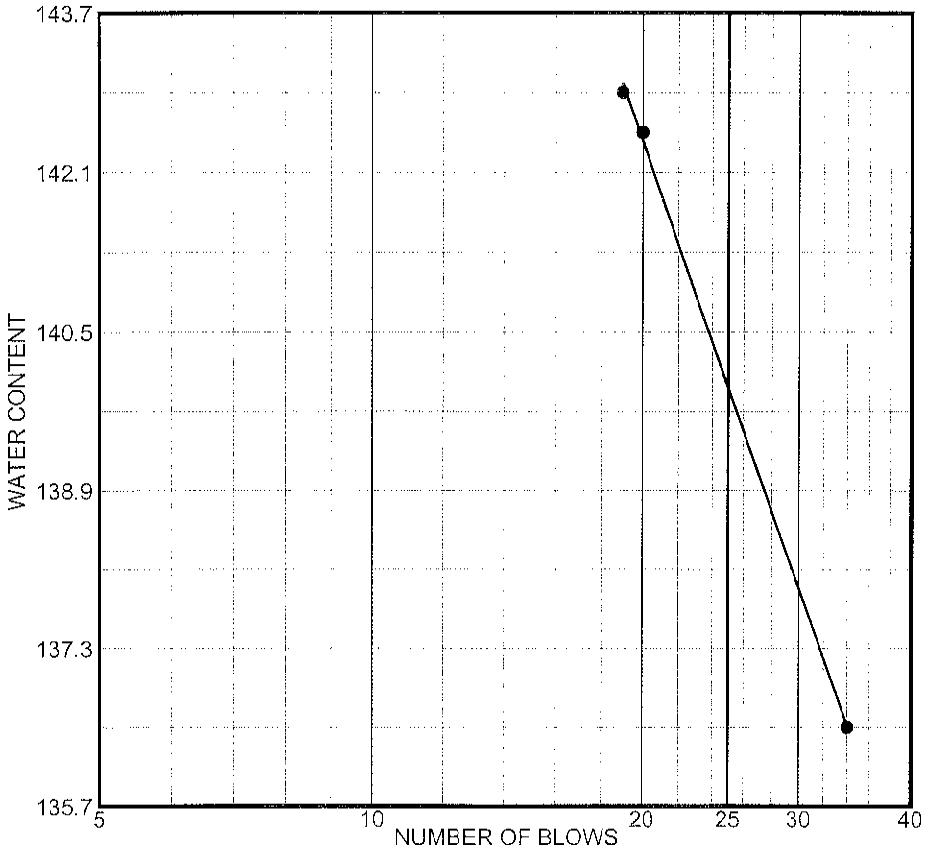
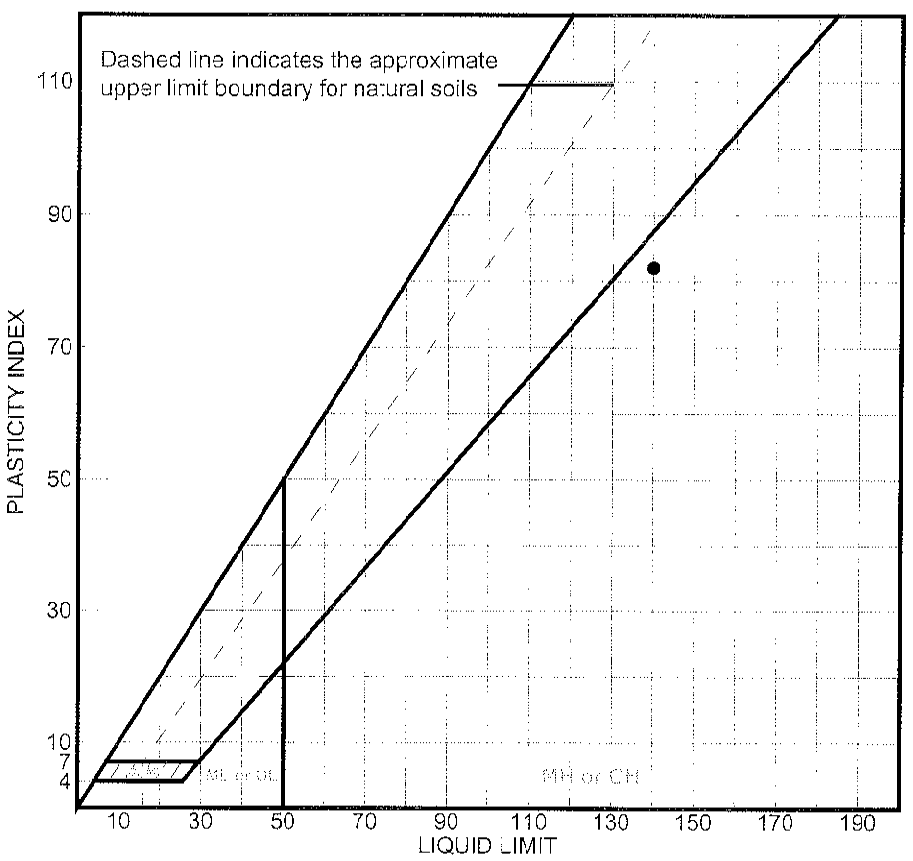
LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-411	8	25.5'- 27.0'		MH	Brown Sandy SILT	127.1	140	82

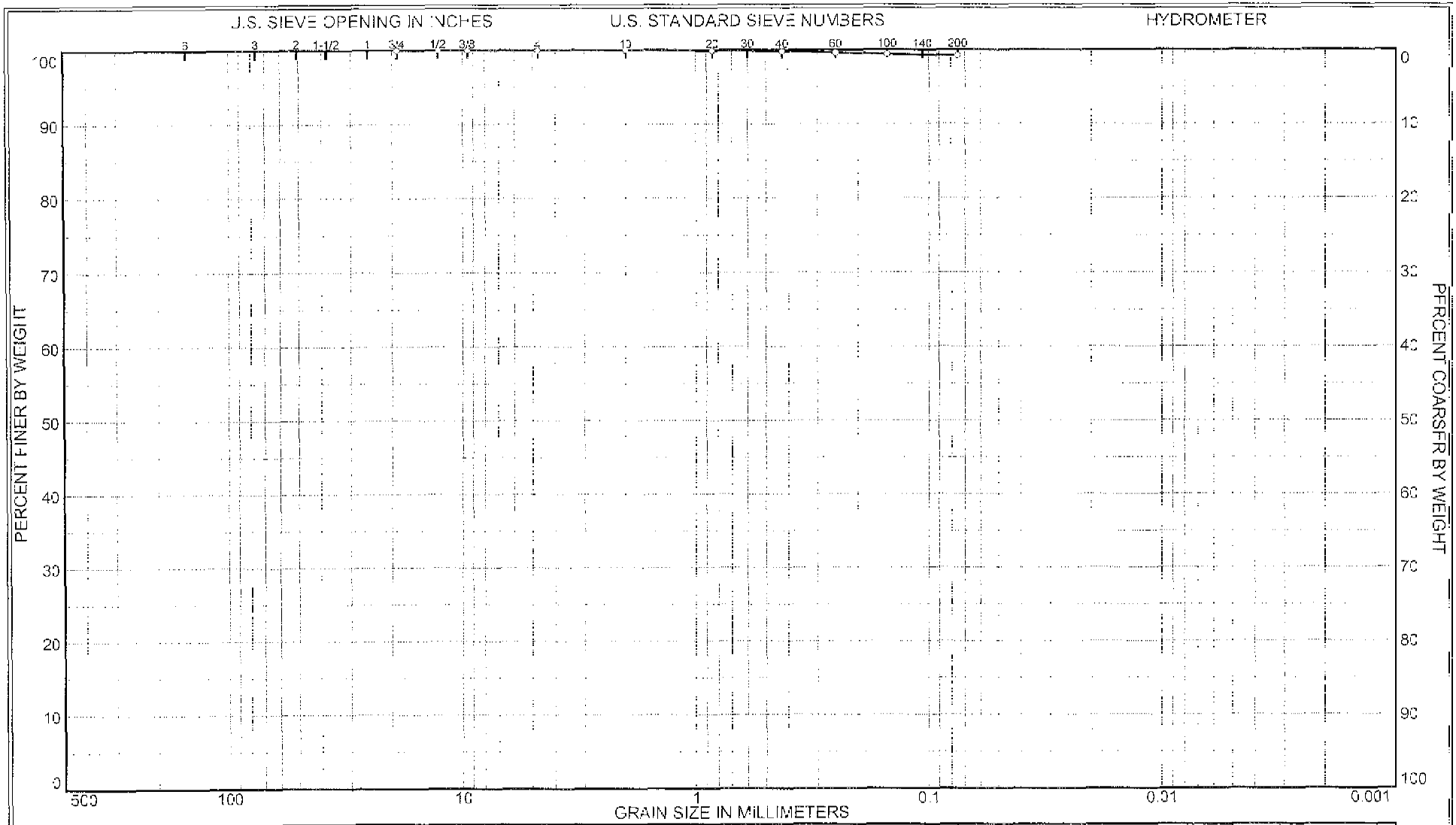
Client US Army Corps of Engineers

Project Savannah Harbor Expansion

Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
12	45.5'- 47.0'	Yellow-Brown CLAY	50.5	71	31	40

Project Savannah Harbor Expansion

Area

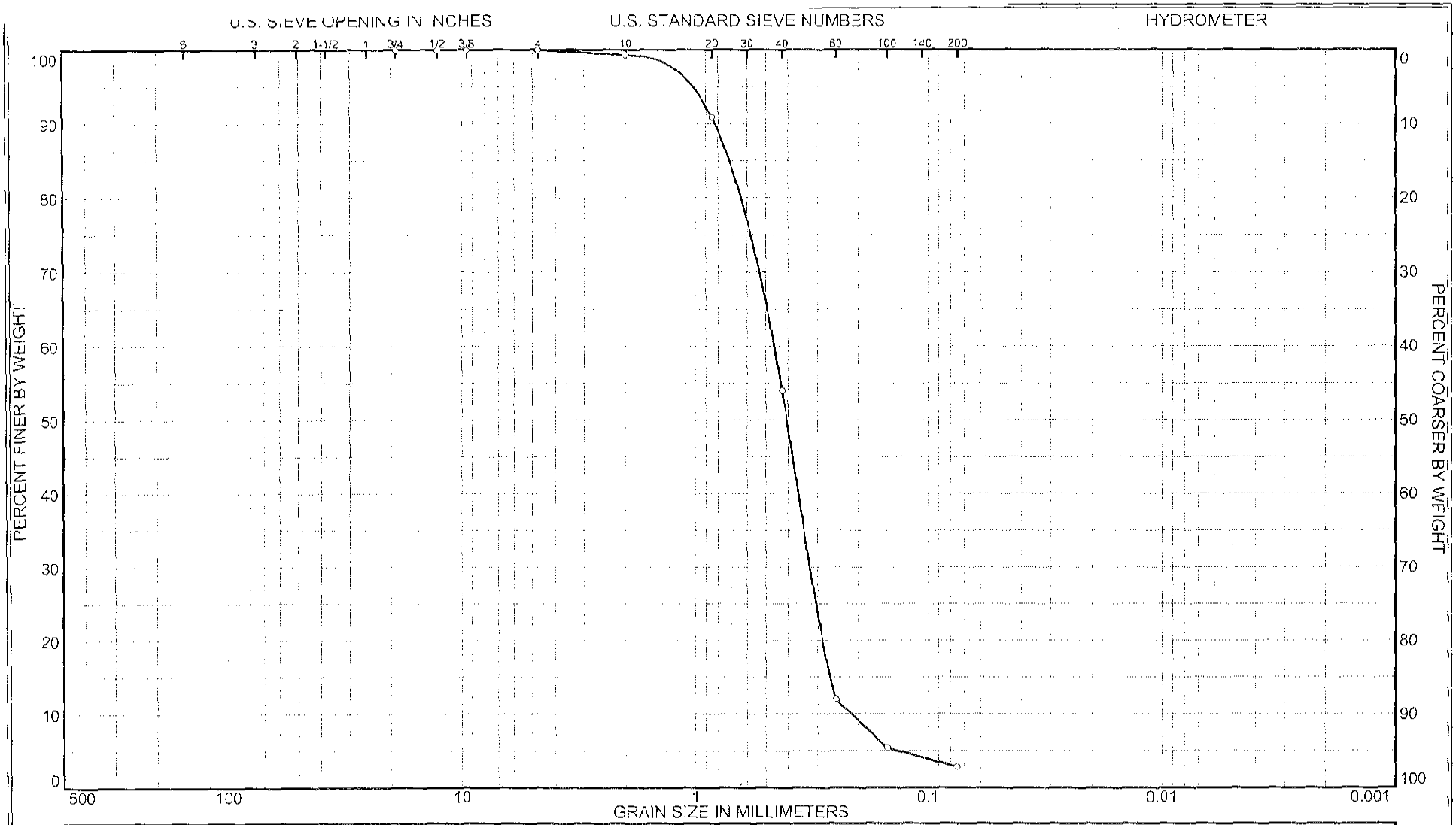
Boring No. Boring No. SH-411

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Grain Size Distribution Report

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
14	58.5'- 60.0'	Brown Fine SAND w/ a trace of silt	18.9			

Project Savannah Harbor Expansion

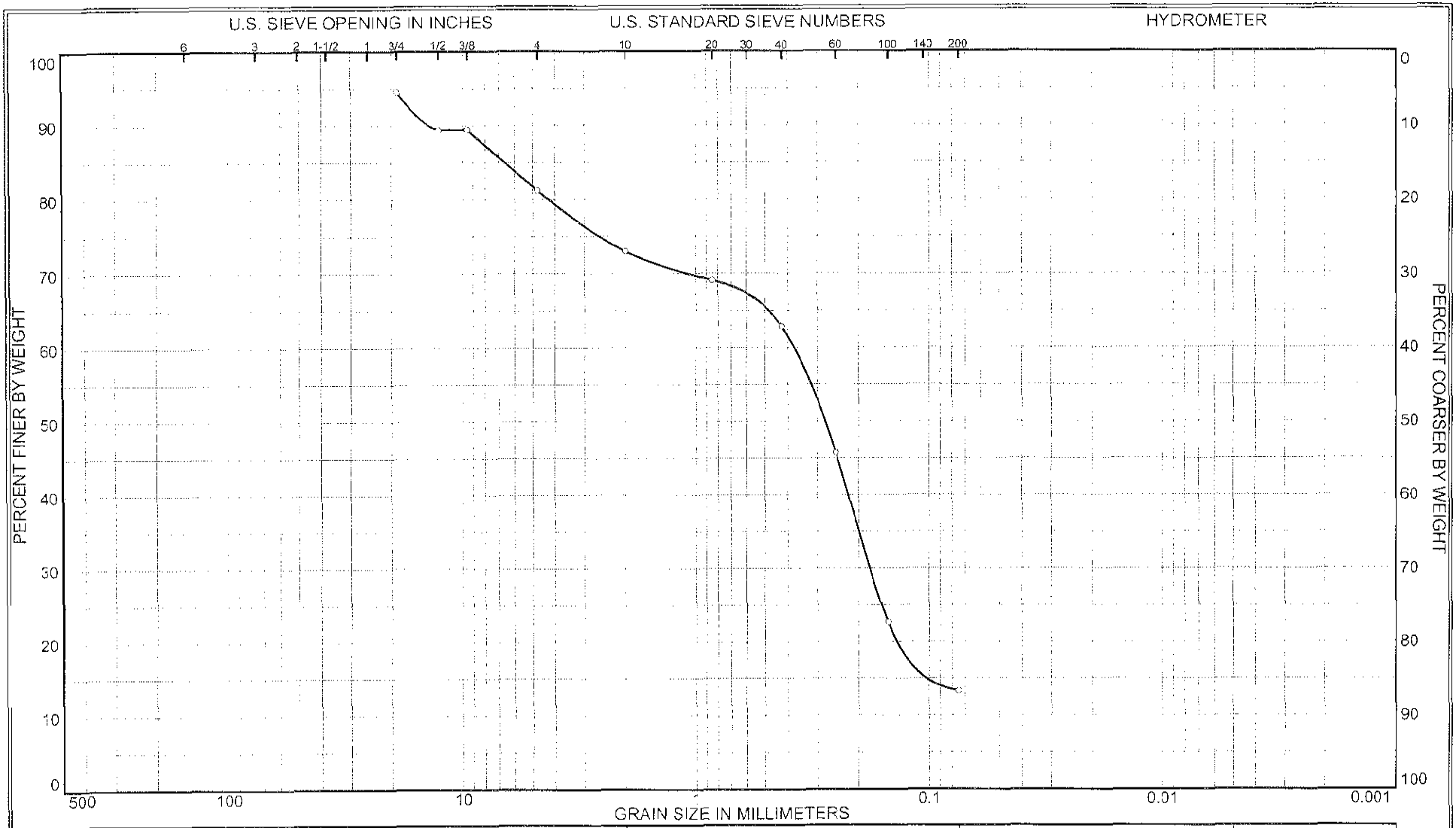
Area

Boring No. Boring No. SH-411

Grain Size Distribution Report

Date: 1/17/2003 **WOLF TECHNOLOGIES, INC.**

ENG FORM 1 MAY 63 2087



	Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
○	2	4.5'- 6.0'	Dark Gray-Brown Silty Fine SAND w/ some rock fragments and wood	89.2	38	28	10

Project Savannah Harbor Expansion

Area

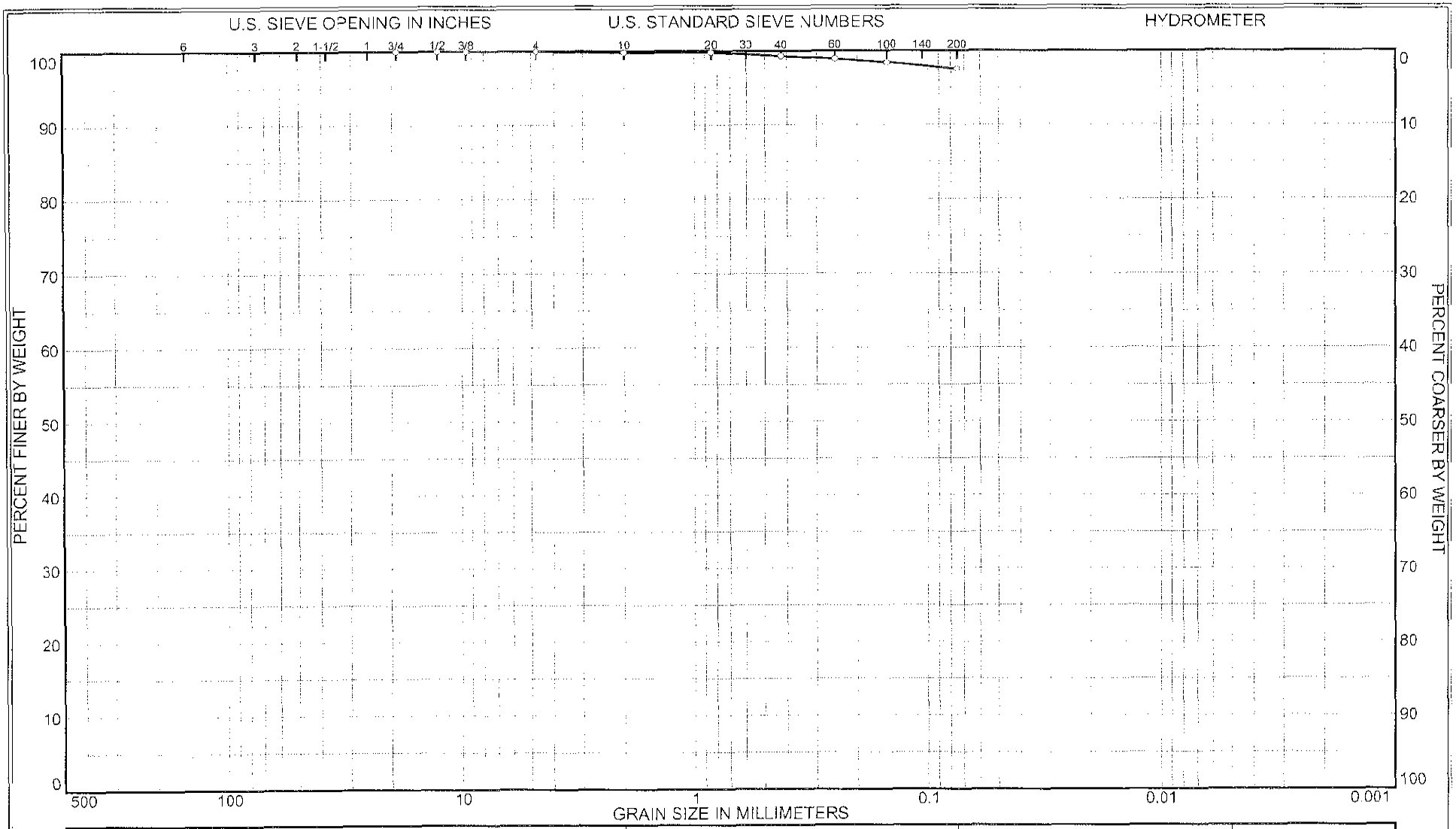
Boring No. Boring No. SH-411

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Grain Size Distribution Report

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
5	15.0'- 16.5'	Yellow-Brown CLAY w/ a trace of fine sand	133.2	178	58	120

Project Savannah Harbor Expansion

Area

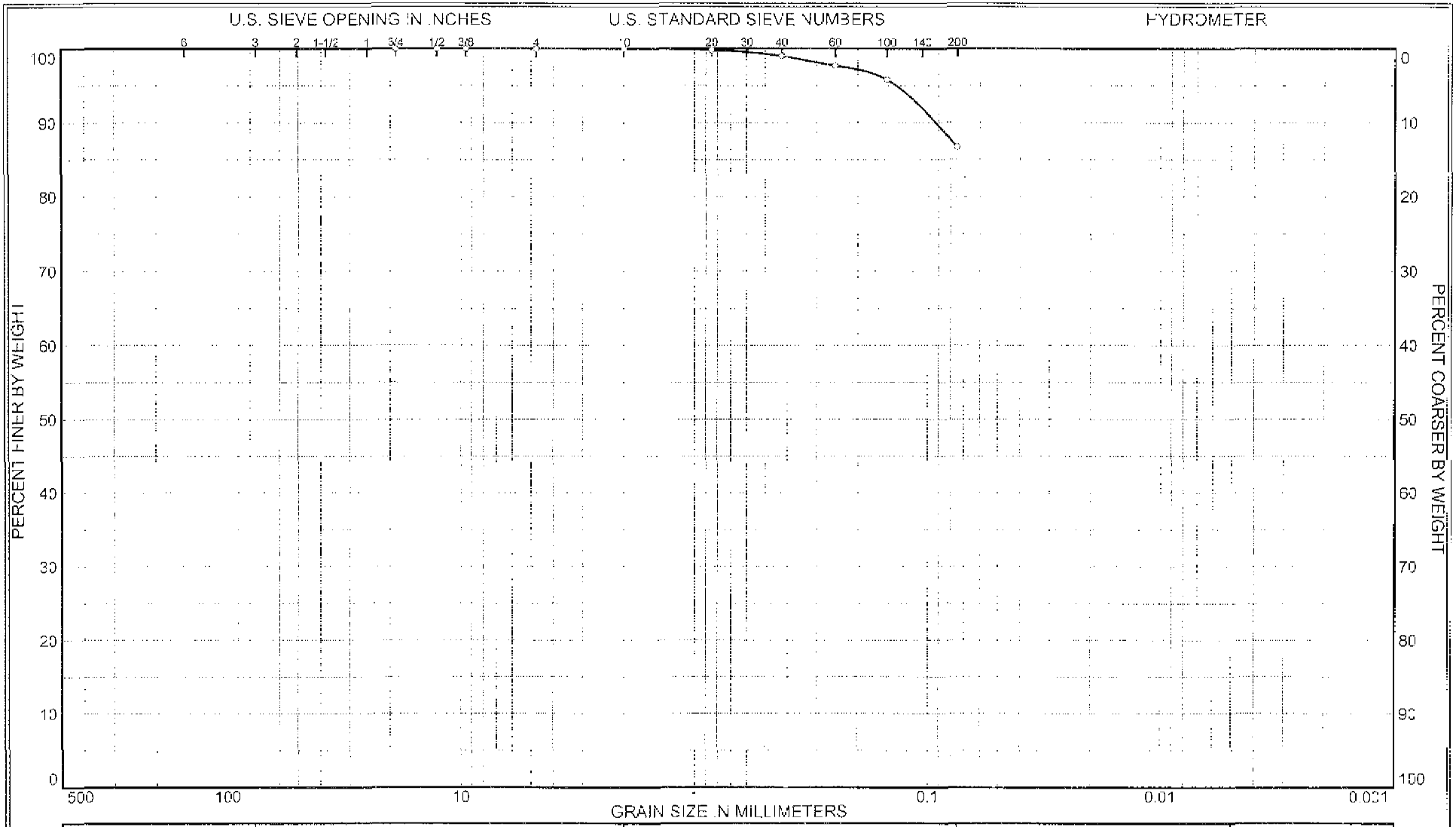
Boring No. Boring No. SH-411

Grain Size Distribution Report

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
8	25.5'- 27.0'	Brown Sandy SILT	127.1	140	58	82

Project Savannah Harbor Expansion

Area

Boring No. Boring No. SH-41

Grain Size Distribution Report

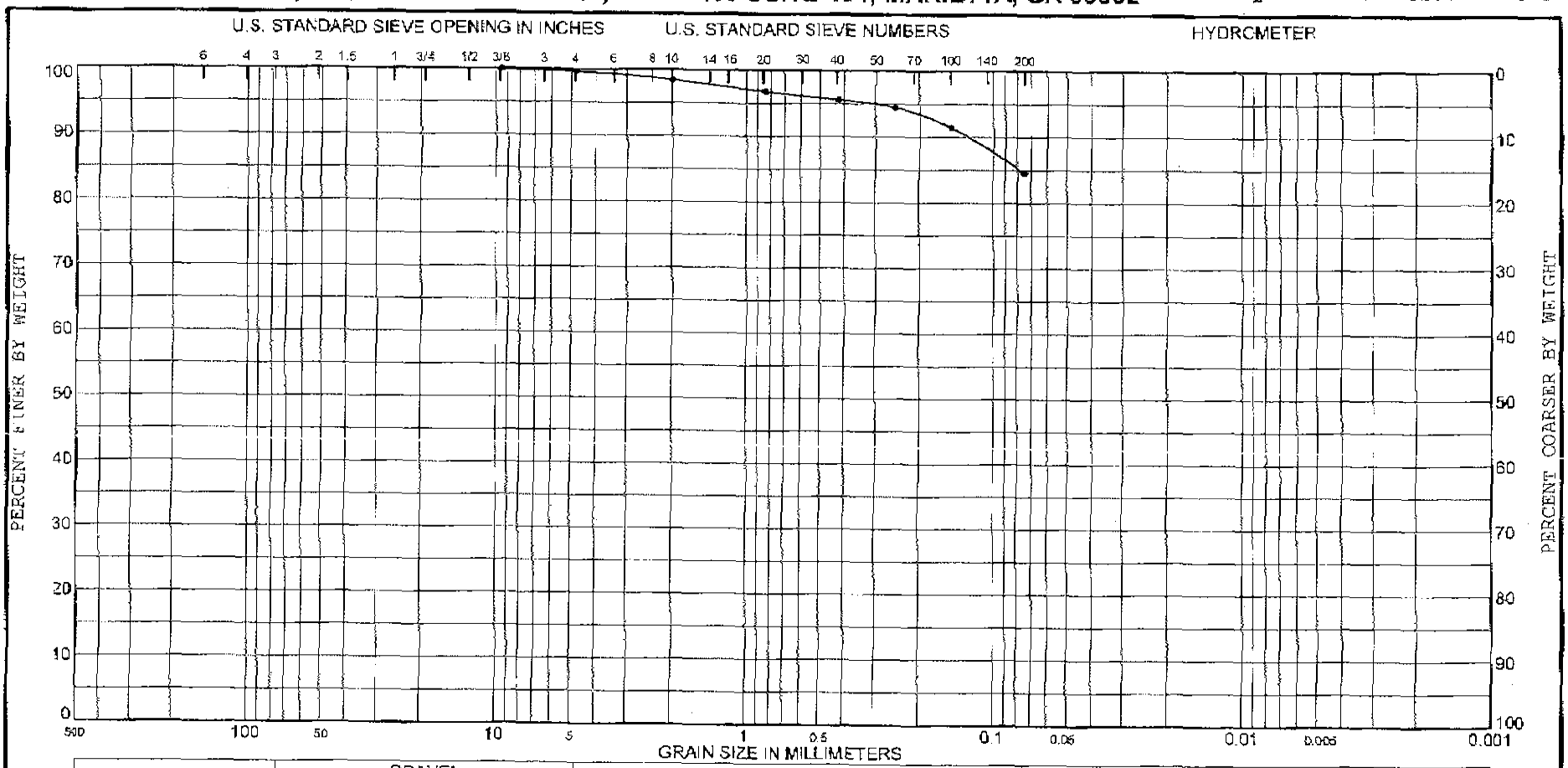
Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

ENG FORM 1 MAY 63 2087

DEPARTMENT OF THE ARMY, SAVANNAH DISTRICT, ENVIRONMENTAL & MATERIALS UNIT
CORPS OF ENGINEERS, 200 N. COBB PARKWAY, BLDG 400 SUITE 404, MARIETTA, GA 30062

WORK ORDER: 270e
REQUISITION: W33SJG30132375



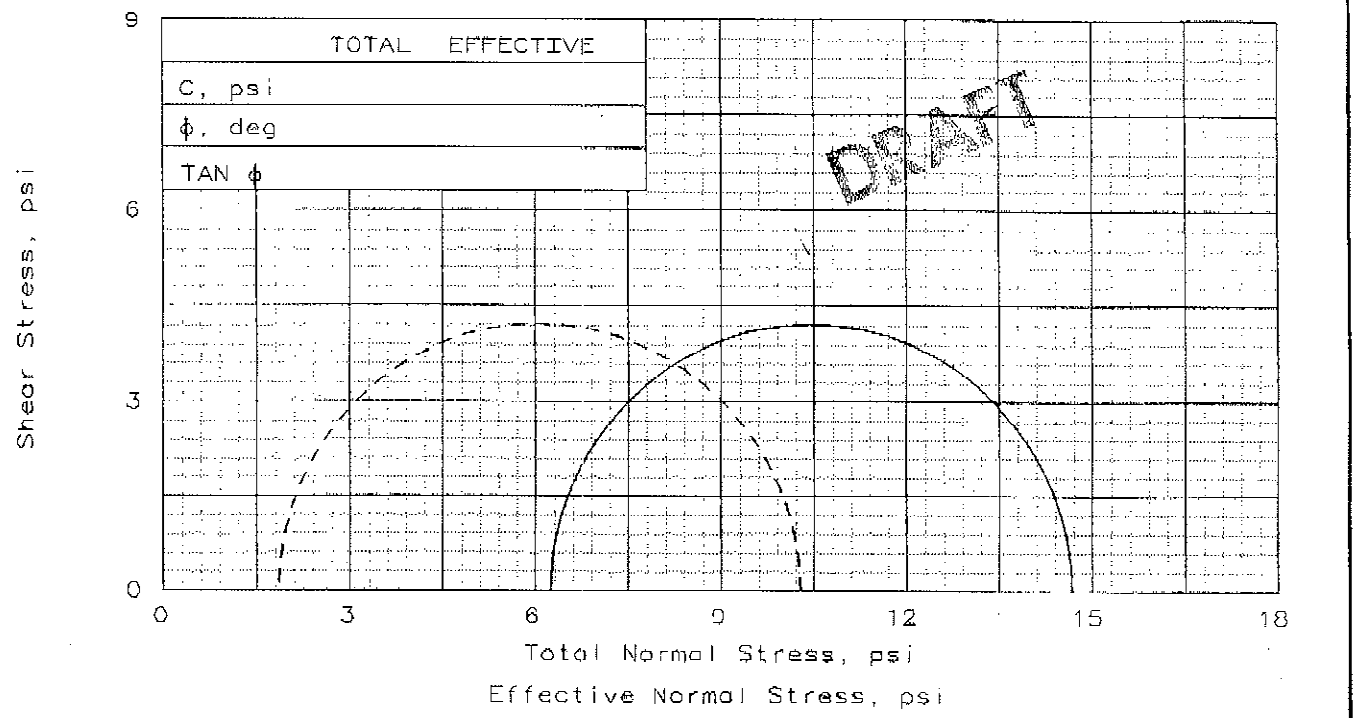
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

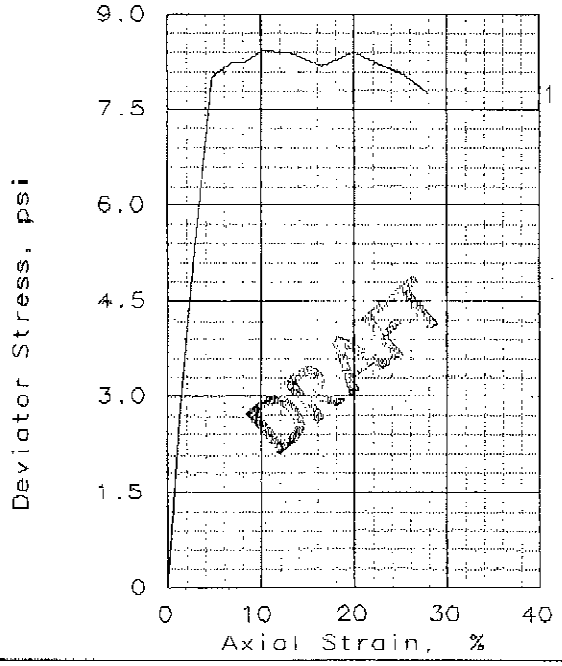
Sample No.	Depth (ft)	Classification	Nat w%	LL	PL	PI
	13.0 - 15.0	Dark Gray, Clayey Inorganic Silt High Liquid Limit (MH), with	103.0	85	39	46
		a little sand sizes, a trace of sand size wood fragments				
		and mica.				
		Plots Near the A-Line.				
		Specific Gravity = 2.54.				

Project Savannah Harbor
Harbor Expansion, Savannah, Georgia
Lab No. K6/177
Boring No. SH411
Date 2/3/03

Tests Conducted in General Accordance with ASTM's D422, D4318, D854, & D2487.

GRADATION CURVES





SAMPLE NO.:		1
INITIAL	WATER CONTENT, %	81.2
	DRY DENSITY, pcf	51.8
	SATURATION, %	100.0
	VOID RATIO	2.062
	DIAMETER, in	2.76
	HEIGHT, in	4.58
AT TEST	WATER CONTENT, %	60.5
	DRY DENSITY, pcf	62.5
	SATURATION, %	100.0
	VOID RATIO	1.638
	DIAMETER, in	2.59
	HEIGHT, in	4.46
BACK PRESSURE, psi		70.0
INIT. EFF. STR., psi		6.3
FAILURE STRESS, psi		8.4
PORE PRESSURE, psi		74.4
TIME TO FAILURE, min.		80.00
RATE, %/min.		0.13
ULTIMATE STRESS, psi		8.4

DRAFT

DESCRIPTION Dark Gray, Clayey Inorganic Silt High LL (MH), with a little sand sizes, and a trace of sand size wood fragments and mica.

LL= 85	PL= 39	PI= 46	Gs= 2.64	CONTROLLED STRAIN TEST
TYPE OF SPECIMEN UNDISTURBED				TYPE OF TEST R w/pore pressures

REMARKS Tested in general accordance with ASTM's D4767, D422, D4318, D2216, D854, & D2487.

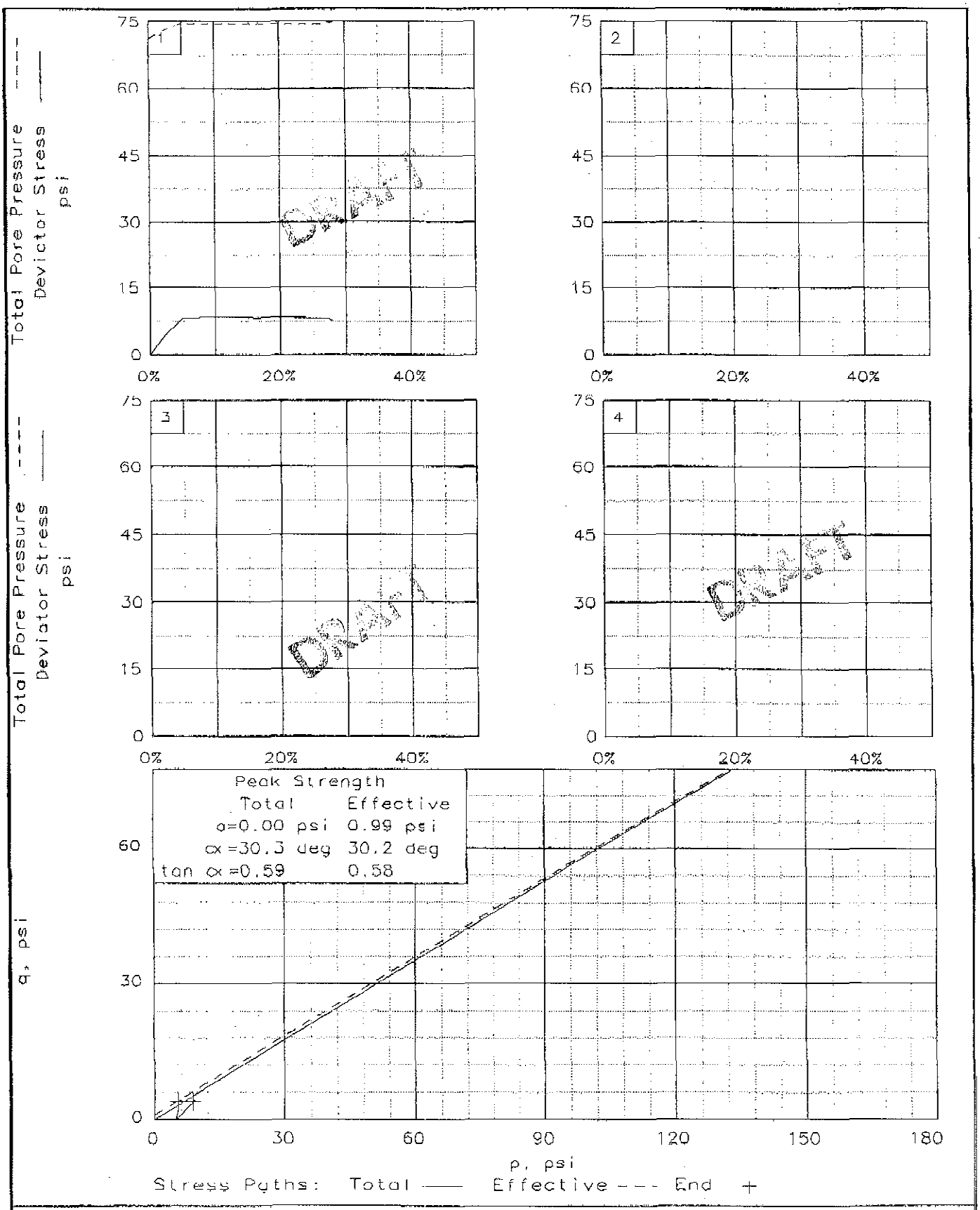
PROJECT SAVANNAH HARBOR EXPANSION
SLOPE STABILITY ANALYSIS
AREA Savannah, Georgia
LAB. NO. K6/177
BORING. NO. SH411
SAMPLE. NO.
DEPTH/ELEV 13.0 - 15.0'
LABORATORY DATE 3 FEB 2003

TRIAXIAL SHEAR TEST REPORT

Work Order No. 270e
Regulation No. W33SJG30132373

Work Order No. 270●

Requisition No. W33SJG30132373



PROJECT SAVANNAH HARBOR EXPANSION SLOPE STABILITY ANALYSIS

BORING SH411 **SAMPLE** **DEPTH/ELEV** 13.0 - 15.0'

TYPE OF TEST R w/pore pressures **LAB NO.** K9/177

LABORATORY **Fig. No.:** 2/2 **DATE** 3 FEB 2003

GRAIN SIZE DISTRIBUTION TEST DATA

Project: Savannah Harbor Expansion

Sample Data

Source: Boring No. SH-411
Sample No.: 2
Elev. or Depth: 4.5'- 6.0'
Sample Length (in./cm.):
Location:
Description: Dark Gray-Brown Silty Fine SAND w/ some rock fragments and wood
PL: 28
LL: 38
PI: 10
Nat W.%: 89.2

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	77.78	74.86
Tare =	50.09	50.09
Dry sample weight =	27.69	24.77

Minus #200 from wash= 10.5 %
Tare for cumulative weight retained= .00

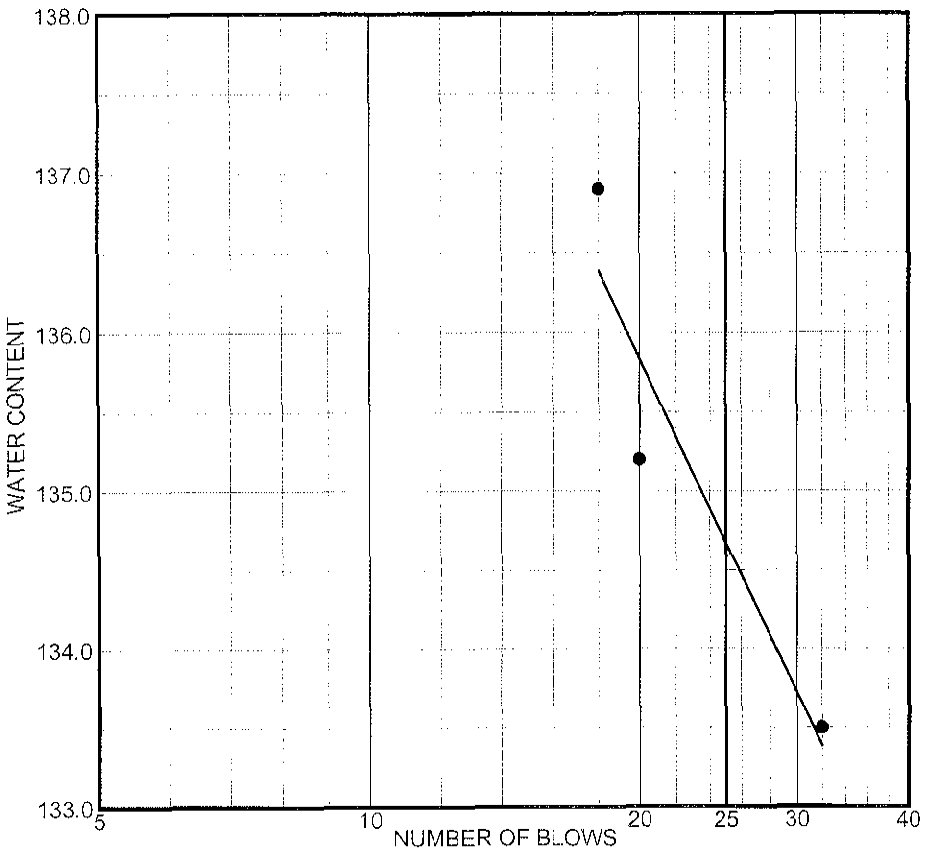
Sieve	Cumul. Wt. retained	Percent finer
.75 inch	1.53	94.5
.50 inch	2.94	89.4
.375 inch	2.94	89.4
# 4	5.21	81.2
# 10	7.48	73.0
# 20	8.55	69.1
# 40	10.30	62.8
# 60	15.04	45.7
# 100	21.42	22.6
# 200	24.00	13.3

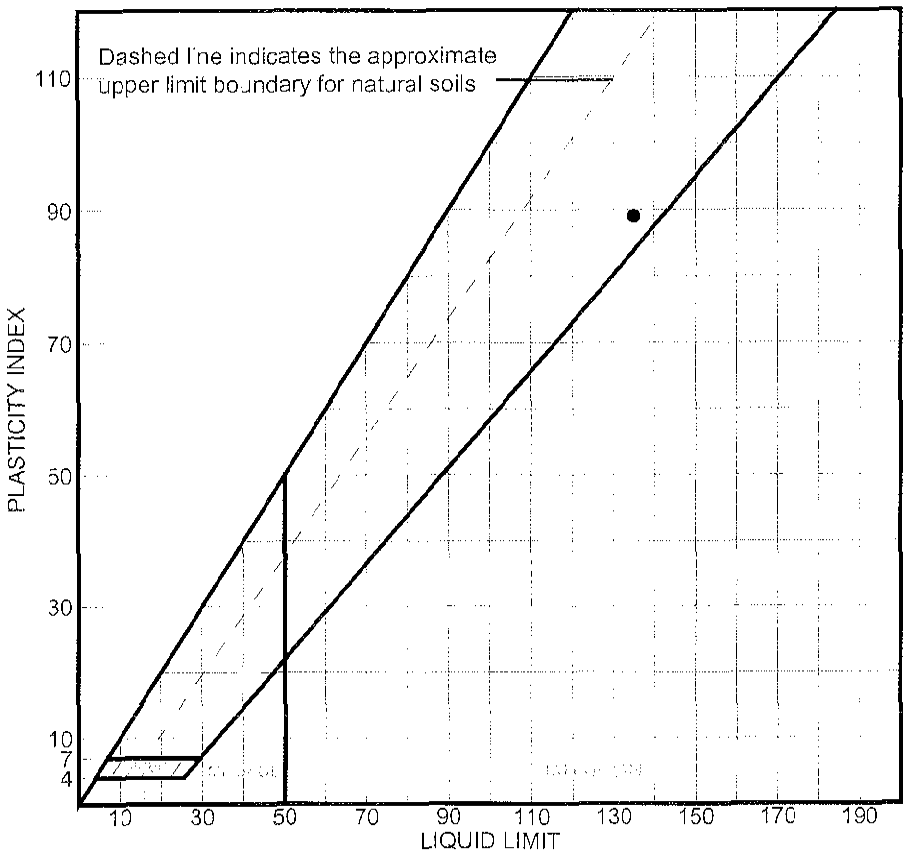
Fractional Components

Gravel/Sand based on #10
Sand/Fines based on #200
% COBBLES = % GRAVEL = % SAND = 59.7
% FINES = 13.3

D_{85}= 6.59 D_{60}= 0.38 D_{50}= 0.28
D_{30}= 0.18 D_{15}= 0.10

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-412	5	15.0'- 16.5'		CH	Yellow-Brown Sandy CLAY w/ rock fragments and organics	129.5	135	89

Client US Army Corps of Engineers

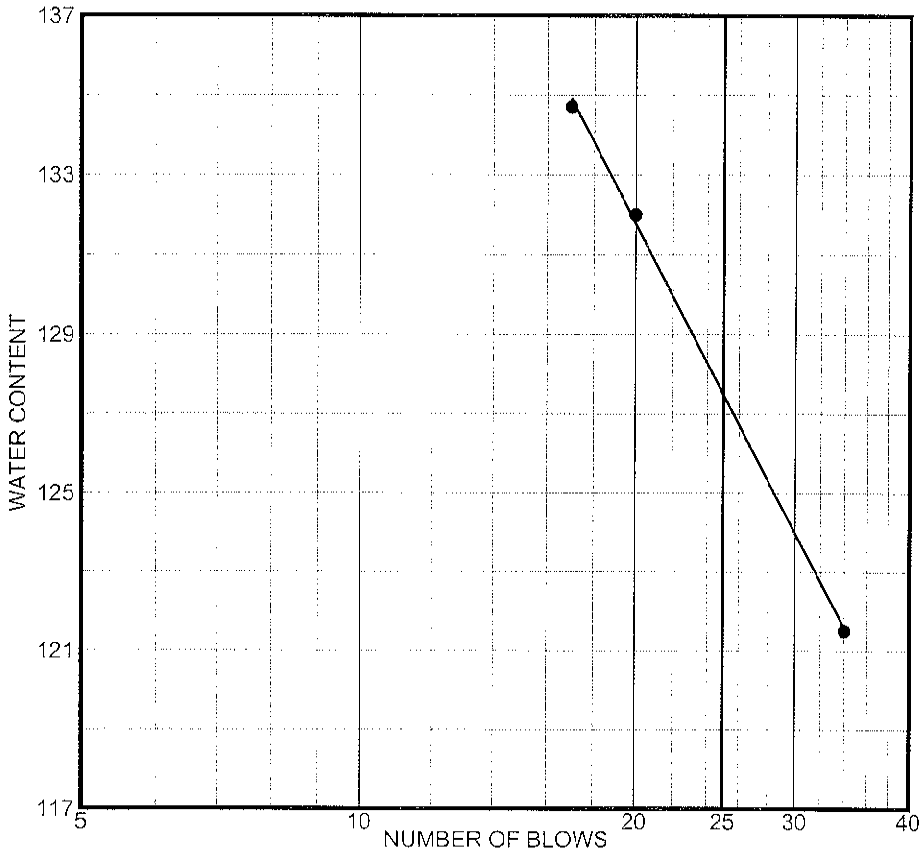
Project Savannah Harbor Expansion

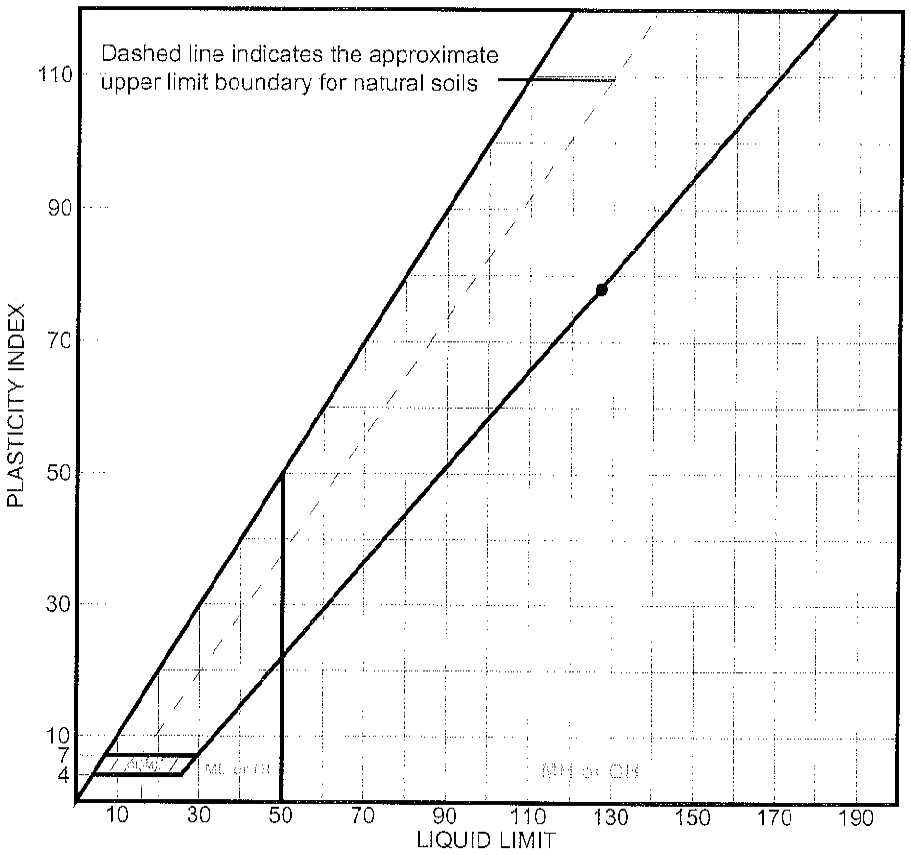
Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/E_EV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-412	UD-1	11.5'- 11.7'		MH	Brown Sandy SILT w/ a trace of rock fragments and some organics	90.9	127	78

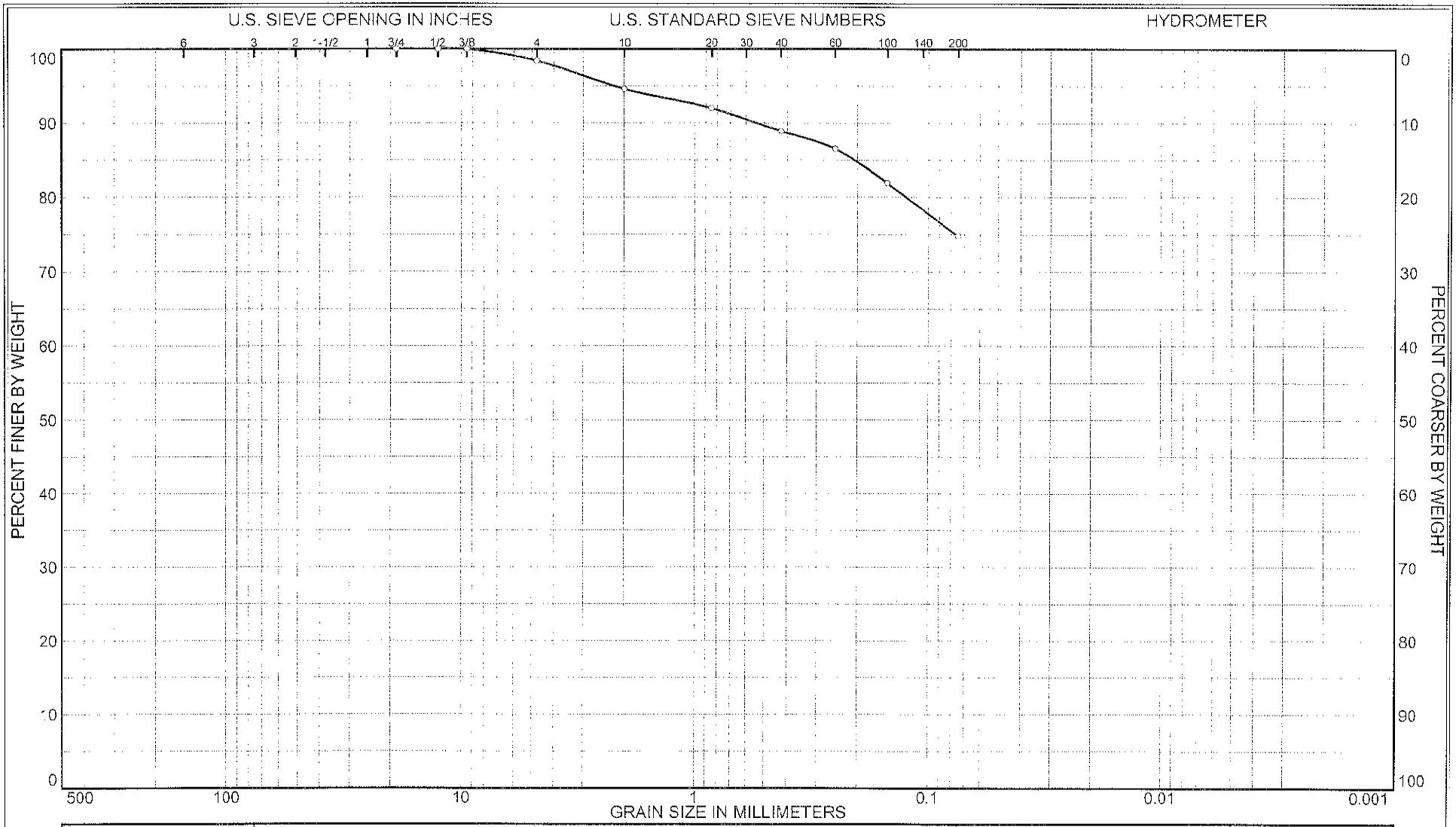
Client US Army Corps of Engineers

Project Savannah Harbor Expansion

Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●



	Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
○	5	15.0'- 16.5'	Yellow-Brown Sandy CLAY w/ rock fragments and organics	129.5	135	46	89

Project Savannah Harbor Expansion

Area

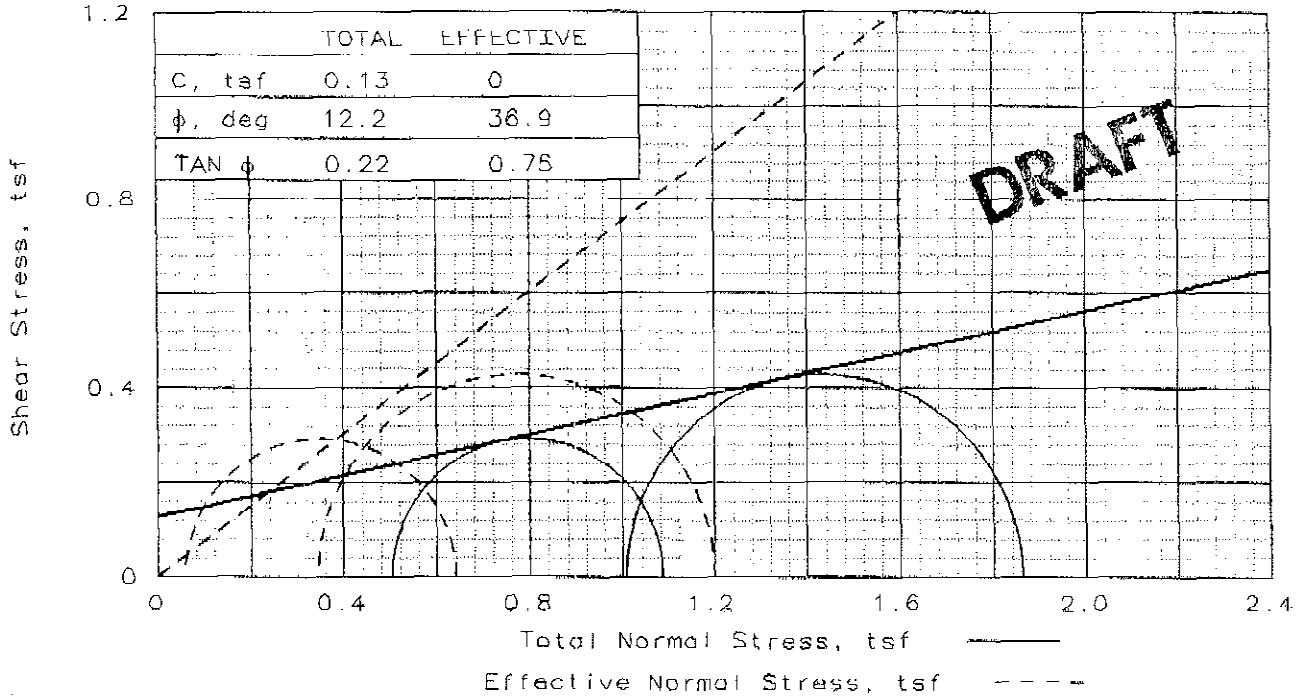
Boring No. Boring No. SH-412

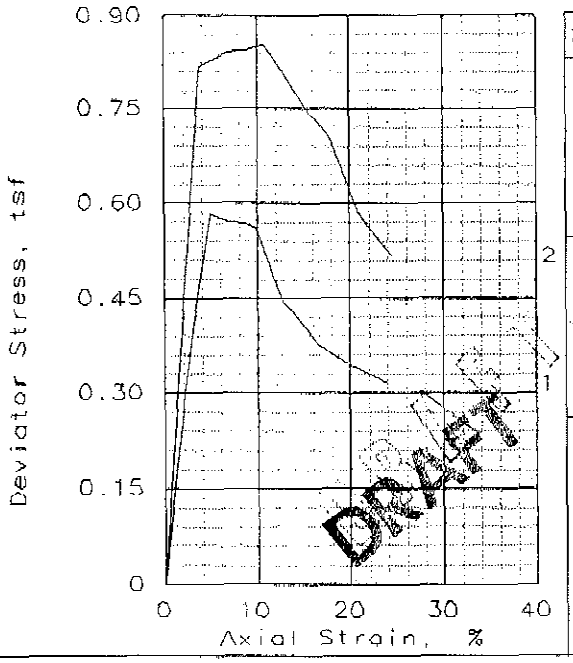
Grain Size Distribution Report

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Requisition No. W33J030132375 Work Order No. 270e





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	83.0	83.0
	DRY DENSITY, pcf	50.0	49.0
	SATURATION, %	96.5	94.2
	VOID RATIO	2.219	2.238
	DIAMETER, in	2.79	2.64
	HEIGHT, in	5.05	5.07
AT TEST	WATER CONTENT, %	75.5	65.0
	DRY DENSITY, pcf	54.6	59.8
	SATURATION, %	100.0	100.0
	VOID RATIO	1.948	1.651
	DIAMETER, in	2.71	2.45
	HEIGHT, in	4.98	4.87
BACK PRESSURE, tsf		5.04	5.04
INIT. EFF. STR., tsf		0.50	1.01
FAILURE STRESS, tsf		0.58	0.85
PORE PRESSURE, tsf		5.49	5.70
TIME TO FAILURE, min.		45.00	85.00
RATE, %/min.		0.11	0.13
ULTIMATE STRESS, tsf		0.35	0.56

DRAFT

DESCRIPTION Dark Grayish Brown, Sandy Fat Clay (CH), with some sand size wood fragments, and a trace of mica.

LL= 76	PL= 35	PI= 41	Gs= 2.58	CONTROLLED STRAIN TEST
TYPE OF SPECIMEN UNDISTURBED				TYPE OF TEST R w/pore pressures

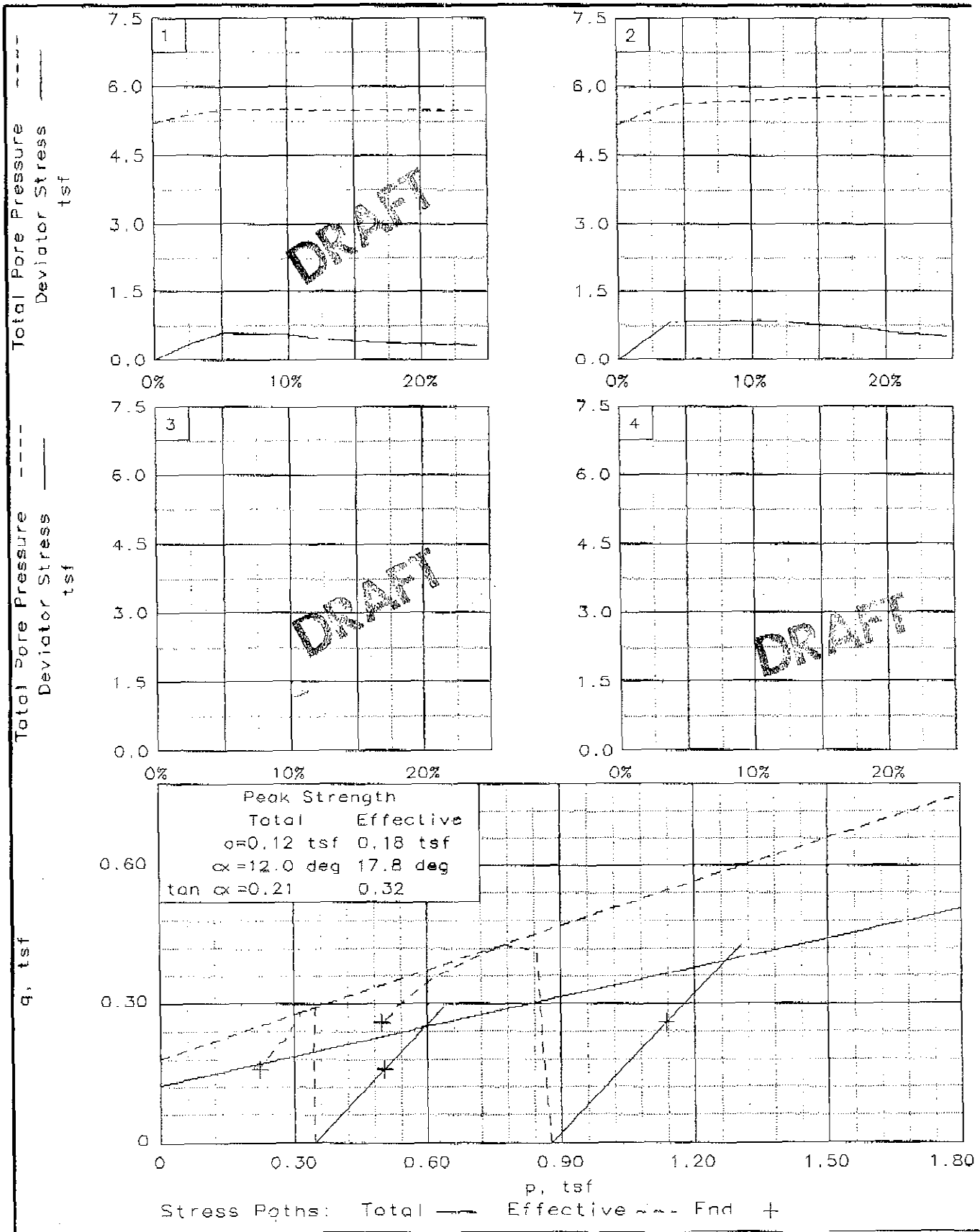
REMARKS Tested in general accordance with ASTM's D4767, D422, D4318, D2216, D854, & D2487.

PROJECT SAVANNAH RIVER HARBOR EXPANSION
SLOPE STABILITY ANALYSIS
AREA Savannah, Georgia
LAB. NO. K6/185
BORING. NO. SH412
SAMPLE. NO.
DEPTH/ELEV 11.5 - 13.3'
LABORATORY **DATE** 3 FEB 2003

TRIAXIAL SHEAR TEST REPORT

Work Order No. 270e

Requisition No. W33SJG30132373



PROJECT SAVANNAH RIVER HARBOR EXPANSION SLOPE STABILITY ANALYSIS

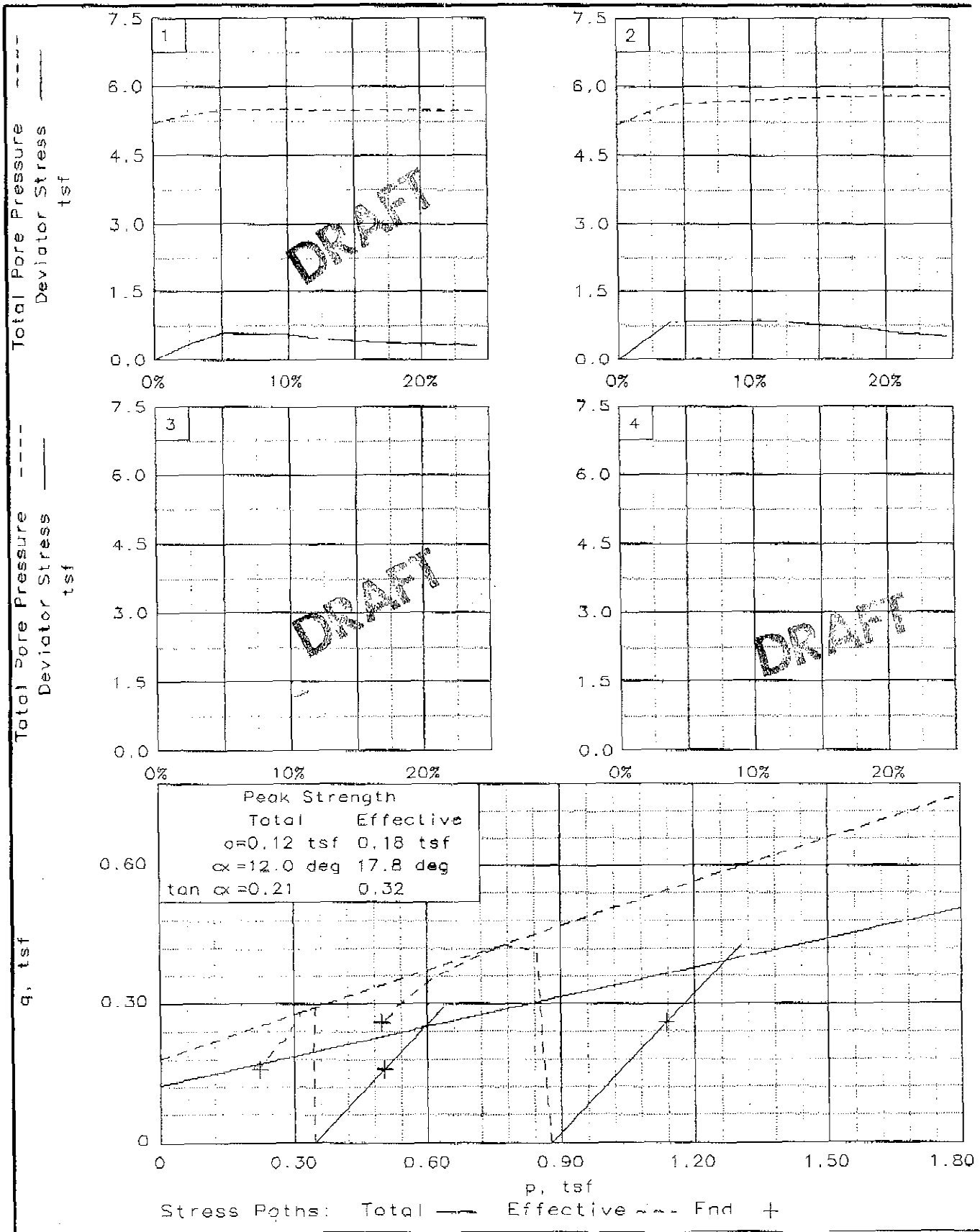
BORING SH412 **SAMPLE** **DEPTH/ELEV** 11.5 - 13.3'

TYPE OF TEST R w/pore pressures **LAB NO.** K6/185

LABORATORY **Fig. No.:** 2/2 **DATE** 3 FEB 2003

Work Order No. 270e

Requisition No. W33SJG30132373



PROJECT SAVANNAH RIVER HARBOR EXPANSION SLOPE STABILITY ANALYSIS

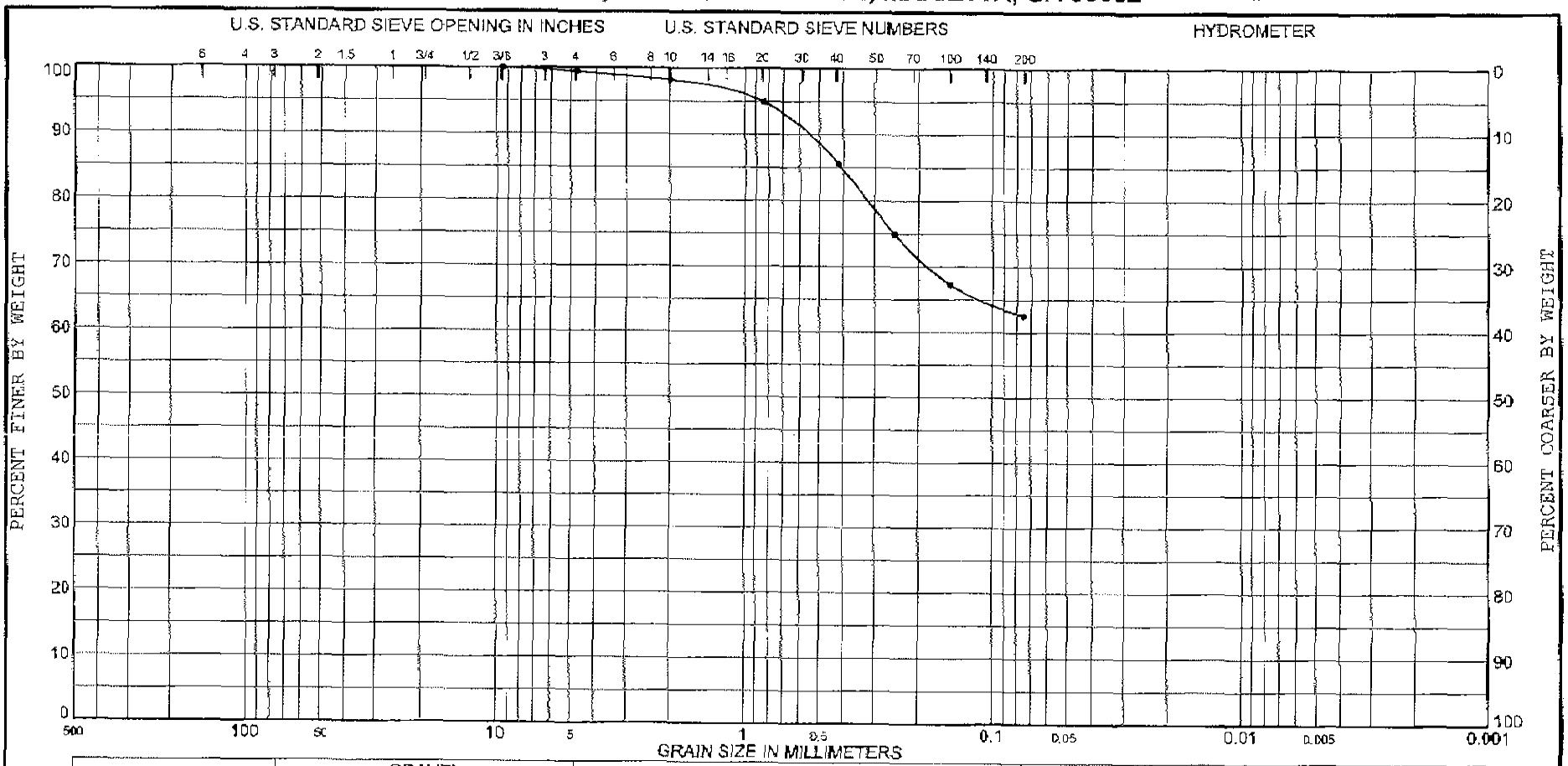
BORING SH412 **SAMPLE** **DEPTH/ELEV** 11.5 - 13.3'

TYPE OF TEST R w/pore pressures **LAB NO.** K6/185

LABORATORY **Fig. No.:** 2/2 **DATE** 3 FEB 2003

DEPARTMENT OF THE ARMY, SAVANNAH DISTRICT, ENVIRONMENTAL & MATERIALS UNIT
CORPS OF ENGINEERS, 200 N. COBB PARKWAY, BLDG 400 SUITE 404, MARIETTA, GA 30062

WORK ORDER: 270e
REQUISITION: W33SJG30132375



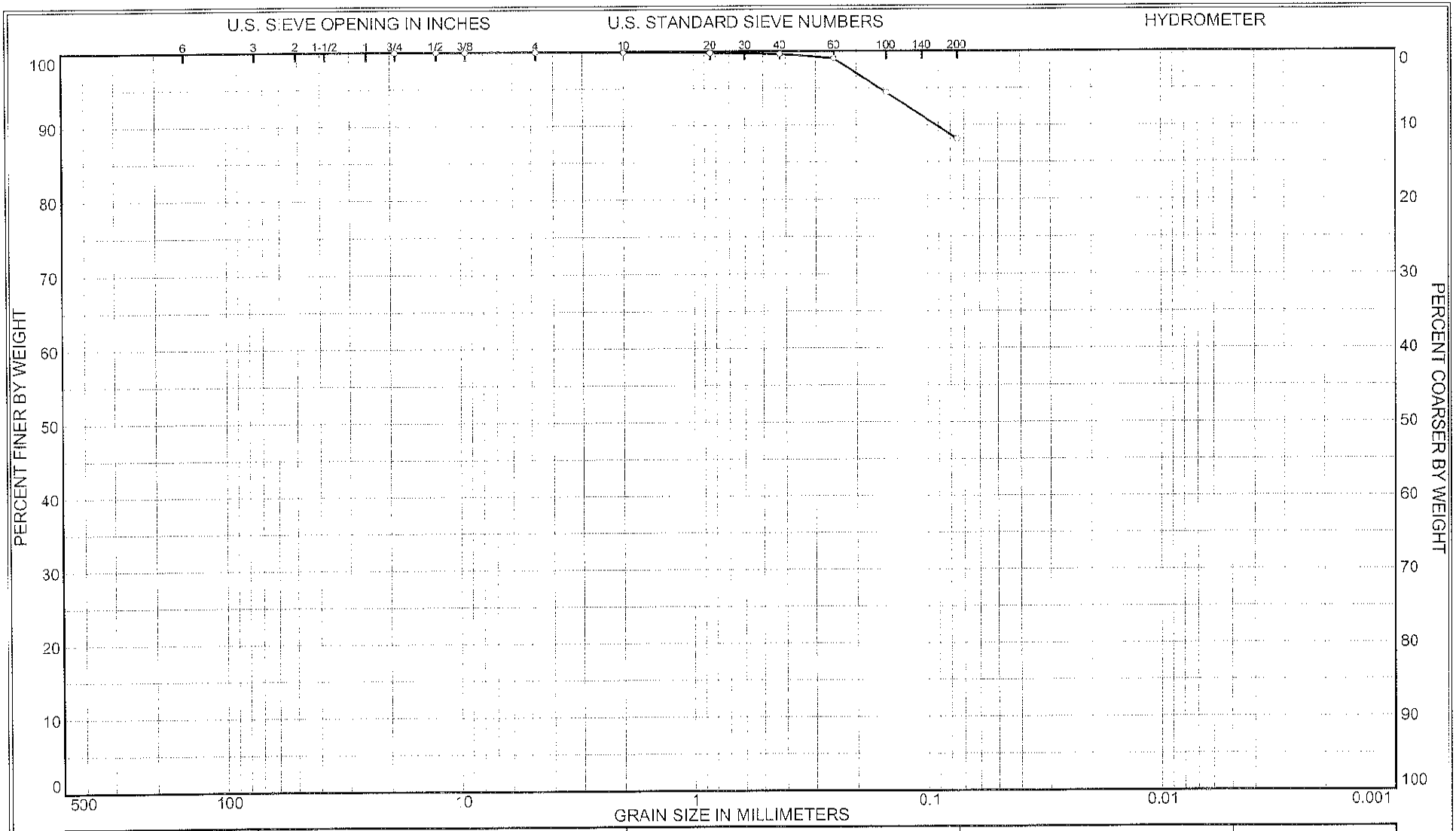
COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Depth (ft)	Classification	Nat w%	LL	PL	PI
	11.5 - 13.3	Dark Grayish Brown, Sandy Fat Clay (CH), with some sand size	83.0	76	35	41
		wood fragments, and a trace of mica.				
		Plots Near the A-Line.				
		Specific Gravity = 2.58.				

GRADATION CURVES

Project Savannah Harbor
Harbor Expansion, Savannah, Georgia
Lab No. K6/185
Boring No. SH412
Date 2/3/03

Tests Conducted in General Accordance with ASTM's D422, D4318, D854, & D2487.



Sample No.	Elev or Depth	Classification	Nat w%	LL	PL	PI
UD-1	11.5'- 11.7'	Brown Sandy SILT w/ a trace of rock fragments and some organics	90.9	127	49	78

Project Savannah Harbor Expansion

Area

Boring No. Boring No. SH-412

Date: 1/17/2003

WOLF TECHNOLOGIES, INC.

Grain Size Distribution Report

ENG FORM 1 MAY 63 2087

MOISTURE CONTENT DATA

Project Name: Savannah Harbor Expansion

Project No.: 1452-01-40

Date: 1-7-03

ASTM D2216

Boring No.	Sample No.	Tare No.	Tare Wt. (grams)	Wet Wt. (grams)	Dry Wt. (grams)	Water Content, %
SH-410A	7	18	49.88	113.91	76.42	141.26
	8	54	50.22	126.64	86.37	111.40
	17	81	49.56	109.17	84.92	68.58
SH-411	4	13	50.04	114.73	78.86	124.46
	10	9	49.75	121.71	91.82	71.05
SH-412	4	82	49.45	139.72	97.54	87.71

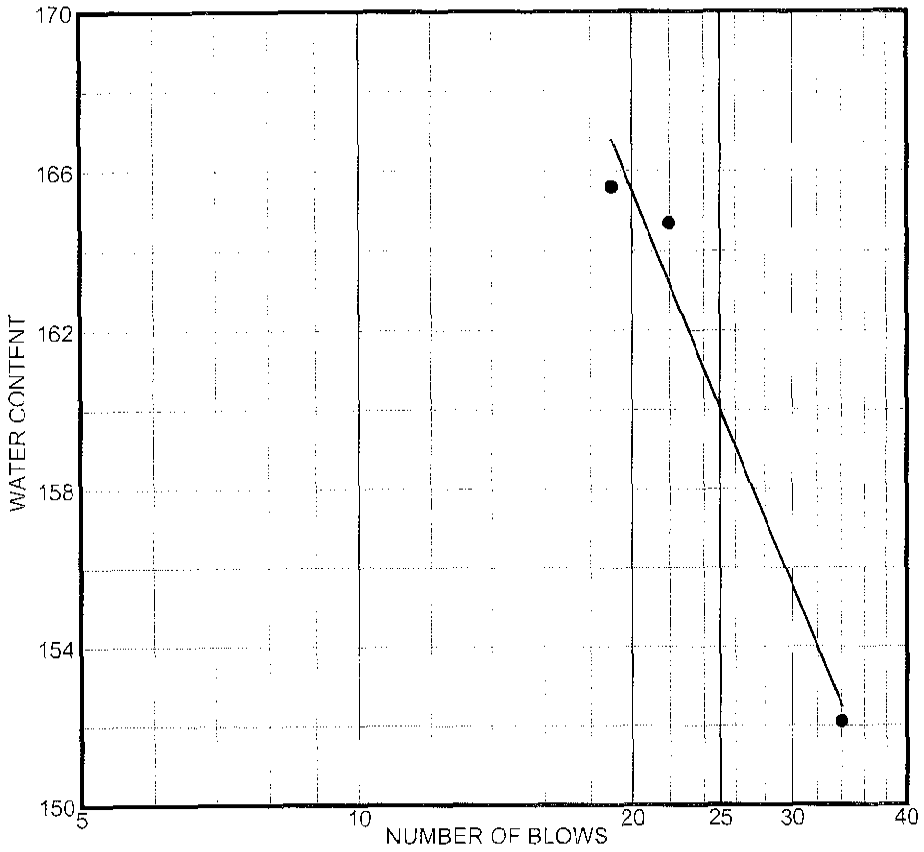
Performed by:CMjr

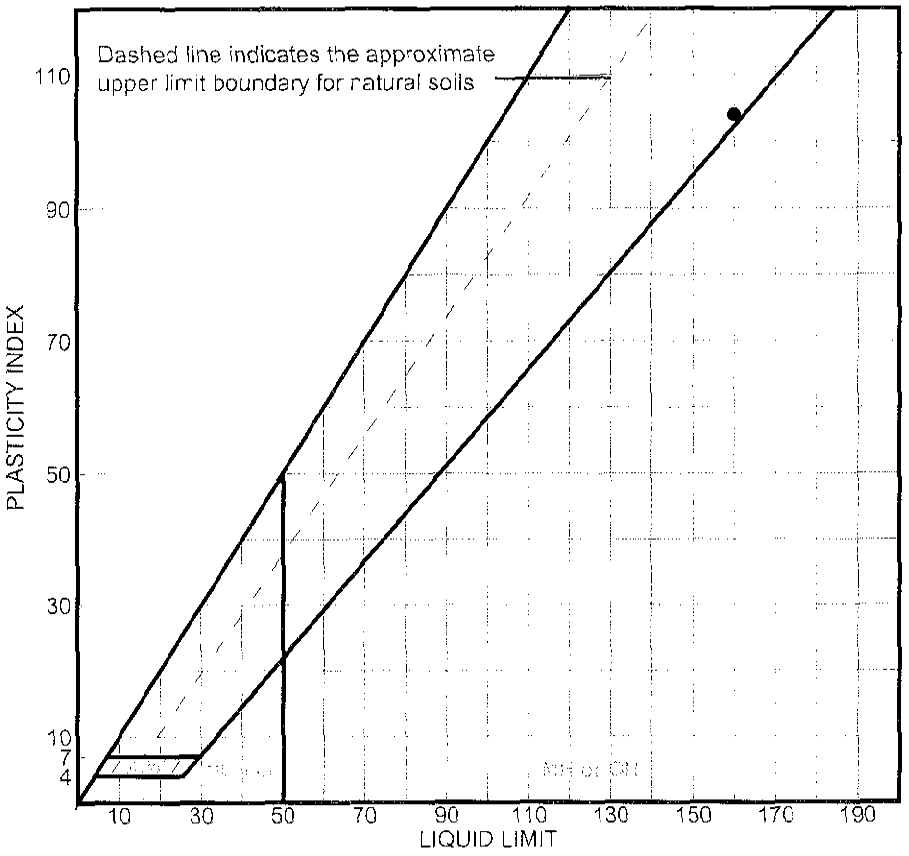
Checked by: CM

Equipment used: LB-1, LO-2

WOLF TECHNOLOGIES, INC.

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●	Boring No. SH-410A	4	11.5'- 13.0'		CH	Brown Sandy CLAY w/ some rock fragments	107.3	160	104

Client US Army Corps of Engineers

Project Savannah Harbor Expansion

Project No. 1452-01-40

WOLF TECHNOLOGIES, INC.

●

APPENDIX C

MAPS GENERAL

MAPS GENERAL
SLOPE STABILITY STUDY AREAS

OVERALL STUDY MAPS

Savannah River Project Location Map

Savannah River Project Outline Stations 114+000 to -85+000

Savannah River Project Outline (ERDC) Stations 114+000 to -85+000

CLOSE STUDY MAPS

Savannah River Channel Stations 66+000 to 68+000

Savannah River Channel Stations 69+500 to 71+500

Savannah River Channel Stations 73+000 to 73+700

Savannah River Channel Stations 75+000 to 76+500

Savannah River Channel Stations 77+000 to 79+000

Savannah River Channel Stations 85+000 to 88+500

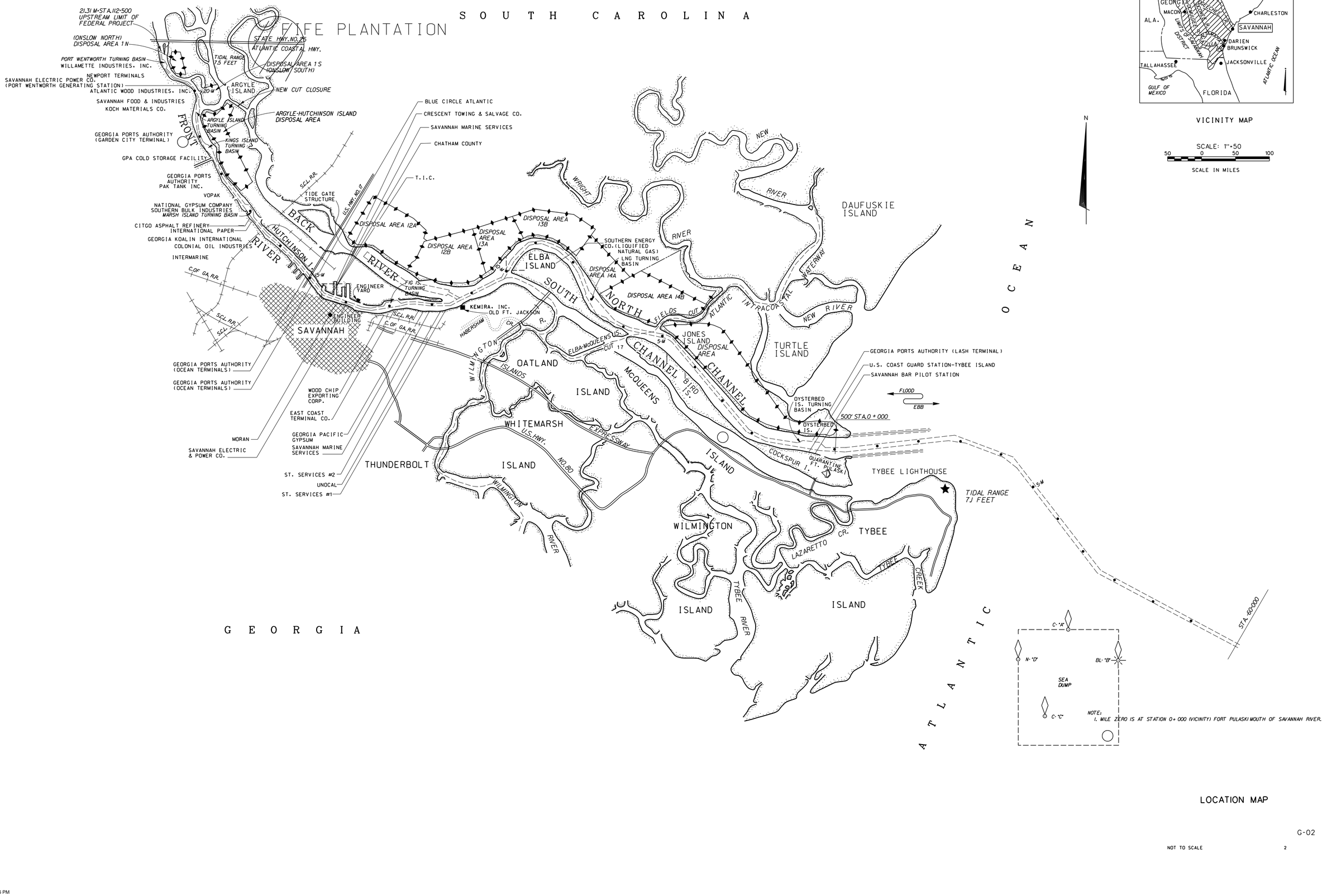
Savannah River Channel Stations 96+000 to 97+500

Savannah River Channel Stations 98+000 to 103+000

ADDITIONAL INFORMATION

General Project Information

Coastal GIS Site (Slow & Unreliable)



G-02

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HUTCHINSON ISLAND

SAVANNAH HARBOR EXPANSION

72

71

70

69

E 995000

E 994000

N 758000

TOP SLOPE
E 993621.7
N 758426.6

71+295 TOP SLOPE
E993822.7
N758449.0

TOP SLOPE
E 995173.9
N 758406.5

TOP SLOPE
E 995125.1
N 758408.4

FIG ISLAND

32-S

BN-60

72·000

0.7 ACRES

ESTIMATED TOP OF SLOPE

EL. +8 MLW

1.5 ACRES

EL. 0 MLW

T1 PROPOSED TOE

BN-62

REVISED TOE (WES) / EXISTING TOE

SH-34 (77)

SH-102 (83)

SH-101 (83)

71·500

71·295

328'

69·730

69·500

RANGE

26

250'

FLOOD

EBB

SAVANNAH RIVER

33-G

N

NOTES:

1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER. (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 69+500 TO 71+500

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURVD JAN 2003	SHEET X OF XX

.dgn

LEGEND

EXISTING CHANNEL TOES - LEVEL 20 - SOLID RED LINE

PRELIMINARY DESIGN TOES (SAV'H DISTRICT) - LEVEL 10 - DASHED WHITE LINE

PRELIMINARY DESIGN TOES BASED ON SHIP SIMULATION (ERDC) - LEVEL 2 - DASH/DOT GREEN LINE

SAVANNAH RIVER

N

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FIG ISLAND

67

66

65

SAVANNAH ELECTRIC AND POWER COMPANY TRANSMISSION LINE

FIG ISLAND TURNING BASIN
900'X1000'X34' DEEP

68

PIPELINE & CABLE AREA

ROCK JETTY

BN-58

SH-215

EXISTING & PROPOSED CHANNEL TOE

PROPOSED CHANNEL TOE (WES)

PROPOSED CHANNEL TOE (PREVIOUS)

SH-220

RANGE

SH-219

24

FLOOD

EBB

SH-218

400'

250'

SH-214A

25

SH-214

250'

PROPOSED CHANNEL TOE (PREVIOUS & WES)

EXISTING CHANNEL TOE

PROPOSED CHANNEL TOE (PREVIOUS)

CONCRETE PIERS

PROPOSED CHANNEL TOE (WES)

SH-411

BN-57

RIPRAP

BOLLARD

CPT 411DS

CPT 411& DMT 411

CPT 411US

SH-76(82)

29-G

BERTH 4

WOOD CHIP EXPORTING CORP.

EAST COAST TERMINAL CO.

PILING LINE

Y-759000

X-759000

Y-758000

X-758000

X-997000

X-998000

X-999000

X-1000000

NOTES:

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4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=100'

200 0 200

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION
SLOPE STABILITY STUDY
STATIONS 66+000 TO 68+000

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F			
SCALE: AS SHOWN		SUR'D	SHEET

HUTCHINSON ISLAND

SAVANNAH HARBOR EXPANSION

72

71

70

69

E 995000

E 994000

N 758000

TOP SLOPE
E 993621.7
N 758426.6

71+295 TOP SLOPE
E993822.7
N758449.0

TOP SLOPE
E 995173.9
N 758406.5

TOP SLOPE
E 995125.1
N 758408.4

FIG ISLAND

32-S

BN-60

72·000

0.7 ACRES

ESTIMATED TOP OF SLOPE

EL. +8 MLW

1.5 ACRES

EL. 0 MLW

T1 PROPOSED TOE

BN-62

REVISED TOE (WES) / EXISTING TOE

SH-34 (77)

SH-102 (83)

SH-101 (83)

71·500

71·295

328'

69·730

69·500

RANGE

26

250'

FLOOD

EBB

SAVANNAH RIVER

33-G

N

NOTES:

1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER. (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 69+500 TO 71+500

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURVD JAN 2003	SHEET X OF XX

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SAVANNAH HARBOR EXPANSION

74

73

E 991,000

E 992,000

N 759,000

SH-412
X 991671.8
Y 759038.8

NOTES:

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4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

PROPOSED CHANNEL TOE

EXISTING CHANNEL TOE

-10'
-15'
-20'
-25'
-30'
-35'
-40'
-45'
-5'
0'
5'
10'

14.96
12.76
10.30
11.65
11.48
10.69
11.33
11.13
12.38

73+500

FLOOD
EBB

SAVANNAH RIVER

EXISTING CHANNEL TOE

PROPOSED CHANNEL TOE

SCALE: 1"=100'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
SHIPWRECK AREA
CHANNEL STATIONS 73+000 TO 73+700
SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURD JAN 2003	SHEET X OF XX

.dgn

SAVANNAH HARBOR EXPANSION

N 760,000

N 759,000

E 989,000

E 990,000

PROPOSED CHANNEL TOE (PREVIOUS)

PROPOSED CHANNEL TOE (WES)

EXISTING CHANNEL TOE

EXISTING CHANNEL TOE

PROPOSED CHANNEL TOE

CHANNEL CENTERLINE

SAVANNAH RIVER

SH-410

SH-410A

T.I.C. STEEL BULKHEAD
TOP OF SLOPE APPROX. -9 MLW

76+170

76+068

75+500

250'

250'

0'

-5'

-10'

-25'

-30'

-40'

-45'

76

75

FLOOD

EBB

NOTES:

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4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=100'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 75+000 TO 76+500

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURD JAN 2003	SHEET X OF XX

X

.dgn

SAVANNAH HARBOR EXPANSION

79+000

78+500

78+140

78+000

77+945

77+701

77+500

39-S

38-G

SH-91 (83)

SH-138 (87)

SH-407 (97)

SH-128 (84)

EXISTING CHANNEL TOE

PROPOSED CHANNEL TOE

PROPOSED CHANNEL TOE (WES)

FLOOD

EBB

12.67

N 761,000

E 987,000

E 988,000

FORMERLY
COLONIAL OIL INDUSTRIES, INC.

SAVANNAH MARINE

ESTIMATED TOP OF SLOPE (1992)

CHANNEL IMPROVEMENT / SLOUGHING EASEMENT (1992)

PROPERTY LINE

FORMERLY
P.D. OIL & CHEMICAL STORAGE

STEEL BULKHEAD

APPARENT HIGH WATER LINE (1992)

76 FT OLD

NOTES:

1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=100'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 77+000 TO 79+000

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURD JAN 2003	SHEET X OF XX

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SAVANNAH HARBOR EXPANSION

HUTCHINSON ISLAND

SAVANNAH RIVER

EST. TOP OF SLOPE
STATION 88+288
X 980755.6
Y 768108.2

88

SH-86 (83)

88+500

PROPOSED CHANNEL TOE (PREVIOUS)

SH-406 (97)

0.9 ACRES ABOVE +8 MLW
4.3 ACRES ABOVE 0 MLW

SH-112 (83)

88+000

EST. TOP OF SLOPE
STATION 87+500
X 981212.3
Y 767571.4

ESTIMATED (PREVIOUS)
TOP OF SLOPE

87

PROPOSED CHANNEL TOE

87+750

ESTIMATED (NEW)
TOP OF SLOPE

87+500

EST. TOP OF SLOPE
STATION 87+000
X 981557.2
Y 767210.4

300'

PROPOSED CHANNEL TOE

250'

87+000

EST. TOP OF SLOPE
STATION 86+500
X 981922.4
Y 766869.4

86

EXISTING CHANNEL TOE

CHANNEL

86+500

ALIGNMENT

EST. TOP OF SLOPE
STATION 86+000
X 982233.4
Y 766470.2

43-G

FLOOD

EBB

250'

250'

85+500

85+000

85

EXISTING CHANNEL TOE

E 980,000

E 981,000

E 982,000

E 983,000

N 768,000

N 767,000

N 766,000

NOTES:

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4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 85+000 TO 88+500

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SUR'D JAN 2003	SHEET X OF XX

.dgn

SAVANNAH HARBOR EXPANSION

E 975.000

E 976.000

E 977.000

N 775.000

N 774.000

97

96

97.500

97.000

96.500

96.000

FRT. C. G. SAILING RANGE

REAR C. G. SAILING RANGE

EST. TOP OF SLOPE
STATION 97+000
X=975722.98
Y=775044.26

ESTIMATED
TOP OF SLOPE

EST. TOP OF SLOPE
STATION 96+000
X 976169.3
Y 774149.4

EST. TOP OF SLOPE
STATION 95+720
X=976264.72
Y=773889.30

FLOOD
EBB

PROPOSED CHANNEL TOE

EXISTING CHANNEL TOE

CHANNEL ALIGNMENT

SAVANNAH RIVER

NOTES:

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3. VERTICAL DATUM: MEAN LOW WATER (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

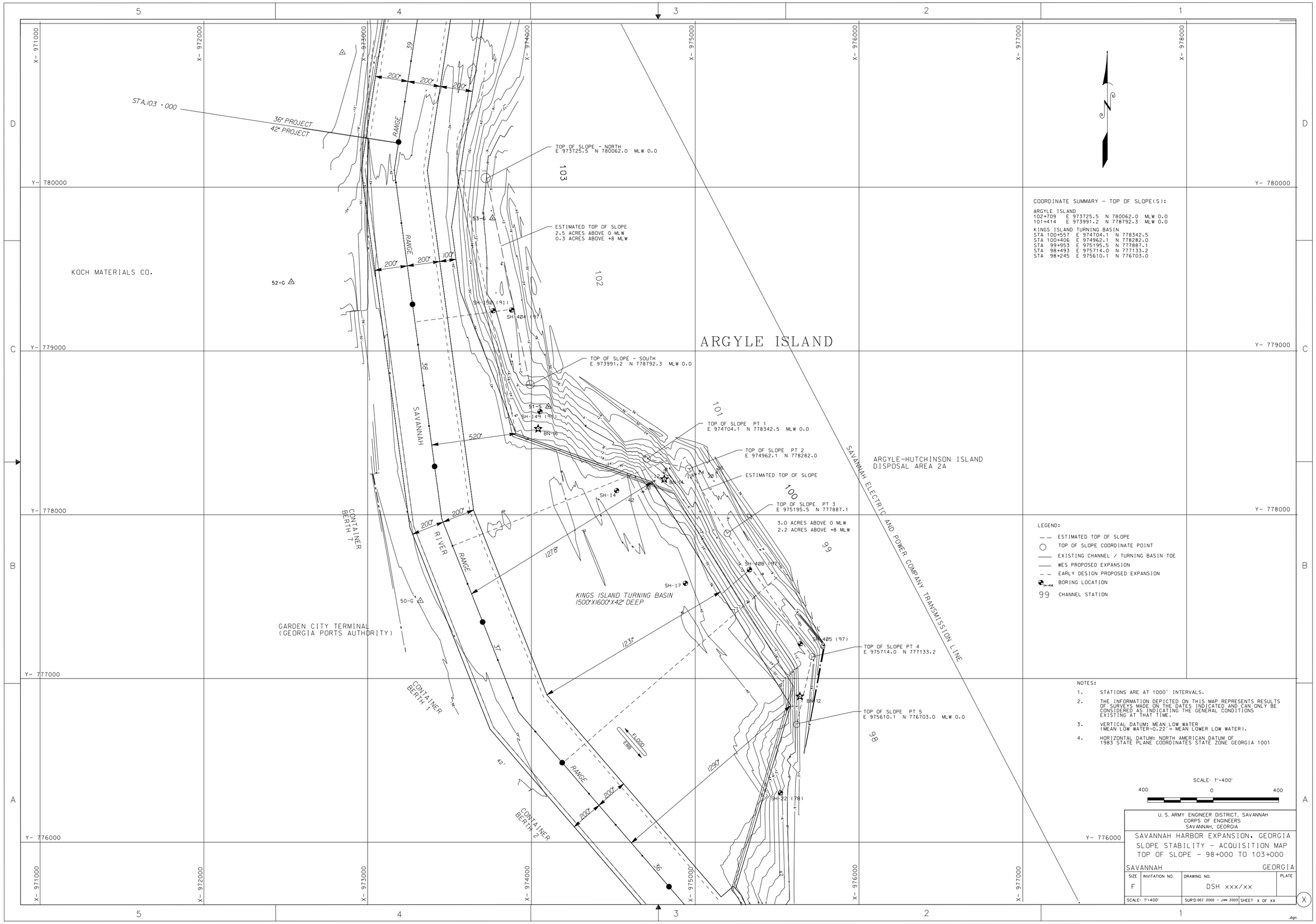
400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS
SAVANNAH 96+000 TO 97+500 GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURD JAN 2003	SHEET X OF XX

.dgn


X- 971000
X- 972000
X- 973000
X- 974000
X- 975000
X- 976000
X- 977000
X- 978000
Y- 780000
Y- 779000
Y- 778000
Y- 777000
Y- 776000
STA 103 + 000
36' PROJECT
42' PROJECT
RANGE
200'
100'
520'
1278'
1290'
123'
FLOOD
EBB
TOP OF SLOPE - NORTH
E 973725.5 N 780062.0 MLW 0.0
ESTIMATED TOP OF SLOPE
2.5 ACRES ABOVE 0 MLW
0.3 ACRES ABOVE +8 MLW
TOP OF SLOPE - SOUTH
E 973991.2 N 778792.3 MLW 0.0
TOP OF SLOPE PT 1
E 974704.1 N 778342.5 MLW 0.0
TOP OF SLOPE PT 2
E 974962.1 N 778282.0
ESTIMATED TOP OF SLOPE
TOP OF SLOPE PT 3
E 975195.5 N 777887.1
3.0 ACRES ABOVE 0 MLW
2.2 ACRES ABOVE +8 MLW
TOP OF SLOPE PT 4
E 975714.0 N 777133.2
TOP OF SLOPE PT 5
E 975610.1 N 776703.0 MLW 0.0
103
102
101
100
99
98
KOCH MATERIALS CO.
ARGYLE ISLAND
ARGYLE-HUTCHINSON ISLAND
DISPOSAL AREA 2A
SAVANNAH ELECTRIC AND POWER COMPANY TRANSMISSION LINE
GARDEN CITY TERMINAL
(GEORGIA PORTS AUTHORITY)
KINGS ISLAND TURNING BASIN
1500'X1600'X42' DEEP
CONTAINER BERTH 7
CONTAINER BERTH 1
CONTAINER BERTH 2
RIVER RANGE
SAVANNAH RANGE
52-6
53-6
51-5
50-6
SH-182 (91)
SH-404 (97)
SH-149 (97)
SH-14
SH-17
SH-408 (97)
SH-405 (97)
SH-22 (78)
BN-6
BN-14
BN-12
COORDINATE SUMMARY - TOP OF SLOPE(S):
ARGYLE ISLAND
102+709 E 973725.5 N 780062.0 MLW 0.0
101+414 E 973991.2 N 778792.3 MLW 0.0
KINGS ISLAND TURNING BASIN
STA 100+557 E 974704.1 N 778342.5
STA 100+406 E 974962.1 N 778282.0
STA 99+953 E 975195.5 N 777887.1
STA 98+493 E 975714.0 N 777133.2
STA 98+245 E 975610.1 N 776703.0
LEGEND:
ESTIMATED TOP OF SLOPE
TOP OF SLOPE COORDINATE POINT
EXISTING CHANNEL / TURNING BASIN TOE
WES PROPOSED EXPANSION
EARLY DESIGN PROPOSED EXPANSION
BORING LOCATION
99 CHANNEL STATION
NOTES:
1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001
SCALE: 1"=400'
400 0 400
U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA
SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY - ACQUISITION MAP
TOP OF SLOPE - 98+000 TO 103+000
SAVANNAH GEORGIA
SIZE F
INVITATION NO.
DRAWING NO. DSH xxx/xx
PLATE
SCALE: 1"=400'
SUR'D DEC 2002 - JAN 2003
SHEET x OF xx
.dgn

APPENDIX D

CROSS SECTION DRAWINGS

CROSS SECTIONS ANALYZED FOR SLOPE STABILITY

Note: These drawings were originally developed using MicroStation Version 7. The files attached below have been converted to Adobe .pdf format and as such will not be readable without using zoom control to read layer soils data.
Originals may be requested by contacting the Corps of Engineers office in Savannah, Georgia for those with the ability to read original design files.

Channel Station 66+250

Channel Station 70+500

Channel Station 73+500

Channel Station 76+068

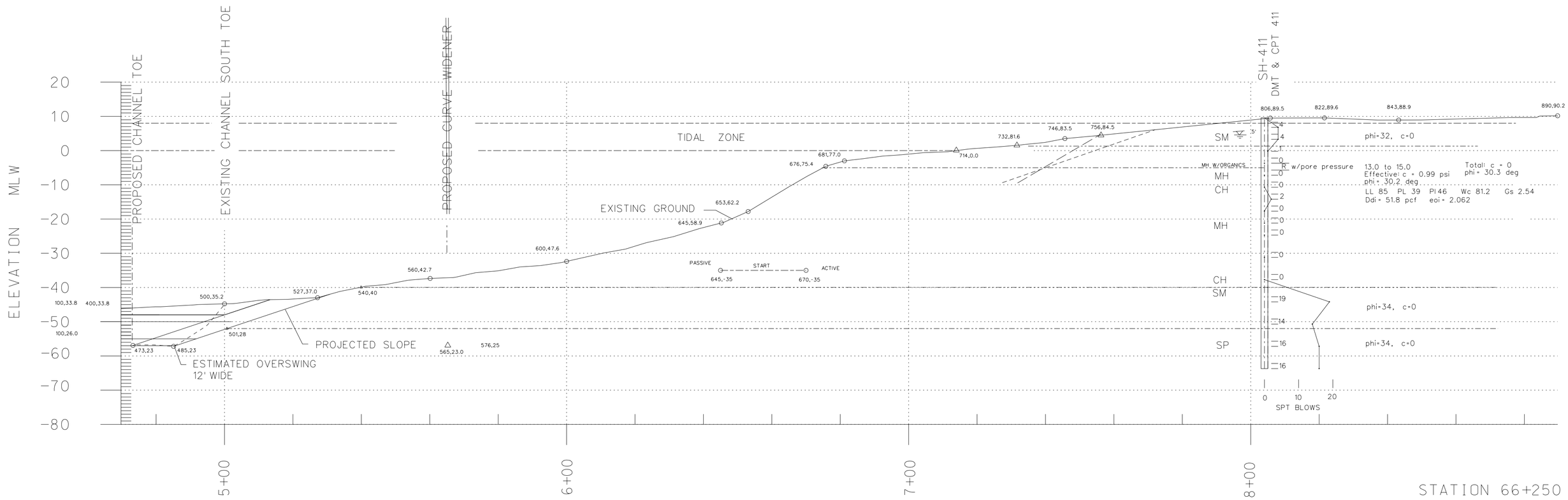
Channel Station 77+500

Channel Station 88+000

Channel Station 96+500

Channel Station 98+605

Channel Station 101+887



NOTE:

1. MAXIMUM DEPTH IS 57 MLW
2. OVERSWING OF PROPOSED TOE ESTIMATED AT 12 FEET

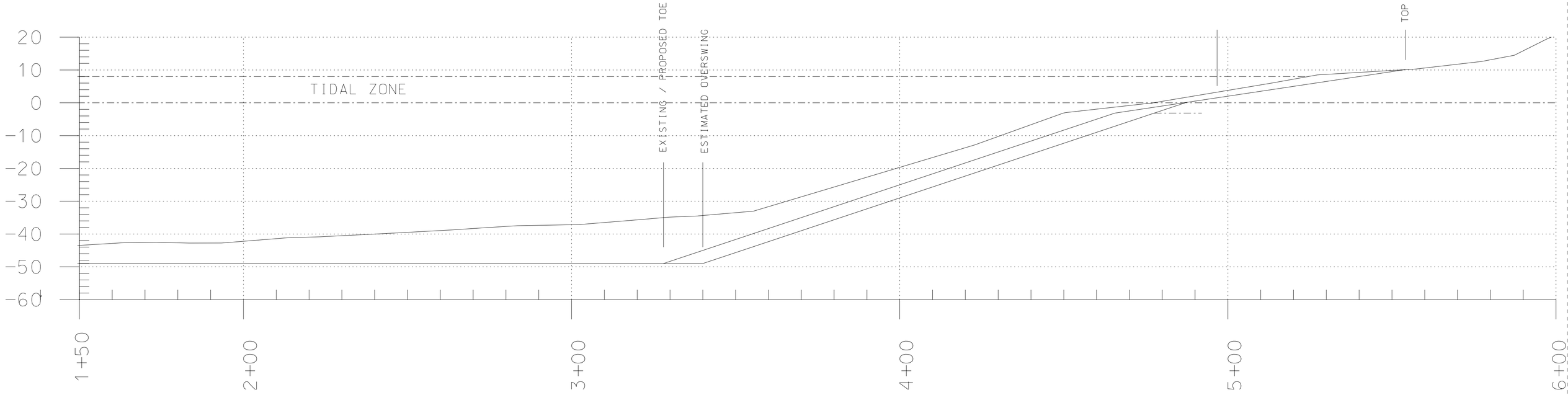
N ⟷ S

STATION 66+250

SAVANNAH HARBOR EXPANSION
SCALE: 1" = 20'

BELOW WOOD CHIP FACILITY

20 FEB 2003 - JDH



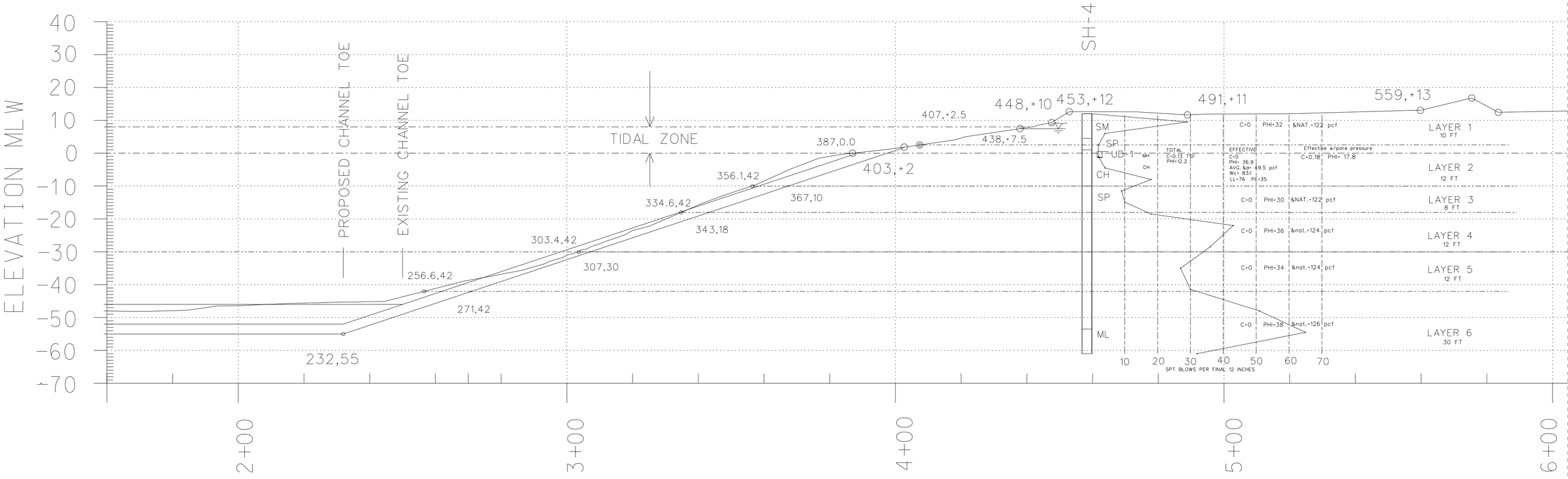
NOTES:

1. MAXIMUM DEPTH = -49 MLW
2. MAINTAIN EXISTING SLOPE

STATION 70+500

S ⟷ N

BANK STABILITY ANALYSIS
SAVANNAH HARBOR EXPANSION
69+700 TO 72+100
10 APR 2003



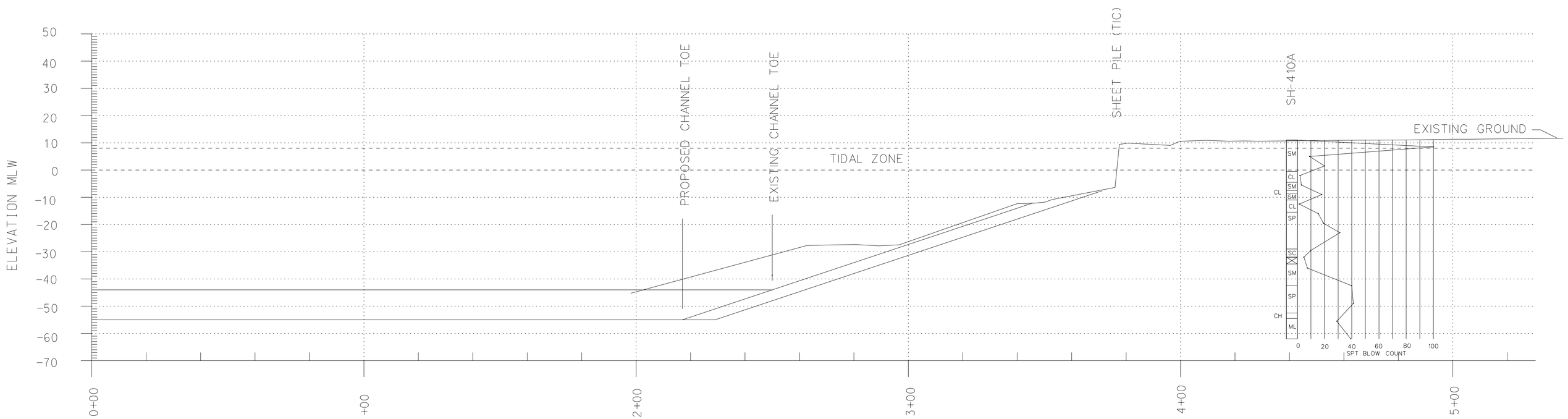
NOTES:

1. MAXIMUM DEPTH = -55 MLW
2. MAINTAIN EXISTING SLOPE

S ⟷ N

STATION 73+500

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 73+500
01 APR 2003



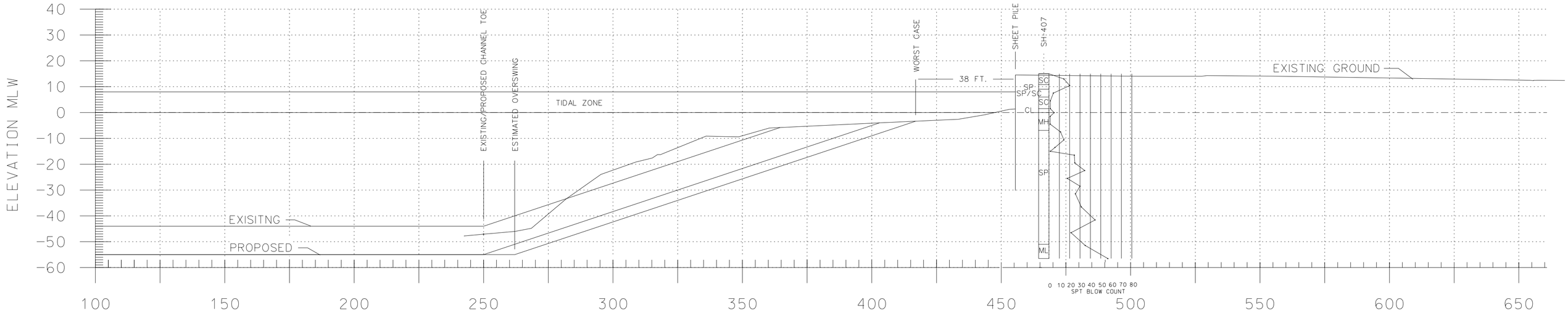
NOTES:

1. MAXIMUM DEPTH = -55 MLW
2. MAINTAIN EXISTING SLOPE

STATION 76+068

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 77+068
05 APR 2003

SAVANNAH MARINE

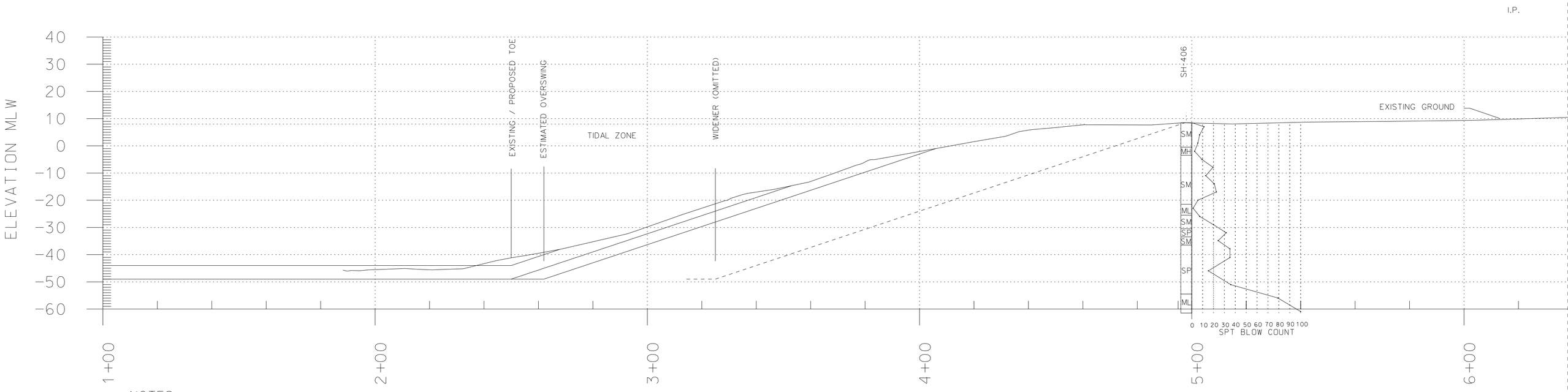


NOTES:

1. MAXIMUM DEPTH = -55 MLW
2. MAINTAIN EXISTING SLOPE

STATION 77+500

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 77+500
07 APR 2003

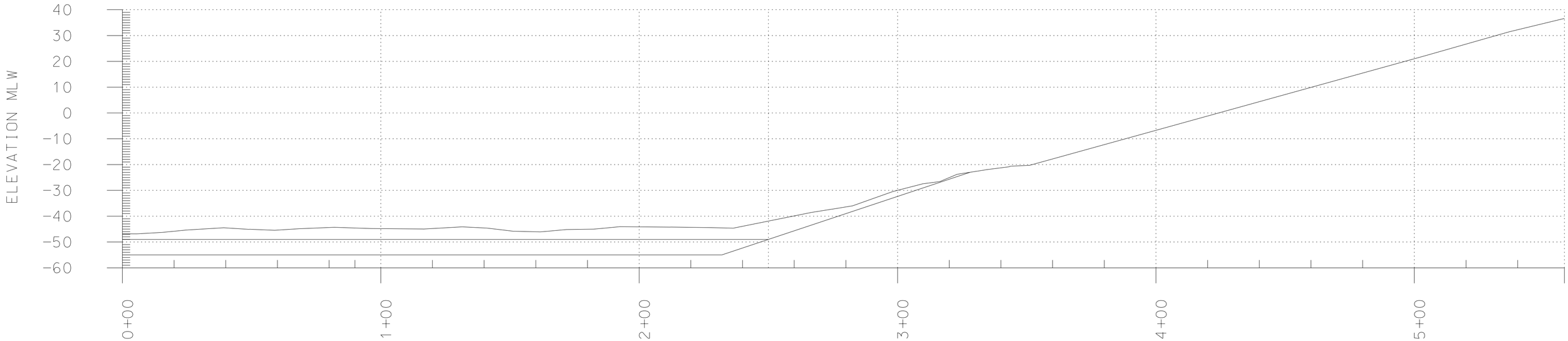


NOTES:

1. MAXIMUM DEPTH = -49 MLW
2. MAINTAIN EXISTING SLOPE

STATION 88+000

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 88+000
09 APR 2003



NOTES:

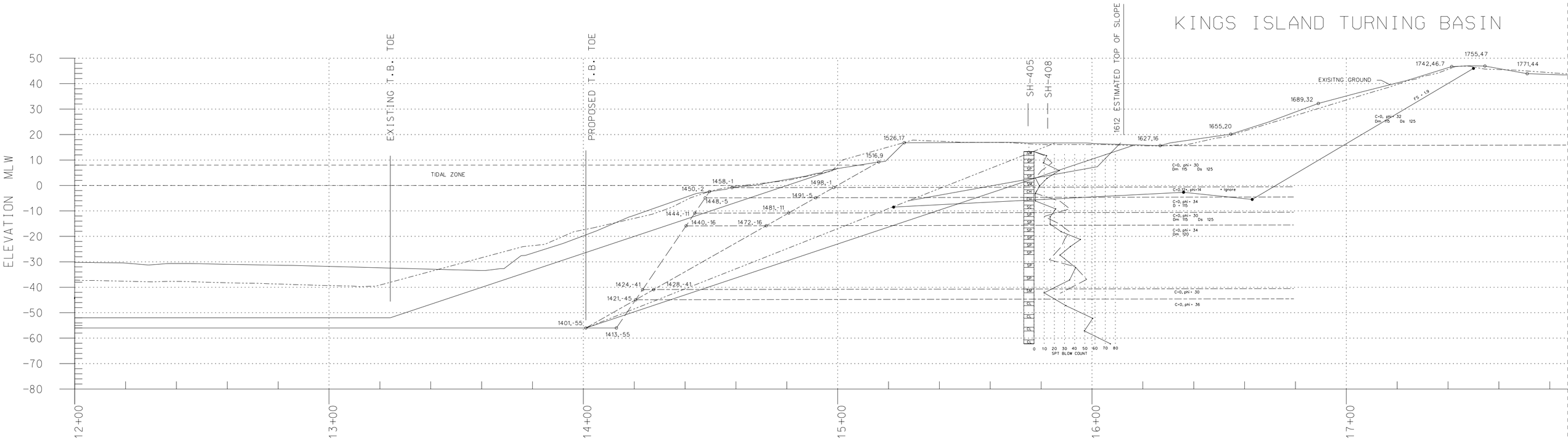
1. MAXIMUM DEPTH = -55 MLW

S ◄——— ———► N

STATION 96+500

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 96+500
08 APR 2003

KINGS ISLAND TURNING BASIN



NOTES:

1. MAXIMUM DEPTH = -55 MLW
2. WIDENER AREA

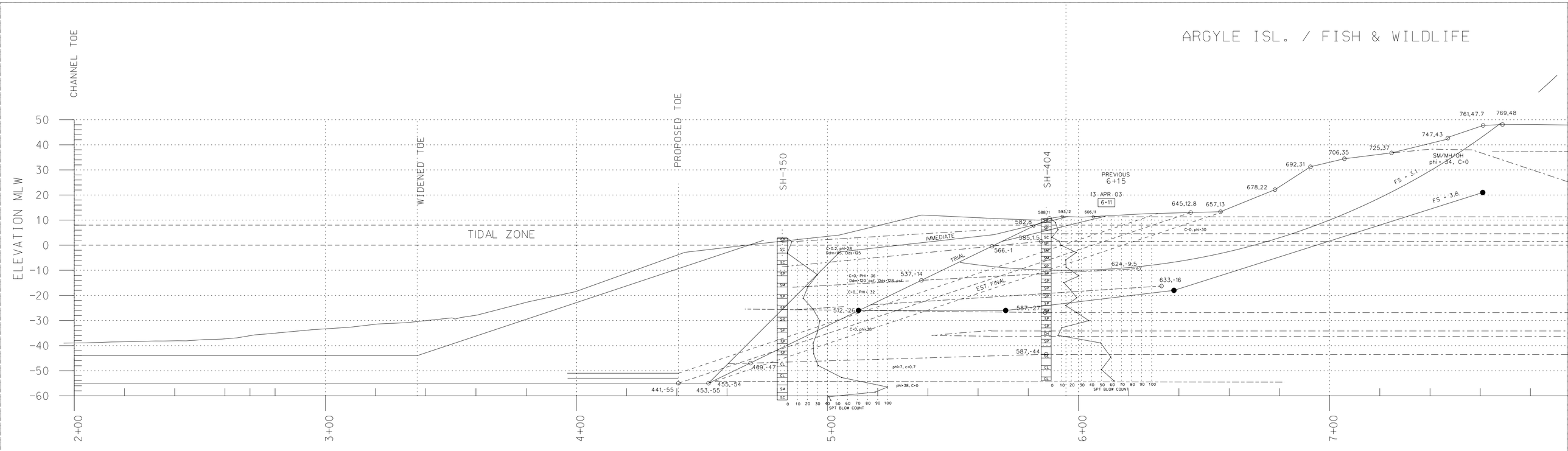
S ◄——————————► N

STATION 98+500

STATION 98+605

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 98+605
08 APR 2003

ARGYLE ISL. / FISH & WILDLIFE



NOTES:

S ◄——— | ———► N

1. MAXIMUM DEPTH = -55 MLW
2. WIDENER AREA

STATION 101+887

BANK STABILITY ANALYSIS
SAVANNAH HARBOR
STATION 101+887
07 APR 2003

APPENDIX E

SLOPE DATA INPUT & OUTPUT

SLOPE DATA INPUT AND OUTPUT

Depth Requirements

Soil Boring Analyses

Trial Setup - Station 66+250

Trial Setup - Station 98+500

Trial Setup - Station 101+887

UTexas3 Input File Station 98+605

UTexas3 Output File Station 98+605

UTexas3 Input File Station 101+887

UTexas3 Output File Station 101+887

UTexas3 Input File Station 101+887 Circular Arc

UTexas3 Output File Station 101+887 Circular Arc

Note:
The Annual Survey Sheets, Aerial photos, River Soundings, and River Borings have not been included in this report. These files are over 6 gigabits in size and should be available either on our GIS database or in paper form, upon request.

Savannah Harbor Depths

Station	Project Depth (feet below MLW)	Advance Maintenance (feet)	Allowable Overdepth (feet)	Disturbed Depth (feet)	Total O&M Dredging Depth (feet below MLW)	Channel Deepening 2-Foot Improvement	Channel Deepening 4-Foot Improvement	Channel Deepening 6-Foot Improvement
60+000B TO 14+000B	44	0	2	3	49	51	53	55
14+000B TO 0+000B	42	2	2	3	49	51	53	55
0+000B TO 24+000	42	2	2	3	49	51	53	55
24+000 TO 35+000	42	4	2	3	51	53	55	57
35+000 TO 37+000	42	6	2	3	53	55	57	59
37+000 TO 70+000	42	4	2	3	51	53	55	57
70+000 TO 102+000	42	2	2	3	49	51	53	55
102+000 TO 103+000	42	0	2	3	47	49	51	53
103+000 TO 105+500	36	2	2	3	43	45	47	49
105+500 TO 112+500	30	2	2	3	37	39	41	43
OYSTER ISLAND TURNING BASIN	40	0	2	3	45			
ELBA ISLAND TURNING BASIN	38	0	2	3	43			
FIG ISLAND TURNING BASIN	34	4	2	3	43			
MARSH ISLAND TURNING BASIN	34	0	2	3	39			
KINGS ISLAND TURNING BASIN	42	8	2	3	55			
ARGYLE ISLAND TURNING BASIN	30	0	2	3	35			
PORT WENTWORTH TURNING BASIN	30	0	2	3	35			
SEDIMENT BASIN	40	0	2	3	45			
0 to 2+000	38	0	2	3	43			

ENV APPROVED BUT NOT CONSTRUCTED

OYSTER ISLAND TURNING BASIN	4
ELBA ISLAND TURNING BASIN	8
FIG ISLAND TURNING BASIN	12
MARSH ISLAND TURNING BASIN	8
ARGYLE ISLAND TURNING BASIN	0
PORT WENTWORTH TURNING BASIN	0
SEDIMENT BASIN	6

SOIL BORING ANALYSES LOCATIONS / PRELIMINARY ASSESSMENT

31 January 2002

1. The existing Savannah Harbor is approximately 32 miles long (along the centerline of the channel), stretching from the Atlantic Ocean to the former New Cut Channel (Channel Stations –60+000 to 103+000). The Savannah Harbor Expansion Project proposes to add 25,000 feet of outer channel (New Channel Stations (-60+000 to -85+000), widen selected turns within the inner harbor, and enlarge the existing Kings Island Turning Basin (Inner harbor). The outer channel work does not impact privately owned real estate. The inner harbor, for the purpose of this study, shall be described as being all reaches from Channel Station 0+000 to 103+000. There is approximately 20 miles of land on each side of the river (approximately 40 miles of river banks), and many properties that could be affected by the project depending, in part, on the proximity of the land to the proposed channel deepening and/or widening. The Corps of Engineers does not recommend taking soil samples from all properties located along the Savannah River and in the Savannah Harbor.

2. The publications by the Department of the Army, Corps of Engineers, Office of the Chief Engineers entitled "Engineering and Design, Geotechnical Investigations," EM 1110-1-1804 (29 February 1984) and "Soil Sampling," EM 1110-2-1907, are the primary sources on how to take soil samples. These engineering manuals indicate how to take the samples, but do not identify with any specificity the locations where samples must be taken. There are no regulations, internal guidelines, policies or other directives that specify the conditions under which soil samples must be obtained or the properties from which soil samples must be taken. The designing soils engineer has the discretion to decide, based on his or her best judgment as an engineer, the locations where it will be necessary to take soil samples for analysis.

3. The soils engineering staff for the Corps of Engineers is responsible for determining where soil samples for slope stability and demolition purposes will be taken in connection with the Savannah Harbor Expansion Project. During the course of determining the locations where it would be necessary for the Corps of Engineers to take soil samples for analysis, we considered the following factors: 1) the proximity of a property to the proposed project, 2) the type of material likely to be encountered (as obtained from past soil borings in the vicinity), 3) the slope of the riverbank, 4) the configuration of the existing channel, 5) hydrographic surveys, 6) topographic surveys and aerial photographs, 7) the configuration of the proposed navigation channel, 8) whether the proposed channel intersects with adjacent property, 9) the proposed method of dredging, 10) the available budget, 11) the cost of taking and analyzing soil borings,[1] and 12) the likelihood that soil sample analysis will yield necessary information. In

[1] The cost of a soil boring, including laboratory testing and analysis, and subsequent analysis of the drilling and test results, varies from approximately $10,000.00 to $12,500.00, per boring.

addition, we considered historic information, including: 1) most recent surveys, 2) problems arising out of most recent dredging projects, and 3) historic structures and artifacts.

4. In connection with the Savannah Harbor Expansion Project, we also conducted site inspections of all areas that could be affected by the project, by boat and by land. Documentation, photographs, and comment from the most recent inspections are contained in Memorandum For Record dated 06 December 2001, Subject: Trip Report, Savannah Harbor Expansion, Savannah, GA; Inspection of Dock Structures, Inner Harbor.

5. The decision whether to test certain property is based on an analysis of the above factors, and not the ownership of the property. The taking of soil samples, like any other expenditure in connection with a harbor expansion project, must be justifiable. Engineering judgment is used to determine the locations where the taking of soil samples will yield necessary information.

6. Soil borings and samples were taken during preliminary study analysis which will need to be augmented based on the now proposed channel configuration, and again (possibly) augmented after final model studies have been completed. Each of the following areas represents a 'taking' or real estate acquisition necessary to accommodate proposed channel widening. Areas which are known to involve 'taking' by virtue of direct intersection of proposed work to the existing channel/river configuration or where there is some question regarding existing bulkhead and/or channel bank stability are 1) Argyle Island between Channel Stations 101+000 and 103+000, 2) Kings Island Turning Basin between Channel Stations 98+700 and 100+500, 3) International Paper, northeast riverbank, between Channel Stations 87+450 and 89+500, 4) Savannah Marine Services and the former Graham Radio Corp. Property, Channel Stations 77+250 to 77+650, 5) T.I.C., Channel Stations 76+000 to 76+200, and 6) Property located at or adjacent to Wood Chip Exporting Corp., Channel Stations 65+950 to 66+200. Each of the above described areas either have been or will be investigated with regard to subsurface condition, profiles, material strength and bank stability.

7. Areas of concern that do not involve a direct intersection of the proposed project to the existing river configuration, and are recommended for soil testing are listed in the following:

a. Hutchinson/Fig Island between the U.S. Army Corps of Engineers Yard and Slip No.1, known as an archeological site consisting of soft fill materials and old ship/boat wrecks (Approximate Channel Stations 72+700 to 73+700). This area is recommended for subsurface exploration and testing to better determine bank stability with regard to the proposed project.

b. South Channel Training Wall, Elba Island side, Channel Stations 50+000 to 51+700, and near Southern Energy Corporation's natural gas pipeline crossing. Channel widening proposed along this reach will likely involve debris and/or training wall (or remnant) removal. Exploratory investigation is planned to determine size and extent of possible debris removal.

c. The extended bar channel area from -60+000 to -85+000. While not of concern to adjacent properties (none), subsurface sampling and testing will be performed to determine the character of materials proposed for removal.

d. Other areas are subject to subsurface testing and analysis. Such include aquifer studies for salt-water intrusion, which are considered beyond the scope of this writing.

8. Problematic areas exist that involve deteriorated, broken and/or highly questionable structures with regard to their stability and are located near or adjacent to the proposed project. These areas are not recommended for subsurface study, but will need to be addressed as separate issues. Each is listed in the following:

a. Cantilevered Parking Lot and Dock Facility (Owner: Sylvan Byck) located between Moran Towing and the eastern end of the original Rousakis Plaza, located opposite the Shrimp Factory on River Street, and approximately between Channel Stations 74+270 and 74+400. The foundation for the cantilevered concrete parking area consists of wood piling. As noted in the trip report dated 06 December 2001, a gap or open area exists that varies from about 1 foot to less than 1 foot between the pile tops and the concrete, depending on pile location. Given the relatively good condition of the pile tops, it is surmised that repeated loading and unloading of the parking lot has subsequently driven the piles into supporting soils beyond the depth that piles were originally installed. In any case, the gap between the pile tops and supporting concrete indicates a pile bearing failure that leaves the concrete section free to flex and move within existing constraints. Repeated movement or flexing of the concrete structure could lead to (if not already) structural problems for the parking facility. This facility in its present condition requires substantial foundation repair(s).

With regard to the proposed harbor expansion, it should be noted that over-swing normally associated with pipeline dredging (estimated at approximately 4 to 6 feet) could lead to an approximate loss of 2 feet of channel side slope soil material that currently helps support the outermost piling. While true for the outermost piles, the estimated 2 feet of possible material loss is unlikely to have an appreciable effect on remaining interior piles. In addition, it is noted that the same amount of remedial or repair work will be required, with or without the harbor expansion project.

Subsurface sampling and testing in this area isn't likely to yield any new or useful information with regard to the facility and therefore is not recommended. It is recommended that the property owner be advised of the foundation conditions discovered before actual dredging occurs

b. International Paper (formerly Union Camp), southwest side, located between Channel Stations 87+500 and 89+600. The sheet-piling bulkhead contains numerous holes approximately 1-foot square in size at or near the zero mlw elevation. It is unclear whether these holes have been cut deliberately (given the near uniform hole sizes), perhaps as a previous drainage effort, or if the holes are the result of long term pile corrosion at the low water mark.

With regard to the proposed project in this vicinity, the resulting side slope from project dredging is not expected to change or alter existing conditions directly adjacent to the

bulkhead. The above expectation is based on the distance of the bulkhead from the proposed channel work and considering usual dredging practices.

Subsurface sampling and testing in this area is not likely to yield any new or useful information with regard to the facility or project and therefore is not recommended. However, it is recommended that the property owner be advised of the bulkhead conditions discovered during our site inspection.

c. Crescent Towing and Salvage Company approximately located between Channel Stations 75+500 and 75+800. Crescent's brick wall and brick retaining wall structures appear to be supported or partially supported on wood piling. The wall is severely cracked, with portions of the wall either removed, or broken and subsequently fallen into the river. The wood piling behind the brick wall and supporting the dock facility appears to exist in a fair to good condition.

With regard to the proposed project and the Crescent property, the harbor expansion could have some effect on the stability of the brick wall and supporting piles. While it is not recommend that sampling and testing be performed solely for this facility, testing and sampling is currently planned for Crescent's neighboring facility, T.I.C., located approximately 400 feet upstream. Given the contiguous nature and similar histories for this reach, the sampling, testing and analysis currently planned should be considered sufficient and cost effective. The results of the analysis for the reach between Channel Stations 75+500 and 76+250 will be applied to the landmass / riverbank without regard to who owns which part. Any subsequent recommendations will be addressed after analysis has been completed.

d. East Coast Terminal Company, approximate Channel Stations 68+000 to 69+700. Observations reveal the supporting foundation for the dock facility at East Coast Terminal exists in an advanced state of deterioration and disrepair. This includes piling, pile bracing, wood retaining structures and portions of the concrete deck.

With regard to the proposed project in this vicinity, the resulting side slope from project dredging is not expected to change or alter existing conditions adjacent to the East Coast dock facility. This conclusion is based on the distance of the dock from the proposed channel work (80 to 120 feet) and considered usual dredging practices.

Subsurface sampling and testing in this area is not is not recommended. However, it is recommended that the property owner be advised of the dock facility foundation conditions discovered during our site inspection.

9. The remaining properties, structures and/or other items within the scope of the proposed harbor expansion exists in or belongs to one of the following conditions:

a. Located by sufficient distances from the proposed work so as not to be impacted and are not recommended for sampling and testing of soil materials or further studies.

b. Located near, but outside, the proposed work and exist in an excellent to good condition. Sampling and testing in the vicinity of such facilities will not provide any

useful information with regard to the proposed work and such sampling and testing is not recommended.

c. Is currently under design for remediation / repair of structural facilities to be implemented as an item separate from the proposed project. i.e. Old Fort Jackson moat and bank protection.

d. Belongs to a group or class probably best described as obstructions and are being addressed as separate issues. i.e. CSS Georgia, sunken barges, training wall(s), etc..

SAVANNAH HARBOR EXPANSION - STATION 66+250
SLOPE STABILTY 09 APRIL 2003

Trial Surface 1 - Worksheet

X	Y	DESCRIPTION	C	phi	Dm	Ds
0	-57					
473	-57					
485	-57					
501	-52	SM	0	38	118	126
527	-43					
540	-40	SP	0	34	118	126
560	-37.3					
600	-32.4					
645	-21.1	SC	0.2	28	115	125
653	-17.8					
676	-4.6	TOP CH	0.071	30	58	90
681	-3					
732	1.6					
756	4.5	CH	0.12	14	91	95
806	9.5	SM	0	32	115	123
822	9.6					
843	8.9					
890	10.2					

Embankment Water Level @ 5.0, Intersection @ 756 4.5
Channel Water Level taken at 0.0, Intersects @ 714

PH Input Line

0	0
714	0
756	4.5
1100	5

NE (Start Neutral Block, Size/Location)

Active Side		Passive Side		Control	Act Inc	Pass Inc.	Vert Inc.
670	-35	645	-35	-2	5	5	2

SAVANNAH HARBOR EXPANSION - STATION 98+500
SLOPE STABILTY 09 APRIL 2003

Trial Surface 1 - Worksheet

X	Y	DESCRIPTION	C	phi	Dm	Ds
0	-55					
1401	-55					
1413	-55					
1421	-45	CL	0	36	120	128
1424	-41	SM	0	32	118	126
1440	-16	SP	0	34	115	125
1444	-11	SP	0	30	115	125
1448	-5	CH / SC	0	34	115	124
1450	-2					
1458	-1	TOP CH	0.12	14	91	95
1516	9					
1526	17					
1627	16	TOP SM - SP	0	30	115	122
1655	20					
1689	32					
1742	46.7	SM / MH / OH	0	32	115	125
1755	47					
1771	44					
1805	42					

Embankment Water Level @ 5.0, Intersection @ 1509
Channel Water Level taken at 0.0, Intersects @ 1500

PH Input Line

0	0
1500	0
1509	5
2000	9

NE (Start Neutral Block, Size/Location)

Active Side		Passive Side		Control	Act Inc	Pass Inc.	Vert Inc.
1475	-14	1465	-14	-2	5	5	2

SAVANNAH HARBOR EXPANSION - STATION 101+887
SLOPE STABILTY 09 APRIL 2003

Trial Surface 1 - Worksheet

X	Y	DESCRIPTION	C	phi	Dm	Ds
0	-55					
441	-55					
453	-55					
455	-54	SM/SC/CL	0	38	118	126
469	-47	CL	0.7	7	91	96
512	-26	SP	0	38	118	126
537	-14	SP	0	32	115	125
566	-1	SM / SP	0	36	120	128
582	8	SC	0.2	28	115	125
588	11					
593	12					
606	11	TOP SM - SP	0	30	115	122
657	13					
678	22					
692	31					
706	35					
725	37					
747	43					
761	47.7	SM / MH / OH	0	34	115	125
769	48					
902	48					
940	43					
1100	43					

Embankment Water Level @ 5.0, Intersection @ 577
Channel Water Level taken at 0.0, Intersects @ 566

PH Input Line

0	0
566	0
577	5
1100	30

NE (Start Neutral Block, Size/Location)

Active Side		Passive Side		Control	Act Inc	Pass Inc.	Vert Inc.
536	-34	526	-34	-2	5	5	2

```
HEADING
  Kings Island Turning Basin, Station 98+605, Savannah, Georgia
  End of construction loading
  Single circular loading
PROFILE LINES
  1  1  Top Spoil Material
  1771  44
  2000  44

  2  2  Top DA Dike (SM-SC)
  1627  16.0
  1655  20.0
  1689  32.0
  1742  46.7
  1755  47.0
  1800  30.0
  1840  20.0
  1900  17.0

  3  3  Directly Beneath Dike & Spoil Area
  1498  17.0
  1526  17.0
  1627  16.0
  2000  16.0

  4  4  Soft River Bank Material
  1458  -1.0
  2000  -1.0

  5  5  Underlying Softer (SC) (Old marsh deposits)
  1481  -5.0
  2000  -5.0

  6  6  Sands & Sand Clay (SM-SC)
  1472 -11.0
  2000 -11.0

  7  7  Medium Dense Sands
  1428  -16.0
  2000  -16.0

  8  8  Dense Sands
  1421  -41.0
  2000  -41.0

  9 9   Dense Sand
     0  -45.0
  2000  -45.0


MATERIAL PROPERTIES
  1  Spoil
    98 = unit weight
   Conventional shear strength
     0 16
   NO pore pressures
  2  Sand (Dike)
   125 = unit weight
   Conventional shear strength
    0  32
   NO pore pressures
  3  Sand
   122 = unit weight
```

```
   Conventional shear strength
    0  30
   NO pore pressures
  4  Upper Embankment lean clay and clayey sand
    95 = unit weight
   Conventional shear strength
    20  14
   NO pore pressures
  5 Soft SC
   111.8 = unit weight
   Conventional shear strength
    80  12.6
   NO pore pressures
  6 Medium sand
   125 = unit weight
   Conventional shear strength
    0  30
   NO pore pressures
  7 Med Dense Sand
   120 = unit weight
   Conventional shear strength
   0  34
   NO pore pressures
  8 Dense Sand
   126 = unit weight
   Conventional shear strength
   0  32
   NO pore pressures
  9 Dense Sand
   128 = unit weight
   Conventional shear strength
   0  36
   NO pore pressures

SURFACE PRESSURES
    0 -55.0     0  0
 1413 -55.0     0  0
 1421 -45.0  2810  0
 1428 -41.0  2560  0
 1472 -16.0  1002  0
 1481 -11.0   688  0
 1526  17.0     0  0
 1627  16.0     0  0
 1655  20.0     0  0
 1689  32.0     0  0
 1742  46.7     0  0
 1755  47.0     0  0
 1771  44.0     0  0
 2000  44.0     0  0

SLOPE GEOMETRY
    0 -55.0
 1413 -55.0
 1421 -45.0
 1428 -41.0
 1472 -16.0
 1481 -11.0
 1526  17.0
 1627  16.0
 1655  20.0
 1689  32.0
 1742  46.7
 1755  47.0
```

```
 1771  44.0
 2000  44.0

ANALYSIS/COMPUTATION
  NonCircular Search
  1500.0, -22
  1640.0, -22
  1660.0, -6
  1750.0, 46

  10, 60
  ITErations
   500
  WATER DEPTH
   4.0
  FACTOR OF SAFETY
   16.0
  CHANGE TRIAL FACTOR

COMPUTE
ASCII
PRINT
```

TRIAL -4- 12 APR 2003

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:12:2003 Time: 16:17:18 Input file: kitb9

TABLE NO. 1

```
****************************************
* COMPUTER PROGRAM DESIGNATION - UTEXAS3 *
* Originally Coded By Stephen G. Wright  *
* Version No. 1.120                      *
* Last Revision Date 10/08/92            *
* (C) Copyright 1985-1992 S. G. Wright   *
* All Rights Reserved                    *
****************************************

************************************************************
*                                                          *
*      RESULTS OF COMPUTATIONS PERFORMED USING THIS COMPUTER *
* PROGRAM SHOULD NOT BE USED FOR DESIGN PURPOSES UNLESS THEY *
* HAVE BEEN VERIFIED BY INDEPENDENT ANALYSES, EXPERIMENTAL   *
* DATA OR FIELD EXPERIENCE. THE USER SHOULD UNDERSTAND THE   *
* ALGORITHMS AND ANALYTICAL PROCEDURES USED IN THE COMPUTER  *
* PROGRAM AND MUST HAVE READ ALL DOCUMENTATION FOR THIS      *
* PROGRAM BEFORE ATTEMPTING ITS USE.                         *
*                                                          *
*      NEITHER THE UNIVERSITY OF TEXAS NOR STEPHEN G. WRIGHT *
* MAKE OR ASSUME LIABILITY FOR ANY WARRANTIES, EXPRESSED OR  *
* IMPLIED, CONCERNING THE ACCURACY, RELIABILITY, USEFULNESS  *
* OR ADAPTABILITY OF THIS COMPUTER PROGRAM.                  *
*                                                          *
************************************************************
```

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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Kings Island Turning Basin, Station 98+605, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 2

```
*************************
* NEW PROFILE LINE DATA *
*************************
```

PROFILE LINE 1 - MATERIAL TYPE = 1
Top Spoil Material

Point	X	Y
1	1771.000	44.000
2	2000.000	44.000

PROFILE LINE 2 - MATERIAL TYPE = 2
Top DA Dike (SM-SC)

Point	X	Y
1	1627.000	16.000
2	1655.000	20.000
3	1689.000	32.000
4	1742.000	46.700
5	1755.000	47.000
6	1800.000	30.000
7	1840.000	20.000

8	1900.000	17.000

PROFILE LINE 3 - MATERIAL TYPE = 3
Directly Beneath Dike & Spoil Area

Point	X	Y
1	1498.000	17.000
2	1526.000	17.000
3	1627.000	16.000
4	2000.000	16.000

PROFILE LINE 4 - MATERIAL TYPE = 4
Soft River Bank Material

Point	X	Y
1	1458.000	-1.000
2	2000.000	-1.000

PROFILE LINE 5 - MATERIAL TYPE = 5
Underlying Softer (SC) (Old marsh deposits)

Point	X	Y
1	1481.000	-5.000
2	2000.000	-5.000

PROFILE LINE 6 - MATERIAL TYPE = 6
Sands & Sand Clay (SM-SC)

Point	X	Y
1	1472.000	-11.000
2	2000.000	-11.000

PROFILE LINE 7 - MATERIAL TYPE = 7
Medium Dense Sands

Point	X	Y
1	1428.000	-16.000
2	2000.000	-16.000

PROFILE LINE 8 - MATERIAL TYPE = 8
Dense Sands

Point	X	Y
1	1421.000	-41.000
2	2000.000	-41.000

PROFILE LINE 9 - MATERIAL TYPE = 9
Dense Sand

Point	X	Y
1	.000	-45.000
2	2000.000	-45.000

All new profile lines defined - No old lines retained
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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Kings Island Turning Basin, Station 98+605, Savannah, Georgia
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TABLE NO. 3
****
* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
****

DATA FOR MATERIAL TYPE 1
Spoil

Unit weight of material = 98.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 16.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 2
Sand (Dike)

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 32.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 3
Sand

Unit weight of material = 122.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 30.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 4
Upper Embankment lean clay and clayey sand

Unit weight of material = 95.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - 20.000
Friction angle - - - - - 14.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 5
Soft SC

Unit weight of material = 111.800

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - 80.000
Friction angle - - - - - 12.600 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 6
Medium sand

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 30.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 7
Med Dense Sand

Unit weight of material = 120.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 34.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 8
Dense Sand

Unit weight of material = 126.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 32.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 9
Dense Sand

Unit weight of material = 128.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 36.000 degrees

No (or zero) pore water pressures

All new material properties defined - No old data retained
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TABLE NO. 10
****
* NEW SURFACE PRESSURE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
****

ALL NEW DATA INPUT - NO OLD DATA RETAINED

Surface Pressures -

Point	X	Y	Normal Pressure	Shear Stress

1	.000	-55.000	.000	.000
2	1413.000	-55.000	.000	.000
3	1421.000	-45.000	2810.000	.000
4	1428.000	-41.000	2560.000	.000
5	1472.000	-16.000	1002.000	.000
6	1481.000	-11.000	688.000	.000
7	1526.000	17.000	.000	.000
8	1627.000	16.000	.000	.000
9	1655.000	20.000	.000	.000
10	1689.000	32.000	.000	.000
11	1742.000	46.700	.000	.000
12	1755.000	47.000	.000	.000
13	1771.000	44.000	.000	.000
14	2000.000	44.000	.000	.000

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TABLE NO. 9
****
* NEW SLOPE GEOMETRY DATA *
****

All new data input - No old data retained

Slope Coordinates -

Point	X	Y
1	.000	-55.000
2	1413.000	-55.000
3	1421.000	-45.000
4	1428.000	-41.000
5	1472.000	-16.000
6	1481.000	-11.000
7	1526.000	17.000
8	1627.000	16.000
9	1655.000	20.000
10	1689.000	32.000
11	1742.000	46.700
12	1755.000	47.000
13	1771.000	44.000
14	2000.000	44.000

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TABLE NO. 15
****
* NEW ANALYSIS/COMPUTATION DATA *
****

Noncircular Shear Surface(s)

Automatic Search Performed

Coordinates of points on shear surface which are to be shifted -

Point	X	Y	Shift Angle
1	1500.000	-22.000	angle to be computed - moveable
2	1640.000	-22.000	angle to be computed - moveable
3	1660.000	-6.000	angle to be computed - moveable
4	1750.000	46.000	angle to be computed - moveable

Initial distance for shifting points on shear surface = 10.000
Maximum steepness permitted for toe of shear surface = 60.00 degrees

Maximum number of iterations allowed for
calculating the factor of safety = 500

Depth of water in crack = 4.000

Initial trial estimate for the factor of safety = 16.000

Initial trial values for factor of safety (and side force inclination for Spencer's procedure) will be changed during search

---

THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for side force inclination = 15.000 degrees
(Applicable to Spencer's procedure only)

Allowed force imbalance for convergence = 100.000

Allowed moment imbalance for convergence = 100.000

Number of increments for slice subdivision = 30

Unit weight of water in crack = 62.400

Seismic coefficient = .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
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TABLE NO. 22
****
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE *
****

CAUTION - INITIAL TRIAL SHEAR SURFACE IS BELOW SLOPE NEAR
THE TOE OF THE SLOPE A DISTANCE = 22.82
SOLUTION WILL BE ERRONEOUS IF THIS DISTANCE IS
VERY LARGE

Crack depth computed to be - - - .88

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 4.056
Side Force Inclination - - - - - - - - - - 12.53
Number of Iterations - - - - - - - - - - 27

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 1 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	1491.51	-27.28	See Message on Next Line(s)		
ERROR AT SLICE 2	X = .150E+04	Y = -.271E+02			
NO PROFILE DATA FOR TOP OF SLICE					
1	1508.49	-16.72	4.395	12.13	4
2	1636.29	-12.72	3.165	11.60	5
2	1643.71	-31.28	5.520	13.33	9
3	1654.33	2.24	4.993	13.50	5
3	1665.67	-14.24	3.765	11.83	4
4	1740.03	45.27	4.175	12.39	3
4	1759.97	45.18	See Message on Next Line(s)		
ERROR AT SLICE 40	X = .176E+04	Y = .439E+02			
NO PROFILE DATA FOR TOP OF SLICE					

Maximum distance shifted for new estimate of shear surface is 10.000 at point 3

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	1500.00	-22.00
2	1636.29	-12.72
3	1665.67	-14.24
4	1750.00	46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.255
Side Force Inclination - - - - - - - - - - 11.68
Number of Iterations - - - - - - - - - - 5

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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations

```
   1      1491.51     -27.28 See Message on Next Line(s)
ERROR AT SLICE   2     X =    .150E+04     Y =   -.267E+02

NO PROFILE DATA FOR TOP OF SLICE

   1      1508.49     -16.72   3.269      11.40           3
   2      1636.20      -2.72   2.552      12.42           5
   2      1636.37     -22.71   3.790      11.82           4
   3      1662.53      -4.74   3.158      11.60           3
   3      1668.82     -23.73   3.890      13.46           4
   4      1740.03      45.27   3.363      11.70           3
   4      1759.97      45.18 See Message on Next Line(s)
ERROR AT SLICE  40     X =    .176E+04     Y =    .436E+02

NO PROFILE DATA FOR TOP OF SLICE


Maximum distance shifted for new estimate of shear
surface is    10.000 at point   3

Coordinates For New Estimate of Shear Surface

     Point       X           Y

        1     1500.00      -22.00
        2     1636.20       -2.72
        3     1662.53       -4.74
        4     1750.00       46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - -   2.324
Side Force Inclination - - - - - - - - -    10.89
Number of Iterations - - - - - - - - - -   7
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  Kings Island Turning Basin, Station 98+605, Savannah, Georgia
  End of construction loading
  Single circular loading

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    3 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =   10.00

                              1-Stage
                              Factor
                                of     Side Force
Point        X          Y     Safety   Inclination   Iterations

   1      1491.51     -27.28 See Message on Next Line(s)
ERROR AT SLICE   2     X =    .150E+04     Y =   -.263E+02

NO PROFILE DATA FOR TOP OF SLICE

   1      1508.49     -16.72   2.175      10.61           4
   2      1635.88       7.28   2.401      13.39           8
   2      1636.53     -12.71   3.160      11.60           5
   3      1660.09       4.96   2.497      11.20           4
   3      1664.97     -14.44   2.574      12.54           4
   4      1740.03      45.27   2.347      10.87           3
   4      1759.97      45.18 See Message on Next Line(s)
```

ERROR AT SLICE 38 X = .176E+04 Y = .439E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is 10.000 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	1508.49	-16.72
2	1636.07	1.45
3	1662.31	-3.87
4	1750.00	46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 2.244
Side Force Inclination - - - - - - - - - - 11.98
Number of Iterations - - - - - - - - - - 3

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 4 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	1500.00	-22.00	2.328	11.64	3
1	1516.98	-11.43	2.128	13.92	4
2	1635.77	-8.55	2.605	10.47	4
2	1636.37	11.44	See Message on Next Line(s)		

FATAL ERROR IN CALCULATING FACTOR OF SAFETY

SOLUTION DID NOT CONVERGE WITHIN 500 ITERATIONS

3	1660.51	5.97	2.281	11.82	5
3	1664.11	-13.70	2.615	15.01	5
4	1740.03	45.27	2.264	12.06	3
4	1759.97	45.18	See Message on Next Line(s)		

ERROR AT SLICE 38 X = .176E+04 Y = .439E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is 10.000 at point 1

Coordinates For New Estimate of Shear Surface

Point X Y

1	1516.98	-11.43
2	1636.07	1.45
3	1661.57	.17
4	1750.00	46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 2.225
Side Force Inclination - - - - - - - - - - 15.37
Number of Iterations - - - - - - - - - - - 3

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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	1508.49	-16.72	2.337	12.67	4
1	1525.47	-6.15	2.538	13.98	4
2	1635.78	11.44	See Message on Next Line(s)		

FATAL ERROR IN CALCULATING FACTOR OF SAFETY

SOLUTION DID NOT CONVERGE WITHIN 500 ITERATIONS

2	1636.36	-8.55	2.156	10.11	4
3	1659.29	9.90	2.129	13.80	3
3	1663.85	-9.57	2.148	13.69	4
4	1740.03	45.27	2.239	15.76	3
4	1759.97	45.18	See Message on Next Line(s)		

ERROR AT SLICE 37 X = .176E+04 Y = .440E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear
surface is 10.000 at point 2

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	1514.97	-12.69
2	1636.36	-8.55
3	1659.29	9.90
4	1750.00	46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 2.776
Side Force Inclination - - - - - - - - - - 10.15
Number of Iterations - - - - - - - - - - - 8

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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Kings Island Turning Basin, Station 98+605, Savannah, Georgia

End of construction loading
Single circular loading

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 7.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	1511.04	-15.13	2.309	13.03	4
1	1522.92	-7.74	2.414	14.66	4
2	1635.87	8.44	2.635	26.98	7
2	1636.27	-5.55	2.009	10.81	4
3	1659.97	6.98	2.127	14.08	3
3	1663.16	-6.65	2.112	13.59	4
4	1743.00	45.84	2.232	15.69	3
4	1757.00	45.74	See Message on Next Line(s)		

ERROR AT SLICE 37 X = .176E+04 Y = .453E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is 7.000 at point 3

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	1515.84	-12.14
2	1636.27	-5.55
3	1663.16	-6.65
4	1750.00	46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 2.004
Side Force Inclination - - - - - - - - - - 10.21
Number of Iterations - - - - - - - - - - - 4

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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 7 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 7.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	1509.90	-15.84	2.252	10.23	4

1	1521.78	-8.44	1.915	10.72	3
2	1636.22	1.45	2.132	13.05	4
2	1636.32	-12.55	3.191	10.76	6
3	1661.26	.09	2.116	10.44	4
3	1665.07	-13.39	2.236	12.12	4
4	1743.00	45.84	2.010	10.23	3
4	1757.00	45.74 See Message on Next Line(s)			

ERROR AT SLICE 41 X = .176E+04 Y = .452E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is 7.000 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	1521.78	-8.44
2	1636.25	-2.73
3	1662.83	-5.48
4	1750.00	46.00

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 1.913
Side Force Inclination - - - - - - - - - - 11.36
Number of Iterations - - - - - - - - - - - 4

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:12:2003 Time: 16:17:18 Input file: kitb9
Kings Island Turning Basin, Station 98+605, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 8 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 7.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations

```
HEADING
  Kings Island Turning Basin, Station 101+887, Savannah, Georgia
  End of construction loading
  Single circular loading
PROFILE LINES
  1  1  Top Spoil Material
   771  47
  2000  47

  2  2  Top DA Dike (SM-SC-MH-OH)  0/32
   400  48.0
   769  48.0
   800  20.0
  2000  20.0

  3  3  Directly Beneath Dike & Spoil Area 0/30
   300  11.0
  2000  11.0

  4  4  SP River Bank  .2/28
     0   8.0
  2000   8.5

  5  5  Underlying Softer (SC) (Old marsh deposits) 0/36
     0  -3.0
   480  -3.0
   585   5.0
  2000   5.0

  6  6  Sands (SM-SP) 0/32
     0 -10.0
   480 -10.0
   585   0.0
  2000   0.0

  7  7  Medium Dense Sands 0/38
     0  -26.0
  2000  -28.0

  8  8  Clay Layer  .7/7
     0  -47.0
   587  -44.0
  2000  -44.0

  9 9   Dense Sand  0/38
     0  -54.0
  2000  -54.0


MATERIAL PROPERTIES
  1  Spoil
    98 = unit weight
   Conventional shear strength
     0 16
   NO pore pressures
  2  Sand (Dike)
   125 = unit weight
   Conventional shear strength
    0  32
   NO pore pressures
  3  Sand
   122 = unit weight
   Conventional shear strength
```

```
    0  30
    NO pore pressures
  4  Upper Embankment lean clay and clayey sand
    95 = unit weight
    Conventional shear strength
    200  28
    NO pore pressures
  5 SP
    125.0 = unit weight
    Conventional shear strength
    0  36.0
    NO pore pressures
  6 Medium sand
    125 = unit weight
    Conventional shear strength
    0  32
    NO pore pressures
  7 Med Dense Sand
    126 = unit weight
    Conventional shear strength
    0  38
    NO pore pressures
  8 Clay
    106 = unit weight
    Conventional shear strength
    1400  7
    NO pore pressures
  9 Dense Sand
    126 = unit weight
    Conventional shear strength
    0  38
    NO pore pressures

SURFACE PRESSURES
    0 -55.0  3025  0
  453 -55.0  3025  0
  469 -47.0  2575  0
  512 -26.0  1420  0
  537 -14.0   759  0
  566  -1.0   440  0
  582   8.0   120  0
  588  11.0     0  0
  593  12.0     0  0
  606  11.0     0  0
  657  13.0     0  0
  678  22.0     0  0
  692  31.0     0  0
  706  35.0     0  0
  725  37.0     0  0
  747  43.0     0  0
  761  47.7     0  0
  769  48.0     0  0
 2000  46.0     0  0

SLOPE GEOMETRY
    0 -55.0
  453 -55.0
  469 -47.0
  512 -26.0
  537 -14.0
  566  -1.0
  582   8.0
  588  11.0
```

```
  593  12.0
  606  11.0
  657  13.0
  678  22.0
  692  31.0
  706  35.0
  725  37.0
  747  43.0
  761  47.7
  769  48.0
 2000  46.0

ANALYSIS/COMPUTATION
  NonCircular Search
   535.0, -14
   570.0, -27
   640.0, -26
   725.0,  10

  10, 60
  ITErations
   500
  WATER DEPTH
   4.0
  FACTOR OF SAFETY
   10.0
  CHANGE TRIAL FACTOR

COMPUTE
ASCII
PRINT
```

Station 101+887 GLOBAL FS = 3.85 TRIAL -5-

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003   Time: 12:41:49   Input file: k2

TABLE NO. 1
```
****************************************
* COMPUTER PROGRAM DESIGNATION - UTEXAS3 *
* Originally Coded By Stephen G. Wright  *
* Version No. 1.120                      *
* Last Revision Date 10/08/92            *
* (C) Copyright 1985-1992 S. G. Wright   *
* All Rights Reserved                    *
****************************************

************************************************************
*                                                          *
*      RESULTS OF COMPUTATIONS PERFORMED USING THIS COMPUTER *
* PROGRAM SHOULD NOT BE USED FOR DESIGN PURPOSES UNLESS THEY *
* HAVE BEEN VERIFIED BY INDEPENDENT ANALYSES, EXPERIMENTAL   *
* DATA OR FIELD EXPERIENCE. THE USER SHOULD UNDERSTAND THE   *
* ALGORITHMS AND ANALYTICAL PROCEDURES USED IN THE COMPUTER  *
* PROGRAM AND MUST HAVE READ ALL DOCUMENTATION FOR THIS      *
* PROGRAM BEFORE ATTEMPTING ITS USE.                         *
*                                                          *
*      NEITHER THE UNIVERSITY OF TEXAS NOR STEPHEN G. WRIGHT *
* MAKE OR ASSUME LIABILITY FOR ANY WARRANTIES, EXPRESSED OR  *
* IMPLIED, CONCERNING THE ACCURACY, RELIABILITY, USEFULNESS  *
* OR ADAPTABILITY OF THIS COMPUTER PROGRAM.                  *
*                                                          *
************************************************************
```
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003   Time: 12:41:49   Input file: k2
  Kings Island Turning Basin, Station 101+887, Savannah, Georgia
  End of construction loading
  Single circular loading

TABLE NO. 2
```
*************************
* NEW PROFILE LINE DATA *
*************************
```

PROFILE LINE 1 - MATERIAL TYPE = 1
Top Spoil Material

Point	X	Y
1	771.000	47.000
2	2000.000	47.000

PROFILE LINE 2 - MATERIAL TYPE = 2
Top DA Dike (SM-SC-MH-OH) 0/32

Point	X	Y
1	400.000	48.000
2	769.000	48.000
3	800.000	20.000
4	2000.000	20.000

PROFILE LINE 3 - MATERIAL TYPE = 3
Directly Beneath Dike & Spoil Area 0/30

Point	X	Y
1	300.000	11.000
2	2000.000	11.000

PROFILE LINE 4 - MATERIAL TYPE = 4
SP River Bank .2/28

Point	X	Y
1	.000	8.000
2	2000.000	8.500

PROFILE LINE 5 - MATERIAL TYPE = 5
Underlying Softer (SC) (Old marsh deposits) 0/36

Point	X	Y
1	.000	-3.000
2	480.000	-3.000
3	585.000	5.000
4	2000.000	5.000

PROFILE LINE 6 - MATERIAL TYPE = 6
Sands (SM-SP) 0/32

Point	X	Y
1	.000	-10.000
2	480.000	-10.000
3	585.000	.000
4	2000.000	.000

PROFILE LINE 7 - MATERIAL TYPE = 7
Medium Dense Sands 0/38

Point	X	Y
1	.000	-26.000
2	2000.000	-28.000

PROFILE LINE 8 - MATERIAL TYPE = 8
Clay Layer .7/7

Point	X	Y
1	.000	-47.000
2	587.000	-44.000
3	2000.000	-44.000

PROFILE LINE 9 - MATERIAL TYPE = 9
Dense Sand 0/38

Point	X	Y
1	.000	-54.000
2	2000.000	-54.000

All new profile lines defined - No old lines retained
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia

End of construction loading
Single circular loading

TABLE NO. 3

****

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

****

DATA FOR MATERIAL TYPE 1
Spoil

Unit weight of material = 98.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 16.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 2
Sand (Dike)

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 32.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 3
Sand

Unit weight of material = 122.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 30.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 4
Upper Embankment lean clay and clayey sand

Unit weight of material = 95.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - 200.000
Friction angle - - - - - 28.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 5
SP

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 36.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 6
Medium sand

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 32.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 7
Med Dense Sand

Unit weight of material = 126.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 38.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 8
Clay

Unit weight of material = 106.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - 1400.000
Friction angle - - - - - 7.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 9
Dense Sand

Unit weight of material = 126.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 38.000 degrees

No (or zero) pore water pressures

All new material properties defined - No old data retained
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 10
****
* NEW SURFACE PRESSURE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
****

ALL NEW DATA INPUT - NO OLD DATA RETAINED

Surface Pressures -

Point	X	Y	Normal Pressure	Shear Stress
1	.000	-55.000	3025.000	.000

2	453.000	-55.000	3025.000	.000
3	469.000	-47.000	2575.000	.000
4	512.000	-26.000	1420.000	.000
5	537.000	-14.000	759.000	.000
6	566.000	-1.000	440.000	.000
7	582.000	8.000	120.000	.000
8	588.000	11.000	.000	.000
9	593.000	12.000	.000	.000
10	606.000	11.000	.000	.000
11	657.000	13.000	.000	.000
12	678.000	22.000	.000	.000
13	692.000	31.000	.000	.000
14	706.000	35.000	.000	.000
15	725.000	37.000	.000	.000
16	747.000	43.000	.000	.000
17	761.000	47.700	.000	.000
18	769.000	48.000	.000	.000
19	2000.000	46.000	.000	.000

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 9
****
* NEW SLOPE GEOMETRY DATA *
****

All new data input - No old data retained

Slope Coordinates -

Point	X	Y
1	.000	-55.000
2	453.000	-55.000
3	469.000	-47.000
4	512.000	-26.000
5	537.000	-14.000
6	566.000	-1.000
7	582.000	8.000
8	588.000	11.000
9	593.000	12.000
10	606.000	11.000
11	657.000	13.000
12	678.000	22.000
13	692.000	31.000
14	706.000	35.000
15	725.000	37.000
16	747.000	43.000
17	761.000	47.700
18	769.000	48.000
19	2000.000	46.000

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 15
****
* NEW ANALYSIS/COMPUTATION DATA *

****

Noncircular Shear Surface(s)

Automatic Search Performed

Coordinates of points on shear surface which are to be shifted -

Point	X	Y	Shift Angle
1	535.000	-14.000	angle to be computed - moveable
2	570.000	-27.000	angle to be computed - moveable
3	640.000	-26.000	angle to be computed - moveable
4	725.000	10.000	angle to be computed - moveable

Initial distance for shifting points on shear surface = 10.000
Maximum steepness permitted for toe of shear surface = 60.00 degrees

Maximum number of iterations allowed for
calculating the factor of safety = 500

Depth of water in crack = 4.000

Initial trial estimate for the factor of safety = 10.000

Initial trial values for factor of safety (and side force inclination for Spencer's procedure) will be changed during search

---

THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for side force inclination = 15.000 degrees
(Applicable to Spencer's procedure only)

Allowed force imbalance for convergence = 100.000

Allowed moment imbalance for convergence = 100.000

Number of increments for slice subdivision = 30

Unit weight of water in crack = 62.400

Seismic coefficient = .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 22
****
* INITIAL COMPUTED INFORMATION FOR SEARCH *
* WITH NONCIRCULAR SHEAR SURFACE *
****

For the initial trial noncircular shear surface at X = 535.00
the Y coordinate was adjusted to -14.96 because the point was
above the surface of the slope

Crack depth computed to be - - - 27.00

FOR INITIAL TRIAL NONCIRCULAR SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 5.091
Side Force Inclination - - - - - - - - - - 7.39
Number of Iterations - - - - - - - - - - 13

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 1 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	525.98	-19.29	4.874	7.57	3
1	544.10	-10.82	5.494	7.04	3
2	568.37	-36.87	5.849	7.70	4
2	571.63	-17.13	5.183	7.18	3
3	637.86	-16.23	4.871	6.75	3
3	642.14	-35.77	6.024	8.15	4
4	715.05	8.95	5.276	7.35	3
4	734.65	12.63	4.831	7.80	3

Maximum distance shifted for new estimate of shear surface is 10.000 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	525.98	-19.29
2	570.64	-23.14
3	637.86	-16.23
4	734.65	12.63

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 4.445
Side Force Inclination - - - - - - - - - - 7.18
Number of Iterations - - - - - - - - - - 4
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 2 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations

```
   1       516.97     -23.61 See Message on Next Line(s)
SHEAR SURFACE SEGMENT BETWEEN POINTS   1 AND   2 CROSSES SLOPE BETWEEN

POINTS   4 AND   5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

   1       535.00     -14.96   4.597       7.10           3
   2       570.55     -13.14   4.844       6.86           4
   2       570.72     -33.14   4.817       7.85           4
   3       635.90      -6.43   4.612       5.95           4
   3       639.83     -26.04   4.545       7.87           3
   4       725.00      10.00   4.666       6.69           3
   4       744.30      15.26   4.267       7.60           3

Maximum distance shifted for new estimate of shear
surface is    10.000 at point   4

Coordinates For New Estimate of Shear Surface

     Point       X           Y

        1      525.98      -19.29
        2      570.64      -23.31
        3      638.11      -17.47
        4      744.30       15.26

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - -   4.261
Side Force Inclination - - - - - - - - - -     7.70
Number of Iterations - - - - - - - - - - -   3
1       UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date:  4:13:2003   Time: 12:41:49   Input file: k2
  Kings Island Turning Basin, Station 101+887, Savannah, Georgia
  End of construction loading
  Single circular loading

TABLE NO. 23
****************************
* SEARCH TRIAL NUMBER    3 *
****************************

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES =   10.00

                              1-Stage
                              Factor
                                of     Side Force
Point        X          Y     Safety   Inclination   Iterations

   1       516.97     -23.61 See Message on Next Line(s)
SHEAR SURFACE SEGMENT BETWEEN POINTS   1 AND   2 CROSSES SLOPE BETWEEN

POINTS   4 AND   5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

   1       535.00     -14.96   4.392       7.62           3
   2       570.62     -33.31   4.641       8.30           4
   2       570.66     -13.31   4.588       7.41           4
   3       636.17      -7.66   4.387       6.72           4
   3       640.05     -27.28   4.466       8.43           4
   4       734.65      12.63   4.439       7.29           3
   4       753.83      18.29   4.081       8.17           3

Maximum distance shifted for new estimate of shear
surface is    10.000 at point   4
```

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	525.98	-19.29
2	570.64	-22.94
3	637.88	-16.31
4	753.83	18.29

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 4.087
Side Force Inclination - - - - - - - - - - 8.09
Number of Iterations - - - - - - - - - - 3
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 4 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	516.97	-23.61	See Message on Next Line(s)		

SHEAR SURFACE SEGMENT BETWEEN POINTS 1 AND 2 CROSSES SLOPE BETWEEN

POINTS 4 AND 5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

1	535.00	-14.96	4.199	8.03	3
2	570.55	-12.94	4.358	7.82	4
2	570.72	-32.94	4.450	8.69	4
3	635.93	-6.50	4.214	7.14	4
3	639.83	-26.11	4.172	8.66	3
4	744.30	15.26	4.270	7.61	3
4	763.51	20.79	3.966	8.40	3

Maximum distance shifted for new estimate of shear
surface is 10.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	525.98	-19.29
2	570.63	-22.21
3	638.07	-17.27
4	763.51	20.79

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.972
Side Force Inclination - - - - - - - - - - 8.45
Number of Iterations - - - - - - - - - - 3
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia

End of construction loading
Single circular loading

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 5 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 10.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	516.97	-23.61	See Message on Next Line(s)		

SHEAR SURFACE SEGMENT BETWEEN POINTS 1 AND 2 CROSSES SLOPE BETWEEN

POINTS 4 AND 5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

1	535.00	-14.96	4.062	8.39	3
2	570.59	-12.21	4.227	8.18	3
2	570.67	-32.21	4.275	8.96	4
3	636.22	-7.45	4.072	7.63	3
3	639.92	-27.10	4.120	9.07	3
4	753.83	18.29	4.095	8.14	3
4	773.51	20.99	See Message on Next Line(s)		

ERROR AT SLICE 45 X = .770E+03 Y = .200E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is .967 at point 3

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	525.98	-19.29
2	570.63	-21.79
3	637.89	-16.32
4	763.51	20.79

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.978
Side Force Inclination - - - - - - - - - - 8.38
Number of Iterations - - - - - - - - - - 3

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 23
****
* SEARCH TRIAL NUMBER 6 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 7.00

1-Stage
Factor

Point	X	Y	of Safety	Side Force Inclination	Iterations
1	519.67	-22.32	3.940	8.46	3
1	532.30	-16.26	4.028	8.42	3
2	570.61	-15.21	4.123	8.30	3
2	570.66	-29.21	4.112	8.74	3
3	636.78	-10.39	4.022	7.94	3
3	639.37	-24.15	4.020	8.84	3
4	756.68	19.25	4.041	8.29	3
4	770.50	21.00	See Message on Next Line(s)		

ERROR AT SLICE 46 X = .770E+03 Y = .208E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is 7.000 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	519.67	-22.32
2	570.63	-22.34
3	638.09	-17.34
4	763.51	20.79

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 3.938
Side Force Inclination - - - - - - - - - 8.47
Number of Iterations - - - - - - - - - - 3

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 7 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 7.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	513.36	-25.35	See Message on Next Line(s)		

SHEAR SURFACE SEGMENT BETWEEN POINTS 1 AND 2 CROSSES SLOPE BETWEEN

POINTS 4 AND 5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

1	525.98	-19.29	3.970	8.46	3
2	570.38	-15.34	See Message on Next Line(s)		

SHEAR SURFACE SEGMENT BETWEEN POINTS 1 AND 2 CROSSES SLOPE BETWEEN

POINTS 4 AND 5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

2	570.89	-29.34	4.070	8.77	3
3	636.79	-10.47	3.983	7.93	3

3	639.39	-24.22	3.988	8.87	3
4	756.68	19.25	4.004	8.31	3
4	770.50	21.00 See Message on Next Line(s)			

ERROR AT SLICE 45 X = .770E+03 Y = .208E+02

NO PROFILE DATA FOR TOP OF SLICE

Maximum distance shifted for new estimate of shear surface is .209 at point 3

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	519.67	-22.32
2	570.63	-22.34
3	638.05	-17.14
4	763.51	20.79

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.938
Side Force Inclination - - - - - - - - - - 8.45
Number of Iterations - - - - - - - - - - 2

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 8 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 4.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	516.07	-24.05	3.927	8.47	2
1	523.28	-20.59 See Message on Next Line(s)			

SHEAR SURFACE SEGMENT BETWEEN POINTS 1 AND 2 CROSSES SLOPE BETWEEN

POINTS 4 AND 5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

2	570.49	-18.34 See Message on Next Line(s)			

SHEAR SURFACE SEGMENT BETWEEN POINTS 1 AND 2 CROSSES SLOPE BETWEEN

POINTS 4 AND 5 AFTER SHIFT - THIS TRIAL SHEAR SURFACE WAS REJECTED

2	570.78	-26.34	3.895	8.53	3
3	637.34	-13.41	3.953	8.19	3
3	638.83	-21.27	3.954	8.71	3
4	759.55	20.21	3.955	8.45	3
4	767.50	20.94	3.951	8.38	3

Maximum distance shifted for new estimate of shear surface is 4.000 at point 2

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	516.07	-24.05
2	570.78	-26.34
3	638.06	-17.23
4	763.76	20.80

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.875
Side Force Inclination - - - - - - - - - - 8.52
Number of Iterations - - - - - - - - - - 3

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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 9 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 4.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	512.46	-25.78	3.861	8.52	2
1	519.67	-22.32	3.896	8.52	2
2	570.59	-22.34	3.928	8.46	3
2	570.97	-30.33	4.108	8.83	4
3	637.21	-13.32	3.902	8.24	3
3	638.92	-21.13	3.877	8.75	2
4	759.79	20.29	3.885	8.51	2
4	767.76	20.95	3.890	8.44	3

Maximum distance shifted for new estimate of shear surface is 4.000 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	512.46	-25.78
2	570.72	-25.07
3	638.43	-18.90
4	763.41	20.79

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.874
Side Force Inclination - - - - - - - - - - 8.62
Number of Iterations - - - - - - - - - - 2

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TABLE NO. 23
****

* SEARCH TRIAL NUMBER 10 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 4.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	508.87	-27.53	3.923	8.58	3
1	516.07	-24.05	3.886	8.61	2
2	570.51	-21.08	3.953	8.56	3
2	570.93	-29.07	4.079	8.80	3
3	637.63	-14.98	3.883	8.35	3
3	639.23	-22.82	3.894	8.84	3
4	759.46	20.18	3.892	8.59	3
4	767.41	20.94	3.886	8.53	3

Maximum distance shifted for new estimate of shear surface is 1.232 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	513.57	-25.25
2	570.68	-24.18
3	638.28	-18.16
4	763.85	20.81

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - 3.891
Side Force Inclination - - - - - - - - - 8.55
Number of Iterations - - - - - - - - - - 3

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 11 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 1.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	511.56	-26.21	3.872	8.62	2
1	513.36	-25.35	3.877	8.61	2
2	570.67	-24.07	3.890	8.60	2
2	570.77	-26.07	3.861	8.63	2
3	638.23	-17.92	3.874	8.55	2
3	638.63	-19.88	3.876	8.67	2
4	762.41	20.75	3.872	8.63	2
4	764.41	20.83	3.877	8.60	2

Maximum distance shifted for new estimate of shear

surface is 1.000 at point 1

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	511.56	-26.21
2	570.77	-26.07
3	638.23	-17.92
4	762.41	20.75

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.855
Side Force Inclination - - - - - - - - - - 8.59
Number of Iterations - - - - - - - - - - 3

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TABLE NO. 23
****
* SEARCH TRIAL NUMBER 12 *
****

INCREMENTAL SHIFT DISTANCE USED TO COMPUTE DERIVATIVES = 1.00

Point	X	Y	1-Stage Factor of Safety	Side Force Inclination	Iterations
1	510.66	-26.65	3.881	8.55	3
1	512.46	-25.78	3.858	8.59	2
2	570.71	-25.07	3.869	8.57	2
2	570.83	-27.07	4.000	8.67	3
3	638.02	-16.95	3.857	8.52	2
3	638.44	-18.90	3.856	8.65	2
4	761.42	20.72	3.853	8.59	2
4	763.41	20.79	3.858	8.57	2

Maximum distance shifted for new estimate of shear
surface is 1.000 at point 4

Coordinates For New Estimate of Shear Surface

Point	X	Y
1	511.92	-26.04
2	570.75	-25.66
3	638.33	-18.39
4	761.42	20.72

FOR NEW ESTIMATE OF SHEAR SURFACE
1-Stage Factor of Safety - - - - - - - - - 3.859
Side Force Inclination - - - - - - - - - - 8.62
Number of Iterations - - - - - - - - - - 2

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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TABLE NO. 25
****
* FINAL CRITICAL SHEAR SURFACE (FOUND AFTER 12 TRIAL POSITIONS) *
****

X	Y
511.56	-26.21
570.77	-26.07
638.23	-17.92
762.41	20.75

1-Stage Factor of Safety = 3.855

Side Force Inclination = 8.59
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
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TABLE NO. 26
****
* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the Critical Shear Surface in the *
* Case of an Automatic Search.) *
****

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	511.6	-26.2					
1	511.8	-26.2	5.8	6	.00	32.00	.0
	512.0	-26.2					
2	516.2	-26.2	2294.7	6	.00	32.00	.0
	520.3	-26.2					
3	524.5	-26.2	6440.6	6	.00	32.00	.0
	528.7	-26.2					
4	532.8	-26.2	10586.6	6	.00	32.00	.0
	537.0	-26.2					
5	540.3	-26.1	11385.2	6	.00	32.00	.0
	543.7	-26.1					
6	547.0	-26.1	13869.9	6	.00	32.00	.0
	550.4	-26.1					
7	553.7	-26.1	16354.5	6	.00	32.00	.0
	557.0	-26.1					
8	560.4	-26.1	18839.0	6	.00	32.00	.0
	563.7	-26.1					
9	564.9	-26.1	7043.2	6	.00	32.00	.0
	566.0	-26.1					
10	568.4	-26.1	15762.1	6	.00	32.00	.0
	570.8	-26.1					
11	573.1	-25.8	16501.1	6	.00	32.00	.0
	575.4	-25.5					
12	578.7	-25.1	25611.6	6	.00	32.00	.0
	582.0	-24.7					
13	582.1	-24.7	1163.9	6	.00	32.00	.0
	582.3	-24.7					
14	583.6	-24.5	11019.6	6	.00	32.00	.0

	585.0	-24.4					
15	586.0	-24.2	8358.3	6	.00	32.00	.0
	587.0	-24.1					
16	587.5	-24.1	4248.0	6	.00	32.00	.0
	588.0	-24.0					
17	590.5	-23.7	21478.3	6	.00	32.00	.0
	593.0	-23.4					
18	596.3	-23.0	27560.2	6	.00	32.00	.0
	599.5	-22.6					
19	602.8	-22.2	26515.7	6	.00	32.00	.0
	606.0	-21.8					
20	610.0	-21.3	31890.7	6	.00	32.00	.0
	614.1	-20.8					
21	618.1	-20.4	31228.1	6	.00	32.00	.0
	622.1	-19.9					

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TABLE NO. 26

```
**************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure      *
*  Information for Individual Slices for Conventional        *
*  Computations or First Stage of Multi-Stage Computations.  *
*  (Information is for the Critical Shear Surface in the     *
*  Case of an Automatic Search.)                             *
**************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	622.1	-19.9					
22	626.1	-19.4	30565.5	6	.00	32.00	.0
	630.2	-18.9					
23	634.2	-18.4	29902.7	6	.00	32.00	.0
	638.2	-17.9					
24	641.4	-16.9	22295.9	6	.00	32.00	.0
	644.5	-16.0					
25	647.6	-15.0	20963.6	6	.00	32.00	.0
	650.7	-14.0					
26	653.9	-13.1	19631.5	6	.00	32.00	.0
	657.0	-12.1					
27	660.5	-11.0	21577.1	6	.00	32.00	.0
	664.0	-9.9					
28	667.5	-8.8	22294.2	6	.00	32.00	.0
	671.0	-7.7					
29	674.5	-6.6	23011.3	6	.00	32.00	.0
	678.0	-5.5					
30	681.5	-4.4	24384.6	6	.00	32.00	.0
	685.0	-3.4					
31	688.5	-2.3	26414.2	6	.00	32.00	.0
	692.0	-1.2					
32	693.9	-.6	14783.8	6	.00	32.00	.0
	695.8	.0					
33	698.3	.8	19921.5	5	.00	36.00	.0
	700.9	1.6					
34	703.4	2.4	19837.1	5	.00	36.00	.0
	706.0	3.2					
35	708.9	4.1	22155.2	5	.00	36.00	.0
	711.8	5.0					
36	714.4	5.8	18795.6	4	200.00	28.00	.0

	716.9	6.6					
37	719.5	7.4	18367.1	4	200.00	28.00	.0
	722.0	8.2					
38	723.5	8.6	10395.2	3	.00	30.00	.0
	725.0	9.1					
39	728.0	10.1	21160.7	3	.00	30.00	.0
	731.1	11.0					
40	735.1	12.2	27340.0	2	.00	32.00	.0
	739.0	13.5					
41	743.0	14.7	27034.1	2	.00	32.00	.0
	747.0	16.0					
42	750.5	17.0	23741.0	2	.00	32.00	.0
	754.0	18.1					

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TABLE NO. 26

```
************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure    *
*  Information for Individual Slices for Conventional      *
*  Computations or First Stage of Multi-Stage Computations.*
*  (Information is for the Critical Shear Surface in the   *
*  Case of an Automatic Search.)                           *
************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	754.0	18.1					
43	757.5	19.2	23889.7	2	.00	32.00	.0
	761.0	20.3					
44	761.7	20.5	4808.2	2	.00	32.00	.0
	762.4	20.8					

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TABLE NO. 27

```
************************************************************
*  Seismic Forces and Forces Due to Surface Pressures for  *
*  Individual Slices for Conventional  Computations or the *
*  First Stage of Multi-Stage Computations.                *
*  (Information is for the Critical Shear Surface in the   *
*  Case of an Automatic Search.)                           *
************************************************************
```

				FORCES DUE TO SURFACE PRESSURES			
Slice No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y
1	511.8	0.	-26.2	695.	0.	511.8	-26.1
2	516.2	0.	-25.1	12108.	0.	516.0	-24.1
3	524.5	0.	-23.1	10071.	0.	524.4	-20.1
4	532.8	0.	-21.1	8034.	0.	532.7	-16.1
5	540.3	0.	-19.3	5285.	0.	540.3	-12.5
6	547.0	0.	-17.8	4747.	0.	547.0	-9.5
7	553.7	0.	-16.3	4210.	0.	553.6	-6.5

8	560.4	0.	-14.8	3673.	0.	560.3	-3.6
9	564.9	0.	-13.8	1137.	0.	564.8	-1.5
10	568.4	0.	-12.9	2148.	0.	568.3	.3
11	573.1	0.	-11.4	1572.	0.	572.9	2.9
12	578.7	0.	-9.7	1420.	0.	578.3	5.9
13	582.1	0.	-8.7	38.	0.	582.1	8.1
14	583.6	0.	-8.2	264.	0.	583.5	8.8
15	586.0	0.	-7.4	89.	0.	585.8	9.9
16	587.5	0.	-7.0	11.	0.	587.3	10.7
17	590.5	0.	-6.4	0.	0.	590.5	11.5
18	596.3	0.	-5.9	0.	0.	596.3	11.8
19	602.8	0.	-5.8	0.	0.	602.8	11.3
20	610.0	0.	-5.4	0.	0.	610.0	11.2
21	618.1	0.	-4.7	0.	0.	618.1	11.5
22	626.1	0.	-4.1	0.	0.	626.1	11.8
23	634.2	0.	-3.4	0.	0.	634.2	12.1
24	641.4	0.	-2.5	0.	0.	641.4	12.4
25	647.6	0.	-1.4	0.	0.	647.6	12.6
26	653.9	0.	-.3	0.	0.	653.9	12.9
27	660.5	0.	1.6	0.	0.	660.5	14.5
28	667.5	0.	4.3	0.	0.	667.5	17.5
29	674.5	0.	6.9	0.	0.	674.5	20.5
30	681.5	0.	10.0	0.	0.	681.5	24.3
31	688.5	0.	13.4	0.	0.	688.5	28.8
32	693.9	0.	15.7	0.	0.	693.9	31.5
33	698.3	0.	17.1	0.	0.	698.3	32.8
34	703.4	0.	18.6	0.	0.	703.4	34.3
35	708.9	0.	20.1	0.	0.	708.9	35.3
36	714.4	0.	21.1	0.	0.	714.4	35.9
37	719.5	0.	22.0	0.	0.	719.5	36.4
38	723.5	0.	22.8	0.	0.	723.5	36.8
39	728.0	0.	24.0	0.	0.	728.0	37.8
40	735.1	0.	26.0	0.	0.	735.1	39.7

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TABLE NO. 27

```
************************************************************
*  Seismic Forces and Forces Due to Surface Pressures for  *
*  Individual Slices for Conventional  Computations or the *
*  First Stage of Multi-Stage Computations.                *
*  (Information is for the Critical Shear Surface in the   *
*  Case of an Automatic Search.)                           *
************************************************************
```

				FORCES DUE TO SURFACE PRESSURES			
Slice No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y
41	743.0	0.	28.3	0.	0.	743.0	41.9
42	750.5	0.	30.6	0.	0.	750.5	44.2
43	757.5	0.	32.9	0.	0.	757.5	46.5
44	761.7	0.	34.1	0.	0.	761.7	47.7

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TABLE NO. 29

```
**********************************************************************
*  Information Generated During Iterative Solution for the Factor    *
*  of Safety and Side Force Inclination by Spencer's Procedure       *
**********************************************************************
```

Iteration	Trial Factor of Safety	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
1	10.00000	15.0000	.8419E+05	.1591E+08		
First-order corrections to F and THETA					-.157E+02	-.975E+00
Values factored by .318E-01 - Deltas too large					-.500E+00	-.310E-01
2	9.50000	14.9690	.8137E+05	.1537E+08		
First-order corrections to F and THETA					-.137E+02	-.999E+00
Values factored by .365E-01 - Deltas too large					-.500E+00	-.365E-01
3	9.00000	14.9325	.7823E+05	.1479E+08		
First-order corrections to F and THETA					-.118E+02	-.103E+01
Values factored by .423E-01 - Deltas too large					-.500E+00	-.434E-01
4	8.50000	14.8891	.7472E+05	.1413E+08		
First-order corrections to F and THETA					-.101E+02	-.106E+01
Values factored by .497E-01 - Deltas too large					-.500E+00	-.526E-01
5	8.00000	14.8364	.7078E+05	.1339E+08		
First-order corrections to F and THETA					-.844E+01	-.110E+01
Values factored by .593E-01 - Deltas too large					-.500E+00	-.651E-01
6	7.50000	14.7714	.6630E+05	.1255E+08		
First-order corrections to F and THETA					-.694E+01	-.115E+01
Values factored by .720E-01 - Deltas too large					-.500E+00	-.825E-01
7	7.00000	14.6889	.6118E+05	.1159E+08		
First-order corrections to F and THETA					-.558E+01	-.121E+01
Values factored by .896E-01 - Deltas too large					-.500E+00	-.108E+00
8	6.50000	14.5809	.5528E+05	.1048E+08		
First-order corrections to F and THETA					-.435E+01	-.128E+01
Values factored by .115E+00 - Deltas too large					-.500E+00	-.148E+00
9	6.00000	14.4334	.4839E+05	.9197E+07		
First-order corrections to F and THETA					-.324E+01	-.139E+01
Values factored by .154E+00 - Deltas too large					-.500E+00	-.213E+00
10	5.50000	14.2199	.4025E+05	.7682E+07		
First-order corrections to F and THETA					-.227E+01	-.153E+01
Values factored by .220E+00 - Deltas too large					-.500E+00	-.336E+00
11	5.00000	13.8835	.3050E+05	.5877E+07		
First-order corrections to F and THETA					-.143E+01	-.174E+01
Values factored by .350E+00 - Deltas too large					-.500E+00	-.609E+00
12	4.50000	13.2747	.1864E+05	.3702E+07		
First-order corrections to F and THETA					-.718E+00	-.207E+01
Values factored by .696E+00 - Deltas too large					-.500E+00	-.144E+01
13	4.00000	11.8320	.4053E+04	.1099E+07		
First-order corrections to F and THETA					-.143E+00	-.252E+01
Second-order correction - Iteration 1					-.139E+00	-.252E+01
Second-order correction - Iteration 2					-.139E+00	-.252E+01

```
  14   3.86131     9.3089  -.7314E+01   .1145E+06
First-order corrections to F and THETA .........  -.586E-02 -.721E+00
Second-order correction - Iteration   1 ........  -.584E-02 -.721E+00
Second-order correction - Iteration   2 ........  -.584E-02 -.721E+00

  15   3.85548     8.5876   .2881E-01   .2244E+03
First-order corrections to F and THETA .........  -.124E-04 -.139E-02
Second-order correction - Iteration   1 ........  -.124E-04 -.139E-02

  16   3.85546     8.5862  -.1501E-01   .1199E+01
First-order corrections to F and THETA .........   .272E-06 -.176E-04

Factor of Safety - - - - - - - -     3.855
Side Force Inclination - - - - -      8.59
Number of Iterations - - - - - -    16
1       UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date:  4:13:2003   Time: 12:41:49   Input file: k2
  Kings Island Turning Basin, Station 101+887, Savannah, Georgia
  End of construction loading
  Single circular loading

TABLE NO. 38
**************************************************************
*  Final Results for Stresses Along the Shear Surface         *
*  (Results for Critical Shear Surface in Case of a Search.)  *
**************************************************************

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety =  3.855     Side Force Inclination =   8.59 Degrees

       -------- VALUES AT CENTER OF BASE OF SLICE---------

                                 Total    Effective
Slice                            Normal    Normal      Shear
  No.   X-center  Y-center       Stress    Stress      Stress

   1       511.8     -26.2      1581.9     1581.9       256.4
   2       516.2     -26.2      1721.0     1721.0       278.9
   3       524.5     -26.2      1988.5     1988.5       322.3
   4       532.8     -26.2      2256.1     2256.1       365.6
   5       540.3     -26.1      2536.5     2536.5       411.1
   6       547.0     -26.1      2837.4     2837.4       459.9
   7       553.7     -26.1      3138.3     3138.3       508.6
   8       560.4     -26.1      3439.1     3439.1       557.4
   9       564.9     -26.1      3641.2     3641.2       590.1
  10       568.4     -26.1      3818.7     3818.7       618.9
  11       573.1     -25.8      3868.7     3868.7       627.0
  12       578.7     -25.1      4006.5     4006.5       649.4
  13       582.1     -24.7      4069.3     4069.3       659.5
  14       583.6     -24.5      4106.8     4106.8       665.6
  15       586.0     -24.2      4166.5     4166.5       675.3
  16       587.5     -24.1      4202.6     4202.6       681.1
  17       590.5     -23.7      4239.1     4239.1       687.0
  18       596.3     -23.0      4184.2     4184.2       678.1
  19       602.8     -22.2      4025.6     4025.6       652.4
  20       610.0     -21.3      3905.7     3905.7       633.0
  21       618.1     -20.4      3824.6     3824.6       619.9
  22       626.1     -19.4      3743.4     3743.4       606.7
  23       634.2     -18.4      3662.3     3662.3       593.6
  24       641.4     -16.9      3321.0     3321.0       538.3
  25       647.6     -15.0      3122.6     3122.6       506.1
  26       653.9     -13.1      2924.1     2924.1       473.9
```

27	660.5	-11.0	2872.7	2872.7	465.6
28	667.5	-8.8	2968.1	2968.1	481.1
29	674.5	-6.6	3063.6	3063.6	496.5
30	681.5	-4.4	3246.4	3246.4	526.2
31	688.5	-2.3	3516.6	3516.6	570.0
32	693.9	-.6	3646.1	3646.1	590.9
33	698.3	.8	3618.5	3618.5	681.9
34	703.4	2.4	3603.2	3603.2	679.0
35	708.9	4.1	3525.7	3525.7	664.4
36	714.4	5.8	3435.1	3435.1	525.6
37	719.5	7.4	3356.6	3356.6	514.8
38	723.5	8.6	3285.0	3285.0	491.9
39	728.0	10.1	3239.6	3239.6	485.1
40	735.1	12.2	3204.6	3204.6	519.4

1

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
41	743.0	14.7	3168.8	3168.8	513.6
42	750.5	17.0	3160.7	3160.7	512.3
43	757.5	19.2	3180.5	3180.5	515.5
44	761.7	20.5	3118.2	3118.2	505.4

CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION = .02 (= .200E-01)
SHOULD NOT EXCEED .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION = .03 (= .264E-01)
SHOULD NOT EXCEED .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN = -.94 (= -.942E+00)
SHOULD NOT EXCEED .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM = .00 (= .419E-02)
SHOULD NOT EXCEED .100E+03

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 12:41:49 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 39
****
* Final Results for Side Forces and Stresses Between Slices. *
* (Results for Critical Shear Surface in Case of a Search.) *
****

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 3.855 Side Force Inclination = 8.59 Degrees

-------------- VALUES AT RIGHT SIDE OF SLICE ----------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	512.0	421.	-26.1	.563	2934.7	1319.2
2	520.3	8035.	-24.3	.456	1396.1	2393.6
3	528.7	15119.	-22.5	.448	1259.3	2398.8
4	537.0	21671.	-21.0	.428	1008.4	2533.3
5	543.7	26592.	-19.9	.412	819.3	2656.4

6	550.4	31616.	-18.9	.396	653.0	2799.9
7	557.0	36741.	-18.1	.380	485.8	2960.3
8	563.7	41968.	-17.3	.364	317.9	3131.4
9	566.0	43787.	-17.1	.357	239.6	3194.0
10	570.8	47796.	-16.6	.342	91.9	3313.3
11	575.4	49316.	-15.7	.329	-43.5	3318.0
12	582.0	51130.	-14.7	.308	-238.4	3329.5
13	582.3	51197.	-14.6	.307	-246.0	3330.2
14	585.0	51780.	-14.2	.299	-313.9	3338.7
15	587.0	52169.	-14.0	.293	-365.0	3345.7
16	588.0	52349.	-13.9	.292	-366.9	3357.6
17	593.0	53234.	-13.3	.289	-398.8	3412.0
18	599.5	54369.	-12.5	.296	-354.9	3507.8
19	606.0	55461.	-11.7	.305	-281.2	3599.7
20	614.1	56774.	-10.8	.314	-205.0	3696.2
21	622.1	58060.	-9.8	.321	-136.5	3781.3
22	630.2	59319.	-8.8	.329	-54.7	3858.0
23	638.2	60550.	-7.8	.337	41.7	3925.0
24	644.5	57412.	-6.3	.340	83.2	3902.9
25	650.7	54460.	-4.8	.343	117.1	3904.5
26	657.0	51697.	-3.4	.336	28.2	3940.7
27	664.0	48659.	-1.9	.310	-259.8	3975.6
28	671.0	45521.	-.3	.278	-561.9	3931.3
29	678.0	42281.	1.3	.244	-798.9	3794.5
30	685.0	38848.	2.9	.209	-956.4	3529.6
31	692.0	35130.	4.6	.180	-1003.4	3185.4
32	695.8	33048.	5.5	.170	-995.5	3032.9
33	700.9	30748.	6.6	.157	-1005.0	2908.3
34	706.0	28458.	7.8	.145	-1007.3	2790.8
35	711.8	25899.	9.0	.132	-1009.4	2682.4
36	716.9	23089.	10.3	.124	-969.1	2513.7
37	722.0	20349.	11.5	.115	-922.7	2334.3
38	725.0	18762.	12.2	.109	-886.0	2203.8
39	731.1	15531.	13.6	.095	-793.0	1903.3
40	739.0	11682.	15.5	.074	-657.7	1502.2

1

---------- VALUES AT RIGHT SIDE OF SLICE ----------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
41	747.0	7877.	17.4	.052	-484.3	1057.9
42	754.0	4534.	19.0	.033	-296.4	625.9
43	761.0	1171.	21.1	.029	-77.6	162.5
44	762.4	0.	216.4	ABOVE	.0	.0

CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION = .02 (= .200E-01)
SHOULD NOT EXCEED .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION = .03 (= .264E-01)
SHOULD NOT EXCEED .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN = -.94 (= -.942E+00)
SHOULD NOT EXCEED .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM = .00 (= .419E-02)
SHOULD NOT EXCEED .100E+03

END-OF-FILE ENCOUNTERED WHILE READING COMMAND
WORDS - END OF PROBLEM(S) ASSUMED

```
STATION 101+887 CIRCULAR ARC FS = 3.1

HEADING
  Kings Island Turning Basin, Station 101+887, Savannah, Georgia
  End of construction loading
  Single circular loading
PROFILE LINES
  1  1  Top Spoil Material
   771  47
  2000  47

  2  2  Top DA Dike (SM-SC-MH-OH)  0/32
   400  48.0
   769  48.0
   800  20.0
  2000  20.0

  3  3  Directly Beneath Dike & Spoil Area 0/30
   300  11.0
  2000  11.0

  4  4  SP River Bank  .2/28
     0   8.0
  2000   8.5

  5  5  Underlying Softer (SC) (Old marsh deposits) 0/36
     0  -3.0
   480  -3.0
   585   5.0
  2000   5.0

  6  6  Sands (SM-SP) 0/32
     0 -10.0
   480 -10.0
   585   0.0
  2000   0.0

  7  7  Medium Dense Sands 0/38
     0  -26.0
  2000  -28.0

  8  8  Clay Layer  .7/7
     0  -47.0
   587  -44.0
  2000  -44.0

  9 9   Dense Sand  0/38
     0  -54.0
  2000  -54.0


MATERIAL PROPERTIES
  1  Spoil
    98 = unit weight
   Conventional shear strength
     0 16
   NO pore pressures
  2  Sand (Dike)
   125 = unit weight
   Conventional shear strength
    0  32
   NO pore pressures
  3  Sand
```

```
   122 = unit weight
   Conventional shear strength
    0  30
   NO pore pressures
  4  Upper Embankment lean clay and clayey sand
    95 = unit weight
   Conventional shear strength
    200  28
   NO pore pressures
  5 SP
   125.0 = unit weight
   Conventional shear strength
    0  36.0
   NO pore pressures
  6 Medium sand
   125 = unit weight
   Conventional shear strength
    0  32
   NO pore pressures
  7 Med Dense Sand
   126 = unit weight
   Conventional shear strength
   0  38
   NO pore pressures
  8 Clay
   106 = unit weight
   Conventional shear strength
   1400  7
   NO pore pressures
  9 Dense Sand
   126 = unit weight
   Conventional shear strength
   0  38
   NO pore pressures

SURFACE PRESSURES
    0 -55.0  3025  0
  453 -55.0  3025  0
  469 -47.0  2575  0
  512 -26.0  1420  0
  537 -14.0   759  0
  566  -1.0   440  0
  582   8.0   120  0
  588  11.0     0  0
  593  12.0     0  0
  606  11.0     0  0
  657  13.0     0  0
  678  22.0     0  0
  692  31.0     0  0
  706  35.0     0  0
  725  37.0     0  0
  747  43.0     0  0
  761  47.7     0  0
  769  48.0     0  0
 2000  46.0     0  0

SLOPE GEOMETRY
    0 -55.0
  453 -55.0
  469 -47.0
  512 -26.0
  537 -14.0
  566  -1.0
```

```
  582   8.0
  588  11.0
  593  12.0
  606  11.0
  657  13.0
  678  22.0
  692  31.0
  706  35.0
  725  37.0
  747  43.0
  761  47.7
  769  48.0
 2000  46.0

ANALYSIS/COMPUTATION
  NonCircular Search
   535.0, -14
   570.0, -27
   640.0, -26
   725.0,  10

  10, 60
  ITErations
   500
  WATER DEPTH
   4.0
  FACTOR OF SAFETY
   10.0
  CHANGE TRIAL FACTOR

ANALYSIS/COMPUTATION data follow -
     Circle Search
    570 250  5 -60
     Point through which circles pass follows -
        600 -10

COMPUTE
ASCII
PRINT
```

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 13: 9:22 Input file: k2

TABLE NO. 1

```
****************************************
* COMPUTER PROGRAM DESIGNATION - UTEXAS3 *
* Originally Coded By Stephen G. Wright  *
* Version No. 1.120                      *
* Last Revision Date 10/08/92            *
* (C) Copyright 1985-1992 S. G. Wright   *
* All Rights Reserved                    *
****************************************
```

```
************************************************************
*                                                          *
*      RESULTS OF COMPUTATIONS PERFORMED USING THIS COMPUTER *
* PROGRAM SHOULD NOT BE USED FOR DESIGN PURPOSES UNLESS THEY *
* HAVE BEEN VERIFIED BY INDEPENDENT ANALYSES, EXPERIMENTAL   *
* DATA OR FIELD EXPERIENCE. THE USER SHOULD UNDERSTAND THE   *
* ALGORITHMS AND ANALYTICAL PROCEDURES USED IN THE COMPUTER  *
* PROGRAM AND MUST HAVE READ ALL DOCUMENTATION FOR THIS      *
* PROGRAM BEFORE ATTEMPTING ITS USE.                         *
*                                                          *
*      NEITHER THE UNIVERSITY OF TEXAS NOR STEPHEN G. WRIGHT *
* MAKE OR ASSUME LIABILITY FOR ANY WARRANTIES, EXPRESSED OR  *
* IMPLIED, CONCERNING THE ACCURACY, RELIABILITY, USEFULNESS  *
* OR ADAPTABILITY OF THIS COMPUTER PROGRAM.                  *
*                                                          *
************************************************************
```

1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 13: 9:22 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 2

```
*************************
* NEW PROFILE LINE DATA *
*************************
```

PROFILE LINE 1 - MATERIAL TYPE = 1
Top Spoil Material

Point	X	Y
1	771.000	47.000
2	2000.000	47.000

PROFILE LINE 2 - MATERIAL TYPE = 2
Top DA Dike (SM-SC-MH-OH) 0/32

Point	X	Y
1	400.000	48.000
2	769.000	48.000
3	800.000	20.000
4	2000.000	20.000

PROFILE LINE 3 - MATERIAL TYPE = 3
Directly Beneath Dike & Spoil Area 0/30

Point	X	Y

1	300.000	11.000
2	2000.000	11.000

PROFILE LINE 4 - MATERIAL TYPE = 4
SP River Bank .2/28

Point	X	Y
1	.000	8.000
2	2000.000	8.500

PROFILE LINE 5 - MATERIAL TYPE = 5
Underlying Softer (SC) (Old marsh deposits) 0/36

Point	X	Y
1	.000	-3.000
2	480.000	-3.000
3	585.000	5.000
4	2000.000	5.000

PROFILE LINE 6 - MATERIAL TYPE = 6
Sands (SM-SP) 0/32

Point	X	Y
1	.000	-10.000
2	480.000	-10.000
3	585.000	.000
4	2000.000	.000

PROFILE LINE 7 - MATERIAL TYPE = 7
Medium Dense Sands 0/38

Point	X	Y
1	.000	-26.000
2	2000.000	-28.000

PROFILE LINE 8 - MATERIAL TYPE = 8
Clay Layer .7/7

Point	X	Y
1	.000	-47.000
2	587.000	-44.000
3	2000.000	-44.000

PROFILE LINE 9 - MATERIAL TYPE = 9
Dense Sand 0/38

Point	X	Y
1	.000	-54.000
2	2000.000	-54.000

All new profile lines defined - No old lines retained
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 13: 9:22 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 3
****
* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
****

DATA FOR MATERIAL TYPE 1
Spoil

Unit weight of material = 98.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 16.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 2
Sand (Dike)

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 32.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 3
Sand

Unit weight of material = 122.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 30.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 4
Upper Embankment lean clay and clayey sand

Unit weight of material = 95.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - 200.000
Friction angle - - - - - 28.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 5
SP

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 36.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 6
Medium sand

Unit weight of material = 125.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 32.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 7
Med Dense Sand

Unit weight of material = 126.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 38.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 8
Clay

Unit weight of material = 106.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - 1400.000
Friction angle - - - - - 7.000 degrees

No (or zero) pore water pressures

DATA FOR MATERIAL TYPE 9
Dense Sand

Unit weight of material = 126.000

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS
Cohesion - - - - - - - - .000
Friction angle - - - - - 38.000 degrees

No (or zero) pore water pressures

All new material properties defined - No old data retained
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 13: 9:22 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 10
****
* NEW SURFACE PRESSURE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *
****

ALL NEW DATA INPUT - NO OLD DATA RETAINED

Surface Pressures -

Point	X	Y	Normal Pressure	Shear Stress
1	.000	-55.000	3025.000	.000
2	453.000	-55.000	3025.000	.000
3	469.000	-47.000	2575.000	.000

4	512.000	-26.000	1420.000	.000
5	537.000	-14.000	759.000	.000
6	566.000	-1.000	440.000	.000
7	582.000	8.000	120.000	.000
8	588.000	11.000	.000	.000
9	593.000	12.000	.000	.000
10	606.000	11.000	.000	.000
11	657.000	13.000	.000	.000
12	678.000	22.000	.000	.000
13	692.000	31.000	.000	.000
14	706.000	35.000	.000	.000
15	725.000	37.000	.000	.000
16	747.000	43.000	.000	.000
17	761.000	47.700	.000	.000
18	769.000	48.000	.000	.000
19	2000.000	46.000	.000	.000

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TABLE NO. 9
****
* NEW SLOPE GEOMETRY DATA *
****

All new data input - No old data retained

Slope Coordinates -

Point	X	Y
1	.000	-55.000
2	453.000	-55.000
3	469.000	-47.000
4	512.000	-26.000
5	537.000	-14.000
6	566.000	-1.000
7	582.000	8.000
8	588.000	11.000
9	593.000	12.000
10	606.000	11.000
11	657.000	13.000
12	678.000	22.000
13	692.000	31.000
14	706.000	35.000
15	725.000	37.000
16	747.000	43.000
17	761.000	47.700
18	769.000	48.000
19	2000.000	46.000

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TABLE NO. 15
****
* NEW ANALYSIS/COMPUTATION DATA *
****

Noncircular Shear Surface(s)

Automatic Search Performed

Coordinates of points on shear surface which are to be shifted -

Point	X	Y	Shift Angle
1	535.000	-14.000	angle to be computed - moveable
2	570.000	-27.000	angle to be computed - moveable
3	640.000	-26.000	angle to be computed - moveable
4	725.000	10.000	angle to be computed - moveable

Initial distance for shifting points on shear surface = 10.000
Maximum steepness permitted for toe of shear surface = 60.00 degrees

Maximum number of iterations allowed for
calculating the factor of safety = 500

Depth of water in crack = 4.000

Initial trial estimate for the factor of safety = 10.000

Initial trial values for factor of safety (and side force inclination for Spencer's procedure) will be changed during search

---

THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for side force inclination = 15.000 degrees
(Applicable to Spencer's procedure only)

Allowed force imbalance for convergence = 100.000

Allowed moment imbalance for convergence = 100.000

Number of increments for slice subdivision = 30

Unit weight of water in crack = 62.400

Seismic coefficient = .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER
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TABLE NO. 15
****
* NEW ANALYSIS/COMPUTATION DATA *
****

Circular Shear Surface(s)

Automatic Search Performed

Starting Center Coordinate for Search at -
X = 570.000

Y = 250.000

Required accuracy for critical center (= minimum spacing between grid points) = 5.000

Critical shear surface not allowed to pass below Y = -60.000

For the initial mode of search all circles pass through the point at -

X = 600.000
Y = -10.000

THE FOLLOWING REPRESENT EITHER DEFAULT OR PREVIOUSLY DEFINED VALUES:

Initial trial estimate for the factor of safety = 10.000

Initial trial estimate for side force inclination = 15.000 degrees (Applicable to Spencer's procedure only)

Maximum number of iterations allowed for calculating the factor of safety = 500

Allowed force imbalance for convergence = 100.000

Allowed moment imbalance for convergence = 100.000

Initial trial values for factor of safety (and side force inclination for Spencer's procedure) will be changed during search

Maximum subtended angle to be used for subdivision of the circle into slices = 3.00 degrees

Depth of crack = .000

Search will be continued to locate a more critical shear surface (if one exists) after the initial mode is complete

Depth of water in crack = 4.000

Unit weight of water in crack = 62.400

Seismic coefficient = .000

Conventional (single-stage) computations to be performed

Procedure used to compute the factor of safety: SPENCER

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TABLE NO. 17
INFORMATION FOR CURRENT MODE OF SEARCH - All Circles Pass Through the Fixed Point at X = 600.000 and Y = -10.000

Center Coordinates			1-Stage Factor of Safety	Side Force Inclination (degrees)	Iterations
X	Y	Radius			

```
    420.00    100.00    210.95 Bottom of circle exceeds allowable
                               depth - CIRCLE REJECTED
    570.00    100.00    114.02   4.730       6.34        13
    720.00    100.00    162.79 Bottom of circle exceeds allowable
                               depth - CIRCLE REJECTED
    420.00    250.00    316.23 Bottom of circle exceeds allowable
                               depth - CIRCLE REJECTED
    570.00    250.00    261.73   3.591      11.78        16
    720.00    250.00    286.36 See Message on Next Line(s)
ERROR AT SLICE  24     X =    .770E+03     Y =   -.320E+02

NO PROFILE DATA FOR TOP OF SLICE

    420.00    400.00    447.77   4.539       9.68        14
    570.00    400.00    411.10 See Message on Next Line(s)
ERROR AT SLICE  27     X =    .770E+03     Y =    .408E+02

NO PROFILE DATA FOR TOP OF SLICE

    720.00    400.00    427.20 See Message on Next Line(s)
ERROR AT SLICE  23     X =    .770E+03     Y =   -.243E+02

NO PROFILE DATA FOR TOP OF SLICE


    545.00    225.00    241.35   4.510       6.43        14
    570.00    225.00    236.91   3.839      11.55        15
    595.00    225.00    235.05   3.393      11.59        16
    545.00    250.00    265.75   4.224       9.01        14
    595.00    250.00    260.05   3.259      11.72        16
    545.00    275.00    290.26   3.861      10.87        15
    570.00    275.00    286.57   3.444      11.78        16
    595.00    275.00    285.04   3.151      11.85        17

    620.00    250.00    260.77 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .770E+03     Y =    .367E+02

NO PROFILE DATA FOR TOP OF SLICE

    620.00    275.00    285.70 See Message on Next Line(s)
ERROR AT SLICE  29     X =    .770E+03     Y =    .318E+02

NO PROFILE DATA FOR TOP OF SLICE

    570.00    300.00    311.45   3.325      11.84         3
    595.00    300.00    310.04 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .770E+03     Y =    .441E+02

NO PROFILE DATA FOR TOP OF SLICE

    620.00    300.00    310.64 See Message on Next Line(s)
ERROR AT SLICE  27     X =    .770E+03     Y =    .280E+02

NO PROFILE DATA FOR TOP OF SLICE


    580.00    260.00    270.74   3.398      11.75         4
    595.00    260.00    270.05   3.208      11.80         3
    610.00    260.00    270.19 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .423E+02

NO PROFILE DATA FOR TOP OF SLICE
```

```
    580.00    275.00    285.70   3.324      11.79         3
    610.00    275.00    285.18 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .389E+02

NO PROFILE DATA FOR TOP OF SLICE

    580.00    290.00    300.67   3.253      11.87         3
    595.00    290.00    300.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .461E+02

NO PROFILE DATA FOR TOP OF SLICE

    610.00    290.00    300.17 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .360E+02

NO PROFILE DATA FOR TOP OF SLICE


    590.00    270.00    280.18   3.222      11.83         3
    595.00    270.00    280.04   3.167      11.85         2
    600.00    270.00    280.00 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .769E+03     Y =    .470E+02

NO PROFILE DATA FOR TOP OF SLICE

    590.00    275.00    285.18   3.198      11.87         3
    600.00    275.00    285.00 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .770E+03     Y =    .461E+02

NO PROFILE DATA FOR TOP OF SLICE

    590.00    280.00    290.17   3.177      11.89         3
    595.00    280.00    290.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .769E+03     Y =    .480E+02

NO PROFILE DATA FOR TOP OF SLICE

    600.00    280.00    290.00 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .770E+03     Y =    .451E+02

NO PROFILE DATA FOR TOP OF SLICE


At the end of the current mode of search the most critical
circle which was found has the following values -
X-center =    595.00     Y-center =    275.00     Radius =    285.04
Factor of Safety =   3.151     Side Force Inclination =  11.85


***** CAUTION ***** FACTOR OF SAFETY COULD NOT BE COMPUTED FOR SOME
                    OF GRID POINTS AROUND THE MINIMUM
***** RESULTS MAY BE ERRONEOUS *****
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  Single circular loading

TABLE NO. 18
INFORMATION FOR CURRENT MODE OF SEARCH - All Circles Are Tangent
to a Horizontal Line at   Y =   -10.044
-----------------------------------------------------------------
```

Center Coordinates X	Y	Radius	Factor of Safety	Side Force Inclination (degrees)	Iterations
445.00	125.00	135.04	See Message on Next Line(s)		

CIRCLE DOES NOT INTERSECT SLOPE

595.00	125.00	135.04	5.629	8.81	29
745.00	125.00	135.04	See Message on Next Line(s)		

ERROR AT SLICE 22 X = .770E+03 Y = -.771E+01

NO PROFILE DATA FOR TOP OF SLICE

445.00	275.00	285.04	See Message on Next Line(s)		

CIRCLE DOES NOT INTERSECT SLOPE

745.00	275.00	285.04	See Message on Next Line(s)		

ERROR AT SLICE 16 X = .770E+03 Y = -.894E+01

NO PROFILE DATA FOR TOP OF SLICE

445.00	425.00	435.04	See Message on Next Line(s)		

CIRCLE DOES NOT INTERSECT SLOPE

595.00	425.00	435.04	See Message on Next Line(s)		

ERROR AT SLICE 26 X = .770E+03 Y = .267E+02

NO PROFILE DATA FOR TOP OF SLICE

745.00	425.00	435.04	See Message on Next Line(s)		

ERROR AT SLICE 14 X = .770E+03 Y = -.932E+01

NO PROFILE DATA FOR TOP OF SLICE

570.00	250.00	260.04	3.693	11.81	4
595.00	250.00	260.04	3.259	11.72	3
620.00	250.00	260.04	See Message on Next Line(s)		

ERROR AT SLICE 32 X = .770E+03 Y = .376E+02

NO PROFILE DATA FOR TOP OF SLICE

570.00	275.00	285.04	3.503	11.80	4
620.00	275.00	285.04	See Message on Next Line(s)		

ERROR AT SLICE 29 X = .770E+03 Y = .326E+02

NO PROFILE DATA FOR TOP OF SLICE

570.00	300.00	310.04	3.365	11.83	3
595.00	300.00	310.04	See Message on Next Line(s)		

ERROR AT SLICE 31 X = .770E+03 Y = .441E+02

NO PROFILE DATA FOR TOP OF SLICE

620.00	300.00	310.04	See Message on Next Line(s)		

ERROR AT SLICE 27 X = .770E+03 Y = .287E+02

NO PROFILE DATA FOR TOP OF SLICE

580.00	260.00	270.04	3.416	11.75	4
595.00	260.00	270.04	3.208	11.80	3

```
    610.00    260.00    270.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .425E+02

NO PROFILE DATA FOR TOP OF SLICE

    580.00    275.00    285.04   3.337      11.78         3
    610.00    275.00    285.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .391E+02

NO PROFILE DATA FOR TOP OF SLICE

    580.00    290.00    300.04   3.265      11.84         3
    595.00    290.00    300.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .461E+02

NO PROFILE DATA FOR TOP OF SLICE

    610.00    290.00    300.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .770E+03     Y =    .362E+02

NO PROFILE DATA FOR TOP OF SLICE


    590.00    270.00    280.04   3.224      11.82         3
    595.00    270.00    280.04   3.167      11.85         2
    600.00    270.00    280.04 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .769E+03     Y =    .470E+02

NO PROFILE DATA FOR TOP OF SLICE

    590.00    275.00    285.04   3.200      11.86         3
    600.00    275.00    285.04 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .770E+03     Y =    .460E+02

NO PROFILE DATA FOR TOP OF SLICE

    590.00    280.00    290.04   3.178      11.89         3
    595.00    280.00    290.04 See Message on Next Line(s)
ERROR AT SLICE  30     X =    .769E+03     Y =    .480E+02

NO PROFILE DATA FOR TOP OF SLICE

    600.00    280.00    290.04 See Message on Next Line(s)
ERROR AT SLICE  31     X =    .770E+03     Y =    .450E+02

NO PROFILE DATA FOR TOP OF SLICE


At the end of the current mode of search the most critical
circle which was found has the following values -
X-center =    595.00     Y-center =    275.00     Radius =    285.04
Factor of Safety =   3.151     Side Force Inclination =  11.85


***** CAUTION ***** FACTOR OF SAFETY COULD NOT BE COMPUTED FOR SOME
                    OF GRID POINTS AROUND THE MINIMUM
***** RESULTS MAY BE ERRONEOUS *****
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          Single circular loading
```

TABLE NO. 21
***** 1-STAGE FINAL CRITICAL CIRCLE INFORMATION *****

X Coordinate of Center	595.000
Y Coordinate of Center	275.000
Radius	285.044
Factor of Safety	3.151
Side Force Inclination	11.85
Number of circles tried	70
No. of circles F calc. for	33

***** CAUTION ***** FACTOR OF SAFETY COULD NOT BE COMPUTED FOR SOME OF GRID POINTS AROUND THE MINIMUM
***** RESULTS MAY BE ERRONEOUS *****

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TABLE NO. 26
****
* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the Critical Shear Surface in the *
* Case of an Automatic Search.) *
****

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	552.8	-6.9					
1	558.3	-7.6	4280.3	6	.00	32.00	.0
	563.7	-8.3					
2	564.9	-8.4	1986.0	6	.00	32.00	.0
	566.0	-8.6					
3	570.7	-9.0	12401.6	6	.00	32.00	.0
	575.4	-9.4					
4	578.7	-9.6	12698.8	6	.00	32.00	.0
	582.0	-9.7					
5	582.1	-9.8	620.0	6	.00	32.00	.0
	582.3	-9.8					
6	583.6	-9.8	6041.1	6	.00	32.00	.0
	585.0	-9.9					
7	586.0	-9.9	4775.1	6	.00	32.00	.0
	587.0	-9.9					
8	587.5	-9.9	2484.6	6	.00	32.00	.0
	588.0	-10.0					
9	590.5	-10.0	12920.9	6	.00	32.00	.0
	593.0	-10.0					
10	594.0	-10.0	5284.8	6	.00	32.00	.0
	595.0	-10.0					
11	600.5	-9.9	28237.4	6	.00	32.00	.0
	606.0	-9.8					
12	613.4	-9.3	36885.9	6	.00	32.00	.0
	620.9	-8.9					
13	628.3	-8.0	35277.5	6	.00	32.00	.0
	635.7	-7.1					
14	643.1	-5.9	32157.4	6	.00	32.00	.0
	650.4	-4.6					
15	653.7	-3.9	13119.3	6	.00	32.00	.0

	657.0	-3.2					
16	663.5	-1.6	26922.0	6	.00	32.00	.0
	670.0	.0					
17	674.0	1.2	18303.6	5	.00	36.00	.0
	678.0	2.3					
18	682.2	3.7	21165.7	5	.00	36.00	.0
	686.4	5.0					
19	689.2	6.0	15892.6	4	200.00	28.00	.0
	692.0	7.0					
20	693.6	7.6	9676.3	4	200.00	28.00	.0
	695.3	8.2					
21	698.9	9.6	21071.1	3	.00	30.00	.0
	702.5	11.0					

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TABLE NO. 26

```
**************************************************************
*  Coordinate, Weight, Strength and Pore Water Pressure      *
*  Information for Individual Slices for Conventional        *
*  Computations or First Stage of Multi-Stage Computations.  *
*  (Information is for the Critical Shear Surface in the     *
*  Case of an Automatic Search.)                             *
**************************************************************
```

Slice No.	X	Y	Slice Weight	Matl. Type	Cohesion	Friction Angle	Pore Pressure
	702.5	11.0					
22	704.2	11.7	9992.0	2	.00	32.00	.0
	706.0	12.5					
23	712.8	15.5	34266.2	2	.00	32.00	.0
	719.6	18.6					
24	722.3	20.0	11323.1	2	.00	32.00	.0
	725.0	21.3					
25	731.5	24.9	22730.8	2	.00	32.00	.0
	738.1	28.5					
26	742.5	31.2	11811.0	2	.00	32.00	.0
	747.0	33.9					
27	753.2	38.0	10977.2	2	.00	32.00	.0
	759.4	42.2					
28	760.2	42.7	936.7	2	.00	32.00	.0
	761.0	43.3					
29	764.2	45.6	1744.2	2	.00	32.00	.0
	767.3	47.9					

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TABLE NO. 27

```
**************************************************************
*  Seismic Forces and Forces Due to Surface Pressures for    *
*  Individual Slices for Conventional  Computations or the   *
*  First Stage of Multi-Stage Computations.                  *
*  (Information is for the Critical Shear Surface in the     *
*  Case of an Automatic Search.)                             *
**************************************************************
```

FORCES DUE TO SURFACE PRESSURES

Slice No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y
1	558.3	0.	-6.0	6262.	0.	558.1	-4.6
2	564.9	0.	-5.0	1137.	0.	564.8	-1.5
3	570.7	0.	-3.7	3720.	0.	570.3	1.4
4	578.7	0.	-1.9	1420.	0.	578.3	5.9
5	582.1	0.	-1.2	38.	0.	582.1	8.1
6	583.6	0.	-.8	264.	0.	583.5	8.8
7	586.0	0.	-.2	89.	0.	585.8	9.9
8	587.5	0.	.1	11.	0.	587.3	10.7
9	590.5	0.	.5	0.	0.	590.5	11.5
10	594.0	0.	.7	0.	0.	594.0	11.9
11	600.5	0.	.5	0.	0.	600.5	11.4
12	613.4	0.	.7	0.	0.	613.4	11.3
13	628.3	0.	1.7	0.	0.	628.3	11.9
14	643.1	0.	3.1	0.	0.	643.1	12.5
15	653.7	0.	4.4	0.	0.	653.7	12.9
16	663.5	0.	7.1	0.	0.	663.5	15.8
17	674.0	0.	10.9	0.	0.	674.0	20.3
18	682.2	0.	14.5	0.	0.	682.2	24.7
19	689.2	0.	17.9	0.	0.	689.2	29.2
20	693.6	0.	19.6	0.	0.	693.6	31.5
21	698.9	0.	21.3	0.	0.	698.9	33.0
22	704.2	0.	23.1	0.	0.	704.2	34.5
23	712.8	0.	25.6	0.	0.	712.8	35.7
24	722.3	0.	28.3	0.	0.	722.3	36.7
25	731.5	0.	31.8	0.	0.	731.5	38.8
26	742.5	0.	36.5	0.	0.	742.5	41.8
27	753.2	0.	41.5	0.	0.	753.2	45.1
28	760.2	0.	45.1	0.	0.	760.2	47.4
29	764.2	0.	46.7	0.	0.	764.2	47.8

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TABLE NO. 29

```
**********************************************************************
*  Information Generated During Iterative Solution for the Factor    *
*  of Safety and Side Force Inclination by Spencer's Procedure       *
**********************************************************************
```

Iteration	Trial Factor of Safety	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
1	10.00000	15.0000	.6039E+05	.1042E+08		
First-order corrections to F and THETA					-.215E+02	-.408E+00
Values factored by .232E-01 - Deltas too large					-.500E+00	-.946E-02
2	9.50000	14.9905	.5891E+05	.1016E+08		
First-order corrections to F and THETA					-.190E+02	-.415E+00
Values factored by .264E-01 - Deltas too large					-.500E+00	-.110E-01
3	9.00000	14.9796	.5727E+05	.9879E+07		
First-order corrections to F and THETA					-.165E+02	-.424E+00
Values factored by .302E-01 - Deltas too large					-.500E+00	-.128E-01

```
   4   8.50000    14.9667   .5544E+05   .9563E+07
First-order corrections to F and THETA .........  -.143E+02 -.435E+00
Values factored by  .350E-01 - Deltas too large   -.500E+00 -.152E-01

   5   8.00000    14.9515   .5337E+05   .9208E+07
First-order corrections to F and THETA .........  -.122E+02 -.448E+00
Values factored by  .411E-01 - Deltas too large   -.500E+00 -.184E-01

   6   7.50000    14.9331   .5103E+05   .8806E+07
First-order corrections to F and THETA .........  -.102E+02 -.463E+00
Values factored by  .489E-01 - Deltas too large   -.500E+00 -.226E-01

   7   7.00000    14.9105   .4836E+05   .8345E+07
First-order corrections to F and THETA .........  -.843E+01 -.481E+00
Values factored by  .593E-01 - Deltas too large   -.500E+00 -.285E-01

   8   6.50000    14.8820   .4527E+05   .7815E+07
First-order corrections to F and THETA .........  -.680E+01 -.504E+00
Values factored by  .735E-01 - Deltas too large   -.500E+00 -.370E-01

   9   6.00000    14.8449   .4166E+05   .7195E+07
First-order corrections to F and THETA .........  -.533E+01 -.533E+00
Values factored by  .938E-01 - Deltas too large   -.500E+00 -.500E-01

  10   5.50000    14.7949   .3739E+05   .6463E+07
First-order corrections to F and THETA .........  -.402E+01 -.573E+00
Values factored by  .124E+00 - Deltas too large   -.500E+00 -.713E-01

  11   5.00000    14.7236   .3227E+05   .5586E+07
First-order corrections to F and THETA .........  -.287E+01 -.629E+00
Values factored by  .174E+00 - Deltas too large   -.500E+00 -.110E+00

  12   4.50000    14.6140   .2601E+05   .4516E+07
First-order corrections to F and THETA .........  -.187E+01 -.713E+00
Values factored by  .267E+00 - Deltas too large   -.500E+00 -.190E+00

  13   4.00000    14.4238   .1820E+05   .3184E+07
First-order corrections to F and THETA .........  -.104E+01 -.853E+00
Values factored by  .480E+00 - Deltas too large   -.500E+00 -.410E+00

  14   3.50000    14.0139   .8193E+04   .1497E+07
First-order corrections to F and THETA .........  -.370E+00 -.113E+01
Second-order correction - Iteration   1 ........  -.339E+00 -.113E+01
Second-order correction - Iteration   2 ........  -.339E+00 -.113E+01

  15   3.16137    12.8840  -.7757E+02   .9128E+05
First-order corrections to F and THETA .........  -.110E-01 -.103E+01
Second-order correction - Iteration   1 ........  -.109E-01 -.103E+01
Second-order correction - Iteration   2 ........  -.109E-01 -.103E+01

  16   3.15051    11.8495   .6641E-01  -.4874E+03
First-order corrections to F and THETA .........   .630E-04  .501E-02
Second-order correction - Iteration   1 ........   .631E-04  .501E-02

  17   3.15057    11.8545   .1953E-02   .1214E+01
First-order corrections to F and THETA .........  -.195E-06 -.963E-05

Factor of Safety - - - - - - - -     3.151
Side Force Inclination - - - - -     11.85
Number of Iterations - - - - - -    17
1       UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date:  4:13:2003   Time: 13: 9:22   Input file: k2
  Kings Island Turning Basin, Station 101+887, Savannah, Georgia
```

End of construction loading
Single circular loading

TABLE NO. 38
****
* Final Results for Stresses Along the Shear Surface *
* (Results for Critical Shear Surface in Case of a Search.) *
****

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 3.151 Side Force Inclination = 11.85 Degrees

-------- VALUES AT CENTER OF BASE OF SLICE---------

Slice No.	X-center	Y-center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	558.3	-7.6	1069.0	1069.0	212.0
2	564.9	-8.4	1487.9	1487.9	295.1
3	570.7	-9.0	1854.1	1854.1	367.7
4	578.7	-9.6	2268.7	2268.7	450.0
5	582.1	-9.8	2403.3	2403.3	476.7
6	583.6	-9.8	2469.4	2469.4	489.8
7	586.0	-9.9	2572.0	2572.0	510.1
8	587.5	-9.9	2633.6	2633.6	522.3
9	590.5	-10.0	2714.7	2714.7	538.4
10	594.0	-10.0	2761.3	2761.3	547.7
11	600.5	-9.9	2656.7	2656.7	526.9
12	613.4	-9.3	2515.0	2515.0	498.8
13	628.3	-8.0	2365.1	2365.1	469.1
14	643.1	-5.9	2126.2	2126.2	421.7
15	653.7	-3.9	1909.8	1909.8	378.8
16	663.5	-1.6	1954.7	1954.7	387.7
17	674.0	1.2	2121.0	2121.0	489.1
18	682.2	3.7	2311.0	2311.0	532.9
19	689.2	6.0	2568.5	2568.5	497.0
20	693.6	7.6	2671.8	2671.8	514.4
21	698.9	9.6	2616.1	2616.1	479.4
22	704.2	11.7	2523.8	2523.8	500.6
23	712.8	15.5	2204.9	2204.9	437.3
24	722.3	20.0	1800.4	1800.4	357.1
25	731.5	24.9	1469.1	1469.1	291.4
26	742.5	31.2	1100.7	1100.7	218.3
27	753.2	38.0	718.5	718.5	142.5
28	760.2	42.7	472.3	472.3	93.7
29	764.2	45.6	206.2	206.2	40.9

CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION = .01 (= .116E-01)
SHOULD NOT EXCEED .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION = .02 (= .176E-01)
SHOULD NOT EXCEED .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN = -1.30 (= -.130E+01)
SHOULD NOT EXCEED .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM = .00 (= .329E-02)
SHOULD NOT EXCEED .100E+03
1 UTEXAS3 - VER. 1.120 - 10/08/92 - (C) 1985-1992 S. G. WRIGHT
Date: 4:13:2003 Time: 13: 9:22 Input file: k2
Kings Island Turning Basin, Station 101+887, Savannah, Georgia
End of construction loading
Single circular loading

TABLE NO. 39
****
* Final Results for Side Forces and Stresses Between Slices. *
* (Results for Critical Shear Surface in Case of a Search.) *
****

SPENCER'S PROCEDURE USED TO COMPUTE FACTOR OF SAFETY
Factor of Safety = 3.151 Side Force Inclination = 11.85 Degrees

---------- VALUES AT RIGHT SIDE OF SLICE ----------

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	563.7	6520.	-5.4	.459	766.2	1261.8
2	566.0	8058.	-5.2	.434	610.2	1403.5
3	575.4	14958.	-4.2	.378	290.5	1857.2
4	582.0	19604.	-3.7	.340	44.5	2118.2
5	582.3	19795.	-3.7	.339	35.7	2128.2
6	585.0	21544.	-3.5	.327	-43.9	2221.1
7	587.0	22793.	-3.4	.317	-104.7	2288.3
8	588.0	23403.	-3.4	.318	-100.0	2325.6
9	593.0	26373.	-3.2	.314	-135.6	2492.9
10	595.0	27512.	-3.0	.320	-95.7	2555.7
11	606.0	32858.	-2.0	.367	302.9	2721.6
12	620.9	37966.	-.1	.429	1037.9	2596.0
13	635.7	40854.	2.3	.491	1956.3	2189.9
14	650.4	41723.	5.2	.567	3295.6	1412.5
15	657.0	41567.	6.6	.564	3220.9	1432.4
16	670.0	40287.	9.7	.521	2391.7	1854.4
17	678.0	39283.	11.6	.461	1463.8	2353.8
18	686.4	37489.	13.8	.392	577.5	2700.3
19	692.0	35178.	15.5	.360	229.4	2671.0
20	695.3	33604.	16.6	.354	170.3	2598.0
21	702.5	29587.	19.1	.354	158.9	2359.3
22	706.0	27626.	20.4	.364	226.8	2238.9
23	719.6	19799.	25.8	.402	451.4	1725.2
24	725.0	16804.	28.1	.415	499.1	1528.6
25	738.1	9969.	33.9	.450	566.6	1046.8
26	747.0	5896.	38.3	.480	543.4	693.5
27	759.4	1620.	45.3	.621	545.2	87.0
28	761.0	1227.	46.5	.807	864.8	-256.5
29	767.3	0.	-6.3	BELOW	.0	.0

CHECK SUMS - (ALL SHOULD BE SMALL)
SUM OF FORCES IN VERTICAL DIRECTION = .01 (= .116E-01)
SHOULD NOT EXCEED .100E+03
SUM OF FORCES IN HORIZONTAL DIRECTION = .02 (= .176E-01)
SHOULD NOT EXCEED .100E+03
SUM OF MOMENTS ABOUT COORDINATE ORIGIN = -1.30 (= -.130E+01)
SHOULD NOT EXCEED .100E+03
SHEAR STRENGTH/SHEAR FORCE CHECK-SUM = .00 (= .329E-02)
SHOULD NOT EXCEED .100E+03

END-OF-FILE ENCOUNTERED WHILE READING COMMAND
WORDS - END OF PROBLEM(S) ASSUMED

APPENDIX F

MAPS ACQUISITION

(Links Below)

MAP 1 - 69+500 to 71+295 1.5ac/0 + 0.7ac/+8 MLW

MAP 2 - 86+000 to 88+500 4.3ac/0 + 0.9ac/+8 MLW

MAP 3 - 96+000 to 97+000 (owner State of Georgia)

MAP 4 - 98+200 to 100+500 Kings Island Turning Basin

MAP 4a - 101+200 to 102+500 2.5ac/0 + 0.3ac/+8 MLW

HUTCHINSON ISLAND

SAVANNAH HARBOR EXPANSION

72

71

70

69

E 995000

E 994000

N 758000

TOP SLOPE
E 993621.7
N 758426.6

71+295 TOP SLOPE
E993822.7
N758449.0

TOP SLOPE
E 995173.9
N 758406.5

TOP SLOPE
E 995125.1
N 758408.4

FIG ISLAND

32-S

BN-60

72·000

0.7 ACRES

ESTIMATED TOP OF SLOPE

EL. +8 MLW

1.5 ACRES

EL. 0 MLW

T1 PROPOSED TOE

BN-62

REVISED TOE (WES) / EXISTING TOE

SH-34 (77)

SH-102 (83)

SH-101 (83)

71·500

71·295

328'

69·730

69·500

RANGE

26

250'

FLOOD

EBB

SAVANNAH RIVER

33-G

N

NOTES:

1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER. (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 69+500 TO 71+500

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURVD JAN 2003	SHEET X OF XX

.dgn

SAVANNAH HARBOR EXPANSION

HUTCHINSON ISLAND

SAVANNAH RIVER

EST. TOP OF SLOPE
STATION 88+288
X 980755.6
Y 768108.2

88

SH-86 (83)

88+500

PROPOSED CHANNEL TOE (PREVIOUS)

SH-406 (97)

0.9 ACRES ABOVE +8 MLW
4.3 ACRES ABOVE 0 MLW

SH-112 (83)

88+000

EST. TOP OF SLOPE
STATION 87+500
X 981212.3
Y 767571.4

ESTIMATED (PREVIOUS)
TOP OF SLOPE

87

PROPOSED CHANNEL TOE

87+750

ESTIMATED (NEW)
TOP OF SLOPE

87+500

EST. TOP OF SLOPE
STATION 87+000
X 981557.2
Y 767210.4

300'

PROPOSED CHANNEL TOE

250'

87+000

EST. TOP OF SLOPE
STATION 86+500
X 981922.4
Y 766869.4

86

EXISTING CHANNEL TOE

CHANNEL

86+500

ALIGNMENT

EST. TOP OF SLOPE
STATION 86+000
X 982233.4
Y 766470.2

43-G

FLOOD

EBB

250'

250'

85+500

85+000

85

EXISTING CHANNEL TOE

E 980,000

E 981,000

E 982,000

E 983,000

N 768,000

N 767,000

N 766,000

NOTES:

1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS 85+000 TO 88+500

SAVANNAH GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SUR'D JAN 2003	SHEET X OF XX

.dgn

SAVANNAH HARBOR EXPANSION

E 975.000

E 976.000

E 977.000

N 775.000

N 774.000

97

96

97.500

97.000

96.500

96.000

FRT. C. G. SAILING RANGE

REAR C. G. SAILING RANGE

EST. TOP OF SLOPE
STATION 97+000
X=975722.98
Y=775044.26

ESTIMATED
TOP OF SLOPE

EST. TOP OF SLOPE
STATION 96+000
X 976169.3
Y 774149.4

EST. TOP OF SLOPE
STATION 95+720
X=976264.72
Y=773889.30

FLOOD
EBB

PROPOSED CHANNEL TOE

EXISTING CHANNEL TOE

CHANNEL ALIGNMENT

SAVANNAH RIVER

NOTES:

1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001

SCALE: 1"=200'

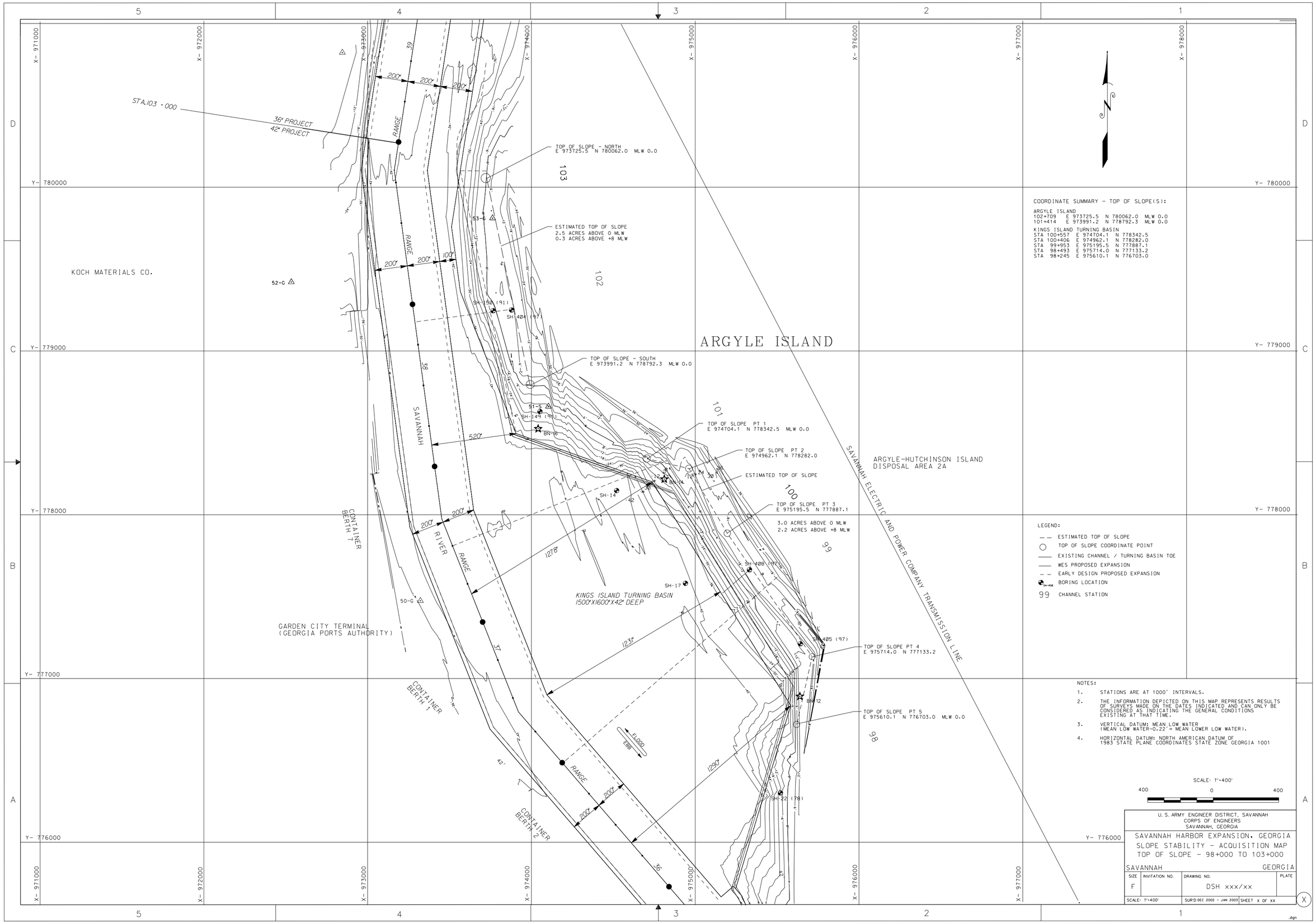
400 0 400

U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA

SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY MAP - 2003
CHANNEL STATIONS
SAVANNAH 96+000 TO 97+500 GEORGIA

SIZE	INVITATION NO.	DRAWING NO.	PLATE
F		XXX/XX	
SCALE: AS SHOWN		SURD JAN 2003	SHEET X OF XX

.dgn


X- 971000
X- 972000
X- 973000
X- 974000
X- 975000
X- 976000
X- 977000
X- 978000
Y- 780000
Y- 779000
Y- 778000
Y- 777000
Y- 776000
STA 103 + 000
36' PROJECT
42' PROJECT
RANGE
200'
100'
520'
1278'
1290'
123'
FLOOD
EBB
TOP OF SLOPE - NORTH
E 973725.5 N 780062.0 MLW 0.0
ESTIMATED TOP OF SLOPE
2.5 ACRES ABOVE 0 MLW
0.3 ACRES ABOVE +8 MLW
TOP OF SLOPE - SOUTH
E 973991.2 N 778792.3 MLW 0.0
TOP OF SLOPE PT 1
E 974704.1 N 778342.5 MLW 0.0
TOP OF SLOPE PT 2
E 974962.1 N 778282.0
ESTIMATED TOP OF SLOPE
TOP OF SLOPE PT 3
E 975195.5 N 777887.1
3.0 ACRES ABOVE 0 MLW
2.2 ACRES ABOVE +8 MLW
TOP OF SLOPE PT 4
E 975714.0 N 777133.2
TOP OF SLOPE PT 5
E 975610.1 N 776703.0 MLW 0.0
103
102
101
100
99
98
KOCH MATERIALS CO.
ARGYLE ISLAND
ARGYLE-HUTCHINSON ISLAND
DISPOSAL AREA 2A
SAVANNAH ELECTRIC AND POWER COMPANY TRANSMISSION LINE
GARDEN CITY TERMINAL
(GEORGIA PORTS AUTHORITY)
KINGS ISLAND TURNING BASIN
1500'X1600'X42' DEEP
CONTAINER BERTH 7
CONTAINER BERTH 1
CONTAINER BERTH 2
RIVER RANGE
SAVANNAH RANGE
52-6
53-6
51-5
50-6
SH-182 (91)
SH-404 (97)
SH-149 (97)
SH-14
SH-17
SH-408 (97)
SH-405 (97)
SH-22 (78)
BN-6
BN-14
BN-12
COORDINATE SUMMARY - TOP OF SLOPE(S):
ARGYLE ISLAND
102+709 E 973725.5 N 780062.0 MLW 0.0
101+414 E 973991.2 N 778792.3 MLW 0.0
KINGS ISLAND TURNING BASIN
STA 100+557 E 974704.1 N 778342.5
STA 100+406 E 974962.1 N 778282.0
STA 99+953 E 975195.5 N 777887.1
STA 98+493 E 975714.0 N 777133.2
STA 98+245 E 975610.1 N 776703.0
LEGEND:
ESTIMATED TOP OF SLOPE
TOP OF SLOPE COORDINATE POINT
EXISTING CHANNEL / TURNING BASIN TOE
WES PROPOSED EXPANSION
EARLY DESIGN PROPOSED EXPANSION
BORING LOCATION
99 CHANNEL STATION
NOTES:
1. STATIONS ARE AT 1000' INTERVALS.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME.
3. VERTICAL DATUM: MEAN LOW WATER (MEAN LOW WATER-0.22' = MEAN LOWER LOW WATER).
4. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 STATE PLANE COORDINATES STATE ZONE GEORGIA 1001
SCALE: 1"=400'
400 0 400
U. S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
SAVANNAH, GEORGIA
SAVANNAH HARBOR EXPANSION, GEORGIA
SLOPE STABILITY - ACQUISITION MAP
TOP OF SLOPE - 98+000 TO 103+000
SAVANNAH GEORGIA
SIZE F
INVITATION NO.
DRAWING NO. DSH xxx/xx
PLATE
SCALE: 1"=400'
SUR'D DEC 2002 - JAN 2003
SHEET x OF xx
.dgn

APPENDIX G

INSPECTION SUMMARY

(Click here)

CESAS-EN-GS 06 DEC 01

MEMORANDUM FOR RECORD

SUBJECT: Trip Report, Savannah Harbor Expansion, Savannah, GA; Inspection of Dock Structures, Inner Harbor

1. DATE OF TRIP: 14 and 15 NOV 2001

2. PURPOSE OF TRIP: To inspect the condition of existing docks and structures located on the Savannah River. Inspection is intended only to document existing conditions prior to the work anticipated for the Savannah Harbor Expansion.

3. PERSONS MAKING TRIP:

Joseph Hudak Jr.,	EN-GS
Judy Wood,	PD-EI
Wilbur Wiggins,	EN-HC
Gabriele Supon,	PD-E
Cone Bostwick,	OP-NE

4. PERSONS CONTACTED:

None

5. BACKGROUND: The Savannah Harbor expansion proposes to deepen the existing shipping channel from approximately -42 to -48 feet mean low water (mlw), while maintaining the existing channel side slopes. The work also anticipates expanding Kings Island Turning Basin and widening selected areas at curves or turns to allow larger ship size(s) access to the port facilities. Based on past experience involving property owners and their claims that channel dredging could impact their facilities, it was decided by the Savannah Harbor Expansion Team that we should try to document conditions of existing facilities along the banks of the proposed new work. Therefore, a trip was planned to take photos and notes under low tide conditions using a small boat and camera.

6. OBSERVATIONS:

The following docks and structures were photographed over a two-day period, 14 and 15 November, 2001. The majority of structures appear to be in good to excellent condition, to the extent they could be observed from a low tide condition. All observations were made while the tide was at or near zero mean low water (mlw) elevation. Photographs are attached illustrating observations. The following condition assessments are the subjective opinion of the observer and do not reflect detailed analyses, as-built research, or underwater investigations. Exceptions to the good or excellent opinion are discussed separately herein.

Property	Condition				
	Excellent	Good	Fair	Poor	Very Poor
Southern Energy Co. Docks	X				
Kemira Inc. Docks	X				
Old Fort Jackson, Moat/Riprap			X		
ST Services #1, Concrete & Steel	X				
Unocal Docks	X				
ST Services #2, Wood & Steel		X			
Standard Concrete Products	X				
Georgia Pacific Gypsum		X			
Wood Chip Exp. Facility		X			

Property (Con't)	Condition				
	Excellent	Good	Fair	Poor	Very Poor
East Cost Terminal, Wood Dock					X
U.S. Army Corps of Engineers, Dock		X			
Marriott Hotel, Deck		X			
River Walk/Savannah Electric		X			
Retaining Structure, Wood (73+000 to 73+400)					X
Weston Hotel, Steel	X				
Convention Center, Steel	X				
Moran Towing, Dock		X			
Parking and Ferry Dock, 74+500				X	
River Street, 74+800 to 75+200		X			
Crescent Towing, Wood Piles			X		
Crescent Towing, Brick Wall					X
T.I.C		X			
Powell Duffryn Dock, Piles		X			
River Street/Hyatt, Concrete Piles	X				
Savannah Electric Substation, Steel		X			
Savannah Marine Services, 77+300		X (located in widener)			
Former Graham Radio Property, 78+000	(No Dock, but in a Widener Area)				
Blue Circle Cement, Concrete/Steel	X				
Tallmadge Bridge Pier North, Concrete	X				
Georgia Ports Authority Docks (All)	X				
and others on GA Side, 79+300 to 103+000		X			
Colonial Terminals		X			
Intermarine		X			
Union Camp, GA Side, Steel				X	
Citgo, Steel		X			
Georgia Kaolin Terminals, Steel		X			

Old Fort Jackson:

The timber piles and wood retaining structure supporting the moat foundation were observed to be in a deteriorated condition. The newer steel sheet piling supporting the moat intake structure was observed to be in excellent condition. Rip rap on both sides of the moat, upstream and downstream, had minor deficiencies consisting of sloughed or failed riprap areas. The Fort Jackson area is designated for remedial work under the O&M program and will not be addressed as a part of the Savannah Harbor Expansion work.

East Coast Terminal Docks:

There's a new concrete dock structure located downstream of East Coast's wood supported docks that appears to be in excellent condition. However, at the time of this writing, it is not clear whether this dock is the property of East Coast Terminal. The wood piling and foundations supporting East Coast's dock was observed to be in an advanced state of disrepair. The vast majority of wood piles and cross-member supports were observed to be worn, broken, and reduced from original size by wear and tear over an extended period of time. All of East Coast Terminal docks are located from 90 feet to 120 feet from the shipping channel.

The retaining structure consists (consisted) of wood piling driven along the riverbank to help retain the softer soils placed for filling an old connecting waterway (many years ago). Some of these piles were removed, and a small

Retaining Structure, Wood, (73+000 to 73+400), Between the Engineer Yard and Slip No.1

portion remains. Due to the expected soft nature of the bank material, side slopes flatter than 1 vertical on 3 horizontal may result. For this reason, subsurface investigation is planned to determine the extent of possible sloughing. It is also noted that the bank at zero mlw is located approximately 130 feet to 150 feet from the shipping channel, well outside the influence of proposed dredging operations.

Parking Area and Ferry Dock, River Street Area, Approximately 74+500

The parking area and dock facility is supported on concrete type bent structures supported on wood piling. The bottom of the concrete and the top of piling occurs at approximate elevation +2 mlw. The contact between the concrete and the wood was observed to mostly open, meaning that a gap exists between the piling and the concrete. The gap is estimated to vary approximately evenly from several inches on the outside to complete contact near the shoreline. While both the wood and the concrete appeared to be in reasonably good condition, the gap suggests that repetitive loading and unloading of the dock resulted in pushing the wood piling lower than original design. Tops of piles did not appear to be ‘broommed’, broken or otherwise damaged. Minor spalling of the concrete portion was noted and photographed. The distance (horizontal) between the nearest piling and the shipping channel is approximately 100 feet.

Crescent Towing & Salvage Co., Brick Wall, Approximately 75+600

The condition of the brick wall and the observable wood supporting structure appears to be in a deteriorated condition. However, the piling and dock immediately behind the wall appear to be in good to fair condition. The horizontal distance between the wall and the shipping channel is approximately 150 feet.

Union Camp, GA Side, Steel, Approximately 87+000 to 88+000

The sheet-piling wall along the Union Camp property was observed to be in an altered, modified and/or deteriorated condition from approximate elevation of 0 to plus 2 mean low water (mlw). The condition noted consisted of irregular to rectangular shape holes breaching the sheet piling. Holes are estimated to be approximately 1 to 2 square feet in size each. The proximity of the sheet piling to the shipping channel varies from approximately 230 feet to 300 feet.

7. DISCUSSION:

a. General

Approximately 101 photographs representing 36 separate properties have been taken and are attached to this report. The properties photographed and addressed herein are not all inclusive of all properties along the Savannah River Expansion Project. Properties outside the scope of work and above channel station 103+000 were not included nor viewed. Properties within the scope of work and located well beyond the proposed new work were not observed or addressed herein. Distances estimated from aerial survey maps and channel alignments of 300 to 1000 feet or more are examples of properties considered beyond the influence of the new work. However, each of these areas was reviewed using the available maps and soundings at the time of this report.

Properties within the scope of work between 91+000 and 103+00 on the Georgia side were observed, but not photographed. These properties are identified on the Annual Survey Sheets as Southern Bulk Industries, National Gypsum Company, Rubberoid Company, G.A.F. Corporation, PAK Tank Incorporation, and GPA's Garden City Terminals. These facilities exist in locations where soundings indicate relatively deep water. Due to existing river depths and proximity of the property to the shipping channel, the proposed expansion work is not anticipated to have any effect whatsoever on these facilities or their respective bank slopes.

The U.S. Coast Guard Station at Tybee, the Savannah Bar Pilots Dock and Oysterbed Island Training Wall were not observed during this trip. However, the depth of water and their respective distances (190 feet to more than 1000 feet)from the shipping channel suggest that the proposed work will have no effect on these structures whatsoever.

b. Structures Considered in Excellent and/or Good Condition

The structures observed and considered in excellent and/or good condition are either (1) in good condition and by their proximity or distance away from the shipping channel, not likely to be influenced by the proposed expansion; or (2) appear to be well engineered, soundly constructed, well maintained, and unlikely to be effected by the proposed expansion regardless of proximity. Again, the above statement is based on observations of the visible and is the opinion of the observer.

c. Structures Considered as Fair, Poor, or Very Poor Condition

Each of these structures appears to need repairs, replacement, or other remedial effort. The proposed expansion work is not expected to affect these structures. However, the property owners should probably be advised of observations made and we should request additional information regarding the as-built construction of these structures (if available) as a supplement to observations.

d. Structures and Properties Located Adjacent to Channel Wideners

Several properties and structures are located in widening areas where such 'wideners' will likely have some impact. These areas are itemized in the following:

(1) Kings Island Turning Basin and North to Station 103+00 adjacent to DMCA 2A. The turning basin expansion and wideners proposed will result directly in a 'taking' situation.

(2) Union Camp Property, Hutchinson Island, Stations 87+500 to 88+300. The proposed widener will result directly in a 'taking' situation.

(3) Savannah Marine Services and the former Graham Radio Corp. Property, Stations 77+500 to 77+800. The proposed widener should be expected to influence the stability of Savannah Marine's sheet pile wall, depending on the as-built construction properties of the wall and may result in a 'taking' situation. Immediately adjacent is the former Graham Radio property and unprotected riverbank where the proposed widener is expected to result directly in a 'taking' situation.

(4) T.I.C. Station 76+200. The proposed widener should be expected to influence the stability of T.I.C.'s sheet pile wall, depending on the as-built construction properties of the wall and may result in a 'taking' situation.

(5) Wood Chip Exporting Corp., Stations 65+900 to 66+200. The proposed widener will result directly in a 'taking' situation.

8. RECOMMENDATIONS:

The only recommendation at this time would be to notify all property owners along the proposed harbor expansion of the intent to deepen and selectively widen certain areas of the shipping channel and request from them any available structural as-built dock information. Specifically, ask for depths of piles, types and sizes of piles, size and location of pile wall tie-backs, and any other information regarding year of construction, type of construction, and allow owners to add any other information they feel is appropriate.

9. If you have any questions, please call Mr. Joe Hudak at (912) 652-5681.

JOSEPH D. HUDAK JR., P.E.
Geotechnical & HTRW Branch,
Soils Section

Trip photos are attached from the following files. Each photo has a short description and associated channel station location.

Trip Report photos 'p14NovA.doc' (first) Attached

Trip Report photos 'p14NovB.doc' (Second) Attached

Trip Report photos 'p15NovA.doc' Attached

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Southern Energy Company LNG–Location M2 between Stations 38+300 to 39+500, Concrete and Steel Piling, Excellent Condition

Southern Energy Company LNG–Dock Fender between Stations 38+300 to 39+500, Steel Piling, Excellent Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Southern Energy Company LNG–Dock Piling between Stations 38+300 to 39+500, Concrete Piling, Excellent Condition

Southern Energy Company LNG–Location M2 between Stations 38+300 to 39+500, Concrete and Steel Piling, Excellent Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Southern Energy Company LNG–Dock and Piling between Stations 38+300 to 39+500, Concrete Piling, Excellent Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Kemira Inc. River Station 56+000, Pipe Dock. Wood Piles, Good Condition

Kemira Inc. River Station 56+000, Pipe Dock. Wood Piles, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Kemira Inc. Dock and Pier. Stations 57+000 to 58+000, Foundation – Concrete and Steel, Good Condition

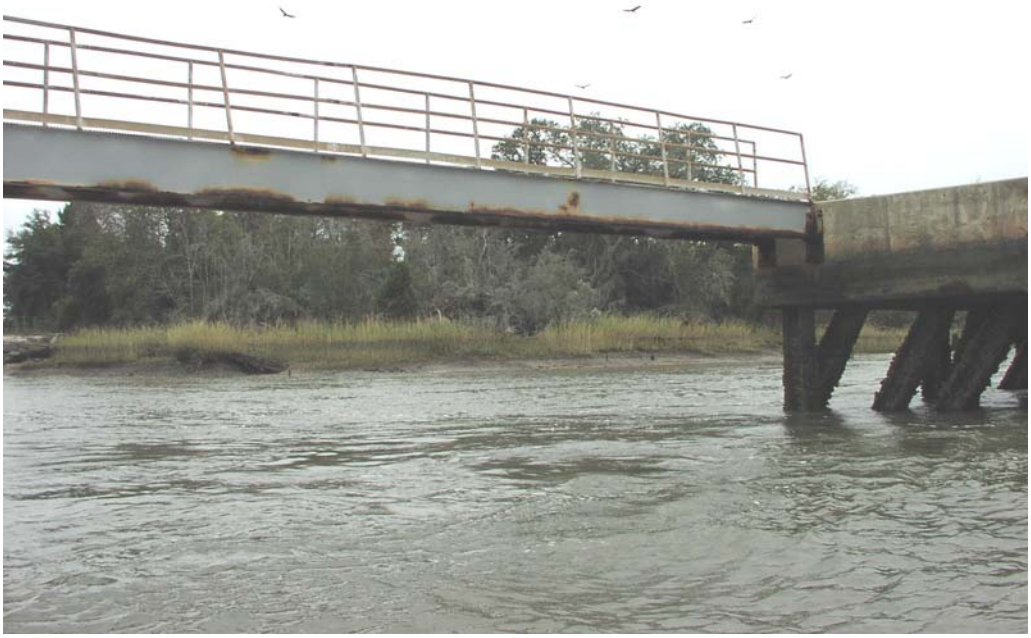
Kemira Inc. Dock and Pier. Stations 57+000 to 58+000, Foundation – Concrete and Steel, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Kemira Inc. Dock and Pier. Stations 57+000 to 58+000, Foundation – Good Condition, Looking Downstream

Kemira Inc. Dock and Pier. Stations 57+000 to 58+000, Piling Foundation – Good Condition, Steel Dock Beams Showing Deterioration

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001



Kemira Inc. Dock and Pier. Stations 57+000 to 58+000, Piling Foundation – Good Condition, Steel Beams Showing Deterioration

Kemira Inc. Dock and Pier. Stations 57+000 to 58+000, Piling Foundation – Good Condition,

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Old Fort Jackson, Downstream RipRap, Station 58+500

Old Fort Jackson, Downstream Moat Brickwork, Station 58+500

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Old Fort Jackson, Downstream Moat Brickwork, Station 58+500

Old Fort Jackson, Upstream Riprap, Station 58+700

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

ST Services #1, Concrete Piling, Station 60+500, Good Condition

ST Services #1, Concrete and Steel Piling, Station 60+500, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Unocal, Concrete Piles, Station 61+000, Good Condition

Unocal, Concrete Piles, Station 61+100, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

ST Services #2, Station 61+900, Wood Piles, Fair Condition

ST Services #2, Station 62+000, Steel Piles, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

ST Services #2, Station 62+200, Wood Piles, Fair Condition

ST Services #2, Station 62+300, Wood Piles, Fair Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Georgia Pacific Gypsum, Station 63+250, Concrete Piles, Good Condition

Georgia Pacific Gypsum, Station 63+250, Concrete Piles, Good Condition (Close-Up)

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Standard Concrete Products, Steel Piles, Station 62+700, Good Condition

Georgia Pacific Gypsum, Steel Piles, Station 63+000, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Georgia Pacific Gypsum, Steel Piles, Station 63+000, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Wood Chip Facility, Station 66+800, Steel Piling, Good Condition

Wood Chip Facility, Station 67+000, Steel Piling, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

East Coast Terminal Company, Station 68+500, Wood Piles

East Coast Terminal Company, Station 69+800, Wood Piles

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

East Coast Terminal, Station 68+100, Wood Piling, Berth 4, Deteriorated/Broken Condition

East Coast Terminal, Station 68+100, Wood Piling, Berth 4, Deteriorated/Broken Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

East Coast Terminal, Station 68+500, Wood Piling, Berth 4, Deteriorated/Broken Condition

East Coast Terminal, Station 68+500, Wood Piling, Deteriorated/Broken Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

East Coast Terminal, Station 69+400, Wood Piling, Deteriorated/Broken Condition

East Coast Terminal, Station 70+000, Wood Piling, Deteriorated Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Marriott Hotel, Concrete Piles, Station 72+300, Good Condition

Marriott Hotel, Concrete Piles, Station 72+350, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Marriott Hotel, Concrete Piles, Station 72+500, Good Condition
Note blocked and broken flap gate at drainage pipe

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

River Walk/Savannah Electric, Concrete Piles, Station 72+600, Good Condition

River Walk/Savannah Electric, Concrete Piles, Station 72+800, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Turecamo/Parking Lot, Concrete Support on Wood Piles, Station 74+400, Poor Condition

Parking Lot/Ferry Dock, Concrete Support on Wood Piles, Station 74+600, Poor Condition
Note: Several to many wood piles not in contact with concrete support(s),Elevation ~1 MLW.

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

River Street, Station 74+800

River Street, Approximate Station 75+200, Concrete and Steel Piling, Good Condition
City Hall Area

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

River Street, Approximate Station 75+500, Hyatt Area

River Street/Savannah Electric, Station 77+000

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Savannah Electric Peaking Plant, Station 77+000, Good Condition

Savannah Electric Peaking Plant, Approx. Station 77+500, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Colonial Terminals, Approx. Station 83+000, Piling in Good Condition

Station 83+500

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Intermarine, Station 83+900, Dock and Piling in Good Condition

Colonial Terminals, Station 86+000, Concrete Piles, Excellent Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Colonial Terminals/Union Camp Corp. Approx. Station 86+900

Union Camp Corp., Approx. Station 88+000, Steel Sheet Piling rusted thru at low water line

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Union Camp Corp., Approx. Station 88+000, Steel Sheet Piling rusted thru at low water line

Union Camp Corp., Approx. Station 88+000, Steel Sheet Piling rusted thru at low water line

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Union Camp Corp., Approx. Station 88+000, Steel Sheet Piling

Citgo Asphalt Refining Co., Station 90+000, Steel Sheet Piling, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

Citgo Asphalt Refining Co., Station 90+000, Steel Sheet Piling, Good Condition

Georgia Kaolin Terminals, Station 90+700, Steel Sheet Piles, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 14 NOVEMBER 2001

North of Kings Island TB, Station 101+400, Widener/Taking Area

North of Kings Island TB, Station 102+200, Widener/Taking Area

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Standard Concrete Products, Station 62+600, Concrete Piers and Beams, Excellent Condition

ST Services #2, Station 62+200, Wood/Steel Piling, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

ST Services #2, Station 62+200 to 61+800, Wood/Steel Piling, Good Condition

ST Services #2, Station 61+900, Wood/Steel Piling, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Unocal, Station 61+800, Wood Piling, Good Condition

Unocal, Station 61+500, Concrete Piling, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

U.S. Army Corps of Engineers Yard, Concrete Piles, Station 72+500, Good Condition

U.S. Army Corps of Engineers Yard, Concrete Sheet Piles, Station 72+800, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Artifact Area, Wood Piles/Retaining, Station 73+000

Artifact Area, Wood Piles/Retaining, Station 73+400

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Weston Hotel, Steel Sheet Piles, Station 74+000, Good Condition

Weston Hotel, Steel Sheet Piles, Station 74+000, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Weston Hotel, Steel Sheet Piles, Station 74+500, Good Condition

Convention Center, Steel Sheet Piles, Station 74+700, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Convention Center, Steel Sheet Piles, Station 74+700, Good Condition

Convention Center, Steel Sheet Piles, Station 75+000, Good Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Cresent Towing & Salvage Company, Station 75+500, Brick Retaining Wall

Cresent Towing & Salvage Company, Station 75+600, Brick Retaining Wall

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

TIC, Station 76+000, Spud Barge

TIC, Station 76+000, Spud Barge

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

TIC, Approx. Station 76+100, Steel Sheet Piling in Good Condition

Powell Duffryn Dock, Station 76+200

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Powell Duffryn Dock, Station 76+300

Powell Duffryn Dock, Station 76+500

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Powell Duffryn Dock, Station 77+000

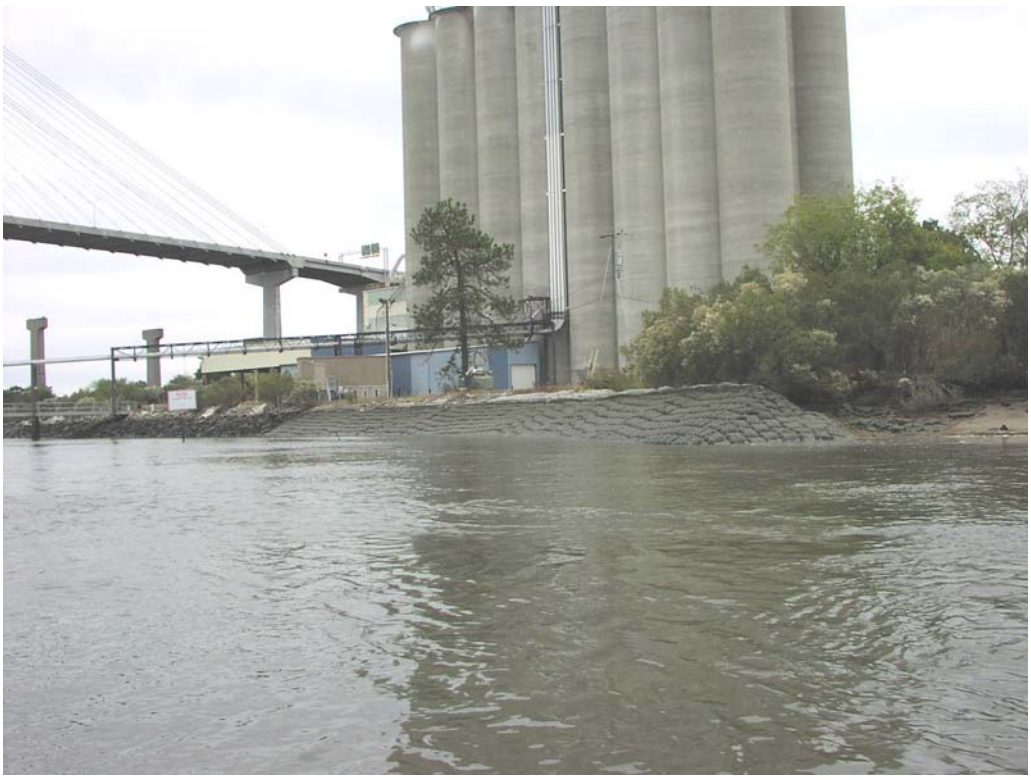
Savannah Marine Services, Station 77+250

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Savannah Marine Services, Station 77+350

Chatham County/Old Radio Station Property, Station 78+000

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001



Blue Circle Cement, Approx. Station 78+300

Blue Circle Cement, Approx. Station 78+550, Steel Shell Piles, Excellent Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Blue Circle Cement, Approx. Station 78+600, Steel Shell Piles, Excellent Condition

Blue Circle Cement, Approx. Station 78+800, Steel Shell Piles, Excellent Condition

SAVANNAH HARBOR EXPANSION – DOCKS – 15 NOVEMBER 2001

Tallmadge Bridge Pier North Side, Station 79+300, Good Condition

Georgia Ports Authority Berth 13, Station 79+700, Concrete Piles, Excellent Condition

APPENDIX H

PRELIMINARY ASSESSMENT

(Click here)

SOIL BORING ANALYSES LOCATIONS / PRELIMINARY ASSESSMENT

31 January 2002

1. The existing Savannah Harbor is approximately 32 miles long (along the centerline of the channel), stretching from the Atlantic Ocean to the former New Cut Channel (Channel Stations –60+000 to 103+000). The Savannah Harbor Expansion Project proposes to add 25,000 feet of outer channel (New Channel Stations (-60+000 to -85+000), widen selected turns within the inner harbor, and enlarge the existing Kings Island Turning Basin (Inner harbor). The outer channel work does not impact privately owned real estate. The inner harbor, for the purpose of this study, shall be described as being all reaches from Channel Station 0+000 to 103+000. There is approximately 20 miles of land on each side of the river (approximately 40 miles of river banks), and many properties that could be affected by the project depending, in part, on the proximity of the land to the proposed channel deepening and/or widening. The Corps of Engineers does not recommend taking soil samples from all properties located along the Savannah River and in the Savannah Harbor.

2. The publications by the Department of the Army, Corps of Engineers, Office of the Chief Engineers entitled "Engineering and Design, Geotechnical Investigations," EM 1110-1-1804 (29 February 1984) and "Soil Sampling," EM 1110-2-1907, are the primary sources on how to take soil samples. These engineering manuals indicate how to take the samples, but do not identify with any specificity the locations where samples must be taken. There are no regulations, internal guidelines, policies or other directives that specify the conditions under which soil samples must be obtained or the properties from which soil samples must be taken. The designing soils engineer has the discretion to decide, based on his or her best judgment as an engineer, the locations where it will be necessary to take soil samples for analysis.

3. The soils engineering staff for the Corps of Engineers is responsible for determining where soil samples for slope stability and demolition purposes will be taken in connection with the Savannah Harbor Expansion Project. During the course of determining the locations where it would be necessary for the Corps of Engineers to take soil samples for analysis, we considered the following factors: 1) the proximity of a property to the proposed project, 2) the type of material likely to be encountered (as obtained from past soil borings in the vicinity), 3) the slope of the riverbank, 4) the configuration of the existing channel, 5) hydrographic surveys, 6) topographic surveys and aerial photographs, 7) the configuration of the proposed navigation channel, 8) whether the proposed channel intersects with adjacent property, 9) the proposed method of dredging, 10) the available budget, 11) the cost of taking and analyzing soil borings,[1] and 12) the likelihood that soil sample analysis will yield necessary information. In

[1] The cost of a soil boring, including laboratory testing and analysis, and subsequent analysis of the drilling and test results, varies from approximately $10,000.00 to $12,500.00, per boring.

addition, we considered historic information, including: 1) most recent surveys, 2) problems arising out of most recent dredging projects, and 3) historic structures and artifacts.

4. In connection with the Savannah Harbor Expansion Project, we also conducted site inspections of all areas that could be affected by the project, by boat and by land. Documentation, photographs, and comment from the most recent inspections are contained in Memorandum For Record dated 06 December 2001, Subject: Trip Report, Savannah Harbor Expansion, Savannah, GA; Inspection of Dock Structures, Inner Harbor.

5. The decision whether to test certain property is based on an analysis of the above factors, and not the ownership of the property. The taking of soil samples, like any other expenditure in connection with a harbor expansion project, must be justifiable. Engineering judgment is used to determine the locations where the taking of soil samples will yield necessary information.

6. Soil borings and samples were taken during preliminary study analysis which will need to be augmented based on the now proposed channel configuration, and again (possibly) augmented after final model studies have been completed. Each of the following areas represents a 'taking' or real estate acquisition necessary to accommodate proposed channel widening. Areas which are known to involve 'taking' by virtue of direct intersection of proposed work to the existing channel/river configuration or where there is some question regarding existing bulkhead and/or channel bank stability are 1) Argyle Island between Channel Stations 101+000 and 103+000, 2) Kings Island Turning Basin between Channel Stations 98+700 and 100+500, 3) International Paper, northeast riverbank, between Channel Stations 87+450 and 89+500, 4) Savannah Marine Services and the former Graham Radio Corp. Property, Channel Stations 77+250 to 77+650, 5) T.I.C., Channel Stations 76+000 to 76+200, and 6) Property located at or adjacent to Wood Chip Exporting Corp., Channel Stations 65+950 to 66+200. Each of the above described areas either have been or will be investigated with regard to subsurface condition, profiles, material strength and bank stability.

7. Areas of concern that do not involve a direct intersection of the proposed project to the existing river configuration, and are recommended for soil testing are listed in the following:

a. Hutchinson/Fig Island between the U.S. Army Corps of Engineers Yard and Slip No.1, known as an archeological site consisting of soft fill materials and old ship/boat wrecks (Approximate Channel Stations 72+700 to 73+700). This area is recommended for subsurface exploration and testing to better determine bank stability with regard to the proposed project.

b. South Channel Training Wall, Elba Island side, Channel Stations 50+000 to 51+700, and near Southern Energy Corporation's natural gas pipeline crossing. Channel widening proposed along this reach will likely involve debris and/or training wall (or remnant) removal. Exploratory investigation is planned to determine size and extent of possible debris removal.

c. The extended bar channel area from -60+000 to -85+000. While not of concern to adjacent properties (none), subsurface sampling and testing will be performed to determine the character of materials proposed for removal.

d. Other areas are subject to subsurface testing and analysis. Such include aquifer studies for salt-water intrusion, which are considered beyond the scope of this writing.

8. Problematic areas exist that involve deteriorated, broken and/or highly questionable structures with regard to their stability and are located near or adjacent to the proposed project. These areas are not recommended for subsurface study, but will need to be addressed as separate issues. Each is listed in the following:

a. Cantilevered Parking Lot and Dock Facility (Owner: Sylvan Byck) located between Moran Towing and the eastern end of the original Rousakis Plaza, located opposite the Shrimp Factory on River Street, and approximately between Channel Stations 74+270 and 74+400. The foundation for the cantilevered concrete parking area consists of wood piling. As noted in the trip report dated 06 December 2001, a gap or open area exists that varies from about 1 foot to less than 1 foot between the pile tops and the concrete, depending on pile location. Given the relatively good condition of the pile tops, it is surmised that repeated loading and unloading of the parking lot has subsequently driven the piles into supporting soils beyond the depth that piles were originally installed. In any case, the gap between the pile tops and supporting concrete indicates a pile bearing failure that leaves the concrete section free to flex and move within existing constraints. Repeated movement or flexing of the concrete structure could lead to (if not already) structural problems for the parking facility. This facility in its present condition requires substantial foundation repair(s).

With regard to the proposed harbor expansion, it should be noted that over-swing normally associated with pipeline dredging (estimated at approximately 4 to 6 feet) could lead to an approximate loss of 2 feet of channel side slope soil material that currently helps support the outermost piling. While true for the outermost piles, the estimated 2 feet of possible material loss is unlikely to have an appreciable effect on remaining interior piles. In addition, it is noted that the same amount of remedial or repair work will be required, with or without the harbor expansion project.

Subsurface sampling and testing in this area isn't likely to yield any new or useful information with regard to the facility and therefore is not recommended. It is recommended that the property owner be advised of the foundation conditions discovered before actual dredging occurs

b. International Paper (formerly Union Camp), southwest side, located between Channel Stations 87+500 and 89+600. The sheet-piling bulkhead contains numerous holes approximately 1-foot square in size at or near the zero mlw elevation. It is unclear whether these holes have been cut deliberately (given the near uniform hole sizes), perhaps as a previous drainage effort, or if the holes are the result of long term pile corrosion at the low water mark.

With regard to the proposed project in this vicinity, the resulting side slope from project dredging is not expected to change or alter existing conditions directly adjacent to the

bulkhead. The above expectation is based on the distance of the bulkhead from the proposed channel work and considering usual dredging practices.

Subsurface sampling and testing in this area is not likely to yield any new or useful information with regard to the facility or project and therefore is not recommended. However, it is recommended that the property owner be advised of the bulkhead conditions discovered during our site inspection.

c. Crescent Towing and Salvage Company approximately located between Channel Stations 75+500 and 75+800. Crescent's brick wall and brick retaining wall structures appear to be supported or partially supported on wood piling. The wall is severely cracked, with portions of the wall either removed, or broken and subsequently fallen into the river. The wood piling behind the brick wall and supporting the dock facility appears to exist in a fair to good condition.

With regard to the proposed project and the Crescent property, the harbor expansion could have some effect on the stability of the brick wall and supporting piles. While it is not recommend that sampling and testing be performed solely for this facility, testing and sampling is currently planned for Crescent's neighboring facility, T.I.C., located approximately 400 feet upstream. Given the contiguous nature and similar histories for this reach, the sampling, testing and analysis currently planned should be considered sufficient and cost effective. The results of the analysis for the reach between Channel Stations 75+500 and 76+250 will be applied to the landmass / riverbank without regard to who owns which part. Any subsequent recommendations will be addressed after analysis has been completed.

d. East Coast Terminal Company, approximate Channel Stations 68+000 to 69+700. Observations reveal the supporting foundation for the dock facility at East Coast Terminal exists in an advanced state of deterioration and disrepair. This includes piling, pile bracing, wood retaining structures and portions of the concrete deck.

With regard to the proposed project in this vicinity, the resulting side slope from project dredging is not expected to change or alter existing conditions adjacent to the East Coast dock facility. This conclusion is based on the distance of the dock from the proposed channel work (80 to 120 feet) and considered usual dredging practices.

Subsurface sampling and testing in this area is not is not recommended. However, it is recommended that the property owner be advised of the dock facility foundation conditions discovered during our site inspection.

9. The remaining properties, structures and/or other items within the scope of the proposed harbor expansion exists in or belongs to one of the following conditions:

a. Located by sufficient distances from the proposed work so as not to be impacted and are not recommended for sampling and testing of soil materials or further studies.

b. Located near, but outside, the proposed work and exist in an excellent to good condition. Sampling and testing in the vicinity of such facilities will not provide any

useful information with regard to the proposed work and such sampling and testing is not recommended.

c. Is currently under design for remediation / repair of structural facilities to be implemented as an item separate from the proposed project. i.e. Old Fort Jackson moat and bank protection.

d. Belongs to a group or class probably best described as obstructions and are being addressed as separate issues. i.e. CSS Georgia, sunken barges, training wall(s), etc..

APPENDIX I

GENERAL CORRESPONDENCE

GENERAL CORRESPONDENCE

NOTE: Not all files available in the Correspondence directory are listed below. Reading availability is dependent on viewing software programs including Arc Info, Arc GIS, MicroStation and/or AutoCad, and Visio.

1. **Assumptions and Problems**
2. **Bridge Article**
3. **Container Facilities Feasibility Study**
4. **Expansion Plan Formulation**
5. **Preliminary Alternative SavHarb Expansion**
6. **Savannah Harbor Expansion**
7. **Savannah Harbor Questions**
8. **Savannah Harbor**
9. **Savannah Harbor Area Map**

APPENDIX J

REVIEW OF PREVIOUS STUDIES

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The following links represent partial, but important reviews of past geotechnical and slope stability studies made in the process of widening and deepening the Savannah River.

Appendix D of the first DM listed, starting on page 168, contains earlier slope stability studies performed for the Savannah River. (Required reading for the not-so feint of heart)

1992 Savannah Harbor Deepening - Design Memorandum and Appendices B-E - Vol 1

1992 Savannah Harbor Deepening - Design Memorandum Appendices F through I - Vol 2

1992 Savannah Harbor Comprehensive Study Main Report

1975 Feasibility Report