FINAL

Coal Combustion Residue Impoundment
Round 9 - Dam Assessment Report

Urquhart Generating Station

Ash Ponds
South Carolina Electric & Gas
Beech Island, South Carolina

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

Under Contract Number: EP-09W001727
November 2011

INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion residue from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008, which flooded more than 300 acres of land and damaged homes and property, is a wake-up call for diligence on coal combustion residue disposal units. A first step toward this goal is to assess the stability and functionality of the ash impoundments and other units, then quickly take any needed corrective measures.

This assessment of the stability and functionality of the Urquhart Generating Station is based on a review of available documents and on the site assessment conducted by Dewberry personnel on February 16, 2011. We found the supporting technical documentation adequate (Section 1.1.3). As detailed in Section 1.2.1, there are two recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Urquhart Generating Station Ash Pond is **SATISFACTORY** for continued safe and reliable operation, with no recognized existing or potential management unity safety deficiencies.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is investigating the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety).

In early 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age and the amount of material placed in the units (See Appendix C).

The purpose of this report is **to evaluate the condition and potential of residue release from management units**. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. Also, after the field visit, additional information was received by Dewberry & Davis LLC about the Urquhart ash ponds that was reviewed and used in preparation of this report.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

Note: The terms "embankment", "berm", "dike" and "dam" are used interchangeably within this report, as are the terms "pond", "basin", and "impoundment".

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

FINAL

Table of Contents

APPENDIX A

Doc 01:	Site Plan
Doc 02:	Water Balance Diagram
Doc 03:	Pond Volumes
Doc 04:	EPA Questionnaire
Doc 05:	F&ME Structural Stability Report
Doc 06:	Dike Landfill Pond Inspections 2009
Doc 07:	Dike Landfill Pond Inspections 2008
Doc 08:	Dike Landfill Pond Inspections 2007
Doc 09:	Dike Landfill Pond Inspections 2006
Doc 10:	Dike Landfill Pond Inspections 2005

APPENDIX B

Doc 11:	Dam Inspection Check List Form

1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit, February 16, 2011, and review of technical documentation provided by South Carolina Electric & Gas (SCE&G).

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

The dike embankments and spillway appear to be structurally sound based on a review of the engineering data provided by the owner's technical staff and Dewberry engineers' observations during the site visit.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

Adequate capacity & freeboard exists to safely pass the design storm.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is adequate. Engineering documentation reviewed is referenced in Appendix A.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management unit provided by the owner was an accurate representation of what Dewberry observed in the field.

1.1.5 Conclusions Regarding the Field Observations

The overall assessment of the ash pond embankment system was that it was in satisfactory condition. Surficial sloughing was observed along the Ash Pond's downstream slope. Embankments appear structurally sound.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operation appear to be adequate for the fly ash management unit. There was no evidence of significant embankment repairs or prior releases observed during the field inspection. Vegetation removal is required on the downstream slope.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The Ash Pond is SATISFACTORY for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Maintenance and Methods of Operation

An action plan should be developed to address removal of woody vegetation along the downstream slope. Specifically, SCE&G needs to:

- Remove brush from the downstream slope
- Address minor rutting along crest and avoid vehicular traffic along crest

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Tim Miller, South Carolina Electric & Gas (SCE&G)
Dave Jerome, South Carolina Electric & Gas (SCE&G)
Toi Bowie, South Carolina Electric & Gas (SCE&G)
Tom Effinger, SCANA
Jean-Claude Younan, SCANA
Frederic Shmurak, Dewberry & Davis, Inc.
Justin Story, Dewberry & Davis, Inc

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on February 16, 2011.

Frederic M Shmurak

Frederic Shmurak, P.E.

NO. 19956
FREDERIC M. SHMURAK

Justin Story

Justin Story, E.I., LEED AP BD+C

2.0 DESCRIPTION OF THE COAL COMBUSTION RESIDUE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The Urquhart Generating Station and ash pond are located in Beech Island, South Carolina just off the Savannah River. The town of Jackson is approximately 7 miles downstream of the ash ponds. Figure 2.1a depicts a vicinity map around the Urquhart Generating Station while Figure 2.1b depicts an aerial view of the Urquhart Generating Station.

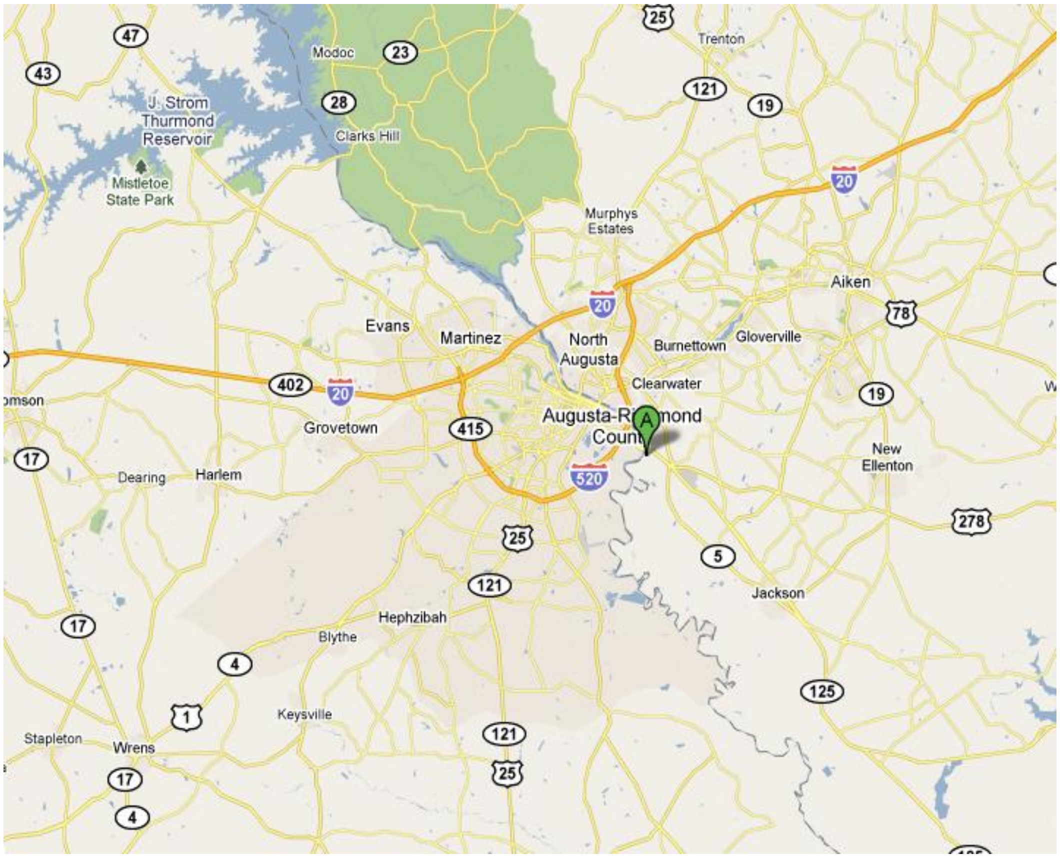


Figure 2.1a: Urquhart Generating Station Vicinity Map

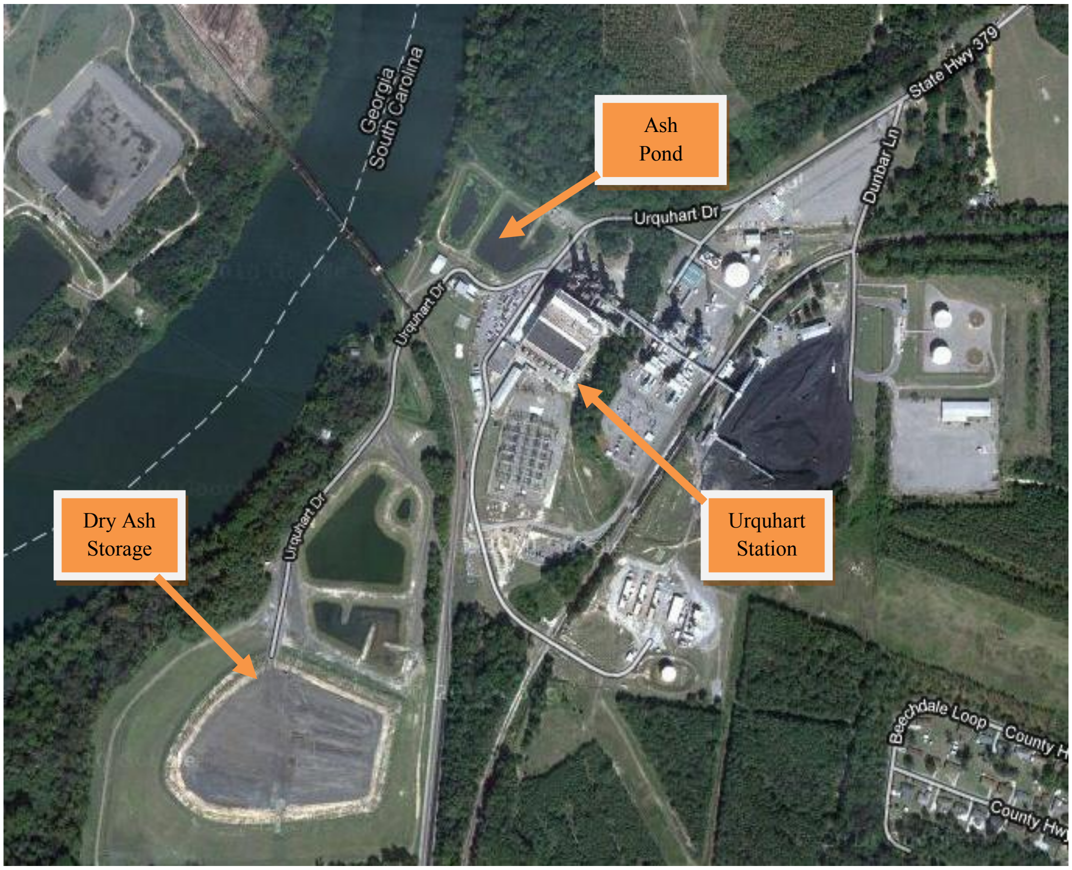


Figure 2.1b: Urquhart Generating Station Aerial View

Table 2.1: Summary of Dam Dimensions and Size

	Urquhart Ash Pond
Dam Height (ft)	Upper Pool 8’; Lower Pool 14’
Crest Width (ft)	12
Length (ft)	1,450
Side Slopes (upstream) H:V	2:1
Side Slopes (downstream) H:V	2:1

Appendix A: Doc 01 – Site Plan

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is collected at the base of the stack by an electrostatic precipitator. The collected ash is stored in hoppers and conveyed pneumatically to a silo. From the silo it is mostly sold for beneficial use. What is not sold is hauled via truck to a permitted dumping site. The plant does not discharge into the ash pond.

Hopper discharge where trucks can load ash material

2.2.2 Bottom Ash

Bottom ash is collected from the furnace and is conveyed hydraulically through a pipe to a dewatering bin. From the dewatering bin it is trucked to a permitted landfill. The transport water overflows from the dewatering bin to the ash pond. A small amount of bottom ash fines may carry over into the ash pond, but this has not been confirmed or quantified.

2.2.3 Boiler Slag

Boiler slag is collected from the boiler and is sluiced into the same pipe that conveys bottom ash into the dewatering bin.

2.2.4 Flue Gas Desulfurization Sludge

No Scrubbers are used in this plant so there is no flue gas desulfurization (FGD) process or related waste products to be discharged.

2.3 SIZE AND HAZARD CLASSIFICATION

The ash pond is partly impounded by an earthen embankment system consisting of a dike configuration and partly incised into natural grade. There is one ash pond for the plant separated into two pools (upper and lower) by an internal dike. Reference Table 2.1 for dam height, crest width, length and side slopes. The current storage volume at the normal pool elevation is 30,810 CY for the ash pond based on a SCE&G Pond Volume map provided (Appendix A: Doc 03 – Pond Volumes).

Table 2.3a: USACE ER 1110-2-106
Size Classification

	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

A Hazard Classification has not been assigned by a regulatory agency, but based on observations, a classification of **Low** appears to be appropriate. Per the Federal Guidelines for Dam Safety dated April 2004, a Low Hazard Potential classification applies to those dams where failure or misoperation results in no probable loss of human life and/or environmental losses. Losses are principally limited to the owner's property.

Table 2.3b: FEMA Federal Guidelines for Dam Safety
Hazard Classification

	Loss of Human Life	**Economic, Environmental, Lifeline Losses**
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

2.4 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

The ash pond contains fly ash, bottom ash, pyrites and boiler slag. The drainage area is essentially the surface area of the ponds.

Table 2.4: Maximum Capacity of Unit

Urquhart Ash Pond	
Surface Area (acre)	2.2
Current Storage Capacity (cubic yards)	29,500-30,810
Current Storage Capacity (acre-feet)	18 - 19
Total Storage Capacity (cubic yards)	Not Provided
Total Storage Capacity (acre-feet)	Not Provided
Crest Elevation (feet)	142.8
Normal Pond Level (feet)	Upper Pool 135.8/Lower Pool 134.6

Appendix A: Doc 04 – EPA Questionnaire

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The ash pond system is located in the flood plain. It contains the following from top to bottom:

- Fill placed circa 1977 for the ponds;
- Fill Placed in the Flood Plain during the original plant construction Circa 1953;
- Naturally occurring Flood Plain Sediment.

It was determined by F&ME Consultants that all fill material used is naturally occurring river and Coastal Plain Sediments from the immediate plant site and there was no evidence of ash material used in the construction of the ponds. (Appendix A: Doc 05 – Subsurface Investigation and Structural Stability Report).

2.5.2 Outlet Structures

The pond has a riser with 18” reinforced concrete pipe (RCP) that discharges into the Savannah River.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

All critical structures were attempted to be located by using aerial photography which might not accurately represent what currently exists down-gradient of the site. No critical infrastructure was found to be downstream of the site.

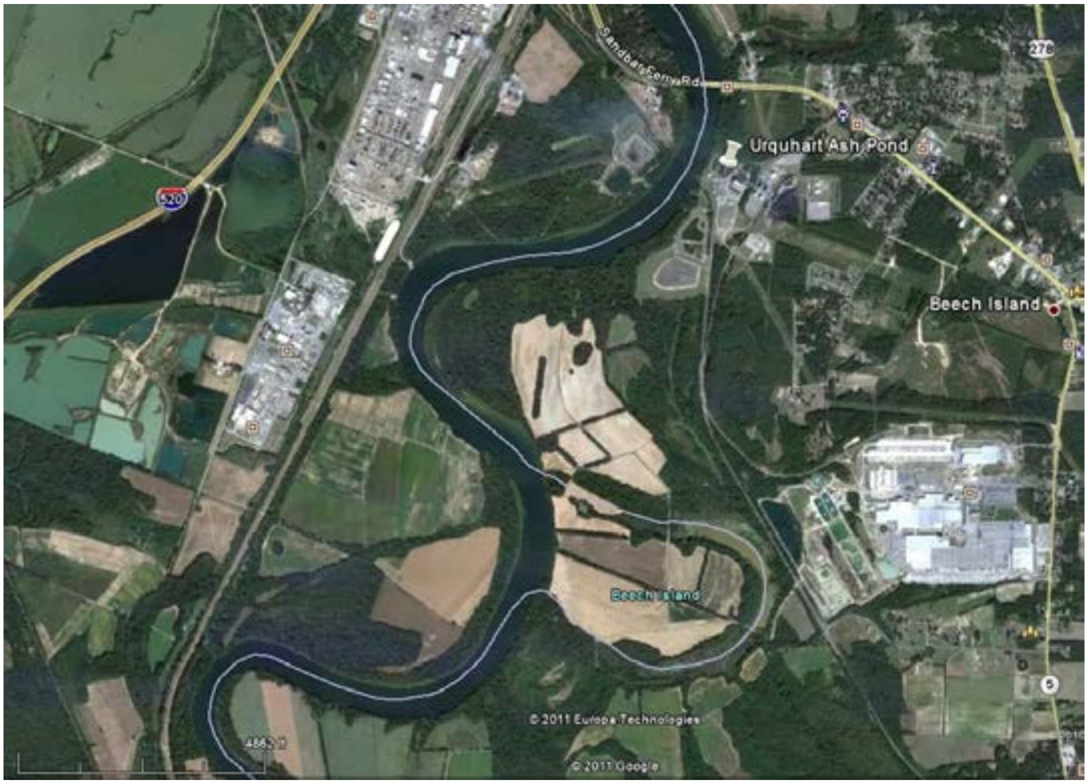


Figure 2.6: Critical Infrastructure Map

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

Summary of Reports on the Safety of the Management Unit

2010 Annual Ash Pond Dike Inspection, Urquhart Station. (Appendix A: Doc 06 – 2010 Urquhart Annual Inspection). Comments from the 2010 report include:

- Minor surface erosion is present on some areas along the berm and needs to have 4 inches of top soil placed and be re-seeded;
- Any new woody vegetation along upstream face of ash pond should be removed;
- Routine maintenance such as grass mowing, fertilizing, applying herbicide to rip rap armored banks and regularly scheduled quarterly visual inspections and an annual inspection should continue;
- Develop an Emergency Action Plan (EAP) for the ash pond.

2009 Ash Pond Dike Inspections, Urquhart Station. (Appendix A: Doc 07 – Dike Landfill Pond Inspections 2009). Comments from the 2009 reports include:

- The January 8, 2009 inspection concluded that no problems were encountered during the inspection and that erosion areas are currently being worked on;
- The April 4, 2009 inspection concluded that erosion areas need to be corrected due to recent rain events;
- The remaining inspections dated July 6, 2009, October 6, 2009, and September 29, 2009 had no comments.

Additional inspection reports can be found in Appendix A: Doc 08-11.

3.1 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

Discharge from the impoundment is regulated by the South Carolina Department of Health and Environmental Control (SCDHEC) and the impoundment has been issued a National Pollutant Discharge Elimination System Permit (Permit No. SC0000574 was issued October 22, 2003).

3.2 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry did not indicate any spills, unpermitted releases, or other performance related problems with the dam over the last 10 years.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The plant began operation in 1953 and, based on documentation from the slope stability analysis report, portions of the embankments were constructed around that time frame. In 1977 additional fill was placed for construction of the ponds. (Appendix A: Doc 05 – Subsurface Investigation and Structural Stability Report). Very limited information was provided for the original construction of the ash pond.

4.1.2 Significant Changes/Modifications in Design since Original Construction

In 1977 additional fill was placed for construction of the ash ponds. No additional information was provided.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No documentation of significant repairs/rehabilitation since the original construction was provided.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The ash pond was designed and operated for reservoir sedimentation and sediment storage of ash. Coal combustion residue and stormwater runoff from around the ash pond facility are discharged into the reservoir. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff are discharged through an unregulated type overflow outlet structure. The ponds are not used for permanent storage and are periodically dredged to remove ash material.

4.2.2 Significant Changes in Operational Procedures and Original Startup

No documentation was provided describing any significant changes in Operating Procedures.

4.2.3 Current Operational Procedures

To the best of our knowledge, original operational procedures for bottom ash handling are in effect. The fly ash system was modified in 2010 to eliminate carryover of fly ash into the ash pond from the transport system. Bottom ash and fly ash are now being disposed in an offsite permitted commercial landfill.

4.2.4 Other Notable Events since Original Startup

No additional information as provided.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Frederic Shmurak, P.E. and Justin Story, E.I., LEED AP BD+C performed a site visit on Wednesday, February 16, 2011 in company with the participants.

The site visit began at 10:00 AM. The weather was cloudy and cool. Photographs were taken of conditions observed. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit. The Dam Inspection Checklist in Appendix B has additional site data.

The overall assessment of the dam was that it was in satisfactory condition and no significant findings were noted.

5.2 URQUHART ASH POND

5.2.1 Crest

The crest had no signs of depressions, tension cracking, or other indications of settlement or shear failure, and appeared to be in satisfactory condition. Minor rutting was observed along portions of the crest (See Photo 5-1.).

Photo 5-1. Rutting along crest

5.2.2 Upstream/Inside Slope

The upstream slopes are mostly vegetated with tall grasses and other wetland vegetation. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed (See Photo 5-2.).

Photo 5-2. Overall view of interior of ash pond

5.2.3 Downstream/Outside Slope and Toe

No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed. Brush was observed along the southeastern section of the downstream slope (See Photo 5-3.).

Photo 5-3. Brush along southeastern downstream slope

5.2.4 Abutments and Groin Areas

The ash pond embankment consists of a dike system completely surrounding the pond; therefore the earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features.

5.3 OUTLET STRUCTURES

5.3.1 Overflow Structure

The outlet structures for the ash pond were properly discharging flow from the pond and visually appeared to be in good condition.

5.3.2 Outlet Conduit

The visual portion of the outlet conduit was functioning properly with no apparent deterioration.

5.3.3 Emergency Spillway

No emergency spillway is present.

5.3.4 Low Level Outlet

No low level outlet is present.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the flood of record.

6.1.2 Inflow Design Flood

According to FEMA Federal Guidelines for Dam Safety, the current practice in the design of dams is to use the Inflow Design Flood (IDF) that is deemed appropriate for the hazard potential of the dam and reservoir, and to design spillways and outlet works that are capable of safely accommodating the floodflow without risking the loss of the dam or endangering areas downstream from the dam to flows greater than the inflow. The recommended IDF or spillway design flood for a low hazard, small-sized structure (See section 2.2), in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria, is the 50-year to 100-year flood (See Table 6.1.2).

Table 6.1.2: USACE Hydrologic Evaluation Guidelines Recommended Spillway Design floods

Hazard	Size	Spillway Design Flood
Low	Small	50 to 100-yr frequency
	Intermediate	100-yr to ½ PMF
	Large	½ PMF to PMF
Significant	Small	100-yr to ½ PMF
	Intermediate	½ PMF to PMF
	Large	PMF
High	Small	½ PMF to PMF
	Intermediate	PMF
	Large	PMF

The Probable Maximum Precipitation (PMP) is defined by American Meteorological Society as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. The National Weather Service (NWS) further states that in consideration of our limited knowledge of the complicated processes and interrelationships in storms, PMP values are identified as estimates. The NWS has published application procedures that can be used with PMP estimates to develop spatial and temporal characteristics of a Probable Maximum Storm (PMS). A PMS thus developed can be used with a precipitation-runoff simulation model to calculate a probable maximum flood (PMF) hydrograph.

The 24-hour, 10-square mile PMP depth is 43 inches. Since the facility has a contributing drainage area equal to the surface area of the impoundment, it is anticipated adequate freeboard exists so the facility would not experience significant flood states. The freeboard of the Active Ash Pond is 98 inches, so adequate freeboard exists to safely pass the design storm.

6.1.3 Spillway Rating

No spillway rating was provided. The ash pond is a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore the impounded pool would not be anticipated to experience significant changes in elevation. The outlet structure type is unregulated and, given little change in the normal pool elevation, the resulting discharge rate is expected to be relatively constant.

6.1.4 Downstream Flood Analysis

No downstream flood analysis was provided.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry is adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Adequate capacity and freeboard exists to safely pass the design storm.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

A stability analysis report for the ash pond dated March 16, 2011, by F&ME Consultants provides information on the stability analysis results and is presented in Section 7.1.4 Factors of Safety and Base Stresses. Steady state (normal) and seismic loading conditions were analyzed. See Appendix A - Doc 05: Subsurface Investigation and Structural Stability Report, for the complete report.

7.1.2 Design Parameters and Dam Materials

A report for the ash pond was prepared by F&ME Consultants, Inc. in 2011. The report includes documentation of the shear strength design properties for the ash pond embankments. Five (5) sections of the embankments were analyzed and only one of the most critical sections, which is adjacent to the Savannah River, is shown in this report (See Figure 7.1.2). For the complete documentation see Appendix A - Doc 05: Subsurface Investigation and Structural Stability Report.

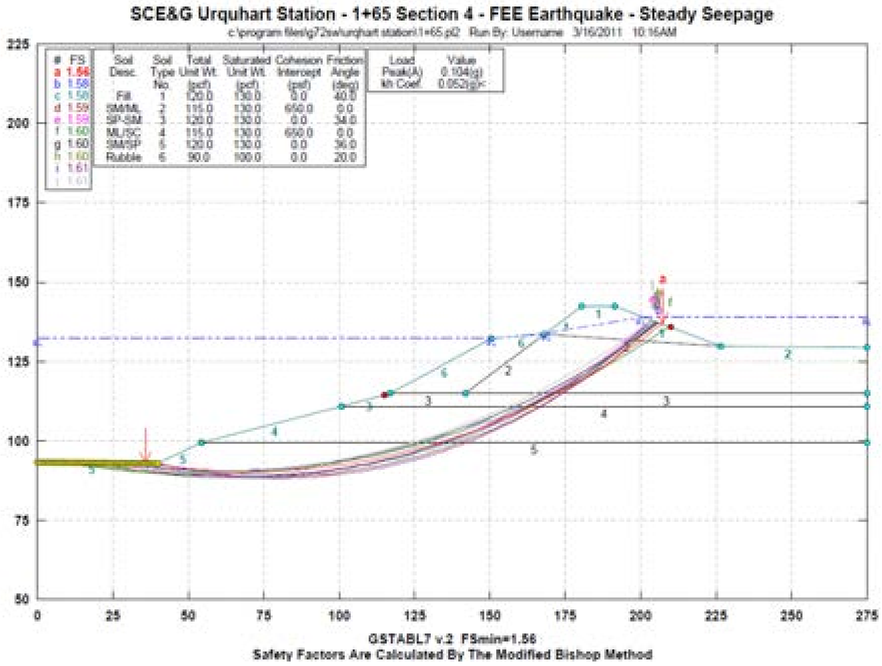


Figure 7.1.2

It should be noted that no portion of the embankment is built over wet ash, slag, or other unsuitable materials.

7.1.3 Uplift and/or Phreatic Surface Assumptions

Monitoring instrumentation devices have not been installed to verify water levels within the embankment. The assumed phreatic surfaces are shown on the figures in section 7.1.2 above and the depiction seems appropriate for these types of structures. No additional information was provided. The water level of the upstream interior pond was stated to be 135.8’ and downstream interior pond to be 134.6’. These elevations were not verified.

7.1.4 Factors of Safety and Base Stresses

Table 7.1.4 Factors of Safety for the Five Analyzed Sections of the Ash Pond (Appendix A: Doc 05 – Subsurface Investigation and Structural Stability Report)

Loading Condition	Location	Performance Criteria	Factor of Safety
Max. Storage Pool-Steady Seepage	Per Stability Report – Section 4 Adjacent to Savannah River	1.5	1.99
Liquefaction-Steady Seepage		>1.0	1.26
FEE Earthquake-Steady Seepage		>1.0	1.56
SEE Earthquake-Steady Seepage		>1.0	1.14

7.1.5 Liquefaction Potential

In the report by F&ME Consultants it was determined that during a seismic event, liquefaction of the foundation soils could occur. The maximum liquefaction induced settlement was estimated to be about five inches. The settlement would be expected over a broad area of the ash pond perimeter and would not be anticipated to create instability of the perimeter containment system. (Appendix A: Doc 05 - Subsurface Investigation and Structural Stability Report)

7.1.6 Critical Geological Conditions

The project site is located on the East side of the Savannah River in Beech Island, Aiken County, South Carolina and is situated within the Upper Coastal Plain of the Physiographic Province near the Fall Line (which lies to the North of the site).

Based on USGS Seismic-Hazard Maps for the Conterminous United States, the facility is located in an area anticipated to experience a 0.12 g acceleration with a 2-percent probability of exceedance in 50 years.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall the structural stability of the dam appears to be satisfactory.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The ash pond was designed and operated for reservoir sedimentation and sediment storage of ash. However, since the fly ash system was modified in 2010, only minor amounts of coal combustion residual and minimal stormwater runoff around the ash pond facility are discharged into the reservoir. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff are discharged through an unregulated type overflow outlet structure. The ponds are not used for permanent storage and are periodically dredged to remove ash material.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

The maintenance of the dam and project facilities is adequate, although the following items need to be addressed:

- Address minor rutting along crest
- Remove brush along downstream slope of southeastern embankment

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on the assessments of this report, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Based on the assessments of this report, maintenance procedures appear to be adequate.

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Quarterly/Annual Inspections:

Quarterly/Annual inspections were provided by SCE&G/SCANA and can be found in Appendix A: Doc 06 - 10.

9.2 INSTRUMENTATION MONITORING

The Urquhart Plan impoundment dikes do not have an instrumentation monitoring system.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is adequate.

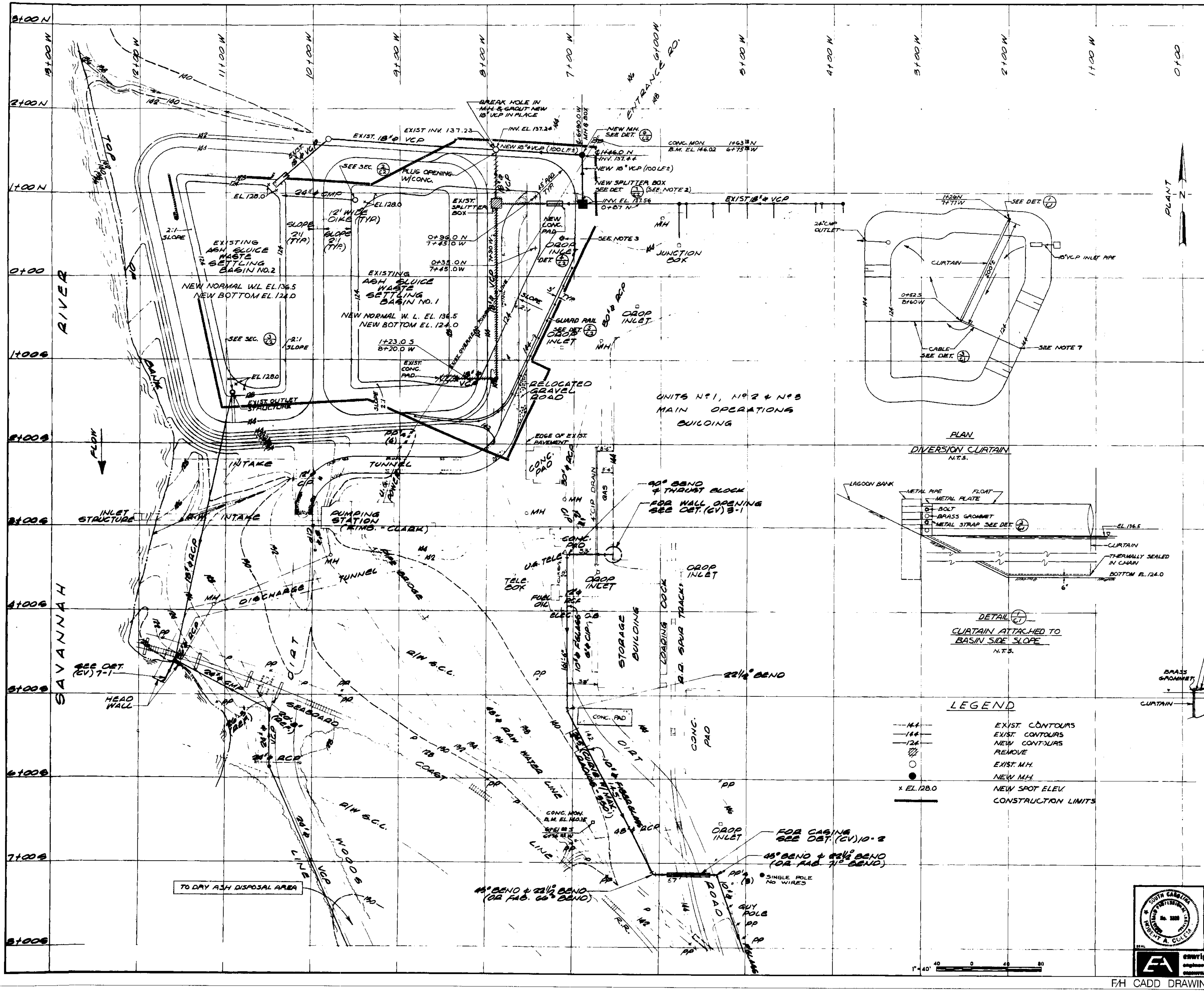
9.3.2 Adequacy of Instrumentation Monitoring Program

No instrumentation is needed for the Urquhart ash pond.

APPENDIX A

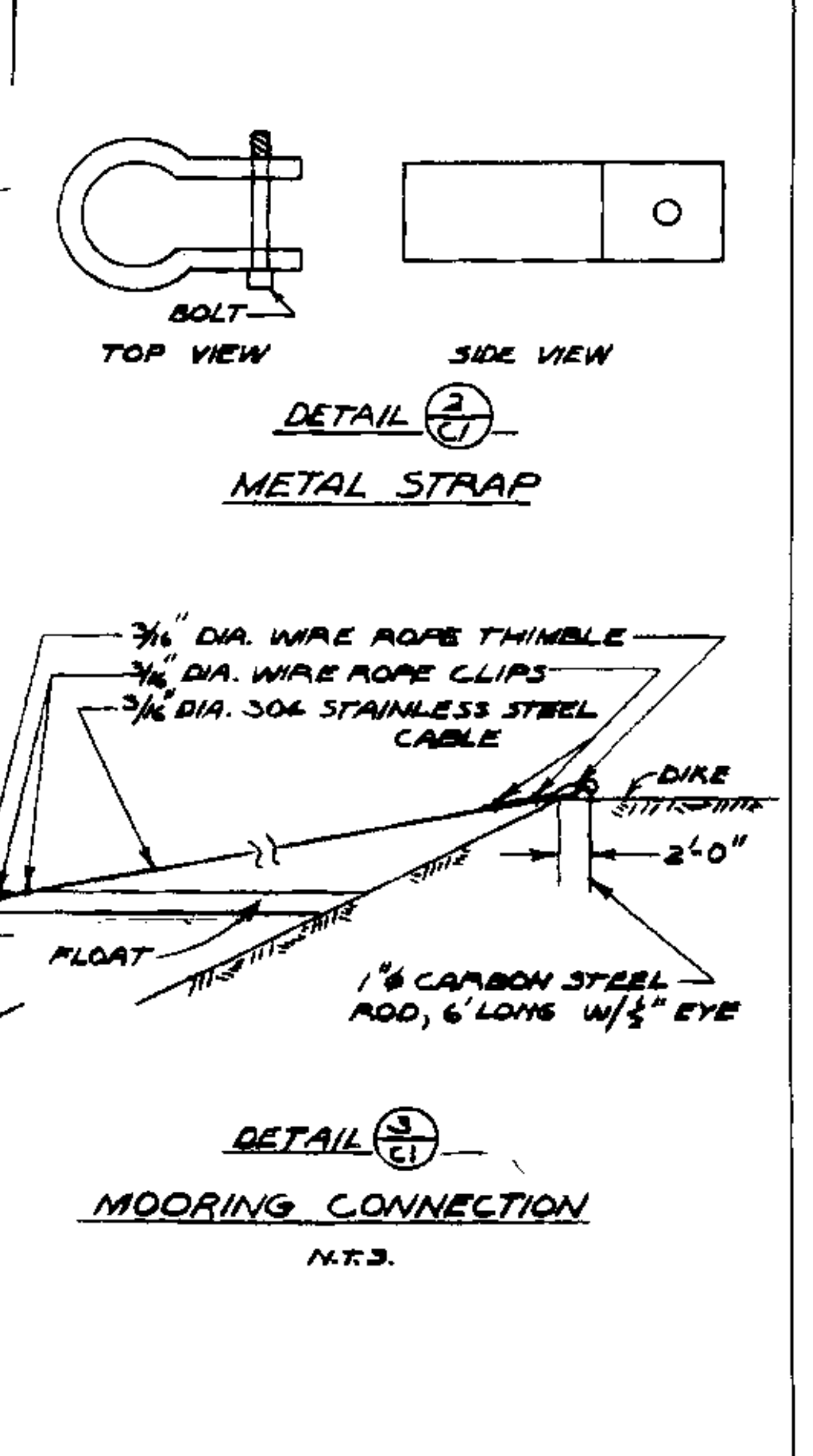
Document 1

Site Plan



LEGEND

144	EXIST. CONTOURS
144	EXIST. CONTOURS
124	NEW CONTOURS
▨	REMOVE
○	EXIST. M.H.
●	NEW M.H.
x EL. 128.0	NEW SPOT ELEV.
▬	CONSTRUCTION LIMITS



NOTES:

1. The contractor shall excavate the basins according to the method selected by South Carolina Electric and Gas Co.
2. The contractor is to construct new splitter box, new 18" VCP, New MH, and make new tie-in to existing MH.
3. The contractor is to remove drop inlet and pipe which are in the excavation area of Basin No.1. Plug opening of remaining pipe with concrete.
4. Existing ash sluice waste settling Basins No.1 and No.2 have a present normal water level El. of 135.5± and a bottom El. of 128±.
5. Waste material from the ash sluice waste settling basins shall be disposed of in the dry ash disposal area or as directed by the owner.
6. Diversion curtain to be BIO-SEPARATOR CURTAIN. The curtain shall be supplied and installed by South Carolina Electric and Gas Co.
7. All mooring connection hardware for the diversion curtain shall be type 304 stainless steel.
8. Slide gates to be salvaged from existing splitter box in Basin No.1 and relocated as shown in details on Dwg. 78056(C)2.
9. Grid coordinates and elevations are tied to the plant grid system and bench mark elevations as shown on this drawing.
10. The contractor is to coordinate all phases of construction concerning procedure and timing of work with the plant superintendent.

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ROBERT A. COLETA
No. 3320

SITE PLAN

URQUHART STATION

SOUTH CAROLINA ELECTRIC & GAS CO.
AIKEN COUNTY, S.C.

enwright associates, inc.
engineers planners surveyors
greenville, south carolina

DRAWN	DESIGN	CHECK	FILE	RETIRED
BCF	PDK	TG	25	
DATE	SCALE	DWG. NO.		
11/29/78	1"=40'	78056(C)1		

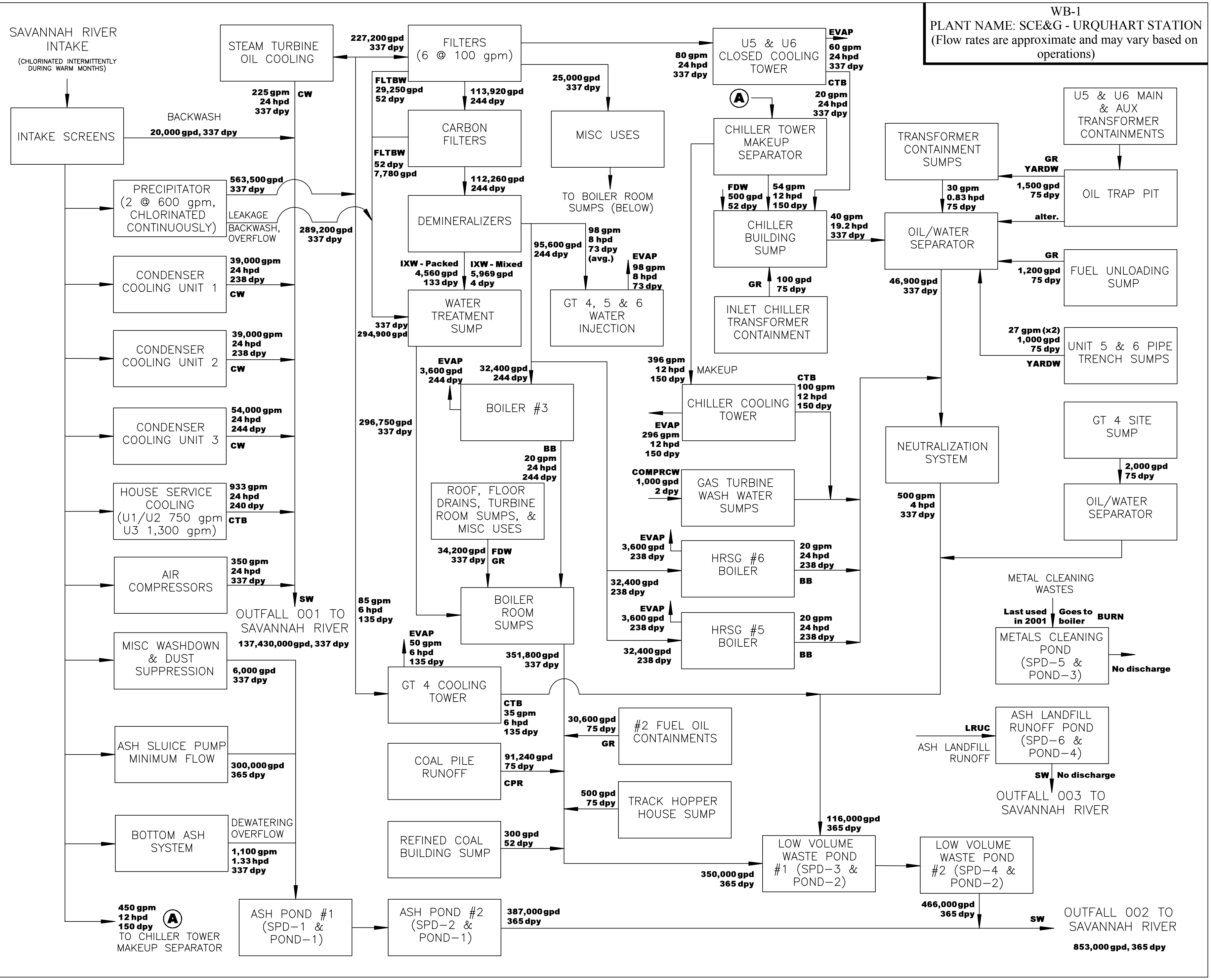
F/H CADD DRAWING DO NOT REVISE MANUALLY

APPENDIX A

Document 2

Water Balance Diagram

WB-1
PLANT NAME: SCE&G - URQUHART STATION
(Flow rates are approximate and may vary based on operations)



E2S ENVIRONMENTAL ENGINEERING SCIENCES, LLC

CAROLINA CERTIFICATE OF AUTHORIZATION
E2S ENVIRONMENTAL ENGINEERING SCIENCES, LLC No. 3535

REVISIONS		
No.	By:	Date:

Issued for:	By:	Date:
Review		
X Permitting	JKD	5-20-11
Bidding		
Construction		
As Built		

SCE&G A SCANA COMPANY

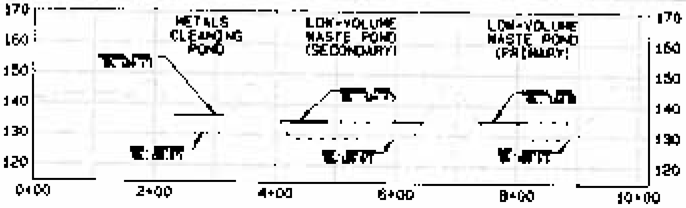
SOUTH CAROLINA ELECTRIC & GAS CO.
URQUHART STATION
WATER BALANCE DIAGRAM

WB-1

APPENDIX A

Document 3

Pond Volumes



LOW VOLUME WASTE POND (PRIMARY)
VOLUME @ NORMAL POOL: 10,650 CY
VOLUME ABOVE WASTE: 7,074 CY*
VOLUME OF WASTE: 3,576 CY

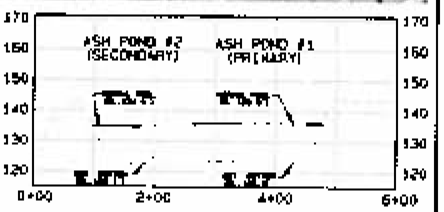
LOW-VOLUME WASTE POND (SECONDARY)
VOLUME @ NORMAL POOL: 20,775 CY
VOLUME ABOVE WASTE: 16,444 CY*
VOLUME OF WASTE: 4,331 CY

METAL CLEANING POND
VOLUME @ NORMAL POOL: 732 CY
VOLUME ABOVE WASTE: 296 CY*
VOLUME OF WASTE: 436CY

ASH POND #1 (PRIMARY)
VOLUME @ NORMAL POOL: 18,470 CY
VOLUME ABOVE WASTE: 12,480 CY*
VOLUME OF WASTE: 5,990 CY

ASH POND #2 (SECONDARY)
VOLUME @ NORMAL POOL: 12,340 CY
VOLUME ABOVE WASTE: 3,888 CY*
VOLUME OF WASTE: 8,452 CY

* - PER BATHYMETRIC SURVEY
MARCH 2008 BY EPS



REVISION	DATE
1)	
2)	
3)	
4)	

SOUTH CAROLINA ELECTRIC AND GAS

URQUHART STATION

POND VOLUMES

JOB NUMBER

SHEET

APPENDIX A

Document 4

EPA Questionnaire

James M. Landreth
Vice President
Fossil & Hydro Operations

jlandreth@scana.com

SCE&G®
A SCANA COMPANY

August 4, 2009

Mr. Richard Kinch
US Environmental Protection Agency (5306P)
Two Potomac Yard
2733 S. Crystal Drive
5th Floor; N-5738
Washington, DC 20460

Dear Mr. Kinch:

This document is prepared in response to the letter from Mr. Barry N. Breen to Plant Manager, Urquhart Generating Station, 100 Urquhart Drive, Beech Island, South Carolina, Re: Request for Information Under Section 104(e) of the Comprehensive Environment Response, Compensation, and Liability Act, 42 U.S.C. 9604(e).

Please find attached my signed certifying document and responses to questions set forth.

Sincerely,

James M. Landreth

Enclosure

CC: Mr. Stephen A. Byrne, Sr. Vice President Generation, Nuclear & Fossil Hydro
Plant Manager, Urquhart Generating Station

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature:
Name: James M. Lambeth
Title: VP

This request has been reviewed and approved by the Office of Management and Budget pursuant to the Paperwork Reduction Act, 44 U.S.C., 3501-3520.

Please send your reply to:

Mr. Richard Kinch
US Environmental Protection Agency (5306P)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

If you are using overnight or hand delivery mail, please use the following address:

Mr. Richard Kinch
US Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Dr.
5th Floor; N-5738
Arlington, VA 22202 2733

1. ***Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than. Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.***

The Urquhart Station ponds do not have a rating. Dams and reservoirs in South Carolina are regulated under the provisions of the SC Dams and Reservoirs Safety Act. In part, Rule 72-2.D of the SC Dams and Reservoirs Safety Act regulations states the following types of dams are exempt from the Dams and Reservoirs Safety Act:

> "1. Unless the hazard potential as determined by the Department is such that dam failure or improper reservoir operation may cause loss of human life, any dam which is or shall be (a) less than twenty-five feet in height from the natural bed of the stream or water course measured at the downstream toe of the dam, or twenty-five feet from the lowest elevation of the outside limit of the dam, if it is not across a stream channel or water course, to the maximum water storage elevation and (b) has or shall have an impounding capacity at maximum water storage elevation of less than fifty acre-feet."

Ash Pond 1 and Ash Pond 2 have approximate maximum heights of 8 and 14 feet, respectively, and have storage impounding capacities of less than fifty acre-feet each. Therefore, the ponds are exempt from the Act per Rule 72-2.D.1 and no ratings have been assigned.

2. ***What year was each management unit commissioned and expanded?***

Ash Pond 1 and Ash Pond 2 were commissioned in 1977 and have received waste to the present.

The description for management units for coal combustion residuals/by-products offered in the USEPA March 9, 2009 letter is widely encompassing and could be broadly interpreted to include the following other ponds/basins at the Urquhart Steam Power Station:

- Metals Pond
- The Low Volume Waste Pond
- Ash Landfill Runoff Basin
- Low Volume Waste Polishing Pond
- Stormwater Runoff Pond

The above ponds/basins are primarily used for wastewater treatment purposes and are not designated as landfills/impoundments for the storage or disposal of coal combustion byproducts. SCE&G therefore believes that these ponds/basins are not consistent with the intentions of EPA's Request for Information and we have limited our responses to Urquhart Station's Ash Pond 1 and Ash Pond 2.

3. ***What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (I) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).***

Ash Ponds 1 and 2 contain fly ash, bottom ash, pyrites, and boiler slag.

4. ***Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?***

Ash Ponds 1 and 2 were designed by a Professional Engineer. The role of a Professional Engineer in the supervision of the pond construction cannot be verified.

Routine, scheduled inspections and monitoring of the ash ponds are not performed under the supervision of a Professional Engineer. Currently, SCE&G performs assessments/evaluations of the dike structure for both ash ponds as part of the NPDES permit on a quarterly basis. The results are internally documented. The annual inspection reports are not submitted to DHEC unless a finding is identified or a corrective action plan is required. A daily visual inspection is performed to look for signs of cracking, settling, slope movement, erosion and vegetative growth. If any follow up action is required, a Work Order is written and the items completed and closed out in a timely manner. All follow up actions to date have been for minor maintenance.

5. ***When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?***

SCE&G is not aware of any previous assessments/evaluations of the structural integrity of the Ash Ponds.

6. ***When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.***

SCE&G is not aware of past inspections by State or Federal officials for the purpose of evaluating the safety (structural integrity) of the Ash Ponds. SCE&G is not aware of any planned State or Federal inspections in the future.

The South Carolina Department of Health and Environmental Control (SCDHEC) periodically inspect the ash ponds. However, these inspections are generally for NPDES permit compliance purposes and do not involve evaluations of the structural integrity of the ponds.

7. ***Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.***

No.

8. ***What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.***

Ash Ponds 1 and 2 are not used for the permanent storage of ash, and are periodically dredged (approximately once every 12 to 18 months) to remove a variable quantity of the accumulated ash waste materials.

Ash Pond 1 has a surface area of approximately 1.4 acres and a total maximum calculated storage capacity of approximately 18,000 cubic yards. When dredged, the volume of materials removed from Ash Pond 1 is estimated to be about 5,000-6,000 cubic yards.

Ash Pond 2 has a surface area of approximately 0.8 acres and a total maximum estimated storage capacity of approximately 11,500 cubic yards. When dredged, the volume of materials removed from Ash Pond 2 is estimated to be about 1,000 cubic yards.

The maximum heights of Ash Ponds 1 and 2 are approximately 8 and 14 feet, respectively.

9. ***Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).***

Upon information and belief, there have not been any spills or unpermitted releases from the Ash Ponds within the last ten years.

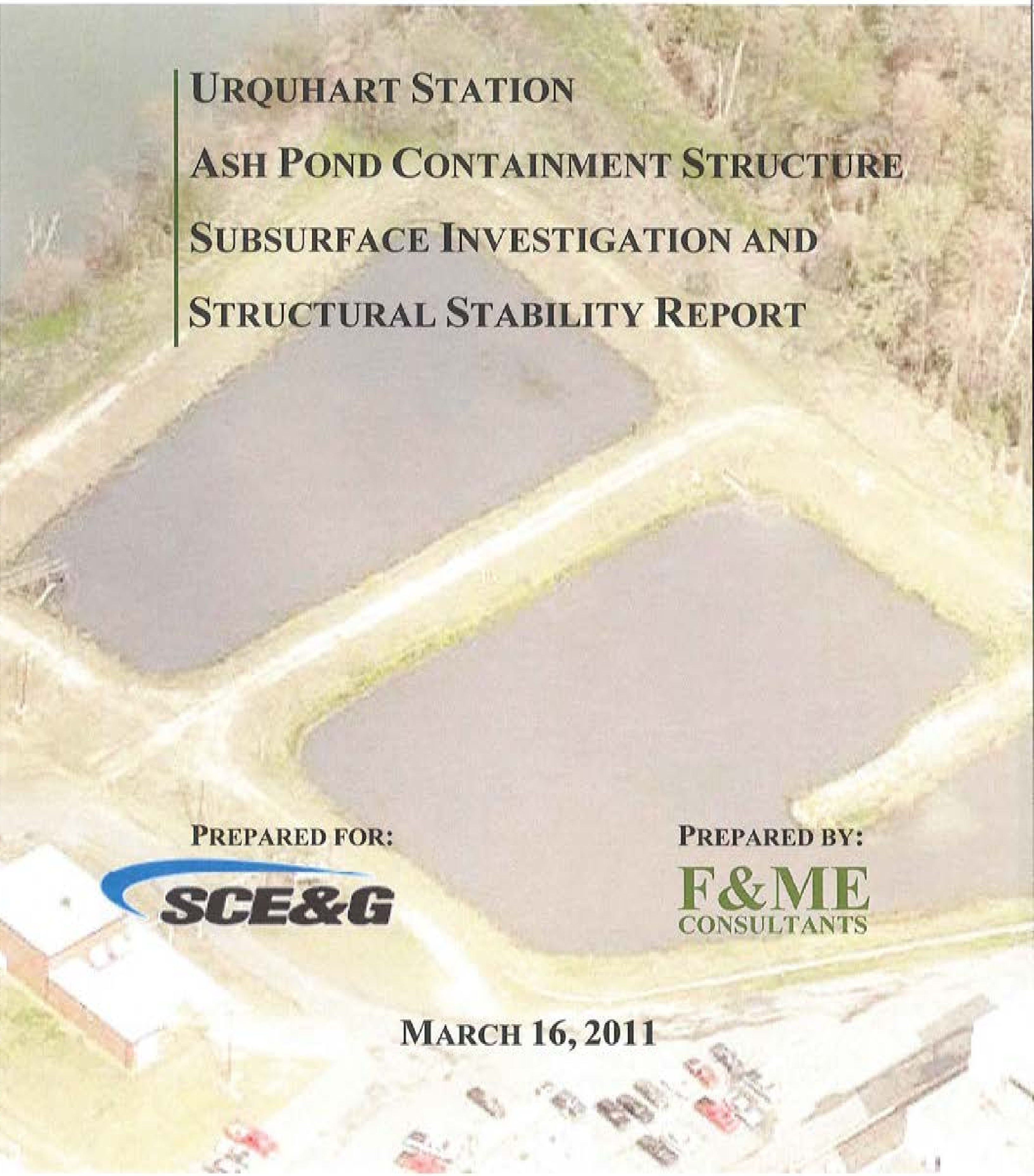
10. ***Please identify all current legal owner(s) and operator(s) at the facility.***

The Urquhart Steam Power Station facility to include the subject Ash Ponds is legally owned and operated by South Carolina Electric & Gas.

APPENDIX A

Document 5

F&ME Structural Stability Report



URQUHART STATION
ASH POND CONTAINMENT STRUCTURE SUBSURFACE INVESTIGATION AND STRUCTURAL STABILITY REPORT

PREPARED FOR:

SCE&G

PREPARED BY:

F&ME
CONSULTANTS

MARCH 16, 2011

F&ME
CONSULTANTS

GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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3112 Devine Street
Columbia, SC 29205
ph (803) 254-4540
fx (803) 254-4542

MYRTLE BEACH OFFICE
1903 Legion Street
Myrtle Beach, SC 29577
ph (843) 626-9253
fx (843) 448-0681

March 16, 2011

Mr. Tim Miller, P.E.
South Carolina Electrical & Gas Company
220 Operations Way
Cayce, South Carolina 29033

Re: Urquhart Station
Ash Pond Containment Structure
Subsurface Investigation and Structural Stability Report

Dear Mr. Miller:

Enclosed herein is a report of our Subsurface Investigation and Structural Stability Analysis. If you have any questions concerning any aspect of our investigation or report, please do not hesitate to contact me or Mr. Mike Miller, our Senior Project Engineer for this investigation.

Respectfully submitted,

Zane W. Abernethy, P.E.
President

AASHTO R18

AASHTO ACCREDITED LABORATORY

www.fmecol.com

EXECUTIVE SUMMARY

A Structural Stability Analysis has been completed for the perimeter containment system of the currently active Ash Ponds at the Urquhart Generating Station located on the Savannah River in Beech Island, South Carolina. The following is a summary of the findings and conclusions of our Site Subsurface Investigation and Structural Stability Analysis.

1. The subsurface lithology of the soil stratigraphic units indentified in our subsurface investigation is complex. The Urquhart Generating Station is situated in the Upper Coastal Plain Physographic Province adjoining the Savannah River. The plant is situated on the Bluff and the Ash Ponds under study are located partially on the Bluff and partially in the Flood Plain of the Savannah River. The portion of the Ash Pond system located in the Bluff is insized. The portion of the Ash Pond system located in the Flood Plain contains from top to bottom:
    a) Fill placed circa 1977 to form the ponds;
    b) Fill placed in the Flood Plain during the original plant construction Circa 1953; and
    c) Naturally occurring Flood Plain Sediment.
2. There is no evidence from our investigation that indicates fly ash or other coal or boiler residue was used in construction of the Ash Ponds.
3. The perimeter containment system for the Ash Ponds has been characterized into two unique segments:
    A. Segment 1: Constructed embankment, which forms the western side of Pond 2 adjoining the Savannah River and;

    B. Segment 2: The remaining perimeter of the ponds, where the ponds are constructed below original or Pre 1977 grade (incised).
4. Based upon our integration of all the data gathered during our investigations, slope stability analyses were performed on 5 “typical” cross sections.
5. Federal Energy Regulatory Commission (FERC) Dam Guidelines and The U.S. Department of Labor Mine Safety and Health Administration (MSHA) Manual for Coal Refuse Disposal Facility Manual were utilized to establish design factors of safety.
6. United States Geologic Survey Seismic Criteria were utilized to determine maximum ground acceleration for our seismic analysis.
7. We understand that there have been no historical slope stability issues within the perimeter containment system.
8. The perimeter containment system exceeds all minimum factors of safety for design static loading conditions.
9. The perimeter containment system exceeds minimum factors of safety for the assumed seismic event loading conditions.

10. During the assumed seismic event, liquefaction of the foundation soils could occur. Maximum liquefaction induced settlement will be about five inches. The settlement is expected to occur over a broad area extending beyond the pond perimeter and to be uniform in nature due to the depth of the liquefiable sediments. The magnitude of anticipated differential settlement would not create instability of the perimeter containment system.

This report has been prepared by F&ME Consultants for use by South Carolina Electric and Gas and/or their parent company, SCANA Services. The following Senior F&ME professionals assisted in the performance of fieldwork and the preparation of this report.

Signatures: Seals:

Zane W. Abernethy, P.E.
Senior Project Engineer/Author

South Carolina Registered Professional Engineer
No. 6485
Zane W. Abernethy

Michael S. Miller, P.E.
Senior Project Engineer

South Carolina Registered Professional Engineer
No. 20955
Michael S. Miller

Shafiq Rahman

M. Shafiq Rahman, P.E.
Project Engineer

South Carolina Licensed Professional Engineer
No. 28737
Muhammad Shafiqur Rahman

South Carolina Certificate of Authorization
Foundation & Materials Engineering, Inc.
No. C00375

TABLE OF CONTENTS

1.0 Introduction

Urquhart Station is a 650-megawatt coal-fired power station owned by SCE&G. The station is located on the Savannah River in Beech Island, South Carolina south of the City of Augusta, Georgia. The plant began operation in 1953. It burns approximately 40 tons of coal and 4 billion cubic feet of natural gas per hour when running at full capacity. Coal fly ash from the plant operations is currently processed in a series of two ponds located northwest of the generating facility adjoining the Savannah River. The ponds are designated as Upper Pond and Lower Pond, with Upper Pond being used for coal ash sluicing activities and Lower Pond being used as a polishing pond. Water is discharged into the River in accordance with the facilities wastewater permit.

The objective of this study is to determine the structural stability of the ponds perimeter containment system. Our study has included a "static" stability analysis which includes various loading combinations from normal operating conditions and a "seismic" stability analysis which includes dynamic earthquake induced loads.

As part of our study, F&ME has:

1. Provided a detailed topographic survey of the ponds and adjoining area. A limited bathometric survey of the two ash ponds and the adjoining Savannah River was included.
2. Performed a review of Historical Photos (pre-dating the plant construction to current) and Mapping (including a 1977 Topo and Ash Pond Design by Enwright and Associates).
3. Performed a detailed subsurface investigation to include soil test borings with standard penetration tests and cone penetrometer soundings with static cone measurements and shear wave velocity determinations.
4. Provided laboratory testing to characterize the soils for development of soil strength parameters and dynamic response parameters.
5. Characterized the ponds perimeter containment system and subsurface soil lithology.
6. Performed slope stability analysis for both static and seismic loading combinations.

2.0 Dike Configuration

The Urquhart Generating Facility is located on the Southern Bluff of the Savannah River. From the data developed in our study, it appears that the plant is situated on the Bluff and the Ash Ponds under study are located partially on the Bluff and partially in the Flood Plain of the Savannah River. The portion of the Ash Pond system located in the Bluff is insized. The portion of the Ash Pond system located in the Flood Plain contains from top to bottom:

d) Fill placed circa 1977 to form the ponds;
e) Fill placed in the Flood Plain during the original plant construction Circa 1953; and
f) Naturally occurring Flood Plain Sediment.

Our investigation indicates that all of the fill material used, both the Circa 1977 and 1953 fill, is naturally occurring river and Coastal Plain Sediments from the immediate plant site.

There was no evidence that ash materials were utilized in construction of the ponds.

3.0 Site Geology and Seismicity

The project site is located on the East side of the Savannah River in Beech Island, Aiken County, South Carolina and is situated within the Upper Coastal Plain of Physiographic Province near the Fall Line (which lies to the North of the site).

As noted in the preceding section, the Ash Ponds are situated in and on a complex subsurface stratigraphy.

South Carolina is considered the highest seismic risk area on the East Coast. The largest earthquake to occur in historical times was the Charleston Earthquake of 1886.

A detailed description of the South Carolina Geology and Seismicity is contained in Appendix E.

4.0 Historical Records Review

Area photographs from The Thomas Cooper Library at The University of South Carolina_ were obtained and reviewed. These photos span a time from 1943 to 1979.

In addition current and historical USGS Quadrant Mapping was reviewed. The oldest USGS Map was dated 1921.

A Topographic Map (Site Plan Sheet 1 of 2 Dated 2/23/77) 1977, prepared by Enwright & Associates (Drawing No.: 75008-(CV) 3) depicting the ground topography prior to construction of the ash ponds and of the finished ash ponds was provided by SCE&G.

Copies of the historical maps are included in Appendix F. Data from the 1977 design drawings are shown on the attached typical cross sections (Section 1, 2 & 3) and the site topographic mapping Appendix H.

5.0 Geotechnical Investigation

F&ME used two different investigation, sampling, and testing techniques as the primary subsurface exploration methods. These were rotary wash drilling with Standard Penetration Tests (SPT) and cone penetrometer (CPT) soundings with shear wave velocity measurements.

A total of seven (7) SPT borings were drilled using the rotary wash method between February 24th and 28th, 2011. The borings were located along the containment structure crest to provide an even distribution of data while assuring that borings were placed near areas of interest. The boring locations are noted as B-1 through B-7 on in Appendix A.

A Guspech GP 1100E truck-mounted drill rig with a manual SPT hammer and a track-mounted Diedrich D-50 with an automatic SPT hammer were used to perform the seven soil test borings. The borings were performed in general accordance with ASTM D 1586 and sampling was continuous for the top 20 feet and thereafter at 5 foot intervals to boring termination. SPT blow counts were obtained by driving a split spoon into the ground by the 140 pound hammer dropping from a free height of 30 inch. The number of blows required to drive each 6-inch of the sample were noted. After the blow counts were recorded, the spoon was withdrawn from the borehole and a representative sample is obtained. The borings were advanced between 52 and 100 feet below current surface elevation.

A registered geologist from F&ME inspected all drilling and CPT operations, logged all recovered soil samples, recorded SPT blow counts and measured groundwater conditions. After boring was complete, the samples were assembled at our laboratory to allow a visual identification and classification of the subsurface stratigraphy. This information is presented in a fence diagram depicting each individual boring stratification, stationing, depth and elevation, groundwater condition, and SPT blow counts. These boring logs are included in Appendix A. The stratification lines indicated on the boring logs represent the approximate boundaries between soil types; in-situ, the transition may be gradual. Variations in soil conditions between borings may be gradual.

Six (6) cone penetration tests (CPT_u) to include three (3) cone penetration tests with Shear Wave Velocity ($SCPT_u$) measurements were performed on 23rd February, 2011. The cone penetrometer soundings were performed with a 20-ton truck mounted rig. Sounding depths ranged from 77 to 101 feet beneath the existing ground surface. The CPT sounding locations are noted as CPT-1 through CPT-6 in Appendix A.

A cone penetrometer sounding is conducted by hydraulically pushing a cone penetrometer into the ground. While being pushed, the cone measures the resistance on the tip of the penetrometer (Tip resistance), the resistance on the outside of the penetrometer (sleeve friction), and the pore water pressure (dynamic pore pressure). These measurements are taken every five centimeters, which provides near continuous data. A compression model electronic piezo cone penetrometer, with a 15 cm^2 tip and a 225 cm2 friction sleeve was used. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80.

This subsurface exploration method provides strength and relative density of the soils as well as the pore water pressure. In-situ soil parameters were determined in accordance with the ConeTec© Interpretation Methods, Revision SZW-Rev 02 (March 12, 2008). The correlated soil strength parameters for each CPT sounding are provided in Appendix A. Being able to compare continuous sampled borings with in-situ data allowed development of a more detailed understanding of the soil stratification and its physical properties.

6.0 Laboratory Testing Procedures

Laboratory testing was conducted on representative soil samples to aid in classification and to assess the physical and engineering properties of the soils. Laboratory tests performed on soil samples included natural moisture contents, liquid and plastic limits, and sieve analysis. All testing was completed in general accordance with applicable ASTM standards. The results of these tests are provided in Appendix B.

7.0 Subsurface Characterization

The soil stratification along the perimeter of the dikes is complex and significant variations in thickness and the lateral extent of individual strata were commonly observed. Generalized subsurface profiles were developed for the four sides of the dikes. These profiles were generated based on evaluation of the data obtained from test borings, CPTs, and laboratory index properties of soil samples.

Based on the fill and the alluvium terrace sediments, the subsurface condition can be divided into two major areas:

(a) the segment of the dike that runs from approximately Stations 1+25 to 4+50 along the east side of the Lower Pond and parallel to the Savannah River; and
(b) all other segments of the dike.

The subsurface condition of the east side segment can be divided into two major profiles. The top 18 to 24 feet of soil consists of fill material consisting of fine to medium sands and non-plastic silt. The top 10 feet of this fill material appears to be compacted (CIRCA 1977 Fill), but below this, the fill material is found to be in very loose condition (CIRCA 1953 Fill). Underneath this fill material, a 46 to 47 feet thick layer of medium dense sand and non-plastic silt of river terrace sediments is encountered. Below this, layers of hard cohesive soil or dense sand were encountered.

East Side of the Lower Pond

This segment of the dike runs from approximately Station 1+25 to Station 4+50. Two borings were drilled in this segment - Boring B-1was drilled to a depth of 100 feet and the Boring B-2 was drilled to a depth of 76 feet below present ground surface. The elevations at the top of borings are found to be 142 and 138 feet, respectively.

Below the top 18 to 24 feet of the profiles, the subsurface condition appears to be similar in soil type and average SPT blow counts. The top 18 to 24 feet of soil consists of fine to medium sand (SM/SC) and non-plastic silt (ML). The consistency of top 10 feet of the soils encountered in Boring B-1 vary from medium dense to very dense (uncorrected SPT N values varies from 26 to 45 bpf) and those of next 8 feet generally vary from loose to medium dense (N varies from 2 to 14, with an average N value of 8 bpf). However, the consistency of top 24 feet of the soils encountered in Boring B-2 is generally found to be very loose (N values range from weight of hammer to 5, with an average value of 2 bpf).

Underneath the surficial mix of soils, a thick layer of loose to medium dense sand (SP/SP-SM) and non-plastic silt (ML) is encountered. The thickness of the layer is approximately between 46 and 47 feet. SPT N values range from 4 to 14 bpf, with an average value of 9 bpf.

Underlying these cohesionless soils, a hard layer of cohesive soil is encountered. In Boring B-1, the soil was classified as plastic silt (ML) and that in Boring B-2 was classified as lean clay (CL). SPT N values vary from 31 to 64 bpf. The thickness of this layer is found to be 4 feet in Boring B-1; however, Boring B-2 was terminated in this material at a depth of 76 feet below the top of the dike.

Below the cohesive soil layer, Boring B-1 extended through a layer of dense silty sand (SM), before it was terminated at a depth of 100 feet below the top of the dike. SPT N values generally vary from 35 to 40, with an average value of 36 bpf.

Based on the CPT_u soundings, groundwater table is estimated to be at a depth of 25 feet (Elevation 117’) in Boring B-1 and at a depth of 21 feet (Elevation 117’) in Boring B-2 below the top of the boring.

Northern Perimeter of the Dike

This segment of the dike begins and ends at approximately Station 4+50 and Station 9+25, respectively and forms the northern perimeter of the ponds. Two borings – Borings B-3 and B-4 were drilled in this segment. Both the borings were drilled to a depth of 75 feet below the top of the boring. The elevations at the top of borings are found to be 143 feet. Soils encountered in these borings are found to be alternating layers of sand and clays.

The top 12 feet of Boring B-3 and 26 feet of Boring B-4 consist of fine to medium sand (SM/SP-SM). In Boring B-3, SPT N values vary from 8 to 13 bpf, whereas in Boring B-4, N values generally vary from 8 to 20 bpf, indicating loose to medium density of the sand.

Underneath this sand layer, a layer of silty clay (CL) was encountered. In Boring B-3, the depth extends to 25.5 feet, whereas in Boring B-4 it extends to a depth of 36 feet below the top of the dike. In Boring B-3, SPT N values generally vary from 10 to 29 bpf, indicating stiff to very stiff consistency of the clay; whereas in Boring B-4, N is found to be 6 bpf, indicating firm clay.

Underlying this is a sand layer (SM/SP-SM). In Boring B-3, the depth extends to 37 feet, whereas in Boring B-4, it extends to a depth of 42 feet below the top of the dike. In Boring B-3, SPT N values vary from 10 to 12 bpf, indicating loose to medium dense sand; whereas in Boring B-4, N is found to be 5 bpf, indicating loose relative density of sand.

Below this is a silty clay layer (CL). In Boring B-3, this layer extends to a depth of 51 feet, wheras in Boring B-4, the depth extends to 54.5 feet below the top of the dike. In Boring B-3, N values vary from 6 to 7 bpf, indicating firm consistency; whereas in Boring B-4, N vary from 3 to 6, indicating soft to firm consistency.

Underneath this is a loose to medium sand layer (SP). SPT N values in this layer vary from 8 to 16 bpf, with an average blow count of 12 bpf. Boring B-4 terminated in this material; however Boring B-3 encountered a layer of plastic silt (ML) at a depth of 74.5 feet before it was terminated at a depth of 75 feet.

Based on the CPT_u soundings, groundwater table is estimated to be at a depth of 28 feet (Elevation 115') below the top of the boring.

West Side of the Upper Pond

This segment of the dike runs from approximately Station 9+25 to Station 12+50. Boring B-5 was drilled in this segment to a depth of 52 below the top of the boring (Elevation 142 feet). The soil profile encountered in this boring can be divided into two layers. The top 27 feet is a very loose to loose sand (SM/SP) and the bottom layer, before it is terminated at a depth of 52 feet, is a layer of hard plastic silt (ML). SPT N values in the sand layer vary from 1 to 10 bpf (average N value is 6 bpf) and in the silt layer N values ranged from 35 to 65 bpf.

Groundwater table is estimated to be at a depth of 25 feet (Elevation 117') below the top of the boring.

Southern Perimeter of the Dike

The southern perimeter of the dike begins at approximately Station 12+50 and ends at the beginning of the east segment of the dike (Station 1+50), approximately a length of 410 feet. Two borings – Borings B-6 and B-7 were drilled in this segment of the dike. Both the borings were drilled approximately to a depth of 75 feet below the top of the boring. From the contour map, the elevations at the top of borings are found to be 143 and 142 feet, respectively. The soil layers encountered in these borings are not found to be similar.

Boring B-6:

The top 11 feet of the boring encountered layers of sand (SC/SM) and non-plastic silt (ML). SPT N values vary from 9 to 72 bpf. The higher N values are at the top probably due to the presence of riverstone.

Between 11and 14 feet below the top of the boring, a silty clay (CL) layer of firm consistency (N = 5 bpf) was encountered.

Underneath this layer to a depth of 19 feet, a very loose to loose layer of clayey sand (SC) was encountered. N values in this layer vary from 4 to 9 bpf.

Below this to a depth of 55 feet is a thick layer of very soft to firm sandy to silty lean clay (CL). N values vary from weight of rod to 8 bpf, with an average value of 4 bpf.

Underlying the clay layer and, extending to the boring termination depth at 74.5 feet, the boring encountered a loose to medium dense of fine to medium sand (SP). N values vary from 10 to 16 bpf.

Boring B-7:

The top 37 feet of the boring encountered layers of sand (SM/SP) and non-plastic silt (ML). SPT N values for the top 14 feet vary from 11 to 28 bpf, indicating a medium dense consistency; between 14 and 29 feet, N values vary from 1 to 5 bpf, with average value of 4 bpf, indicating very loose density; and between 29 to 37 feet, N values vary from 8 to 12 bpf, indicating a loose to medium dense sand.

Underneath the cohesionless soils to a depth of 43.5 feet is a firm layer (N = 8 bpf) of plastic silt (ML). Below the silt layer, a soft layer (N = 3 bpf) of lean clay (CL) was encountered.

Underlying the cohesive soil layers to a depth of 68 feet, a loose to medium dense layer of sand (SP) was encountered. N values vary from 10 to 17 bpf.

Underlying the sand layer and, extending to the boring termination depth at 74.9 feet, the boring encountered a hard layer of plastic silt (ML). N values vary from 73 to greater than 88 bpf.

Based on the CPT_u soundings, groundwater table is estimated to be at a depth of 24 feet (Elevation 119’) below the top of the boring.

8.0 Slope Stability Analysis

Based on the initial screening of the contour map for the steepness and the height of the slope, three cross sections of the entire pond/dike system were developed. These general cross sections are noted as Cross Sections 1, 2 and 3. These cross sections are contained in Appendix G.

The purpose of these general cross sections was to provide a depiction of the ash pond dike, current water surface, current bottom elevation, relationship to the river and adjoining ground surface, "normal" and 100 year flood elevation in the river and the 1977 ground elevation prior to construction of the ash ponds. This information was utilized in the initial evaluation of boring/sounding locations and evaluation of soil stratification. These general cross sections were also used in the selection of cross section locations for slope stability analysis.

We have performed in excess of 60 individual slope stability analyses on the 5 slope geometries selected (Sections 4 through 8). These slope geometries were selected to represent the differing surface configurations and subsurface stratigraphy determined from the topographic survey and subsurface investigation. The two most critical sections, with respect to slope stability, are Sections 4 and 5 where the ash pond adjoins the Savannah River.

For each of the 5 selected sections, a design subsurface stratigraphy was developed based upon historical photos and mapping and the findings our SPT borings and CPT soundings.

The soil strength values assigned to the various strata and utilized in our analysis are based upon the subsurface data developed in the SPT borings, CPT soundings, laboratory test program and 30+ years of experience in evaluating the geologic formations at the site.

The soil strength parameters selected for our static and the presented seismic analysis are the ϕ values and approximately 1/2 the cohesion values determined from the CPT soundings. In our parametric analysis (best case, worst case, and failure case scenarios) we analyzed differing surface water and ground water phreatic conditions. In the most extreme loading assumptions, we utilized soil strength parameters that are approximately 3/4 of the cohesion values determined from the CPT soundings. Our methodology for determination of soil strength parameters is consistent with the EPRI Manual on Estimating Soil Properties for Foundation Design prepared by Cornell University. In no case did we need to utilize full estimated ultimate strength values to achieve a satisfactory factor of safety. For brevity, we have not included all of our analytical data. The calculated factors of safety in our full parametric analysis varied only ±0.01 to 0.05 from those tabulated in this report.

The ground water configurations utilized in our slope stability analysis vary from that indicated at the time of our subsurface investigation. Our boring and CPT data indicate that the ground water in the area of the ash ponds is slightly higher than the river level. The levels indicated in our slope stability cross sections are for parametric analyses of various loading cases. A detailed ground water and flow regime analysis is beyond the scope of our investigation.

The slope stability analyses are based on the following conditions:

(a) It is assumed that a minimum of 3 feet freeboard is maintained in the ponds. Therefore, the maximum water table in the ponds are assumed to be 3 feet below the top of the dike(s).

(b) A high water level (100 Year Flood) in the river elevation of 132 ft-MSL.

Soil Parameters:

Engineering properties assigned to soil layers are based on the nearest soil boring/sounding data. Assumed stratification and soil strength parameter inputs are included on the individual slope stability computer outputs contained in Appendix D. Three distinct loading conditions have been analyzed. These include:

(a) Maximum storage pool with steady state seepage. This is a static loading condition with the anticipated maximum static loads.

(b) Earthquake loads with steady state seepage. This is a dynamic loading condition with forces applied based upon the design ground accelerations.

(c) Liquefaction with steady state seepage. This is a static loading condition, which occurs a short time following the assumed seismic event. There is a time delay between the ground motions of the earthquake and the on-set of liquefaction. During liquefaction, the static soil strength parameters are reduced. This loading condition considers static loads with reduced soil strength parameters in any liquefied soils.

The seismic stability has been analyzed as a static (ie: no seismic coefficient) limit – equilibrium, slope stability model, using post-earthquake shear strengths for the materials in the embankment and foundation.

Note that, this is an industry standard practice for analyzing a water-impounding earthen structure and does not necessarily infer or imply that seepage is in fact occurring through the embankment.

8.1 Seismic Ground Motion Parameters

We have utilized the United States Geological Survey (USGS) ground motion uniform hazard spectrum maps for determination of the peak ground acceleration (PGA) motion values for the seismic design analyses events. The seismic event PGA values used in these analyses were based on a two percent probability of exceedance in 50 years (2%/50 years) and ten percent probability of exceedance in 50 years (10%/50 years). The 2%/50 year event is considered as a Safety Evaluation Event (SEE) earthquake which represents a large ground motion and has a relatively low probability of occurrence within the design life of the structure. The 2%/50 year seismic motion event approximates the ground motions associated with the 1886 Charleston earthquake. The 10%/50 year seismic event is considered as the Functional Evaluation Event (FEE) earthquake which represents a lower ground motion value with a relatively higher probability of occurrence over the design life of the structure.

The latitude and longitude coordinates of the ash ponds entered on the USGS ground motion map web site were 33.4353 and -81.9122 degrees, respectively. The USGS web site generated 2%/50 year $PGA_{B\text{-}C}$ value at the B-C boundary is 0.1847g. The web site generated 10%/50 year $PGA_{B\text{-}C}$ value at the B-C boundary is 0.0651g. The B-C boundary is considered as the predicted earthquake motion values at depth where bedrock is encountered and does not reflect any amplification or damping of the resulting PGA values at ground surface attributed to the overlying soils above bedrock.

To account for amplification or damping of the soils overlying bedrock, a site class seismic category was determined based on the data collected from the two $SCPT_u$ soundings CPT-02 and CPT-05 where shear wave testing was performed. The testing allows the determination of the average soil shear wave velocities in the upper one hundred (100) feet of the subsurface soil profiles. From the two $SCPT_u$ tests which were performed, the results indicate that the average shear wave velocities in the upper 100 feet of the soil's profile range is 954 feet per second (fps). We have included the two graphs from CPT-02 and CPT-05 of the shear wave velocities in the upper 100 feet of the site in Appendix A.

The South Carolina Department of Transportation (SCDOT) has performed extensive research and analysis of the seismicity of South Carolina and is recognized as the local industry standard for engineering seismic analysis in the State of South Carolina. Based upon the August 2008 SCDOT Geotechnical Design Manual (GDM), Chapter 12, and based on the SCPT derived average shear wave velocity of 954 fps, a site class seismic category of D is applicable to this project site. A site class seismic category of D corresponds to a soil profile considered as a stiff soil site. Interpolated from Table 12-26, as listed in the SCDOT GDM (previously referenced), the site coefficient, F_{PGA}, for a site class D, and with a 2%/50 year $PGA_{B\text{-}C}$ value of 0.1847g is 1.43. Multiplication of the F_{PGA} and the 2%/50 year $PGA_{B\text{-}C}$ value to account for local site subsurface soil effects yields a design PGA value at the ground surface of 0.264g for use in SEE seismic performance analyses.

For determination of the 10%/50 year PGA value, from Table 12-26 as listed in the SCDOT GDM (previously referenced), the site coefficient, F_{PGA}, for a site class D, and with a $PGA_{B\text{-}C}$ value of 0.0.0651 is 1.6. Multiplication of the F_{PGA} and the 10%/50 year $PGA_{B\text{-}C}$ value to account for local site subsurface soil effects yields a design PGA value at the ground surface of 0.104g for use in FEE seismic performance analyses.

8.2 Liquefaction Analyses

F&ME Consultants has completed a liquefaction analysis for the identified ash pond containment structure embankments at the SCE&G Urquhart Station facility. The following data has been used in our analysis:

- CPT Soundings (Six Total).

- Borings and laboratory classification tests performed by F&ME. Seven borings were performed within the existing ash pond embankment structure for the collection of soil samples for laboratory analysis. Soil classification testing was performed to evaluate liquefaction potential of the subgrade soils (Appendix B).

- FHWA-HI-99-012; *Geotechnical Earthquake Engineering*, December 1998, and as modified in the Journal of Geotechnical and Geoenvironmental Engineering; *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils*, October 2001.

At the heart of any discussion of liquefaction potential are three factors:

- The magnitude of the design PGA (Peak Ground Acceleration)
- The composition of the soil mass
- The density of the soil mass

With respect to potentially liquefiable soils, expressed in simplified terms, clean, saturated sands can be highly susceptible to liquefaction while fine-grained soils, particularly those with cohesion, are not.

Furthermore, for a soil composed of liquefiable materials, the lower the density, the higher potential for liquefaction. Determination of the in-situ soil density was extrapolated from CPT soundings as total stress, effective stress, tip resistance, and sleeve resistance.

As outlined in the MSHA Design Manual, fly ash may exhibit temporary apparent cohesion but is non-cohesive in a dry or saturated state. Fly ash should be considered “Fluid” in a seismic analysis unless it is in a well compacted or dry and confined state.

We have analyzed the liquefaction potential for the soil mass composing the ash pond containment structure embankments and foundation materials. The general conditions of the soil profile and our findings are as follows:

- The soil composing the ash pond containment structure is predominantly low to moderately dense sandy clay underlain by sandy soils. During the seismic design event, these sandy soils have the potential to liquefy.

- Our analysis indicates liquefaction-induced permanent vertical settlements ranging from 0.6 to 4.8 inches.

- For a Magnitude 7.0 (Richter) earthquake event, the farthest documented liquefaction event relative to the epicenter is about 110 kilometers (approximately 69 miles). The Urquhart Station facility is located beyond this distance from the epicenter of the 1886 Charleston earthquake.

- When exposed to the expected seismic event, ground surface ruptures are not likely. Typically, the resulting phenomena will be in the form of small, localized surface depressions.

In summary, our data and analyses indicates that liquefaction which would create instability in the embankment containment system will not occur.

8.3 Embankment Stability Analyses

F&ME has performed an 'over-all' static and seismic global slope stability analyses of select areas of the embankment creating the ash pond containment structure. The first condition evaluated for static loadings is described as long-term storage of pond water, with water percolating through the embankment to an established steady-state condition of seepage. The ash pond water level elevation was assumed to be at the overflow spillway intake elevation (approximate elevation 139 ft-MSL) as a worst-case condition. The normal ash pond water level is approximately 135 ft-MSL. This condition is referred to as steady seepage with maximum storage pool. A uniform distributed live loading (LL) of 250 pounds per square foot (psf) was applied within roadway areas during our static embankment stability analyses.

For seismic loading conditions, per FHWA-HI-99-012, *Geotechnical Earthquake Engineering*, December 1998, the ground motion horizontal coefficient, K_H, used in seismic global slope stability analyses should be some fraction of the design PGA value. The K_H value used in our seismic slope stability analyses was one-half of the design event PGA value of 0.264g, and this procedure is considered to be industry standard. Roadway surcharge load was neglected during seismic design event analyses.

We also analyzed embankment stability during the indicated liquefiable subgrade soils event. Where a liquefaction condition is expected to occur following the design seismic event, the soil strength parameters were reduced to a residual strength value with the intention of analyzing the stability of the embankment under liquefied soil conditions. The residual liquefied soil strength parameter is about one-half of the soils effective strength as determined by CPT test data.

F&ME utilized the computer software program GSTABL7 w/STEDwin Version 2 for the static, earthquake, and liquefaction embankment slope stability analyses. The computational methodology used in the computer program is the Modified Bishop method of analyses. The subsurface soil stratigraphy, ground water conditions, and soil strength parameters utilized in these analyses were based on generalized conditions as indicated by the CPT soundings. In general, soil parameters for both static and seismic analyses were estimated based on the data from the CPT soundings performed in general proximity to one another.

To be consistent with the hazard potential classification system and criterion for dams in use by Federal Agencies (FEMA, 2004a) The Urquhart Ash Ponds have been classified as having a significant hazard potential. This is for facilities where a failure would likely not result in loss of human life, but can cause economic loss, environmental damage, or disruption of lifeline facilities.

The following table presents the calculated minimum factor of safety (F.S.) results of these analyses. The listed performance criteria are referenced from Chapter IV of *Embankment Dams of the Federal Energy Regulatory Commission, 1991*.

Embankment Slope Stability Results Summary

Location	Loading Condition	F.S.	Performance Criteria
Station 1+65 Section 4	Max. Storage Pool-Steady Seepage	1.99	1.5
	Liquefaction-Steady Seepage	1.26	>1.0
	FEE Earthquake-Steady Seepage	1.56	>1.0
	SEE Earthquake-Steady Seepage	1.14	>1.0
Station 3+50 Section 5	Max. Storage Pool-Steady Seepage	1.88	1.5
	Liquefaction-Steady Seepage	1.16	>1.0
	FEE Earthquake-Steady Seepage	1.50	>1.0
	SEE Earthquake-Steady Seepage	1.09	>1.0
Station 7+25 Section 6	Max. Storage Pool-Steady Seepage	2.23	1.5
	Liquefaction-Steady Seepage	2.23	>1.0
	FEE Earthquake-Steady Seepage	1.96	>1.0
	SEE Earthquake-Steady Seepage	1.36	>1.0
Station 11+00 Section 7	Max. Storage Pool-Steady Seepage	2.28	1.5
	Liquefaction-Steady Seepage	---[1]	>1.0
	FEE Earthquake-Steady Seepage	1.99	>1.0
	SEE Earthquake-Steady Seepage	1.66	>1.0
Station 13+15 Section 8	Max. Storage Pool-Steady Seepage	2.22	1.5
	Liquefaction-Steady Seepage	2.22	>1.0
	FEE Earthquake-Steady Seepage	1.93	>1.0
	SEE Earthquake-Steady Seepage	1.55	>1.0

[1] No liquefiable soils present in boring

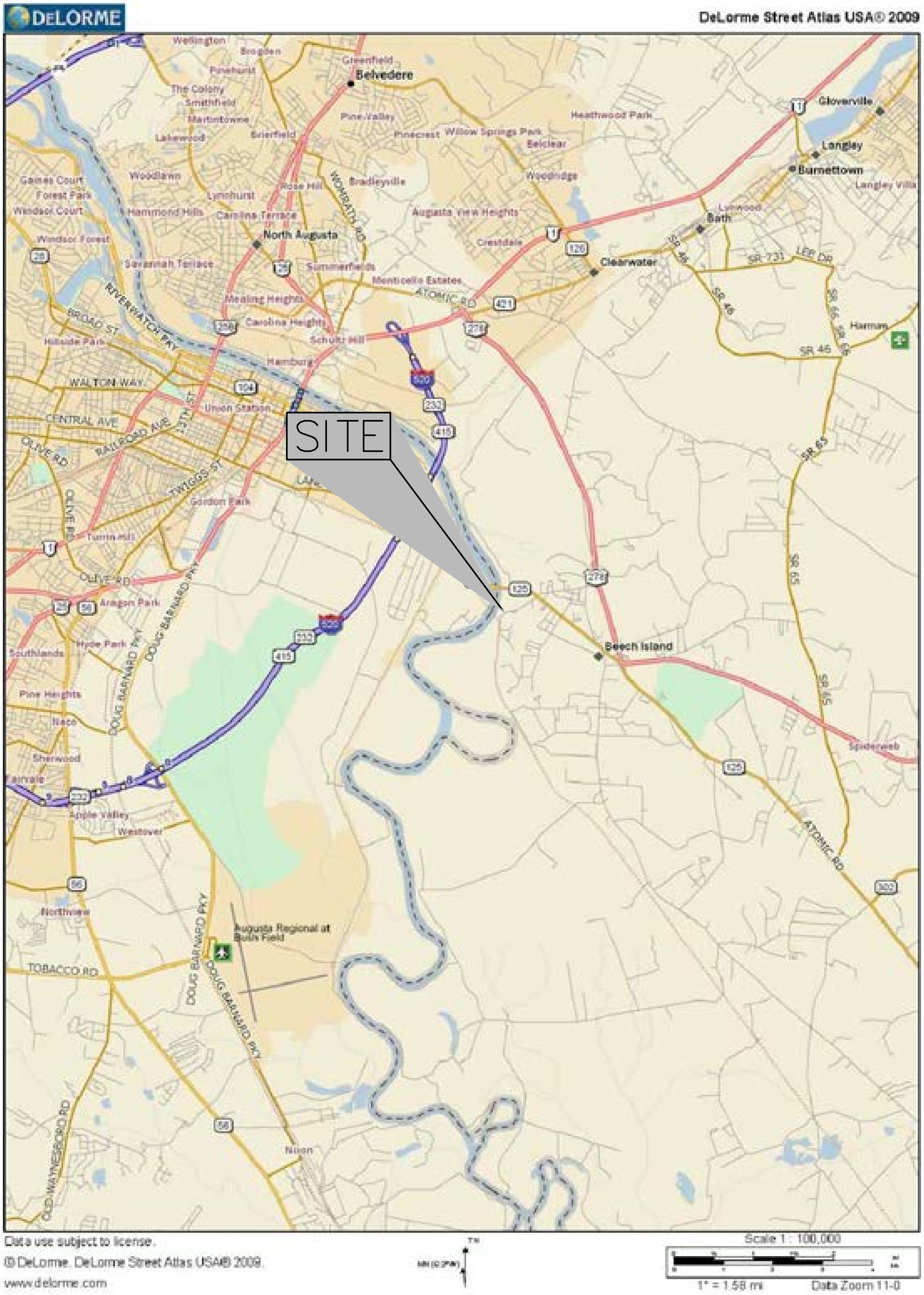
The GSTABL7 output graphs depicting the slope geometry, soil strength parameters, soil profiles and the computer generated critical failure circles of each of the above listed slope stability analyses are presented in Appendix D.

8.4 Summary of Findings

The Urquhart Ash Pond Perimeter Containment System is stable under the selected design loading conditions. The most critical condition is during (earthquake – steady seepage) and immediately following (liquefaction – steady seepage) the assumed seismic event. As noted, the “worst case” conditions were identified for analysis. All computed factors of safety are substantially above the minimum performance criterion.

Appendix A

Site Location Plan
Bore Location Plan
Soil Test Borings
CPT Soundings (CPT$_u$)
CPT Shear Wave Velocities



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www.delorme.com

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA
NOTES:

ORIGINAL:
MARCH 9, 2010
REVISIONS:
1
2
3
4
SCALE:
NONE

F&ME
CONSULTANTS
GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

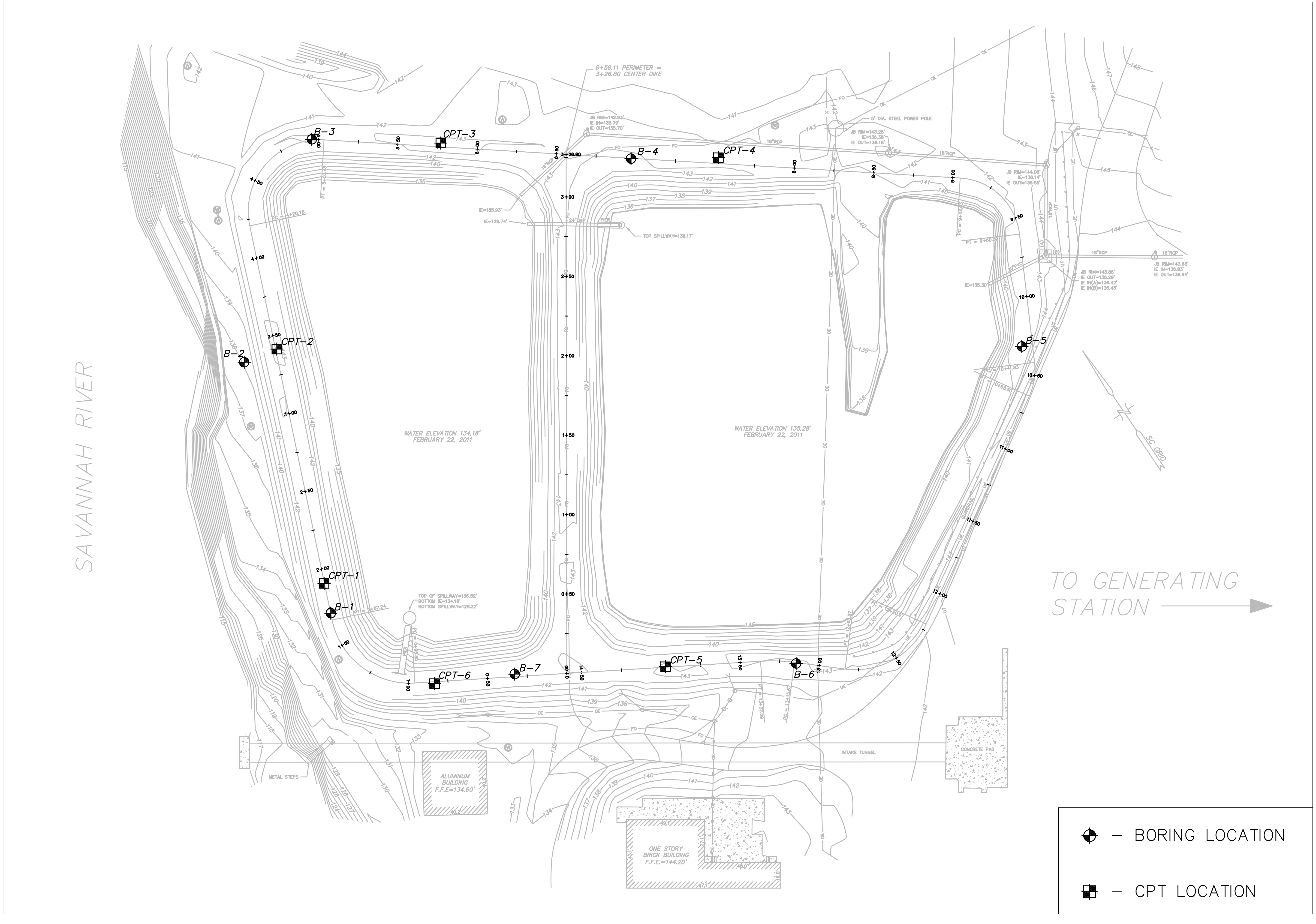
SITE LOCATION PLAN

URQUHART STATION ASH POND DIKE INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE 1



F&ME
CONSULTANTS

GEOTECHNICAL · ENVIRONMENTAL · MATERIALS
COLUMBIA, SOUTH CAROLINA

SEAL NOT VALID UNLESS SIGNED

REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE

NOTES:

DRAWN BY:	CHECKED BY:	APPROVED BY:
WJG	JRW	ZWA

DATE: March, 9 2011

PROJECT NAME:

URQUHART STATION ASH POND DIKE INVESTIGATION

DRAWING NAME:

BORING AND CPT LOCATION PLAN

DRAWING NUMBER:

FIGURE 2

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

LOG OF BORING No. B-1

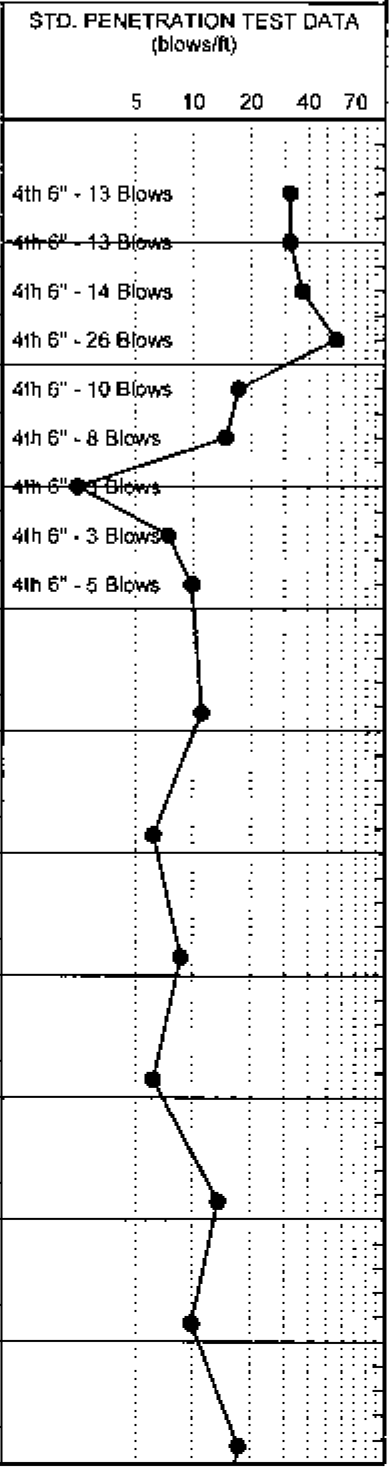
Station:
Offset:

Date Drilled: 02/24/11
Supervisor: Ricky Wessinger
Casing Length (ft):
Approx. Ground Elevation (ft): 142.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 25 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
		Dike
		Dry, Orange/Pink, Silty Fine to Medium SAND (SM)
	2.0	Medium Dense, Dry to Moist, Light Brown, Clayey Fine to Medium SAND (SC) with Kaolin
137.0		
	6.0	Medium Dense to Dense, Dry to Moist, Light Brown Orange, Silty Fine to Medium SAND (SM) with Kaolin => Trace Ash => Ashy
132.0		
	13.0	Soft to Firm, Wet, Brown/Gray, Micaceous Sandy SILT (ML)
127.0		
	18.0	Loose, Moist, Brown, Fine to Medium Silty SAND (SP) with Mica
122.0		
117.0	25.0 ▽	Loose, Moist to Wet, Brown Fine to Medium SAND with SILT
112.0		
	31.0	Loose, Wet, Blue/Gray, Micaceous Clayey Fine to Medium SAND (SC)
	34.0	Firm, Wet, Blue/Gray, SILT (ML)
107.0		
		=> Thin Sandy Seams
102.0		
	43.0	Loose to Medium Dense, Wet, Light Brown Gray, Fine to Medium SAND (SP)
97.0		
92.0		

Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)
0.0						
2.0	SS-1	6	13	13	26	4th 6" - 13 Blows
4.0	SS-2	11	12	14	26	4th 6" - 13 Blows
6.0	SS-3	10	14	16	30	4th 6" - 14 Blows
8.0	SS-4	19	19	26	45	4th 6" - 26 Blows
10.0	SS-5	8	8	6	14	4th 6" - 10 Blows
12.0	SS-6	4	4	8	12	4th 6" - 8 Blows
14.0	SS-7		1/12"	2	2	4th 6" - [illegible] Blows
16.0	SS-8	3	3	3	6	4th 6" - 3 Blows
18.0	SS-9	5	3	5	8	4th 6" - 5 Blows
23.5	SS-10	4	5	4	9	
28.5	SS-11	2	2	3	5	
33.5	SS-12	2	3	4	7	
38.5	SS-13	3	2	3	5	
43.5	SS-14	5	5	6	11	
48.5	SS-15	4	4	4	8	
53.5	SS-16	6	6	8	14	



LEGEND

Continued Next Page

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
AWG - Rock Core, 1-1/8"
NQ - Rock Core, 1-7/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core
PHD - Percussion Hammer Drill

F&ME
CONSULTANTS

Urquhart Station Ash Pond Dike Investigation **Aiken County, South Carolina** **G5044.000**	**LOG OF BORING No. B-1** Station: Offset:

Date Drilled: 02/24/11

Supervisor: Ricky Wessinger

Casing Length (ft):

Approx. Ground Elevation (ft): 142.0

Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:

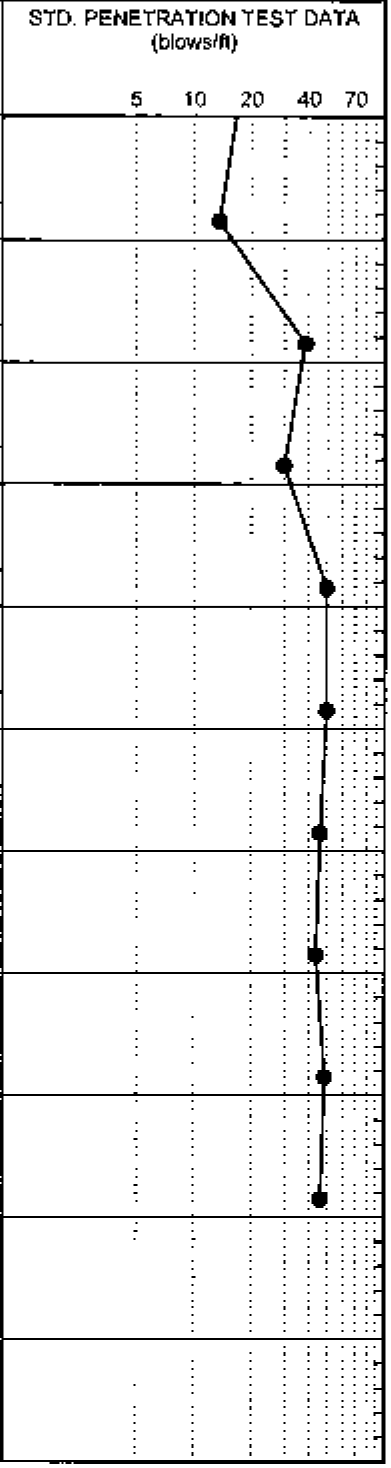
Water Level: 25 Feet at T.O.B.

Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value
		Loose to Medium Dense, Wet, Light Brown Gray, Fine to Medium SAND (SP)						
82.0			58.5	SS-17	7	6	5	11
77.0	64.5	Hard, Wet, White, Micaceous SILT (ML) (Kaolin)	63.5	SS-18	10	13	18	31
72.0	68.5	Medium Dense to Dense, Wet, White, Micaceous Fine to Medium Silty SAND (SM)	68.5	SS-19	7	12	12	24
67.0			73.5	SS-20	16	19	21	40
62.0			78.5	SS-21	10	18	22	40
57.0			83.5	SS-22	12	16	21	37
52.0		=> Trace Gravel	88.5	SS-23	13	13	22	35
47.0			93.5	SS-24	11	15	24	39
42.0	99.6	Hard, Wet, White, SILT (ML) (Kaolin)	98.5	SS-25	12	15	25	37
	100.0	Boring Terminated at 100.0 Feet						
37.0								

STD. PENETRATION TEST DATA (blows/ft)



LEGEND

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
AWG - Rock Core, 1-1/8"
NQ - Rock Core, 1-7/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core
PHD - Percussion Hammer Drill

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

LOG OF BORING No. B-2

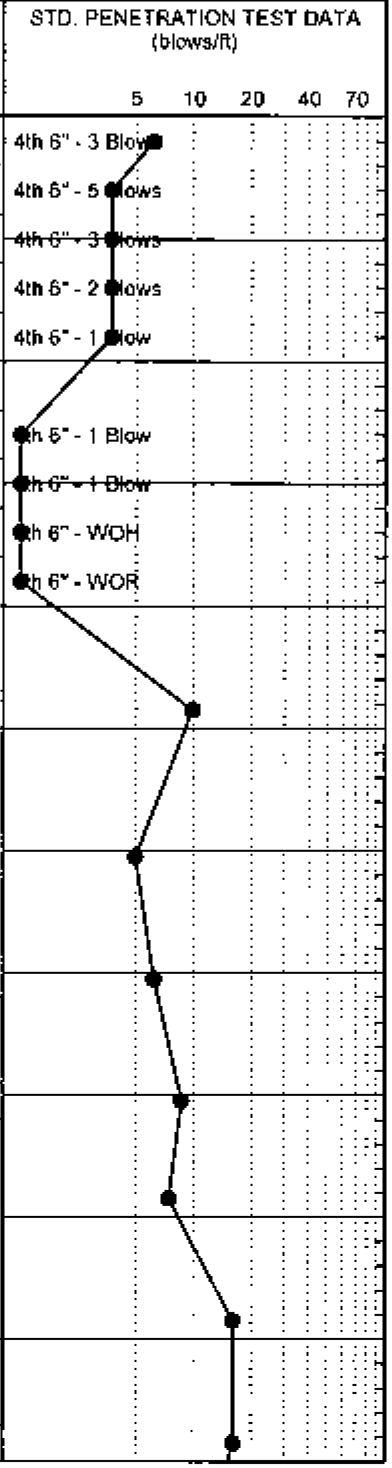
Station:
Offset:

Date Drilled: 2/24/11
Supervisor: Glynn Ellen
Casing Length (ft):
Approx. Ground Elevation (ft): 138.0
Hammer Type: ☐ Gravity ☒ Automatic ☐ Other:
Water Level: 21 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - Diedrich D-50, Water Table Based on CPT Sounding

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
		Terrace on Dike
	0.4	Grassmat
		Soft to Firm, Moist, Orange/Red/Tan, Fine to Medium Sandy SILT (ML) with Mica, trace Fine River Gravel and Organics
133.0		=> Cut through Timber
	6.0	Very Loose, Wet, Light Gray/Orange, Silty Fine to Coarse SAND (SM) with Mica
128.0		
	13.5	Very Soft, Wet, Dark Grayish Brown, Fine to Medium Sandy SILT (ML)
123.0		
118.0		
	∇	
	24.0	Loose, Wet, Dark Brown, Fine to Medium Silty SAND (SM)
113.0		
	26.0	Very Loose, Wet, Dark Gray, Silty Fine Micaceous SAND (SM)
108.0	30.5	Soft to Firm, Wet, Blue/Gray Non-Plastic SILT (ML) with Fine Sand
103.0		=> 2" Sand Seam
98.0	39.5	Loose to Medium Dense, Wet, Tan, Fine to Medium SAND (SP)
93.0		
88.0		

Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)
0.0	SS-1	1	2	3	5	4th 6" - 3 Blows
2.0	SS-2	1	1	2	3	4th 6" - 5 Blows
4.0	SS-3	2	1	2	3	4th 6" - 3 Blows
6.0	SS-4	1	2	1	3	4th 6" - 2 Blows
8.0	SS-5	1	1	2	3	4th 6" - 1 Blow
12.0	SS-6	1	0	1	1	4th 6" - 1 Blow
14.0	SS-7	0	1	0	1	4th 6" - 1 Blow
16.0	SS-8	WOR/18"			0	4th 6" - WOH
18.0	SS-9	WOR/18"			0	4th 6" - WOR
23.5	SS-10	1	4	4	8	
29.5	SS-1t	1	2	2	4	
34.5	SS-12	1	2	3	5	
39.5	SS-13	2	3	4	7	
43.5	SS-14	3	3	3	6	
48.5	SS-15	6	6	7	13	
53.5	SS-16	5	6	7	13	



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LEGEND

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
AWG - Rock Core, 1-1/8"
NQ - Rock Core, 1-7/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core
PHD - Percussion Hammer Drill

F&ME
CONSULTANTS

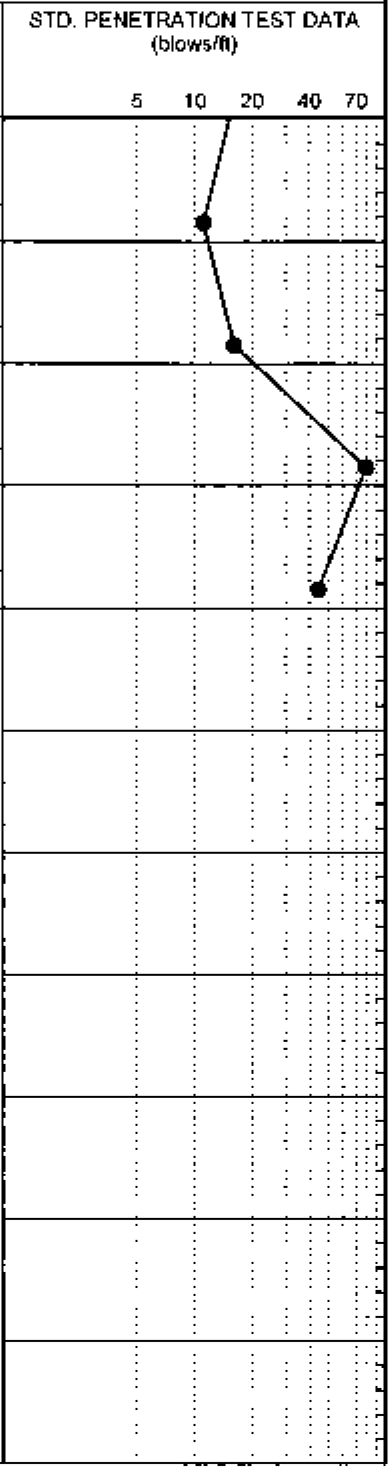
Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

LOG OF BORING No. B-2

Station:
Offset:

Date Drilled: 2/24/11	Supervisor: Glynn Ellen	Notes: Equipment Used - Diedrich D-50, Water Table Based on CPT Sounding
Casing Length (ft):	Approx. Ground Elevation (ft): 138.0	
Hammer Type: ☐ Gravity ☒ Automatic ☐ Other:		
Water Level: 21 Feet at T.O.B.	Drilling Method: Rotary Wash	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value
		Loose to Medium Dense, Wet, Tan, Fine to Medium SAND (SP)	⋯						
				58.5	SS-17	3	4	5	9
78.0									
				63.5	SS-18	6	6	7	13
73.0									
	67.0	Hard, Moist, Orange/Yellow/Gray Fine to Medium Sandy Lean CLAY (CL)	▨						
				68.5	SS-19	16	28	35	64
68.0									
				73.5	SS-20	9	15	21	36
63.0									
	76.0	Boring Terminated at 76.0 Feet							
58.0									
53.0									
48.0									
43.0									
38.0									
33.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	PHD - Percussion Hammer Drill

F&ME CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

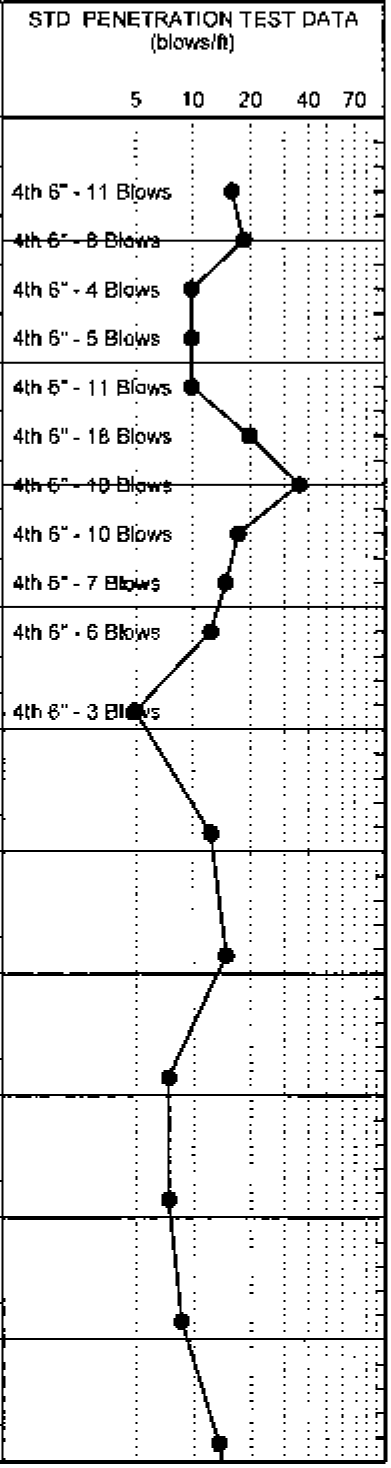
LOG OF BORING No. B-3

Station:
Offset:

Date Drilled: 02/26/11	Supervisor: Glynn Ellen	Notes: Equipment Used - GUSPECH GP 1100E, Water Table Based on CPT Sounding
Casing Length (ft):	Approx. Ground Elevation (ft): 143.0	
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:		
Water Level: 28 Feet at T.O.B.	Drilling Method: Rotary Wash	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
		Dike
		Loose to Medium Dense, Moist to Wet, Light Gray/Orange, Silty Fine to Medium SAND (SM) with Mica and trace riverstone
138.0		
133.0		
	12.0	Stiff to Very Stiff, Wet, Orange/Red, Silty CLAY (CL) with Fine to Coarse Sand Seams
128.0		
123.0	19.5	Medium Dense, Wet, Dark Gray/Dark Orange, Silty Fine to Coarse SAND (SM)
	21.0	Stiff, Wet, Dark Gray/Brown, Orangic CLAY (CL) with fine Sand and Leaf Matter
118.0		
	25.5	Medium Dense, Wet, Light Brown, Clean, Fine to Medium SAND (SP) with Organic Matter
	∇	
113.0		
	31.5	Medium Dense, Wet, Dark Gray, Micaceous Silty Fine SAND (SM)
108.0		
	37.0	Firm, Wet, Dark Blue Gray CLAY (CL), with Mica and Wood Fragments
103.0		
98.0		
		=> Sandy Seams
93.0		
	51.0	Medium Dense, Wet, Light Brown, Fine to Medium SAND (SP)

Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD PENETRATION TEST DATA (blows/ft)
2.0	SS-1	4	6	7	13	4th 6" - 11 Blows
4.0	SS-2	6	8	7	15	~~4th 6" - 8 Blows~~
6.0	SS-3	3	3	5	8	4th 6" - 4 Blows
8.0	SS-4	3	4	4	8	4th 6" - 5 Blows
10.0	SS-5	3	3	5	8	4th 6" - 11 Blows
12.0	SS-6	6	5	11	16	4th 6" - 18 Blows
14.0	SS-7	7	15	14	29	~~4th 6" - 10 Blows~~
16.0	SS-8	3	7	7	14	4th 6" - 10 Blows
18.0	SS-9	3	4	8	12	4th 6" - 7 Blows
20.0	SS-10	3	4	6	10	4th 6" - 6 Blows
23.5	SS-11	3	2	2	4	4th 6" - 3 Blows
28.5	SS-12	5	7	4	10	
33.5	SS-13	5	5	7	12	
38.5	SS-14	3	3	3	6	
43.5	SS-15	2	3	3	6	
48.5	SS-16	2	3	4	7	
53.5	SS-17	4	5	6	11	



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LEGEND

SAMPLER TYPE

SS - Split Spoon	NQ - Rock Core, 1-7/8"
ST - Shelby Tube	CU - Cuttings
AWG - Rock Core, 1-1/8"	CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	PHD - Percussion Hammer Drill

F&ME
CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

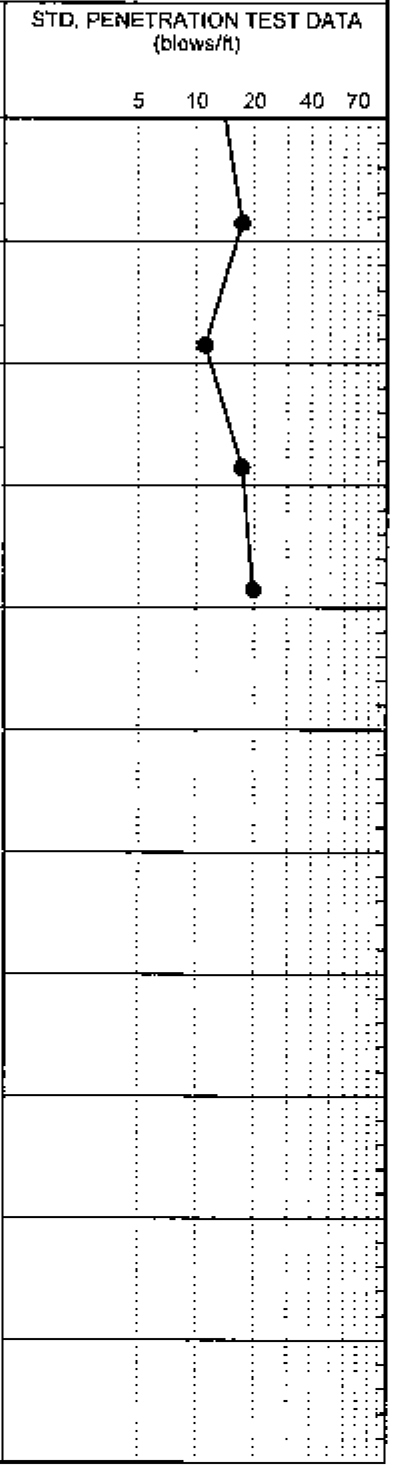
LOG OF BORING No. B-3

Station:
Offset:

Date Drilled: 02/26/11
Supervisor: Glynn Ellen
Casing Length (ft):
Approx. Ground Elevation (ft): 143.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 28 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E, Water Table Based on CPT Sounding

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value
		Medium Dense, Wet, Light Brown, Fine to Medium SAND (SP)							
	58.5	Loose to Medium Dense, Wet, Orange Gray, Micaceous Fine to Medium SAND (SP)		58.5					
83.0					SS-18	6	7	7	14
				63.5					
78.0					SS-19	6	5	4	9
				68.5					
73.0					SS-20	7	6	8	14
				73.5					
	74.5	Very Stiff, Wet, White/Purple SILTY (ML), (Kaolin)			SS-21	5	6	10	16
68.0	75.0	Boring Terminated at 75.0 Feet							
63.0									
58.0									
53.0									
48.0									
43.0									
38.0									



LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
AWG - Rock Core, 1-1/8"
NQ - Rock Core, 1-7/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core
PHD - Percussion Hammer Drill

F&ME CONSULTANTS

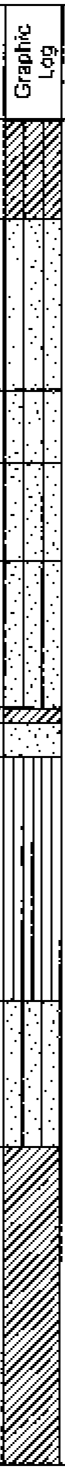
Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

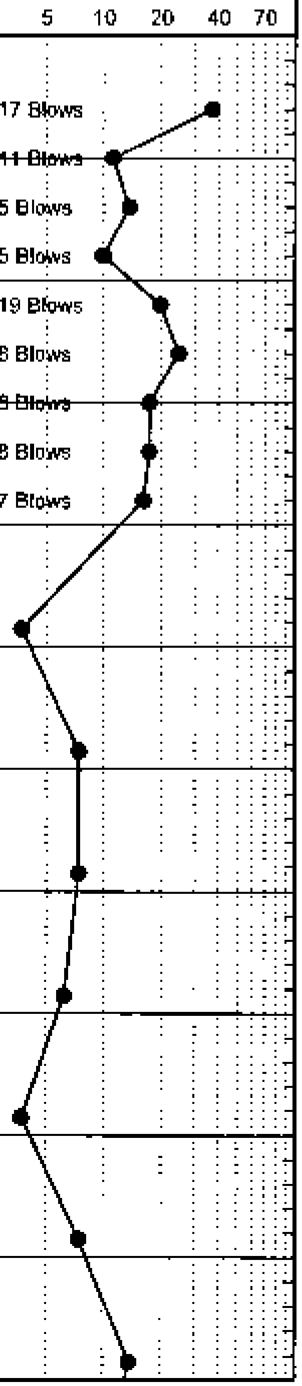
LOG OF BORING No. B-4

Station:
Offset:

Date Drilled: 02/27/11	Supervisor: Ricky Wessinger	Notes: Equipment Used - GUSPECH GP 1100E
Casing Length (ft):	Approx. Ground Elevation (ft): 143.0	
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:		
Water Level: 25 Feet at T.O.B.	Drilling Method: Rotary Wash	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)
		Dike							
		Very Stiff, Moist, Brown, Fine to Medium Sandy Silty CLAY (CL-ML) => with Quartz Fragments	2.0	SS-1	13	14	16	30	4th 6" - 17 Blows
138.0	4.0	Loose to Medium Dense, Moist to Wet, White/Yellow, Micaceous Silty Fine to Medium SAND (SM)	4.0	SS-2	1	2	7	9	4th 6" - 11 Blows
			6.0	SS-3	5	5	6	11	4th 6" - 5 Blows
			8.0	SS-4	5	4	4	8	4th 6" - 5 Blows
133.0			10.0						
	11.0	Medium Dense, Moist to Wet, Brown, Silty Fine to Medium SAND (SM)		SS-5	4	3	13	16	4th 6" - 19 Blows
			12.0	SS-6	11	12	8	20	4th 6" - 8 Blows
128.0	14.0	Medium Dense, Wet, Brown/Yellow/Black, Silty Fine to Coarse SAND (SM) with Gravel and Wood Fragments	14.0	SS-7	5	6	8	14	4th 6" - 8 Blows
			16.0	SS-8	5	6	8	14	4th 6" - 8 Blows
123.0	18.0	Medium Dense, Moist to Wet, Brown/Dark Gray, Silty Fine to Medium SAND (SM) with Wood Fragments	18.0	SS-9	3	4	9	13	4th 6" - 7 Blows
	24.0	Soft, Wet, Gray, CLAY (CL)	23.5	SS-10	2	1	2	3	
118.0	24.6 ▽	Very Loose, Wet, Brown, Fine to Medium SAND (SP)							
	26.0	Firm, Wet, Blue/Gray, SILT (ML)	28.5	SS-11	2	2	4	6	
113.0			33.5	SS-12	2	2	4	6	
108.0	36.0	Loose, Wet, Dark Gray, Micaceous Silty Fine SAND (SM)	38.5	SS-13	1	2	3	5	
103.0	42.0	Soft to Stiff, Wet, Dark Gray Micaceous Silty CLAY (CL) with Wood Fragments	43.5	SS-14	2	1	2	3	
98.0			48.5	SS-15	2	3	3	6	
93.0			53.5	SS-16	5	5	6	11	





LEGEND

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SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	PHD - Percussion Hammer Drill

F&ME
CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

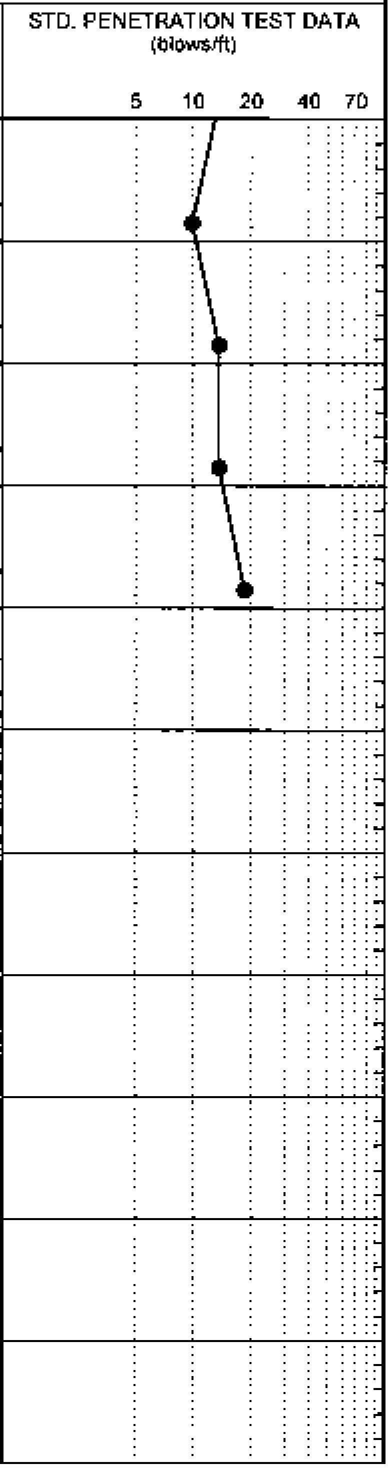
LOG OF BORING No. B-4

Station:
Offset:

Date Drilled: 02/27/11
Supervisor: Ricky Wessinger
Casing Length (ft):
Approx. Ground Elevation (ft): 143.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 25 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value
	55.1	Loose to Medium Dense, Wet, Brown/Yellow, Fine to Medium SAND (SP)	░						
				58.5	SS-17	3	4	4	8
83.0									
				63.5	SS-18	5	5	6	11
78.0									
				68.5	SS-19	7	5	6	11
73.0									
				73.5	SS-20	5	6	9	15
68.0	75.0	Boring Terminated at 75.0 Feet							
63.0									
58.0									
53.0									
48.0									
43.0									
38.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	PHD - Percussion Hammer Drill

SOIL_TEST_BORING G5044-URQUHART STATION ASH POND.GPJ SC_DOT.GDT 3/9/11

F&ME
CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

LOG OF BORING No. B-5

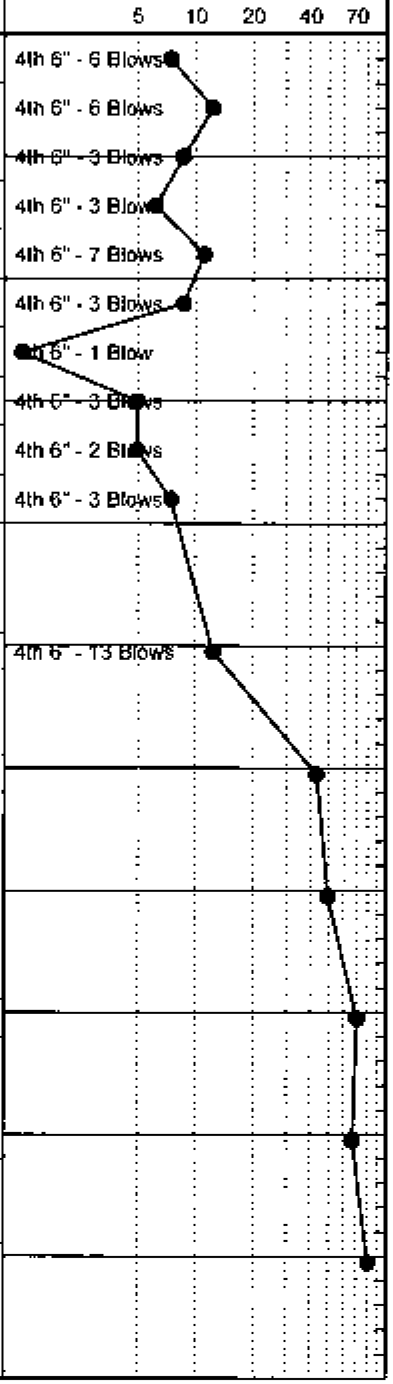
Station:
Offset:

Date Drilled: 02/28/11
Supervisor: Ricky Wessinger
Casing Length (ft):
Approx. Ground Elevation (ft): 142.0
Hammer Type: ☐ Gravity ☒ Automatic ☐ Other:
Water Level: 25 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - Diedrich D-50

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
		Grassed
	1.0	Loose, Moist, Brown, Silty Fine to Medium SAND (SM)
	1.2	Coal Ash
		Loose, Moist, Orange Red Yellow, Silty Fine to Coarse SAND (SM) with Trace Ash to 3'
137.0		
	9.0	Loose, Wet, Gray, Silty Fine to Medium SAND (SM)
132.0		
	13.0	Very Loose, Wet, Brown, Fine to Medium SAND (SP) with Organics and Wood Fragments
127.0		
	16.0	Loose, Wet, White Yellow Gray, Silty Fine to Coarse SAND (SM)
122.0		
117.0	▽	
	27.0	Hard, Moist, White/Red/Purple, SILT (ML), (Kaolin)
112.0		
107.0		
102.0		
97.0		
92.0		
	52.0	Boring Terminated at 52.0 Feet

Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)
0.0 2.0	SS-1	2	2	4	6	4th 6" - 6 Blows
4.0	SS-2	4	5	5	10	4th 6" - 6 Blows
6.0	SS-3	4	3	4	7	4th 6" - 3 Blows
8.0	SS-4	2	3	2	5	4th 6" - 3 Blow
10.0	SS-5	1	3	6	9	4th 6" - 7 Blows
12.0	SS-6	3	4	3	7	4th 6" - 3 Blows
14.0	SS-7	2	1/12"		1	6" - 1 Blow
16.0	SS-8	2	2	2	4	4th 6" - 3 Blows
18.0	SS-9	2	2	2	4	4th 6" - 2 Blows
	SS-10	2	3	3	6	4th 6" - 3 Blows
24.5	SS-11	4	4	6	10	4th 6" - 13 Blows
29.5	SS-12	9	15	20	35	
34.5	SS-13	12	18	22	40	
39.5	SS-14	14	22	35	57	
44.5	SS-15	14	23	31	54	
49.5	SS-16	16	26	39	65	



LEGEND

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
AWG - Rock Core, 1-1/8"
NQ - Rock Core, 1-7/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core
PHD - Percussion Hammer Drill

SOIL_TEST_BORING G5044.URQUHART STATION ASH POND.GPJ SC_DOT.GDT 3/9/11

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

LOG OF BORING No. B-6

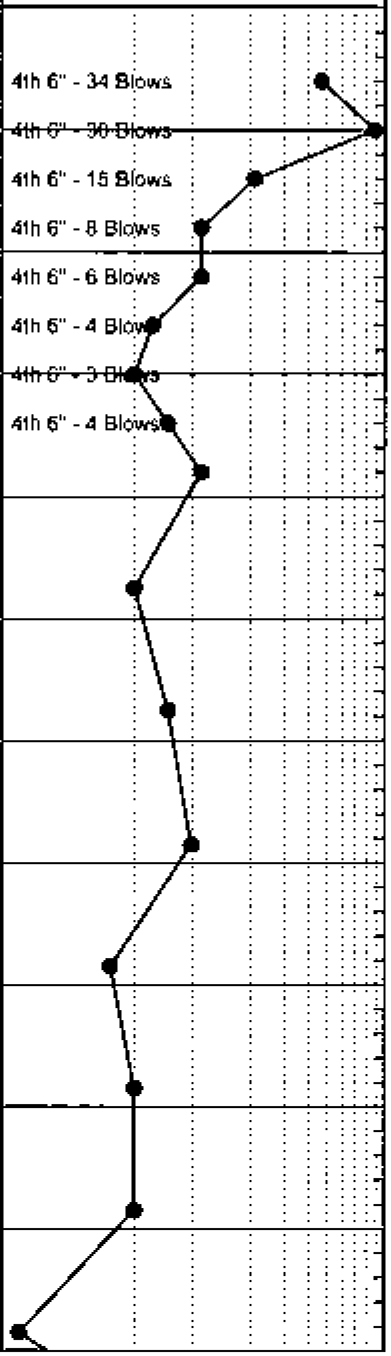
Station:
Offset:

Date Drilled: 02/26/11
Supervisor: Glynn Ellen
Casing Length (ft):
Approx. Ground Elevation (ft): 143.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 27 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E, Water Table Based on CPT Sounding

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION
		Dike
		Medium Dense to Very Dense, Moist, Orange, Clayey Fine to Medium <u>SAND (SC)</u> with trace Riverstone
138.0		
	8.0	Loose, Moist, Orange, Silty Fine to Medium <u>SAND (SM)</u>
133.0		
	12.0	Firm to Stiff, Wet, Reddish Tan/Orange/Light Gray, Fine to Medium Sandy Silty <u>CLAY (CL)</u>
	14.0	Gray Ash Layer around 3" Thick
128.0		Very Loose, Wet, Brown, Clayey Fine to Medium <u>SAND (SC)</u> => Soft Dark Gray Clay Layer
	19.0	Very Soft to Firm, Wet, Dark Gray/Dark Brown <u>SILT (ML)</u> with Mica
123.0		
118.0		
	▽	
		=> Stratified with Red Micaceous Silt
113.0		
108.0		
103.0		
98.0		
93.0		

Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)
0.0						
2.0	SS-1	8	16	22	38	4th 6" - 34 Blows
4.0	SS-2	37	38	34	72	~~4th 6" - 30 Blows~~
6.0	SS-3	9	7	10	17	4th 6" - 15 Blows
8.0	SS-4	4	3	6	9	4th 6" - 8 Blows
10.0	SS-5	5	4	5	9	4th 6" - 6 Blows
12.0	SS-6	2	2	3	5	4th 6" - 4 Blows
14.0	SS-7	3	2	2	4	~~4th 6" - 3 Blows~~
16.0	SS-8	1/12"		6	6	4th 6" - 4 Blows
18.0	SS-9	6	6	3	9	
23.0	SS-10	2	1	3	4	
28.0	SS-11	2	2	4	6	
33.5	SS-12	2	3	5	8	
38.5	SS-13	1	2	1	3	
43.5	SS-14	2	2	2	4	
48.5	SS-15	2	2	2	4	
53.5	SS-16	WOR/18"			0	



LEGEND

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SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
AWG - Rock Core, 1-1/8"
NQ - Rock Core, 1-7/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core
PHD - Percussion Hammer Drill

F&ME CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

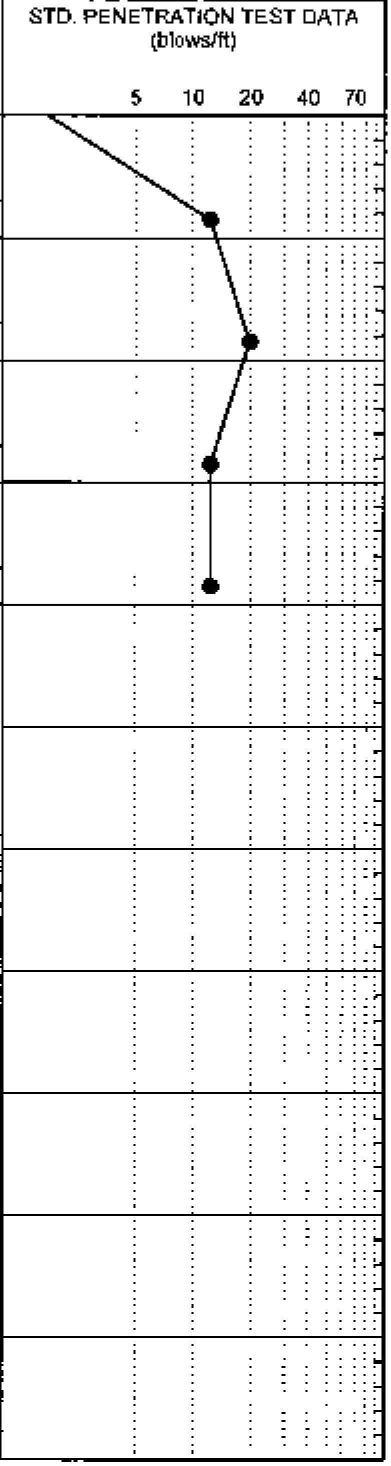
LOG OF BORING No. B-6

Station:
Offset:

Date Drilled: 02/26/11
Supervisor: Glynn Ellen
Casing Length (ft):
Approx. Ground Elevation (ft): 143.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 27 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E, Water Table Based on CPT Sounding

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value
	55.0	Loose to Medium Dense, Wet, Red Tan, Fine to Medium SAND (SP) with Mica							
				58.5	SS-17	4	4	6	10
83.0									
				63.5	SS-18	6	6	10	16
78.0									
				68.5	SS-19	4	5	5	10
73.0									
				73.5	SS-20	6	5	5	10
68.0	75.0	Boring Terminated at 75.0 Feet							
63.0									
58.0									
53.0									
48.0									
43.0									
38.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	PHD - Percussion Hammer Drill

F&ME
CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

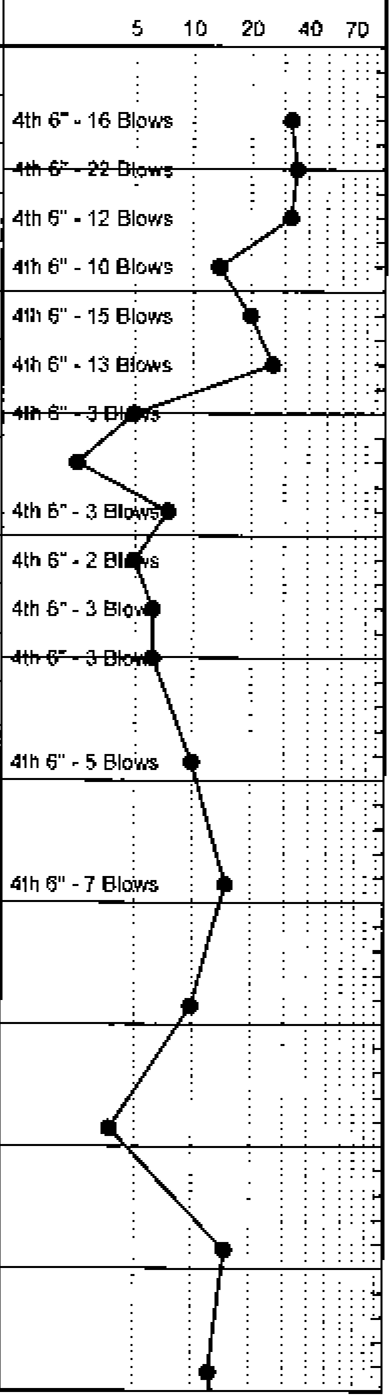
LOG OF BORING No. B-7

Station:
Offset:

Date Drilled: 02/25/11
Supervisor: Ricky Wessinger
Casing Length (ft):
Approx. Ground Elevation (ft): 143.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 24 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value	STD. PENETRATION TEST DATA (blows/ft)
		Top of Dike								
		Used Post Hole Digger to 2 Feet		0.0						
	2.0	Medium Dense, Dry to Moist, White/Pink, Silty Fine to Medium SAND (SM) with Kaolin Granules		2.0	SS-1	8	12	14	26	4th 6" - 16 Blows
138.0				4.0	SS-2	14	16	20	28	4th 6" - 22 Blows
				6.0	SS-3	6	12	14	26	4th 6" - 12 Blows
	8.0	Medium Dense, Moist, Red/Orange/White, Silty Micaceous Fine to Medium SAND (SM) with Trace of Ash		8.0	SS-4	6	5	6	11	4th 6" - 10 Blows
133.0	10.0 10.5	Coal Ash		10.0	SS-5	5	4	12	16	4th 6" - 15 Blows
		Medium Dense, Moist, White/Pink/Gray, Silty Micaceous Fine to Medium SAND (SM)		12.0	SS-6	9	8	13	21	4th 6" - 13 Blows
128.0	14.0	Very Loose, Wet, White/Gray/Brown/Red, Silty Fine to Medium SAND (SM)		14.0	SS-7	5	2	2	4	4th 6" - 3 Blows
				16.0	SS-8	1	1	1/12"	2	
123.0				18.0	SS-9	7	3	3	6	4th 6" - 3 Blows
				20.0	SS-10	1	2	2	4	4th 6" - 2 Blows
	22.0	Loose, Wet, Red/White/Gray, Silty Fine to Coarse SAND (SM) ∇ => with Gravel		22.0	SS-11	2	3	2	5	4th 6" - 3 Blows
118.0				24.0	SS-12	2	2	3	5	4th 6" - 3 Blows
	26.0	Firm, Wet, Gray/Brown, Sandy SILT (ML)								
113.0	29.0	Loose to Medium Dense, Wet, Brown/Gray, Micaceous Fine to Medium SAND (SP)		28.5	SS-13	2	4	4	8	4th 6" - 5 Blows
108.0				33.5	SS-14	5	5	7	12	4th 6" - 7 Blows
103.0	37.0	Firm, Wet, Gray, Micaceous Fine Sandy Plastic SILT (ML)		38.5	SS-15	3	4	4	8	
98.0	43.5	Soft, Wet, Blue/Gray, Micaceous CLAY (CL) with Sandy Seams and Wood Fragments		43.5	SS-16	2	1	2	3	
93.0	47.0	Loose to Medium Dense, Wet, Brown/Orange/Yellow, Micaceous Fine to Coarse SAND (SP)		48.5	SS-17	5	6	6	12	
				53.5	SS-18	5	4	6	10	



Continued Next Page

LEGEND

SAMPLER TYPE

SS - Split Spoon	NQ - Rock Core, 1-7/8"
ST - Shelby Tube	CU - Cuttings
AWG - Rock Core, 1-1/8"	CT - Continuous Tube

DRILLING METHOD

HSA - Hollow Stem Auger	RW - Rotary Wash
CFA - Continuous Flight Augers	RC - Rock Core
DC - Driving Casing	PHD - Percussion Hammer Drill

F&ME
CONSULTANTS

Urquhart Station Ash Pond Dike Investigation
Aiken County, South Carolina
G5044.000

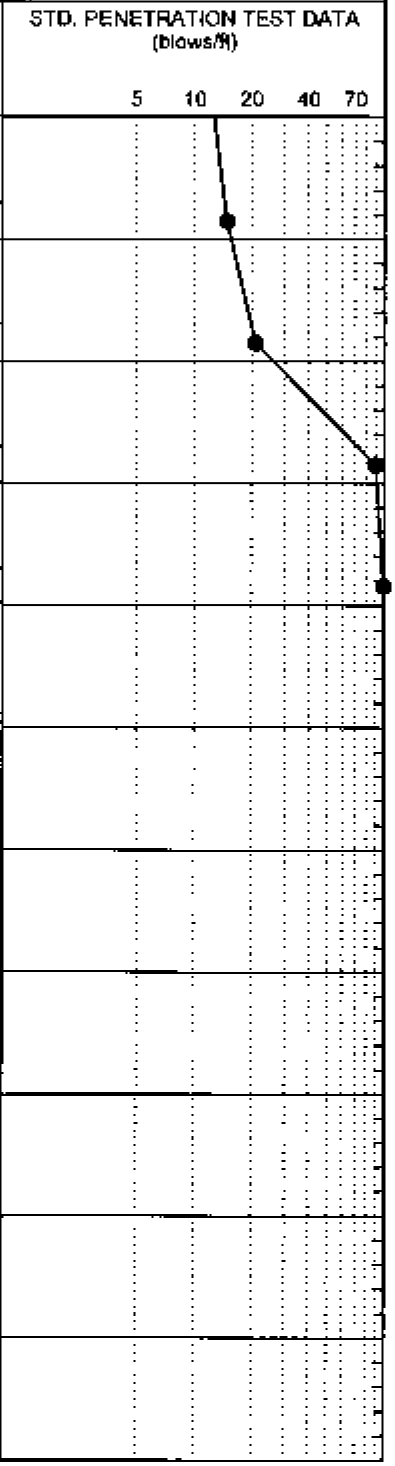
LOG OF BORING No. B-7

Station:
Offset:

Date Drilled: 02/25/11
Supervisor: Ricky Wessinger
Casing Length (ft):
Approx. Ground Elevation (ft): 143.0
Hammer Type: ☒ Gravity ☐ Automatic ☐ Other:
Water Level: 24 Feet at T.O.B.
Drilling Method: Rotary Wash

Notes:
Equipment Used - GUSPECH GP 1100E

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample Type-No.	1st 6"	2nd 6"	3rd 6"	N Value
		Loose to Medium Dense, Wet, Brown/Orange/Yellow, Micaceous Fine to Coarse <u>SAND (SP)</u>							
				58.5	SS-19	6	5	7	12
83.0									
				63.5	SS-20	9	8	9	17
78.0									
	68.0	Hard, Moist, White/Red, <u>SILT (ML)</u> (Kaolin)		68.5	SS-21	19	25	48	73
73.0									
		=> Hard Drilling							
				73.5	SS-22	22	38	50/4.5"	88
68.0	74.9	Boring Terminated at 74.9 Feet							
63.0									
58.0									
53.0									
48.0									
43.0									
38.0									



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	PHD - Percussion Hammer Drill

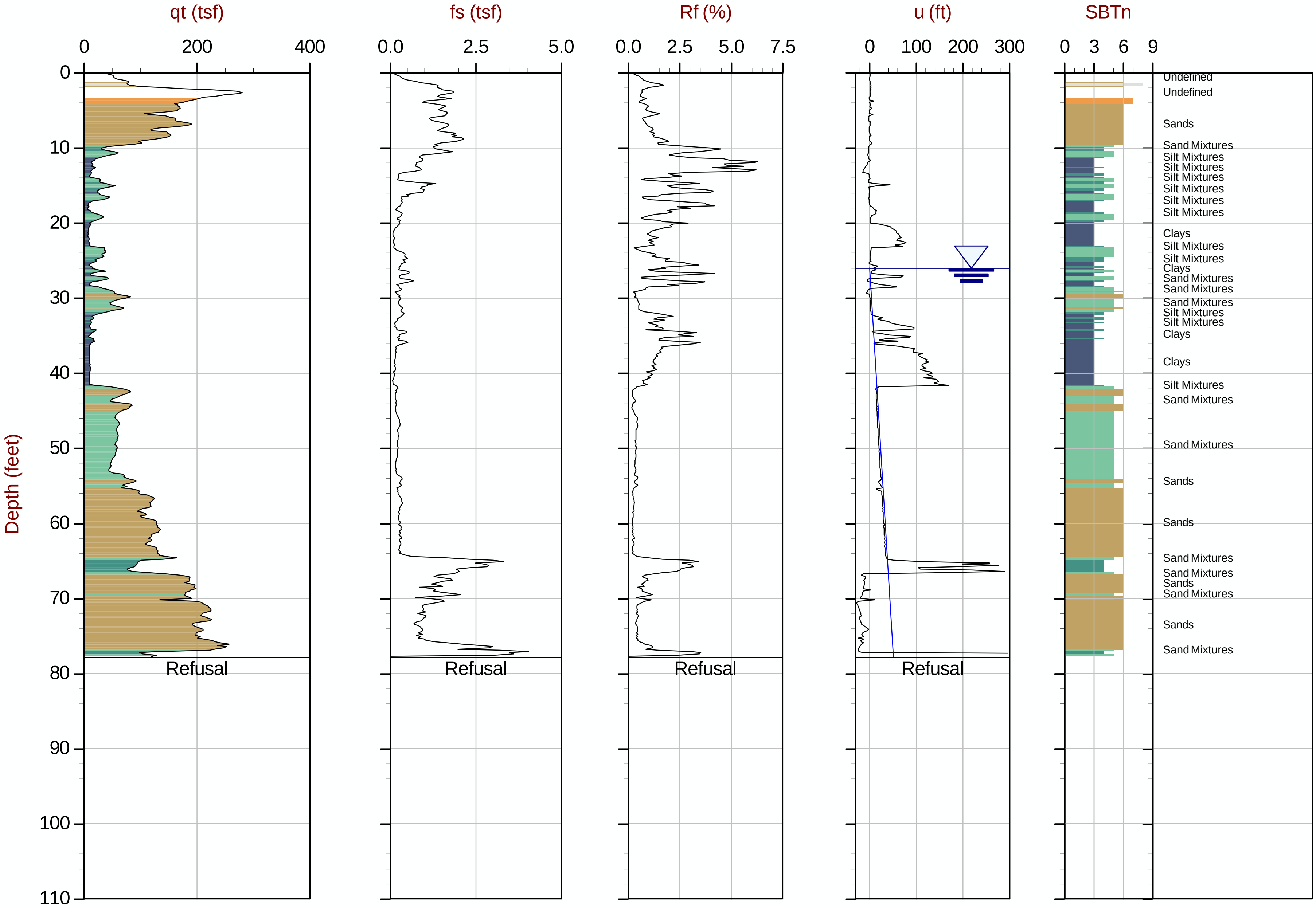
CPTu Plots

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 09:54
Site: Urquhart Fly Ash

Sounding: CPT-01
Cone: 215:T1500F15U500



Max Depth: 23.750 m / 77.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP01.COR
Unit Wt: SBT Chart Soil Zones

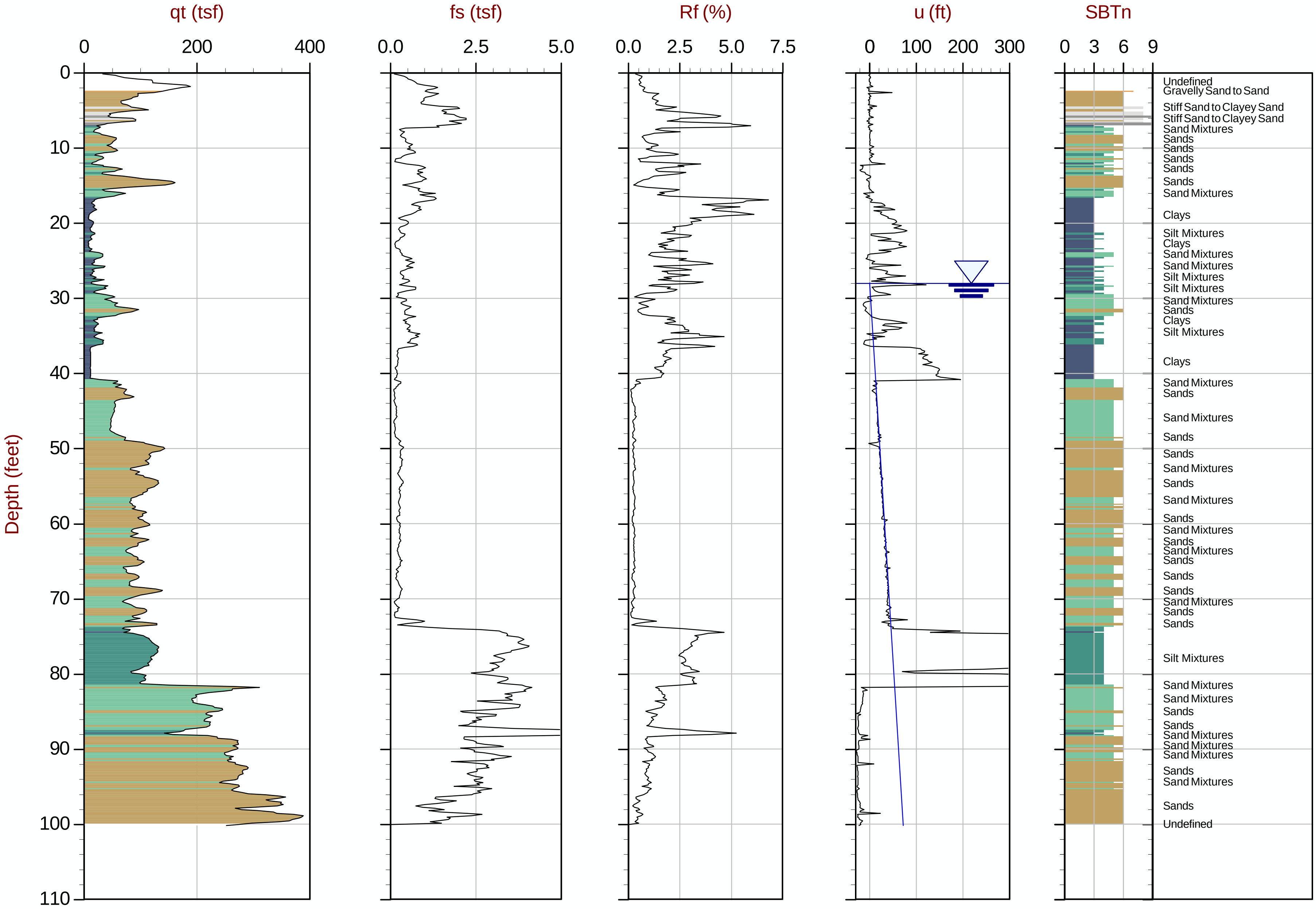
SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.435 E: 81.913 Elev: 0.000
Page No: 1 of 1

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 11:11
Site: Urquhart Fly Ash

Sounding: CPT-02
Cone: 215:T1500F15U500



Max Depth: 30.550 m / 100.23 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP02.COR
Unit Wt: SBT Chart Soil Zones

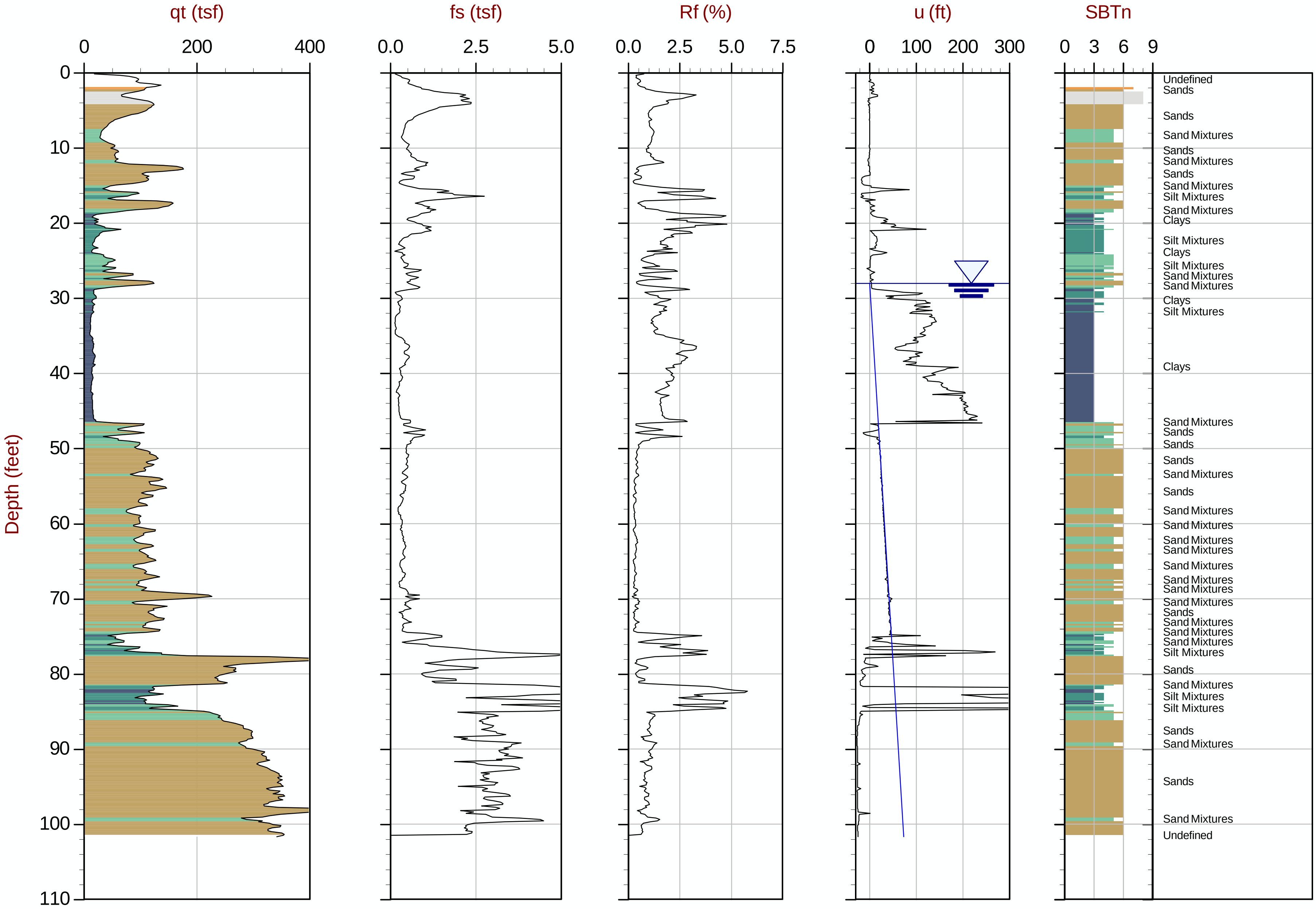
SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.436 E: 81.913 Elev: 0.000
Page No: 1 of 1

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 12:54
Site: Urquhart Fly Ash

Sounding: CPT-03
Cone: 215:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP03.COR
Unit Wt: SBT Chart Soil Zones

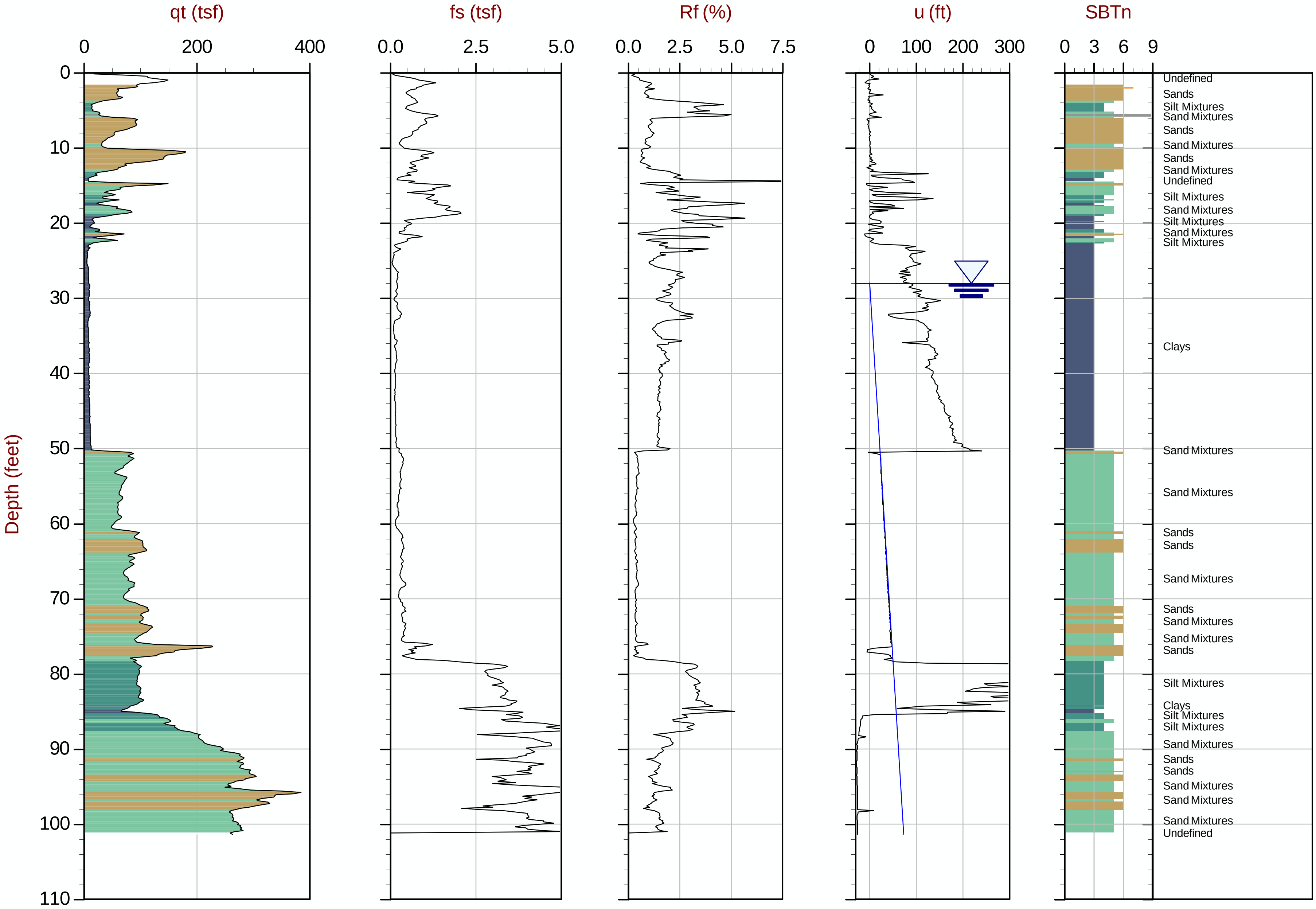
SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.436 E: 81.912 Elev: 0.000
Page No: 1 of 1

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 13:55
Site: Urquhart Fly Ash

Sounding: CPT-04
Cone: 215:T1500F15U500



Max Depth: 30.900 m / 101.38 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP04.COR
Unit Wt: SBT Chart Soil Zones

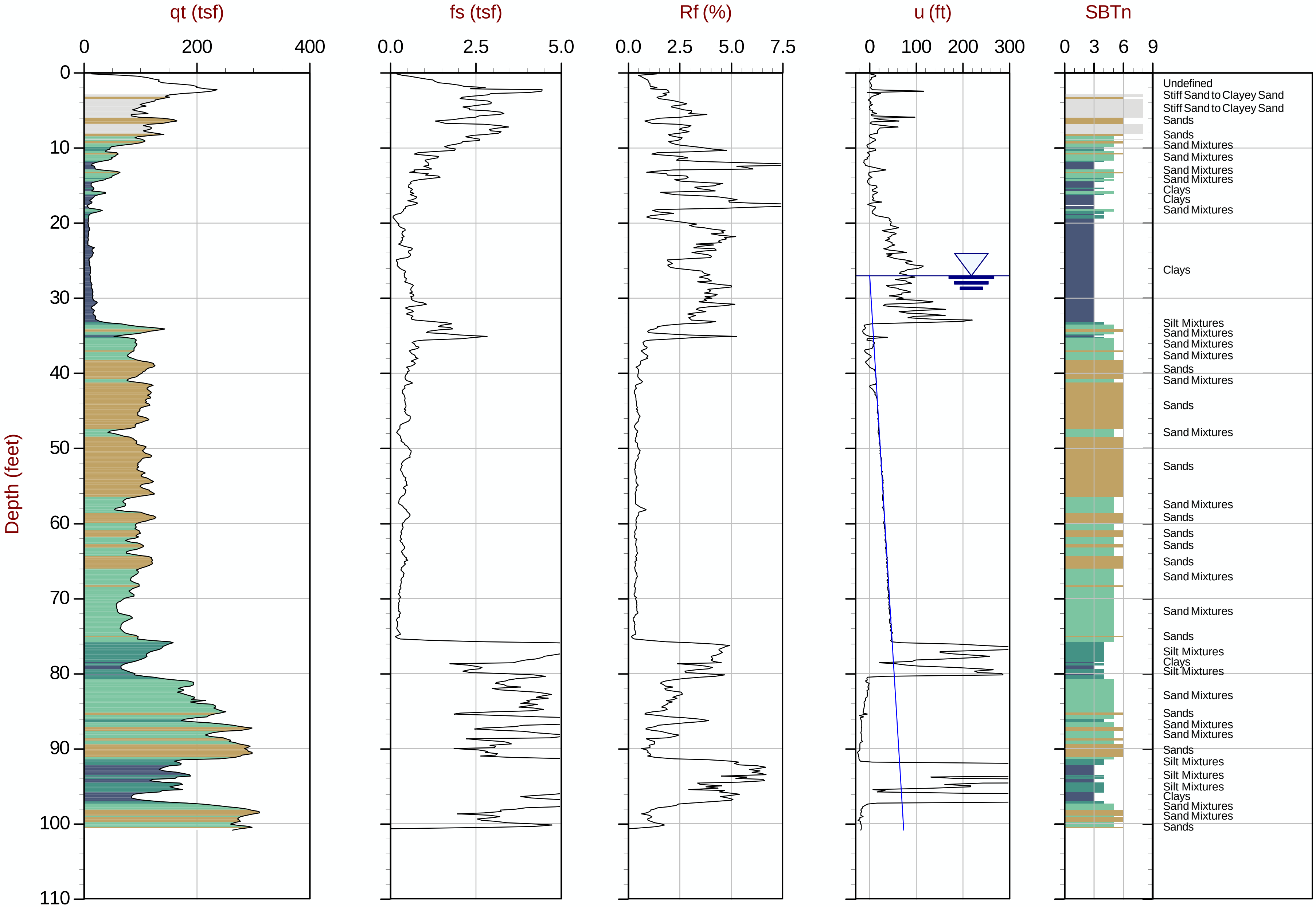
SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.436 E: 81.912 Elev: 0.000
Page No: 1 of 1

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 16:12
Site: Urquhart Fly Ash

Sounding: CPT-05
Cone: 215:T1500F15U500



Max Depth: 30.750 m / 100.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP05B.COR
Unit Wt: SBT Chart Soil Zones

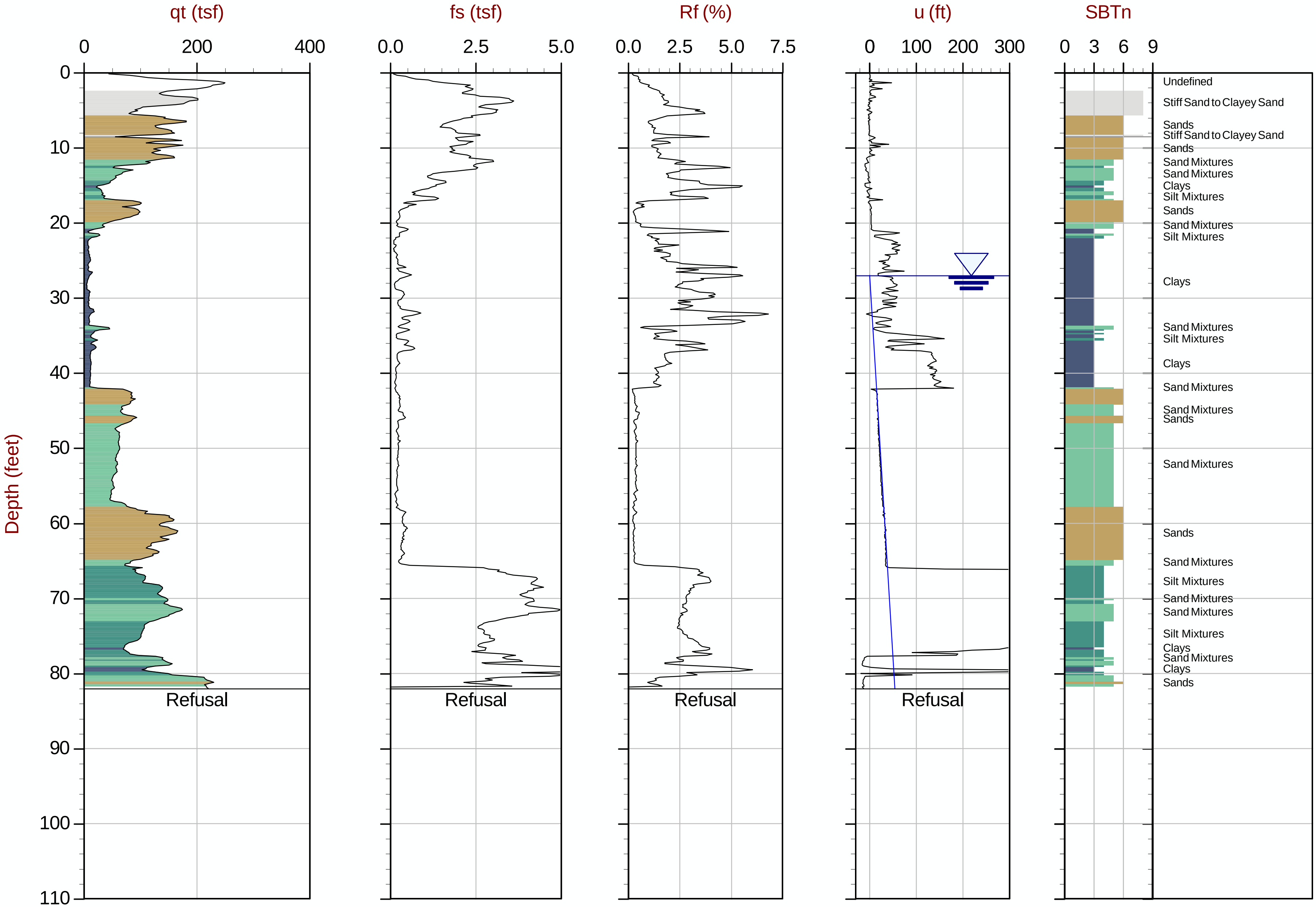
SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.435 E: 81.912 Elev: 0.000
Page No: 1 of 1

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 15:10
Site: Urquhart Fly Ash

Sounding: CPT-06
Cone: 215:T1500F15U500



Max Depth: 25.000 m / 82.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP06.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.435 E: 81.913 Elev: 0.000
Page No: 1 of 1

CONETEC

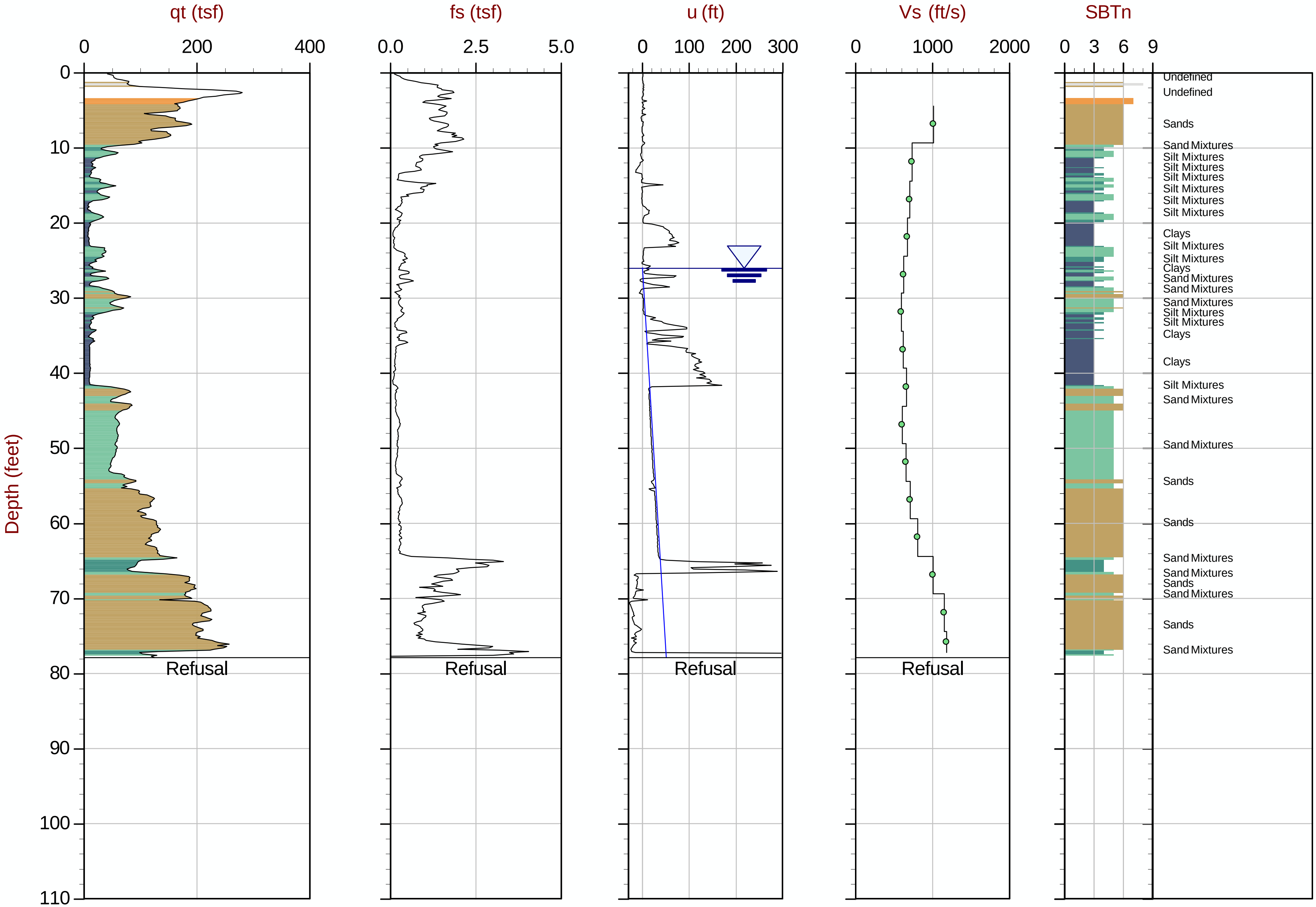
Shear Wave Data and Velocity Estimates

CONETEC

F&ME

Job No: 11-917
Date: 02:23:11 09:54
Site: Urquhart Fly Ash

Sounding: CPT-01
Cone: 215:T1500F15U500



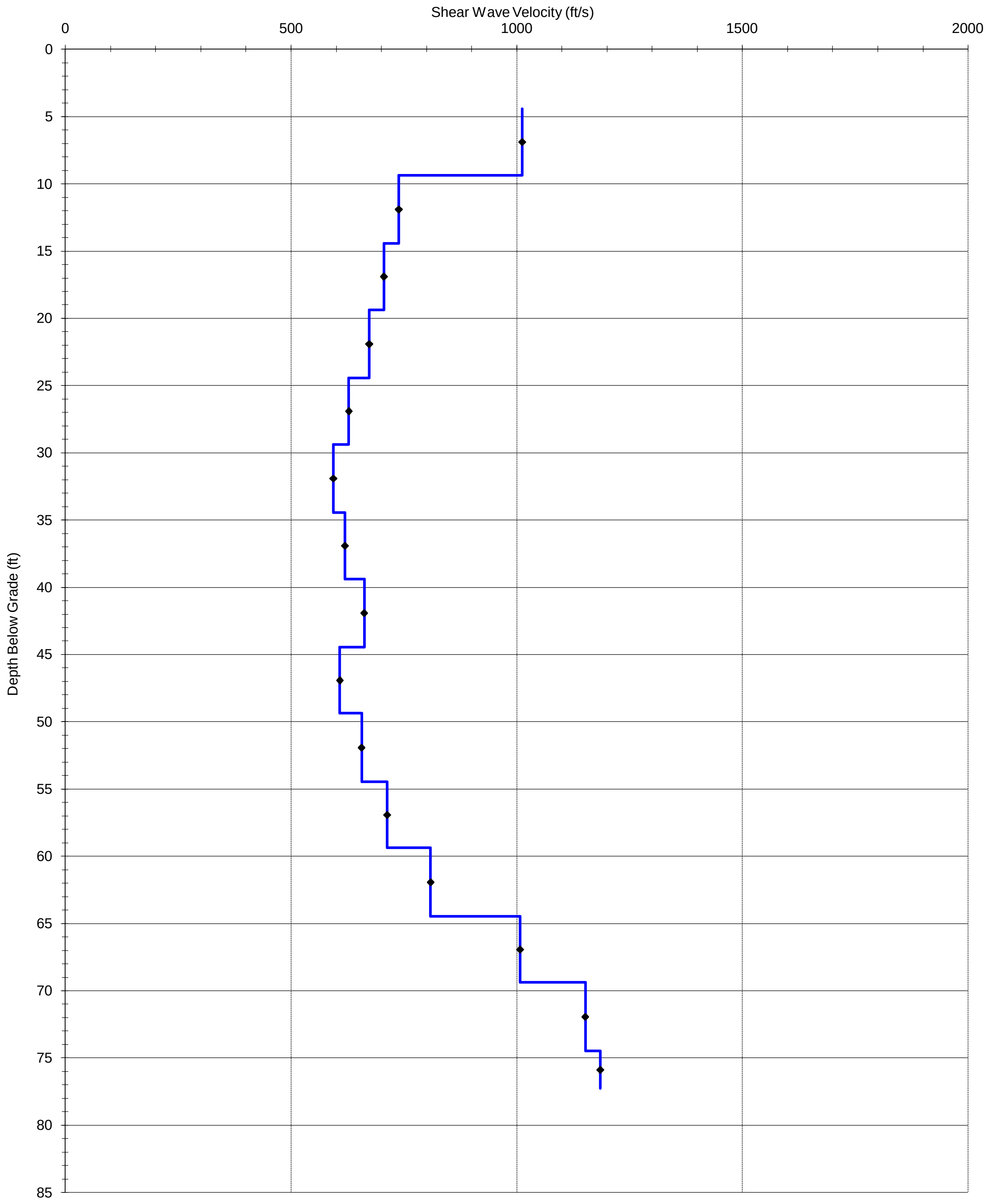
Max Depth: 23.750 m / 77.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP01.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.435 E: 81.913 Elev: 0.000
Page No: 1 of 1

ConeTec

Shear Wave Velocity- CPT-1
Urquhart Fly Ash
11-917
February 23 2011

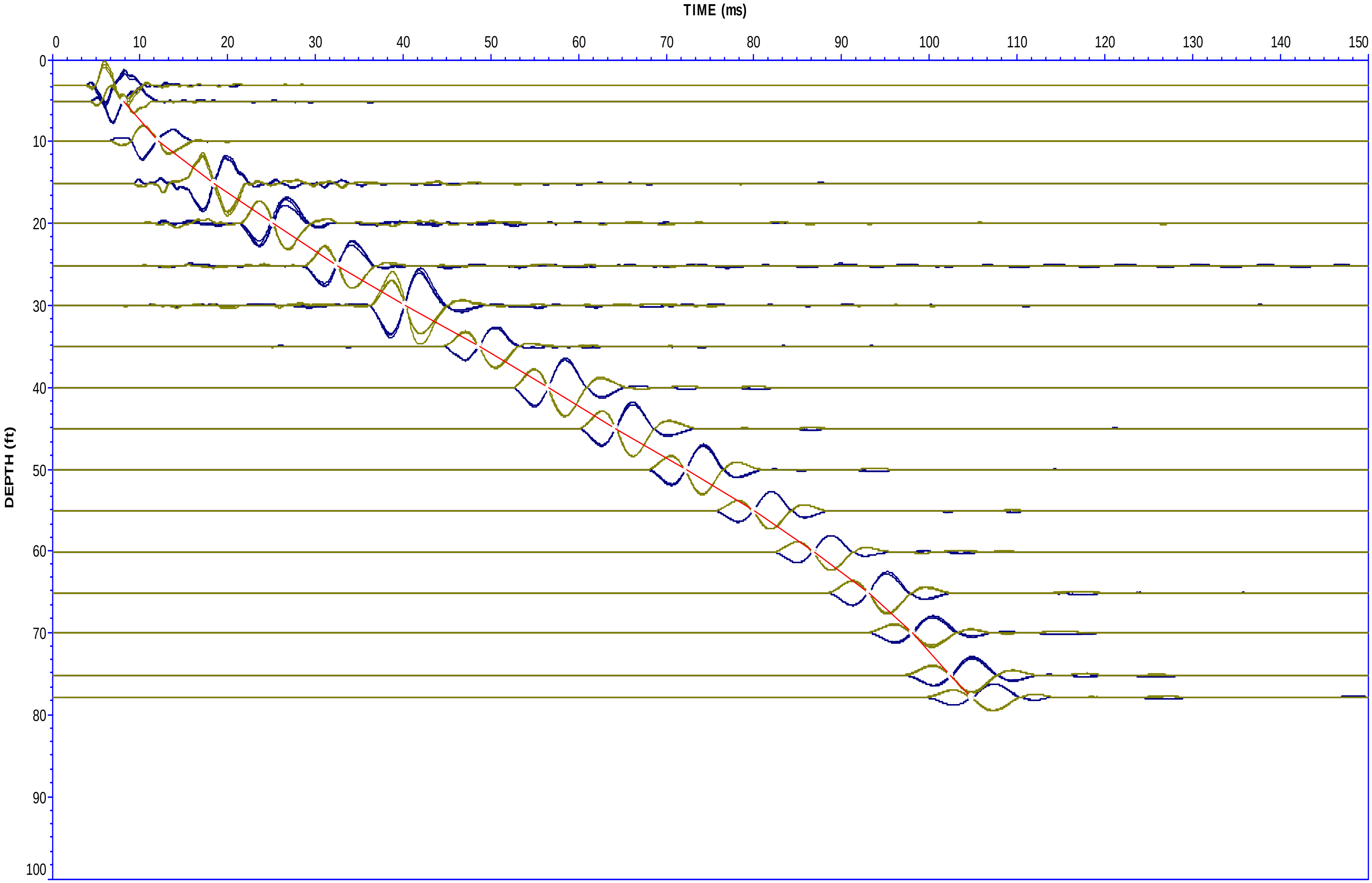


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole:	CPT-1
Location:	Urquhart Fly Ash
Cone:	AD215
Date:	23-Feb-11
Source:	Beam
Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
1.55	1.35	1.98					
3.05	2.85	3.20	3.94	308.5	1012.2	2.10	6.89
4.60	4.40	4.63	6.38	225.1	738.5	3.62	11.89
6.10	5.90	6.08	6.71	215.0	705.3	5.15	16.90
7.65	7.45	7.59	7.38	205.1	673.0	6.67	21.90
9.15	8.95	9.07	7.72	191.3	627.8	8.20	26.90
10.70	10.50	10.60	8.47	180.9	593.6	9.72	31.91
12.20	12.00	12.09	7.89	188.6	618.9	11.25	36.91
13.75	13.55	13.63	7.63	201.7	661.9	12.77	41.91
15.25	15.05	15.12	8.05	185.3	607.9	14.30	46.92
16.80	16.60	16.66	7.72	200.0	656.1	15.82	51.92
18.30	18.10	18.16	6.88	217.3	712.9	17.35	56.92
19.85	19.65	19.70	6.27	246.6	809.1	18.87	61.92
21.35	21.15	21.20	4.87	307.0	1007.1	20.40	66.93
22.90	22.70	22.75	4.40	351.1	1152.0	21.92	71.93
23.75	23.55	23.59	2.35	361.2	1185.0	23.12	75.87

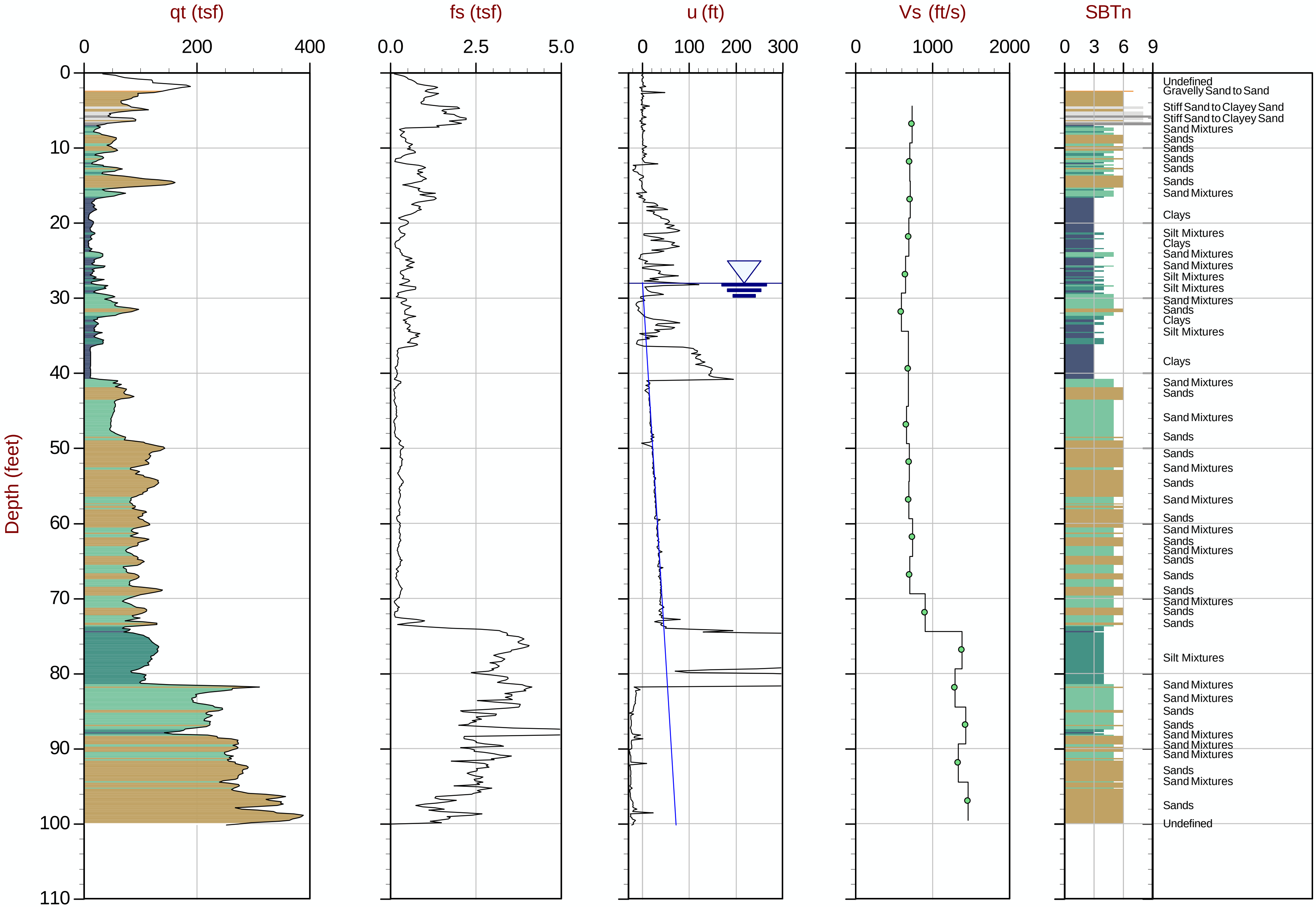
Job No: 11-917 Client: F&ME Project Title: Urquhart Fly Ash Operator: TS-RH Hole: CPT-01 Site: Urquhart Fly As Date: 02:23:11 09:54
Oversite: 215:T1500F15U500



F&ME

Job No: 11-917
Date: 02:23:11 11:11
Site: Urquhart Fly Ash

Sounding: CPT-02
Cone: 215:T1500F15U500

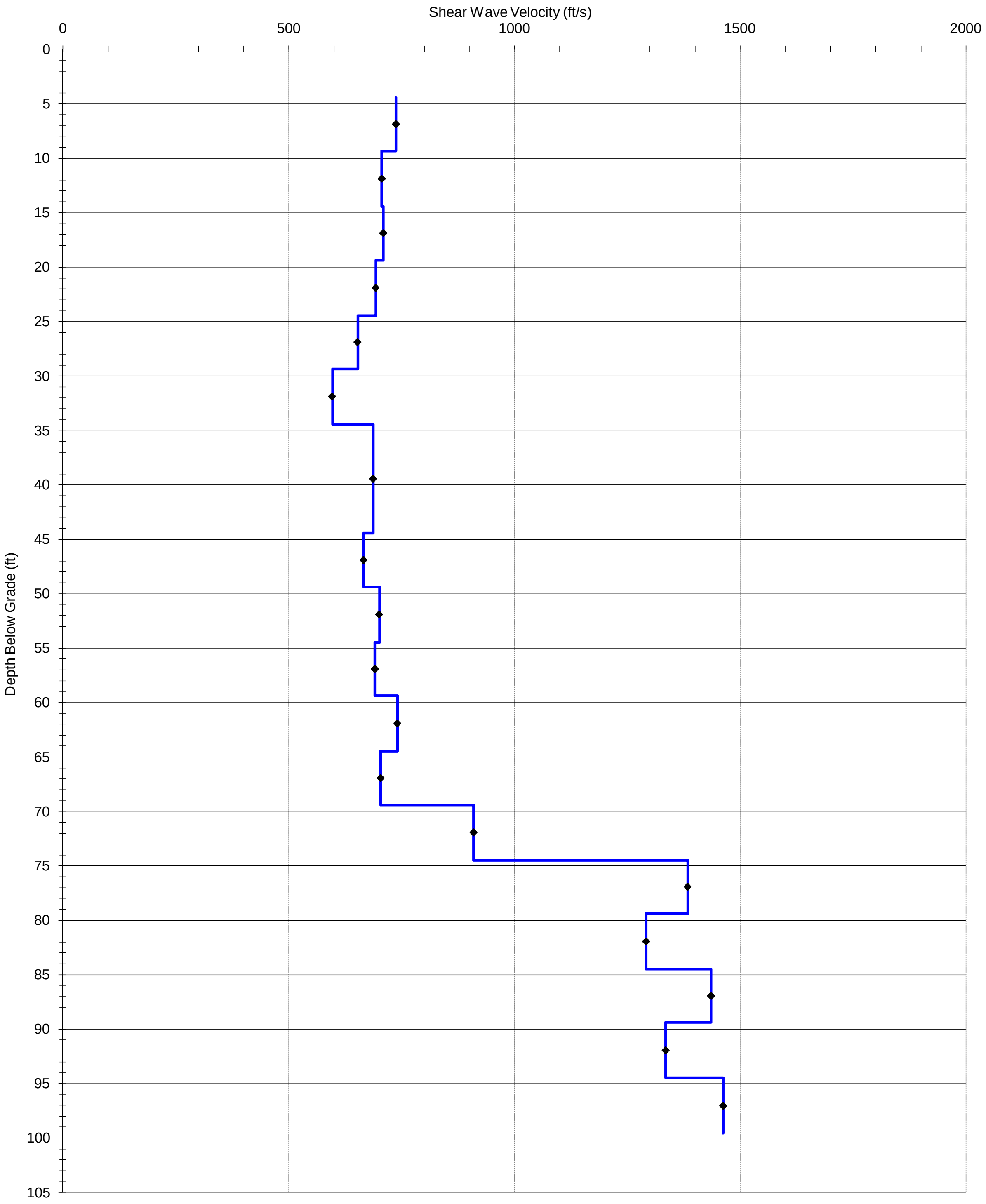


Max Depth: 30.550 m / 100.23 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP02.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.436 E: 81.913 Elev: 0.000
Page No: 1 of 1

Shear Wave Velocity- CPT-2
Urquhart Fly Ash
11-917
February 23 2011



ConeTec Shear Wave Velocity Data Reduction Sheet

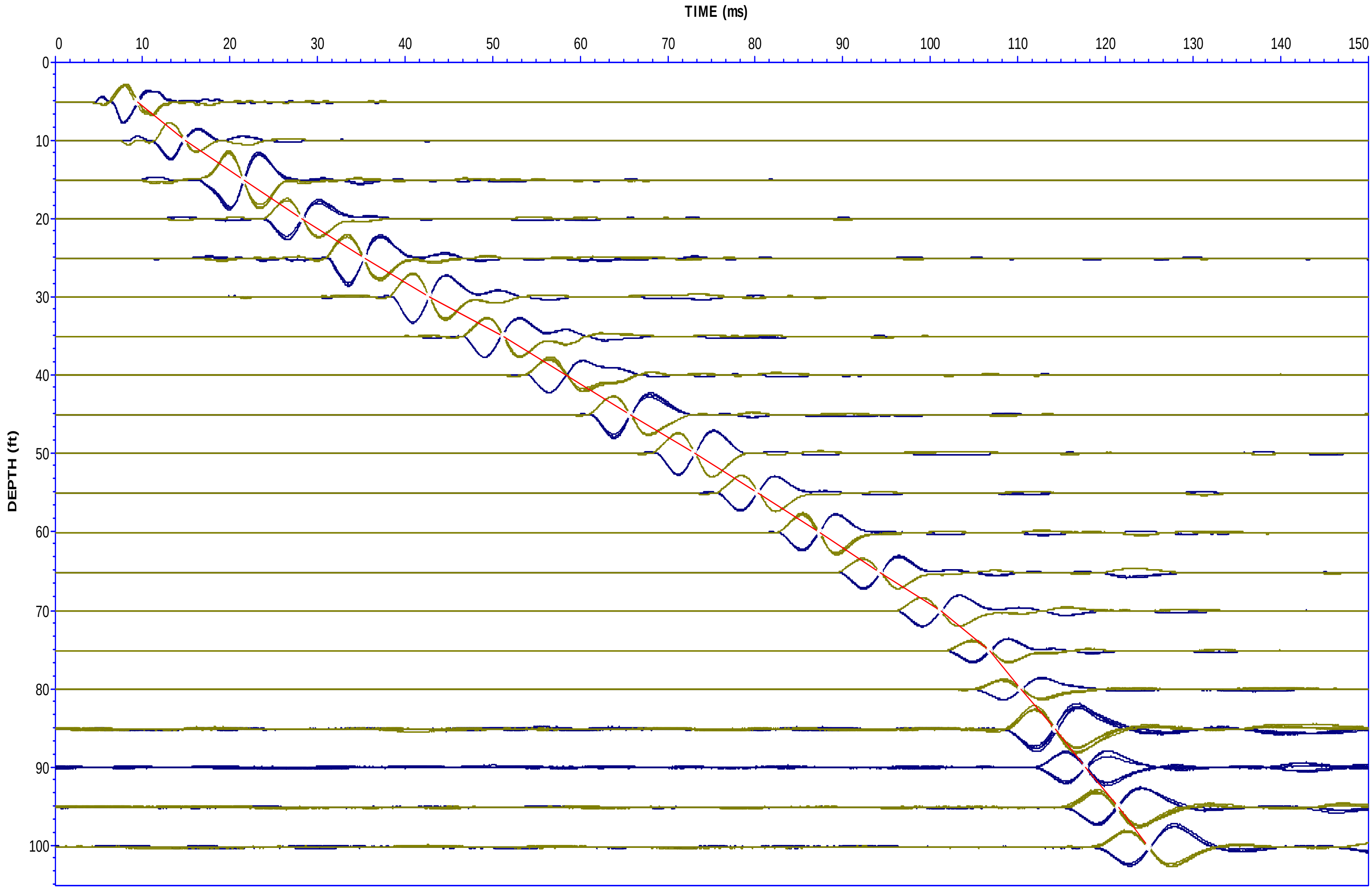
Hole: CPT-2
Location: Urquhart Fly Ash
Cone: AD215
Date: 23-Feb-11
Source: Beam

Source Depth 0.00 m
Source Offset 1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
1.55	1.35	1.98					
3.05	2.85	3.20	5.41	224.8	737.6	2.10	6.89
4.60	4.40	4.63	6.67	215.2	705.9	3.62	11.89
6.10	5.90	6.08	6.67	216.3	709.7	5.15	16.90
7.65	7.45	7.59	7.17	211.1	692.6	6.67	21.90
9.15	8.95	9.07	7.42	198.9	652.6	8.20	26.90
10.70	10.50	10.60	8.43	181.8	596.5	9.72	31.91
13.75	13.55	13.63	14.46	209.3	686.8	12.02	39.45
15.25	15.05	15.12	7.35	202.9	665.7	14.30	46.92
16.80	16.60	16.66	7.23	213.6	700.6	15.82	51.92
18.30	18.10	18.16	7.10	210.5	690.7	17.35	56.92
19.85	19.65	19.70	6.85	225.7	740.6	18.87	61.92
21.35	21.15	21.20	6.97	214.5	703.9	20.40	66.93
22.90	22.70	22.75	5.58	277.2	909.4	21.92	71.93
24.40	24.20	24.24	3.55	421.7	1383.5	23.45	76.93
25.95	25.75	25.79	3.93	393.7	1291.6	24.97	81.94
27.45	27.25	27.29	3.42	437.5	1435.3	26.50	86.94
29.00	28.80	28.84	3.80	406.9	1335.1	28.03	91.94
30.55	30.35	30.38	3.47	445.7	1462.2	29.57	97.03

ConeTec

Job No: 11-917 Client: F&ME Project Title: Urquhart Fly Ash Operator: TS-RH Hole: CPT-02 Site: Urquhart Fly As Date: 02:23:11 11:11
Oversite: 215:T1500F15U500

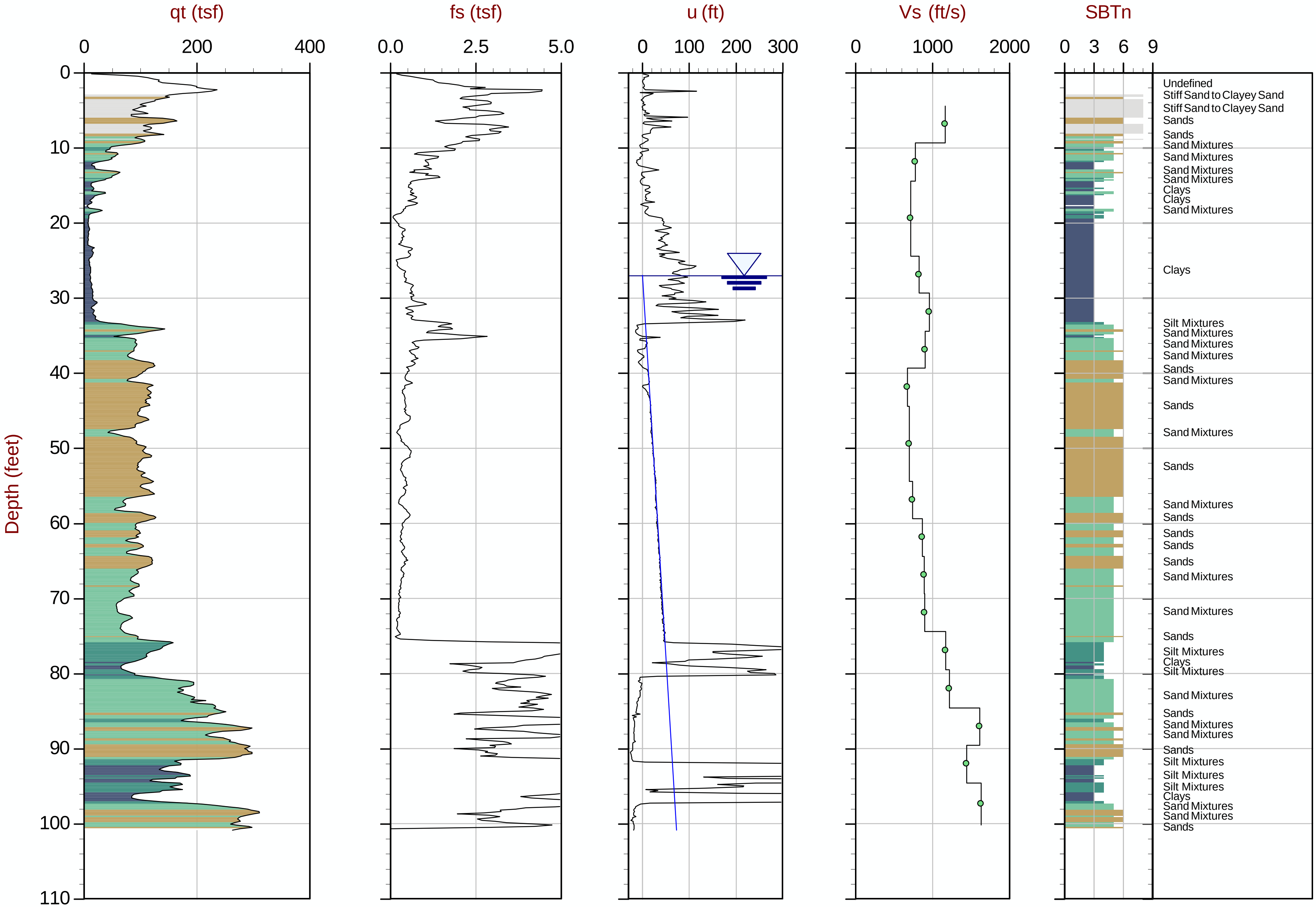


ConeTec

F&ME

Job No: 11-917
Date: 02:23:11 16:12
Site: Urquhart Fly Ash

Sounding: CPT-05
Cone: 215:T1500F15U500



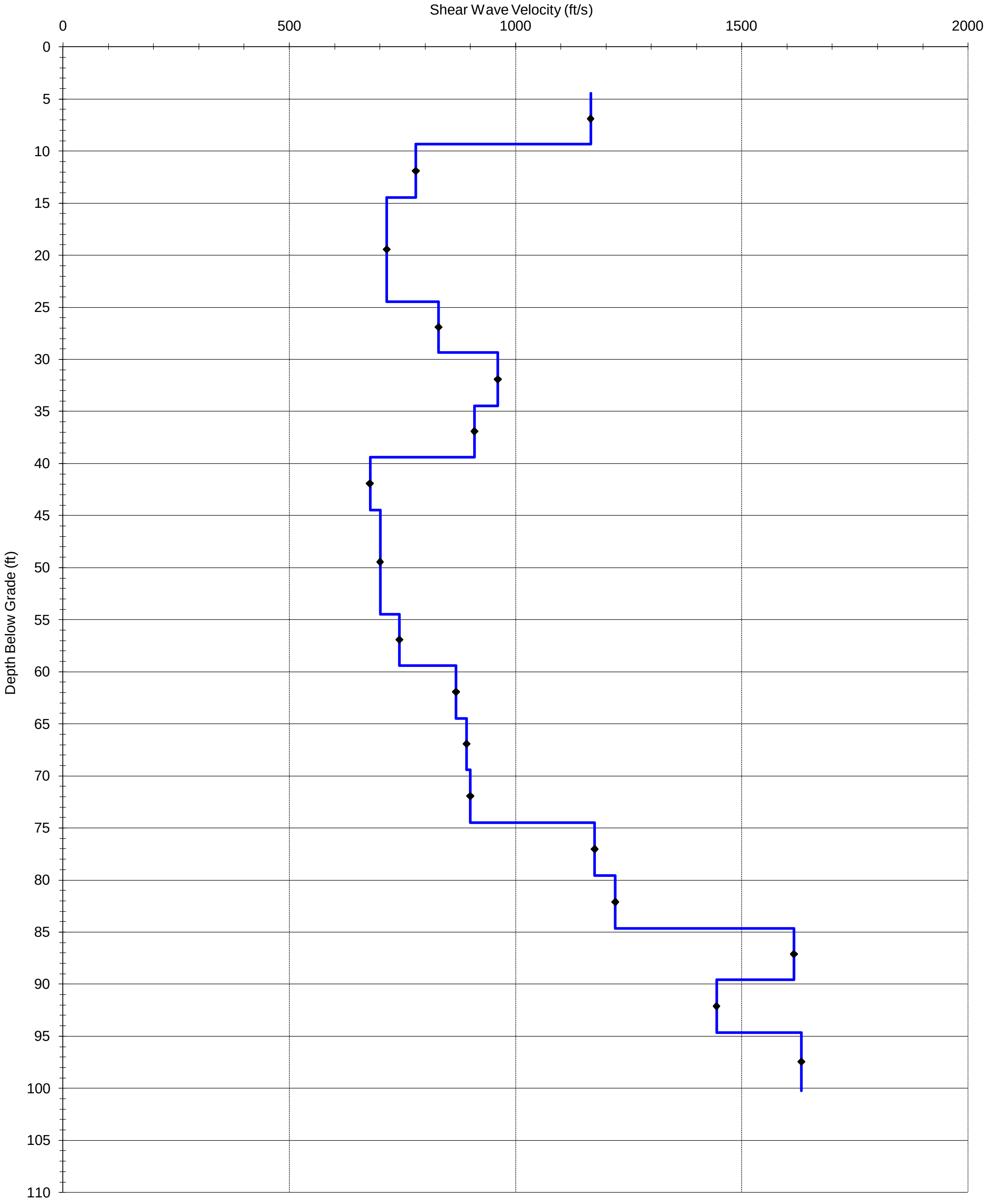
Max Depth: 30.750 m / 100.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 917CP05B.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: N: 33.435 E: 81.912 Elev: 0.000
Page No: 1 of 1

CONETEC

Shear Wave Velocity- CPT-5
Urquhart Fly Ash
11-917
February 23 2011



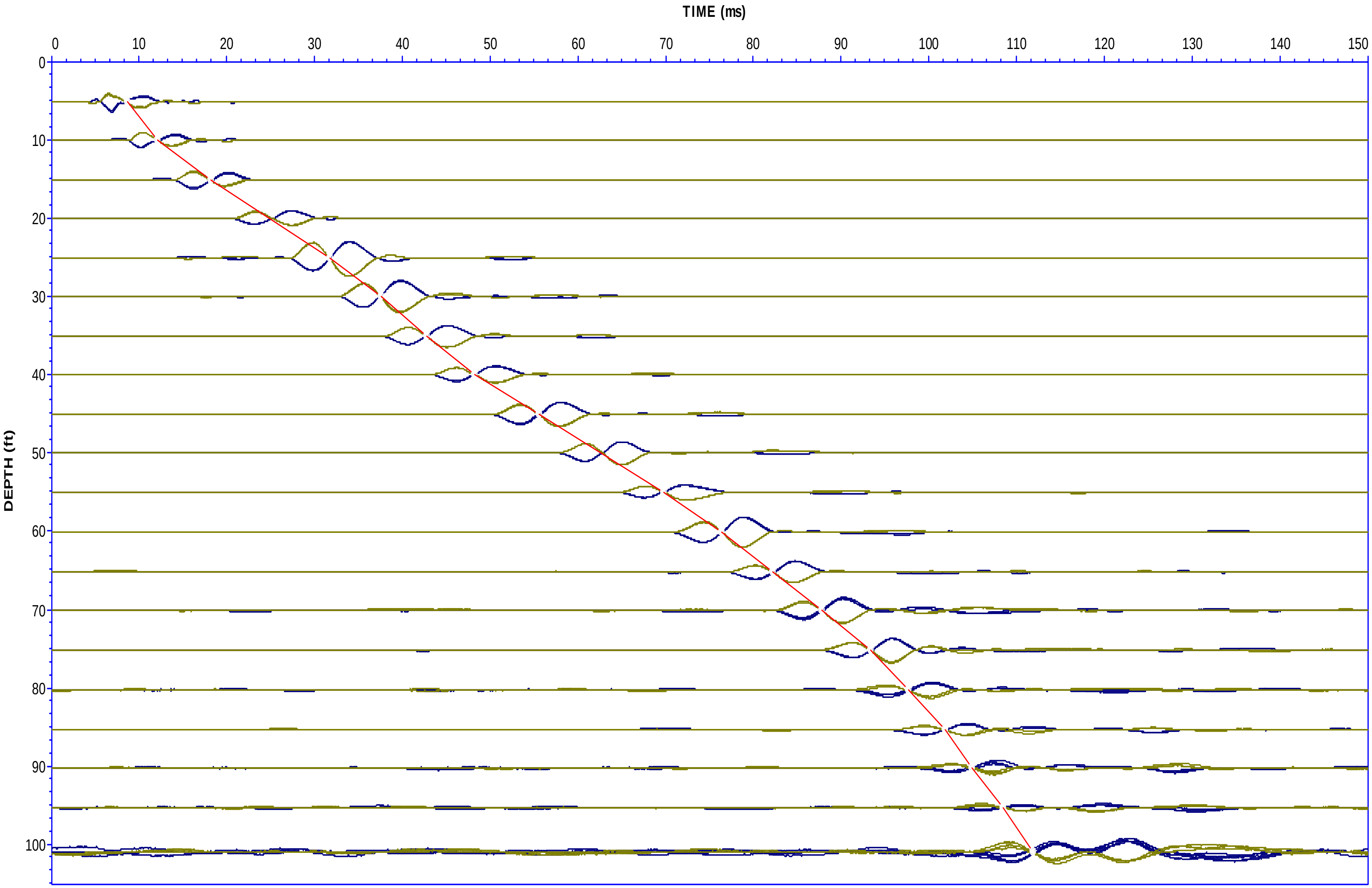
ConeTec Shear Wave Velocity Data Reduction Sheet

Hole:	CPT-2
Location:	Urquhart Fly Ash
Cone:	AD215
Date:	23-Feb-11
Source:	Beam
Source Depth	0.00 m
Source Offset	1.45 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
1.55	1.35	1.98					
3.05	2.85	3.20	3.42	355.4	1166.0	2.10	6.89
4.60	4.40	4.63	6.04	237.6	779.5	3.62	11.89
7.65	7.45	7.59	13.56	218.1	715.6	5.92	19.44
9.15	8.95	9.07	5.84	252.9	829.8	8.20	26.90
10.70	10.50	10.60	5.23	292.8	960.7	9.72	31.91
12.20	12.00	12.09	5.37	277.1	909.0	11.25	36.91
13.75	13.55	13.63	7.45	206.7	678.3	12.77	41.91
16.80	16.60	16.66	14.21	213.6	700.8	15.07	49.46
18.30	18.10	18.16	6.59	226.7	743.7	17.35	56.92
19.85	19.65	19.70	5.84	264.7	868.4	18.87	61.92
21.35	21.15	21.20	5.50	271.9	892.0	20.40	66.93
22.90	22.70	22.75	5.64	274.3	900.0	21.92	71.93
24.45	24.25	24.29	4.32	358.2	1175.1	23.47	77.02
26.00	25.80	25.84	4.16	372.1	1220.7	25.03	82.10
27.50	27.30	27.34	3.04	492.2	1614.8	26.55	87.11
29.05	28.85	28.89	3.52	440.2	1444.1	28.07	92.11
30.75	30.55	30.58	3.42	497.2	1631.3	29.70	97.44

CONETEC

Job No: 11-917 Client: F&ME Project Title: Urquhart Fly Ash Operator: TS-RH Hole: CPT-05 Site: Urquhart Fly As Date: 02:23:11 16:12
Oversite: 215:T1500F15U500



Appendix B

Laboratory Test Results

URQUHART STATION ASH POND DIKE INVESTIGATION
BEECH ISLAND, SC
F&ME PROJECT NO.: G5044
LABORATORY ANALYSIS SUMMARY

BORING NUMBER	SAMPLE DEPTH (ft)	SAMPLE NUMBER	% GRAVEL	% SAND	% FINES (SILT/CLAY)	% MOISTURE	LL	PL	PI	USCS
B-1	2.0-4.0	11-0284A	2.5	63.5	33.9	9.6	28	18	10	SC
B-1	6.0-8.0	11-0284D	3.1	74.6	22.3	12.1	NP	NP	NP	SM
B-1	14.0-16.0	11-0284G	0.1	38.6	61.3	26.9	25	NP	--	ML
B-1	16.0-18.0	11-0284J	1.6	62.0	36.4	20.1				SM
B-1	18.0-20.0	11-0284L	0.3	68.7	31.0	18.5				SM
B-1	23.5-25.0	11-0284N	0.0	92.2	7.8	21.6				SP-SM
B-1	33.5-35.0	11-0284P	0.0	27.2	72.8	37.5	43	32	11	ML
B-1	48.5-50.0	11-0284S	0.0	95.8	4.2	18.9				SP
B-1	78.5-80.0	11-0284U	0.0	54.3	45.7	28.2	31	NP	--	SM
B-2	12.0-14.0	11-0285A	0.8	54.5	44.7	26.7	28	NP	--	SM
B-2	14.0-16.0	11-0285D	0.1	34.2	65.7	29.7	29	NP	--	ML
B-2	16.0-18.0	11-0285G	38.6		61.4	34.3				ML
B-2	18.0-20.0	11-0285I	43.0		57.0	32.8				ML
B-2	23.5-25.0	11-0285K	0.6	89.5	9.9	33.9				SP-SM
B-2	29.5-31.0	11-0285M	0.0	11.4	88.6	52.7	26	NP	--	ML
B-2	39.5-41.0	11-0285P	0.0	95.0	5.0	19.7				SP
B-2	48.5-50.0	11-0285R	0.4	94.7	4.9	21.4				SP
B-2	68.5-70.0	11-0285T	0.0	19.5	80.5	21.5	41	24	17	CL
B-4	2.0-4.0	11-0291A	1.4	41.4	57.1	13.3	25	19	6	CL-ML
B-4	6.0-8.0	11-0291D	0.2	78.3	21.4	14.1	26	NP	--	SM
B-4	10.0-12.0	11-0291G	0.4	80.4	19.1	14.5	26	NP	--	SM
B-4	18.0-20.0	11-0291J	0.0	70.1	29.9	12.9				SM
B-4	28.5-30.0	11-0291L	0.0	7.8	92.2	32.1	34	33	1	ML
B-4	63.5-65.0	11-0291O	0.0	96.0	4.0	28.6				SP
B-6	6.0-8.0	11-0286A	0.9	50.5	48.6	19.2	28	18	10	SC
B-6	10.0-12.0	11-0286D	2.8	53.4	43.9	20.4	37	26	11	SM
B-6	16.0-18.0	11-0286G	3.6	66.3	30.2	14.2	32	22	10	SC
B-6	38.5-40.0	11-0286J	0.0	7.2	92.8	50.5	38	NP	--	ML

F&ME CONSULTANTS
3112 Devine Street
Columbia, South Carolina 29205

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT: Urquhart Station Ash Pond Dike Investigation **PROJECT NO.:** G5044.000

SAMPLE NUMBER: B-1 / 11-0284 **DATE SAMPLE RECEIVED:** 2/28/2011

DESCRIPTION OF SOIL: Various

TESTED BY: L. Guempel **DATE OF TESTING:** 3/1/2011

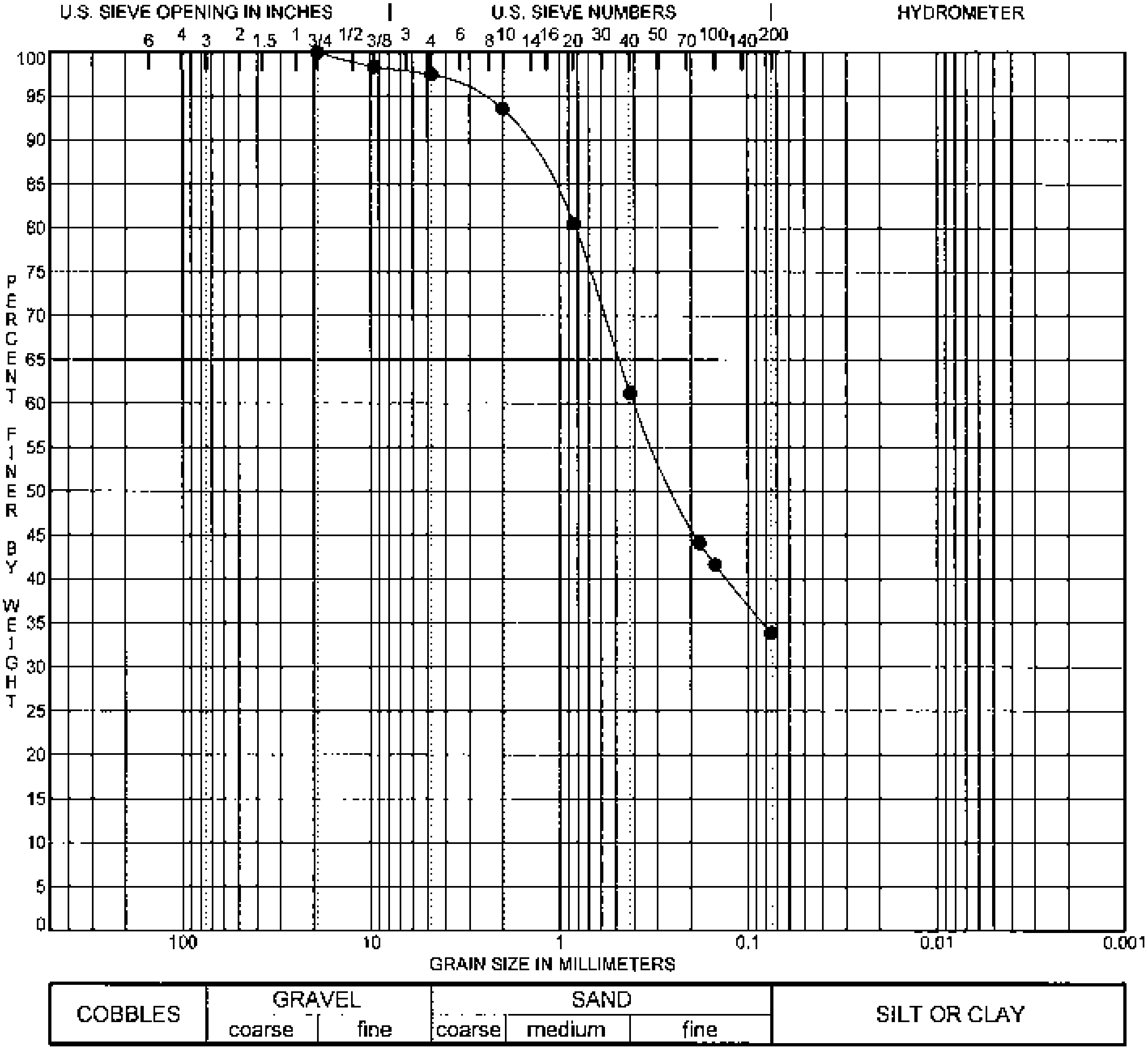
DATE OF WEIGHING: 3/2/2011

BORING NO.	B-1	B-1	B-1	B-1	B-1
SAMPLE NO.	11-0284A	11-0284D	11-0284G	11-0284J	11-0284L
SAMPLE DEPTH	2.0'-4.0'	6.0'-8.0'	14.0'-16.0'	16.0'-18.0'	18.0'-20.0'
WATER CONTENT, W%	9.6	12.1	26.9	20.1	18.5

BORING NO.	B-1	B-1	B-1	B-1	
SAMPLE NO.	11-0284N	11-0284P	11-0284S	11-0284U	
SAMPLE DEPTH	23.5'-25.0'	33.5'-35.0'	48.5'-50.0'	78.5'-80.0'	
WATER CONTENT, W%	21.6	37.5	18.9	28.2	

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-1 (0284B)**	**4.0**	**Lt Brown Clayey F/M SAND (SC)**	**9.6**	**28**	**18**	**10**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-1 (0284B)**	**4.0**	**19.10**	**0.40**			**2.5**	**63.5**	**33.9**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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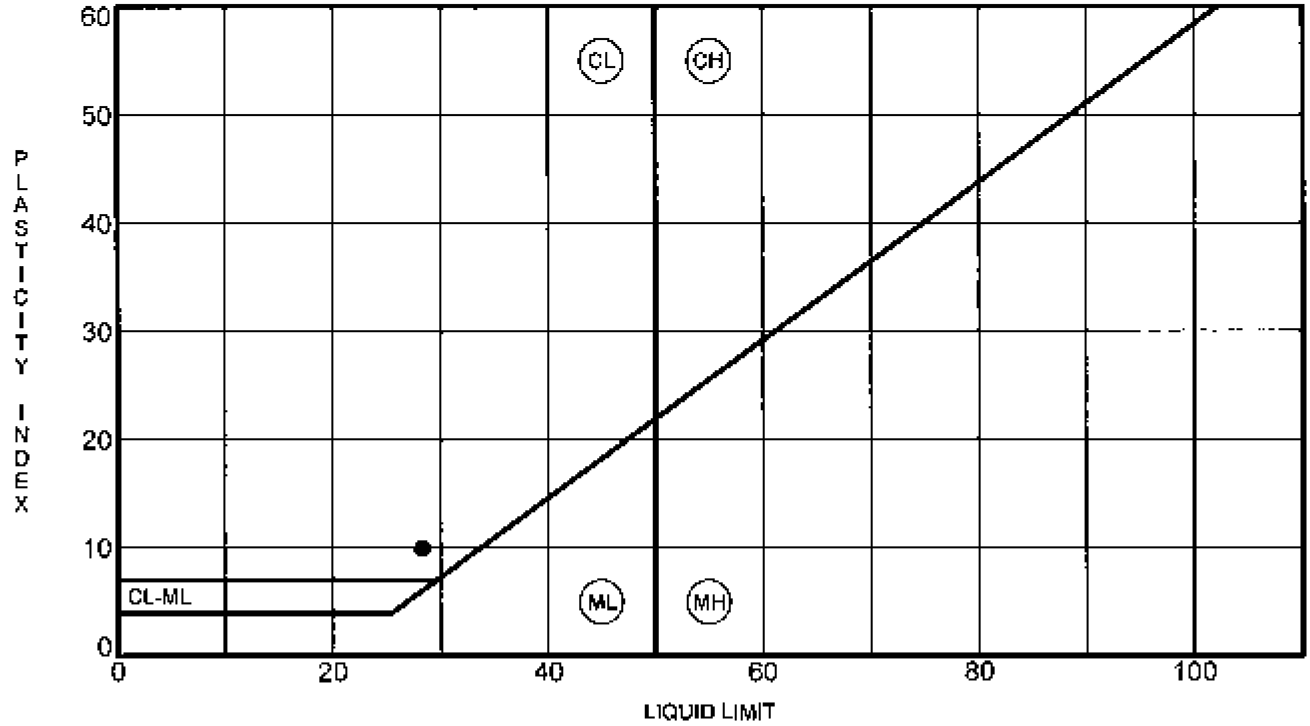
GRADATION CURVES



Specimen Identification		LL	PL	PI	Fines	Classification
● B-1 (0284C)	4.0	28	18	10		Lt. Brown Clayey F/M SAND (SC)

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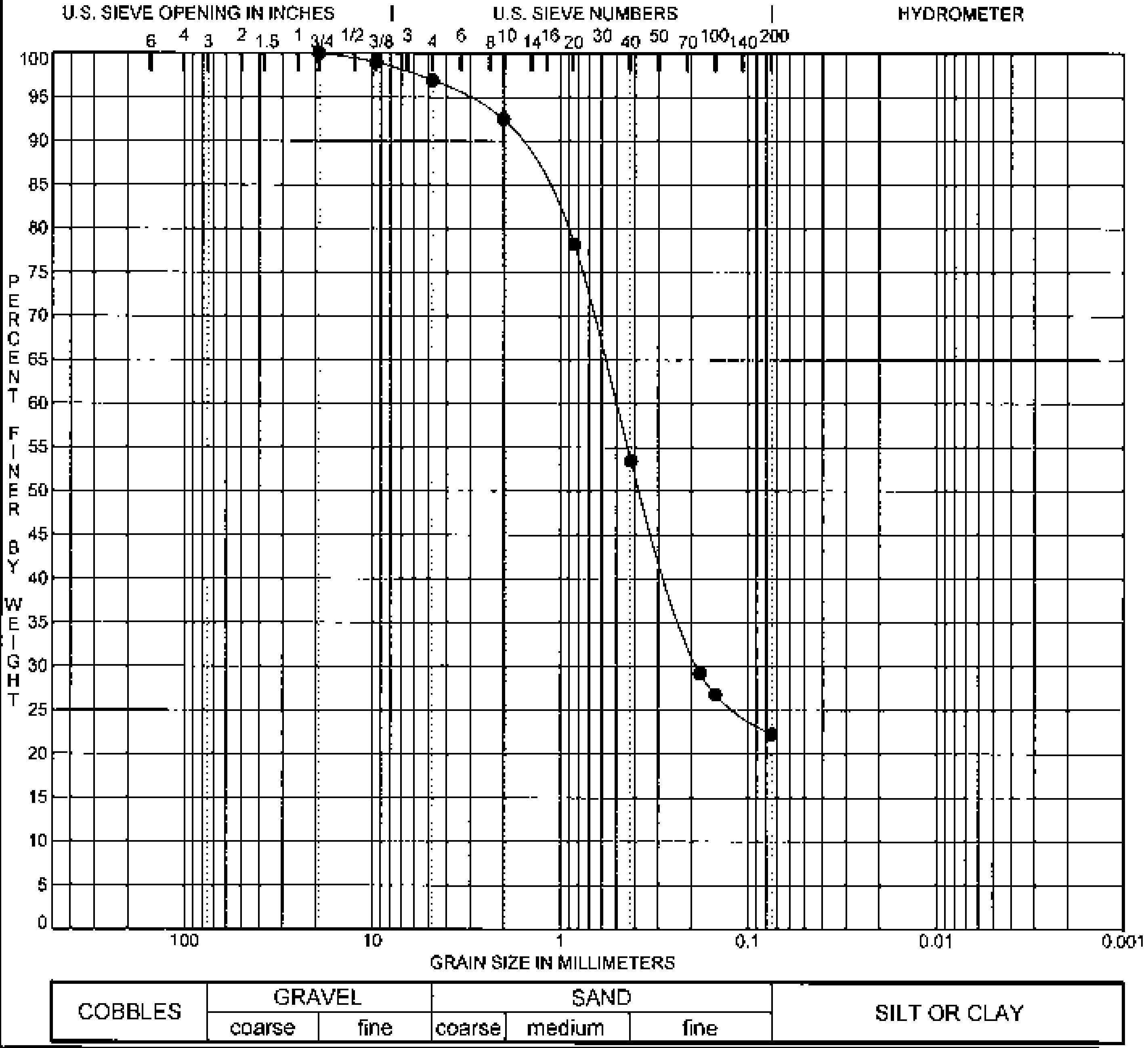
ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **B-1 (0284E) 8.0**	**Lt Brown Silty F/M SAND (SM)**	**12.1**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-1 (0284E) 8.0**	**19.10**	**0.50**	**0.185**		**3.1**	**74.6**	**22.3**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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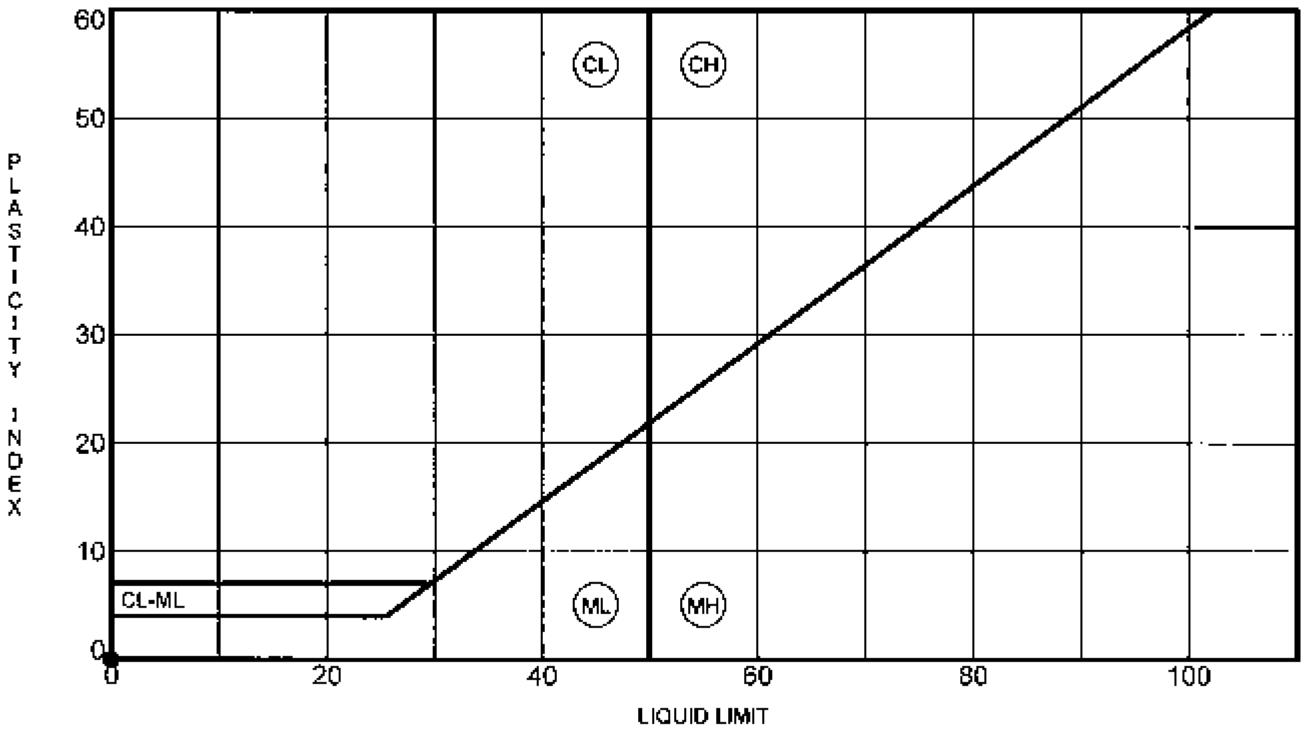
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-1 (0284F)	8.0	NP	NP	NP		Lt. Brown Silty F/M SAND (SM)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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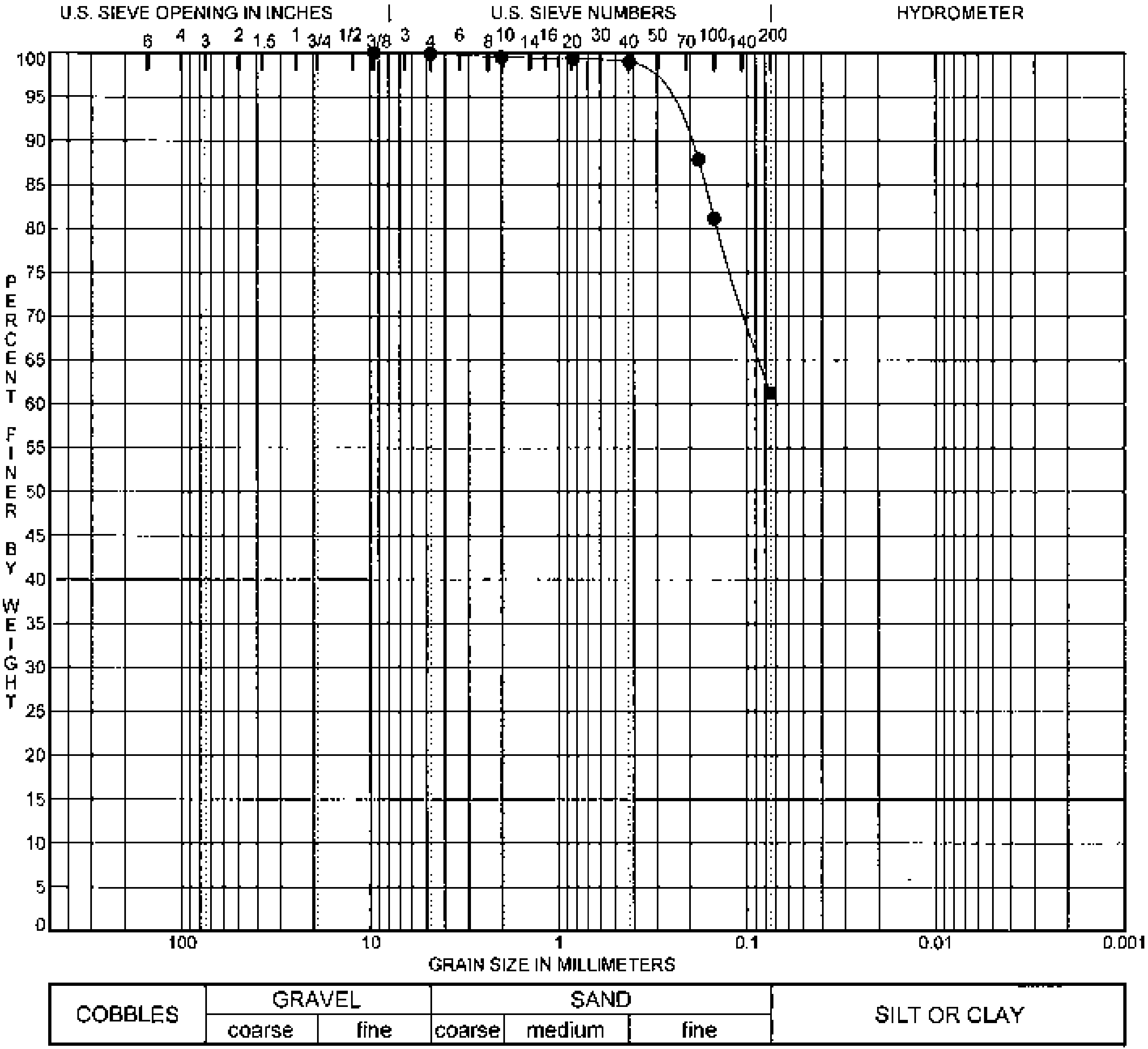

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-1 (0284H) 16.0	Brown/Gray F Sandy SILT (ML)	26.9					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1 (0284H) 16.0	9.52				0.1	38.6	61.3	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/8/11**

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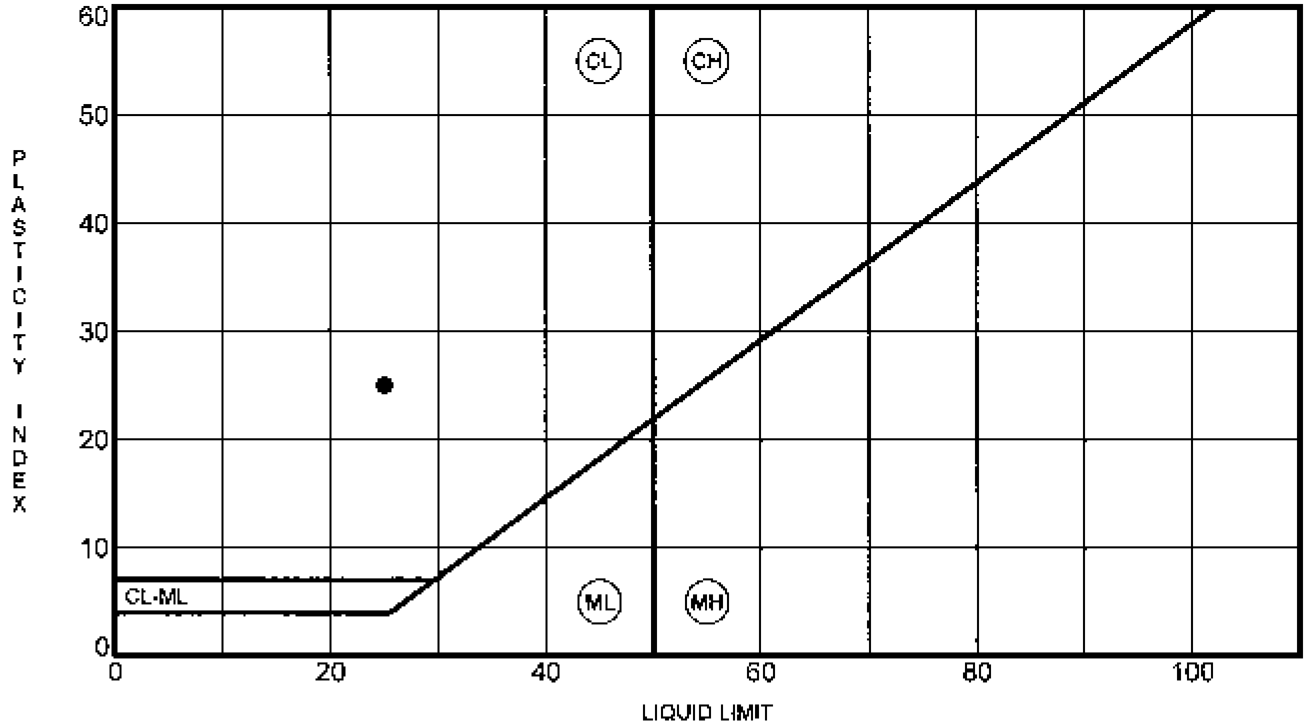
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-1 (0284I)	16.0	25	NP	25		Brown/Gray F Sandy SILT (ML)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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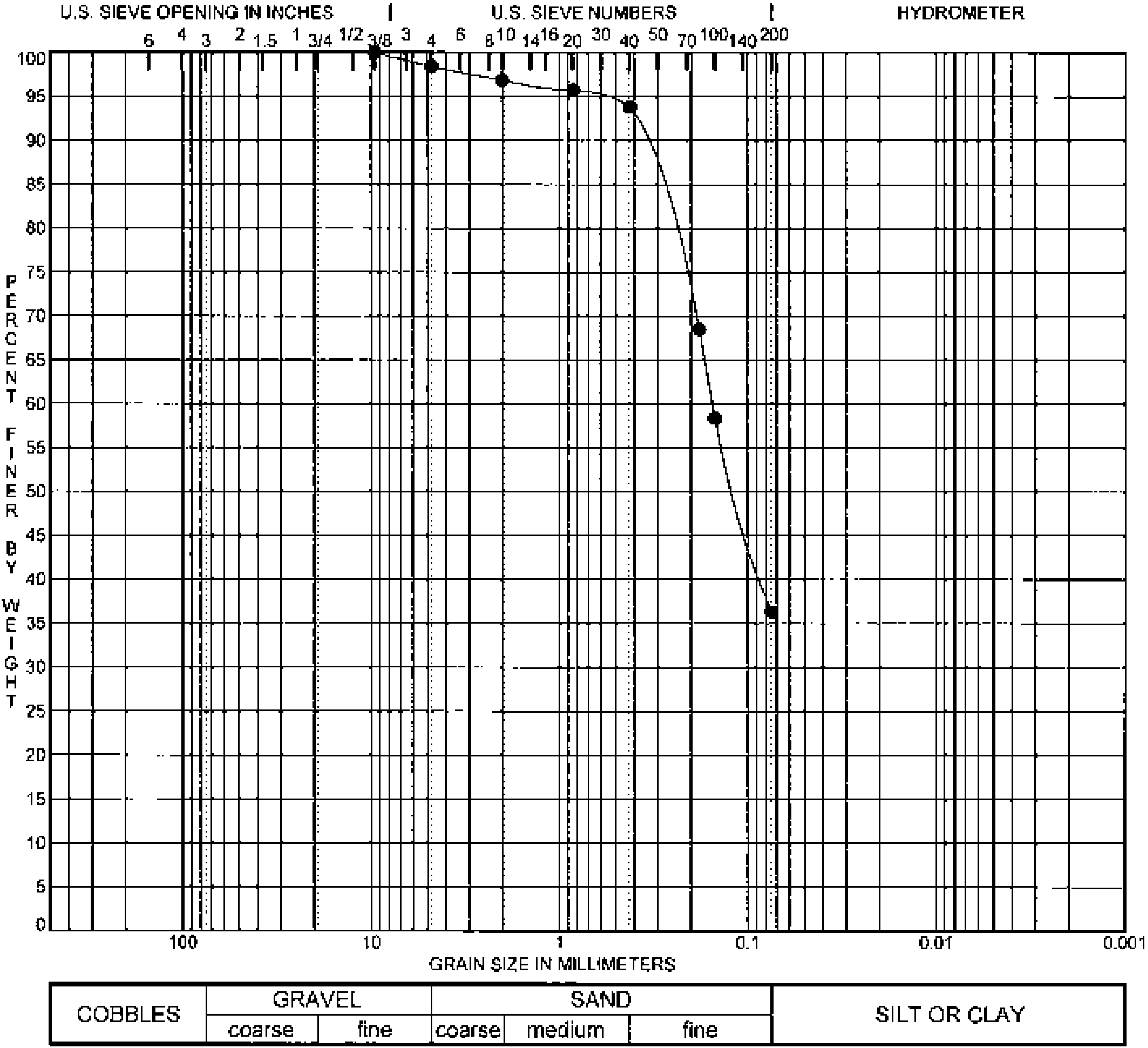

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-1 (0284K) 18.0	Brown Silty F SAND (SM)	20.1					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1 (0284K) 18.0	9.52	0.15			1.6	62.0	36.4	

PROJECT Urquhart Station Ash Pond Dike Investigation
LOCATION Aiken County, South Carolina
JOB NO. G5044.000
DATE 3/8/11

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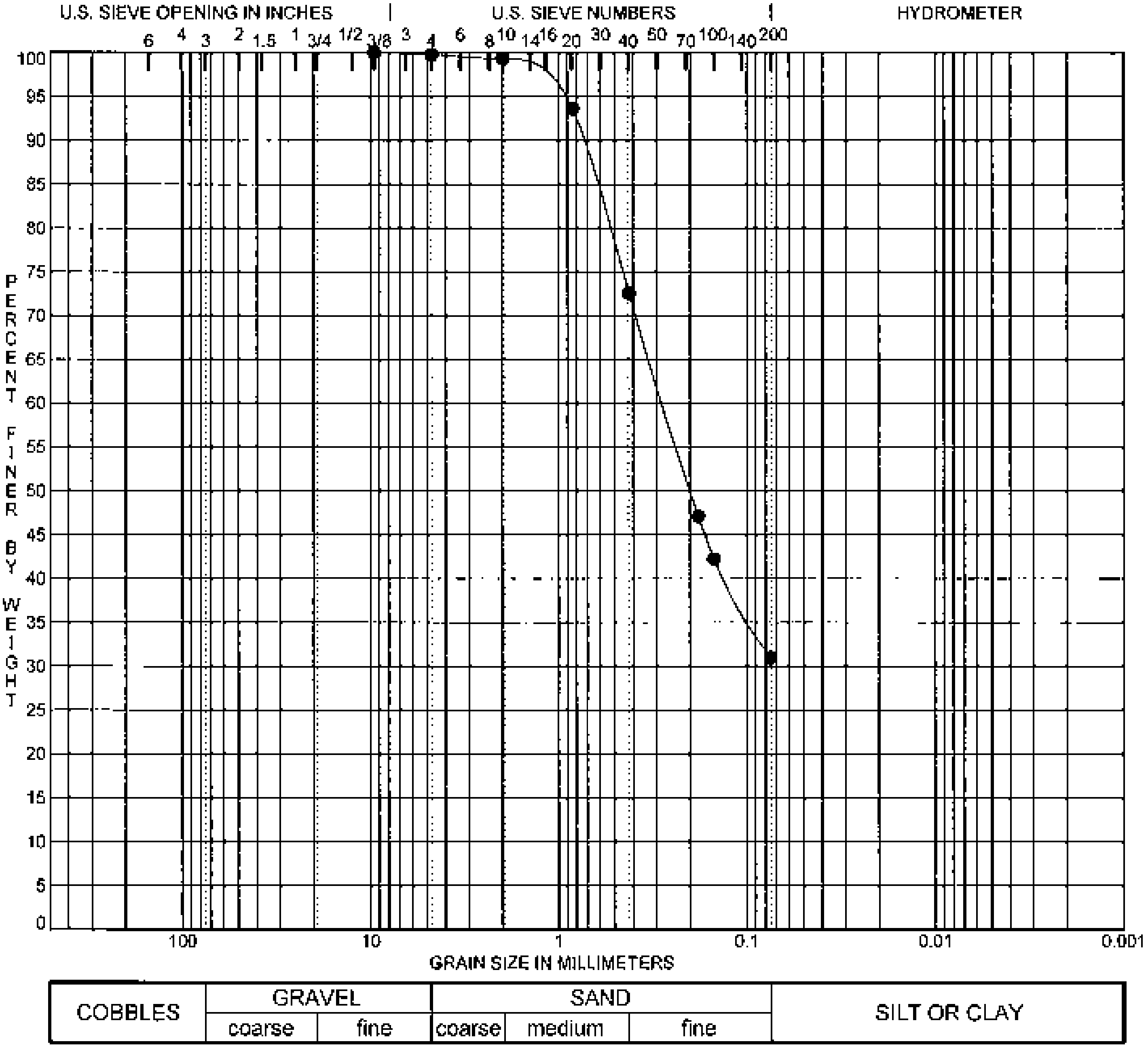

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-1 (0284M) 20.0	Brown Silty F/M SAND (SM)	18.5					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 (0284M) 20.0	9.52	0.28			0.3	68.7	31.0	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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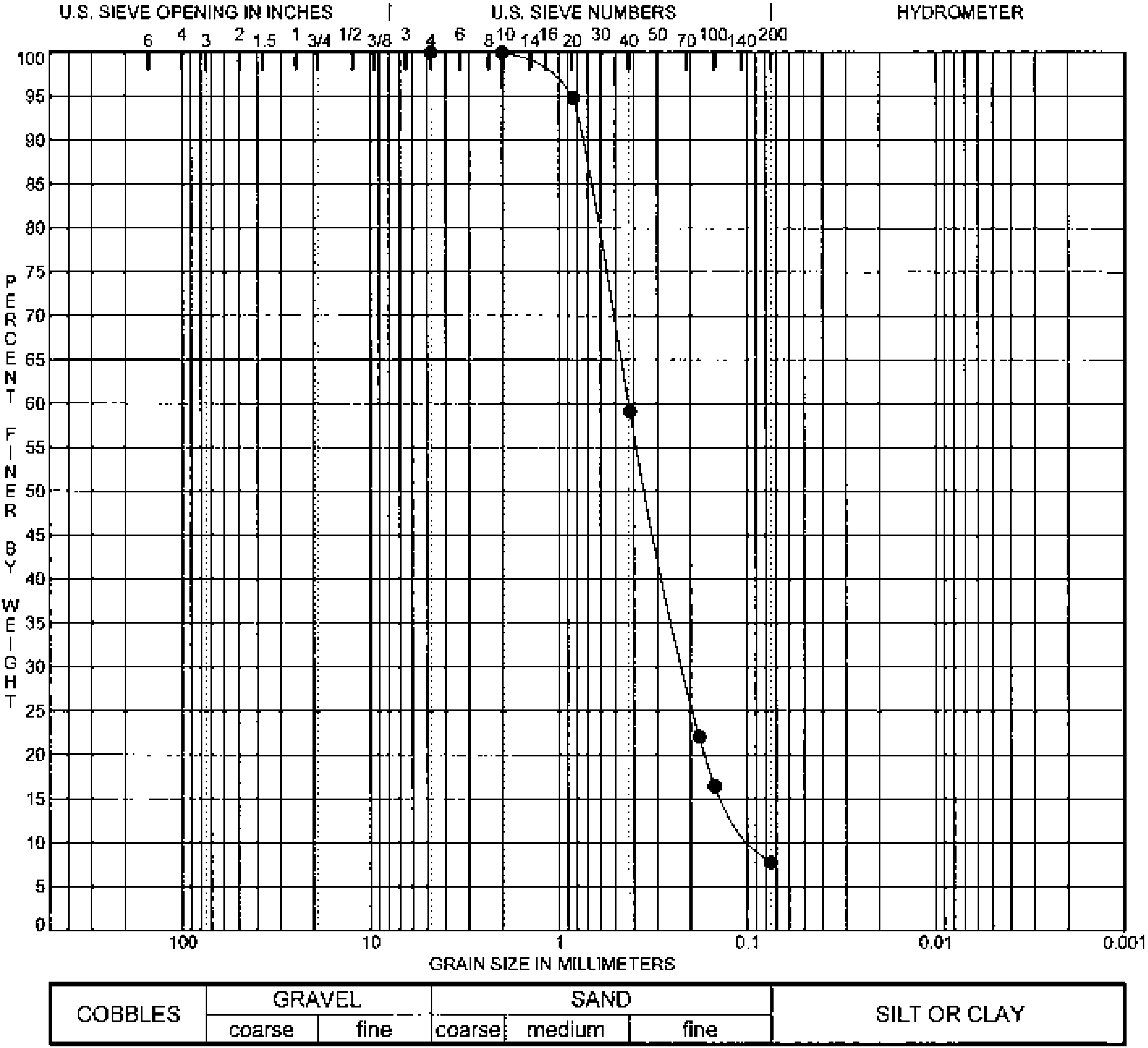
GRADATION CURVES



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-1 (0284O) 25.0	Brown F/M SAND (SP-SM) w/ Silt	21.6				1.22	4.8

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 (0284O) 25.0	4.76	0.43	0.216	0.0893	0.0	92.2	7.8	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/6/11**

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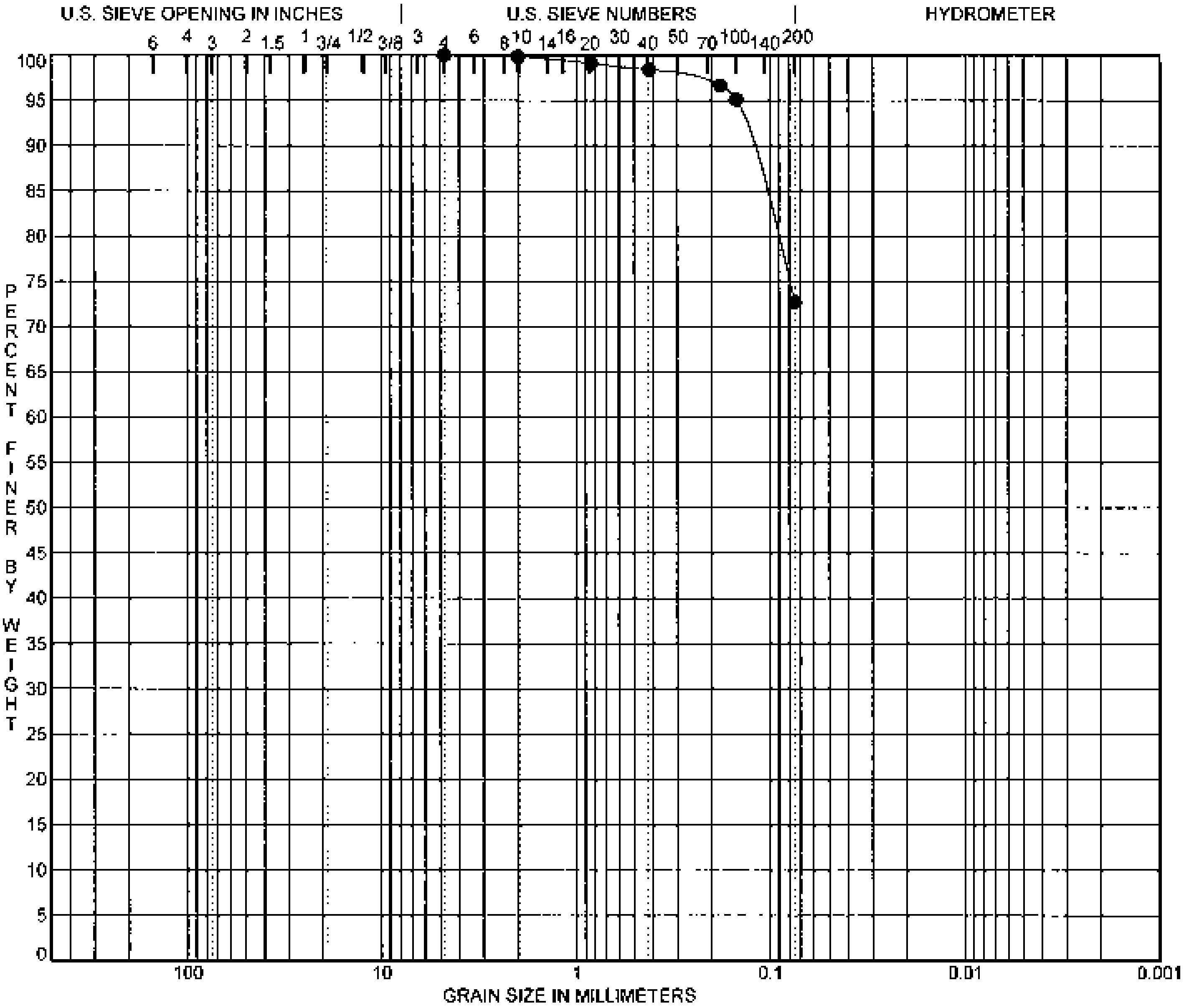

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-1 (0284Q) 35.0	Blue Gray SILT w/ F Sand (ML)	37.5					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1 (0284Q) 35.0	4.76				0.0	27.2	72.8	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/8/11**

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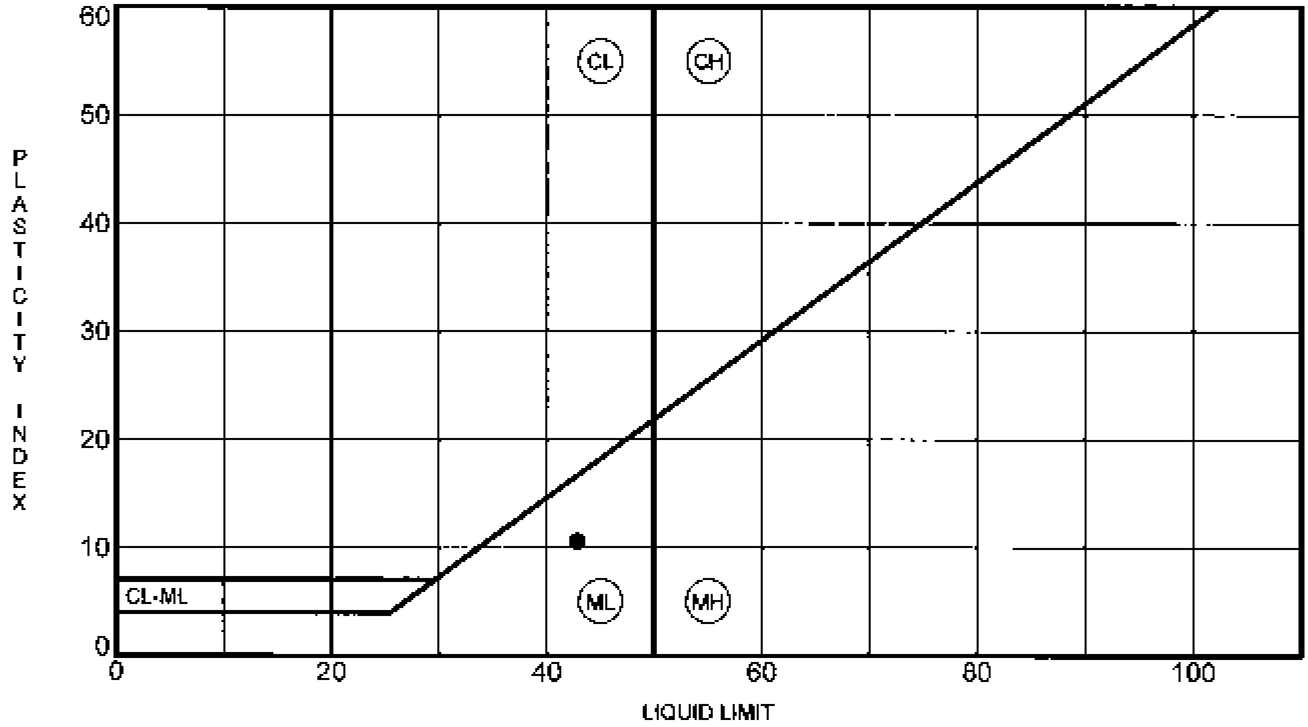
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-1 (0284R)**	**35.0**	**43**	**32**	**11**		**Brown SILT w/ F Sand (ML)**

ATTERBERG LIMITS' RESULTS

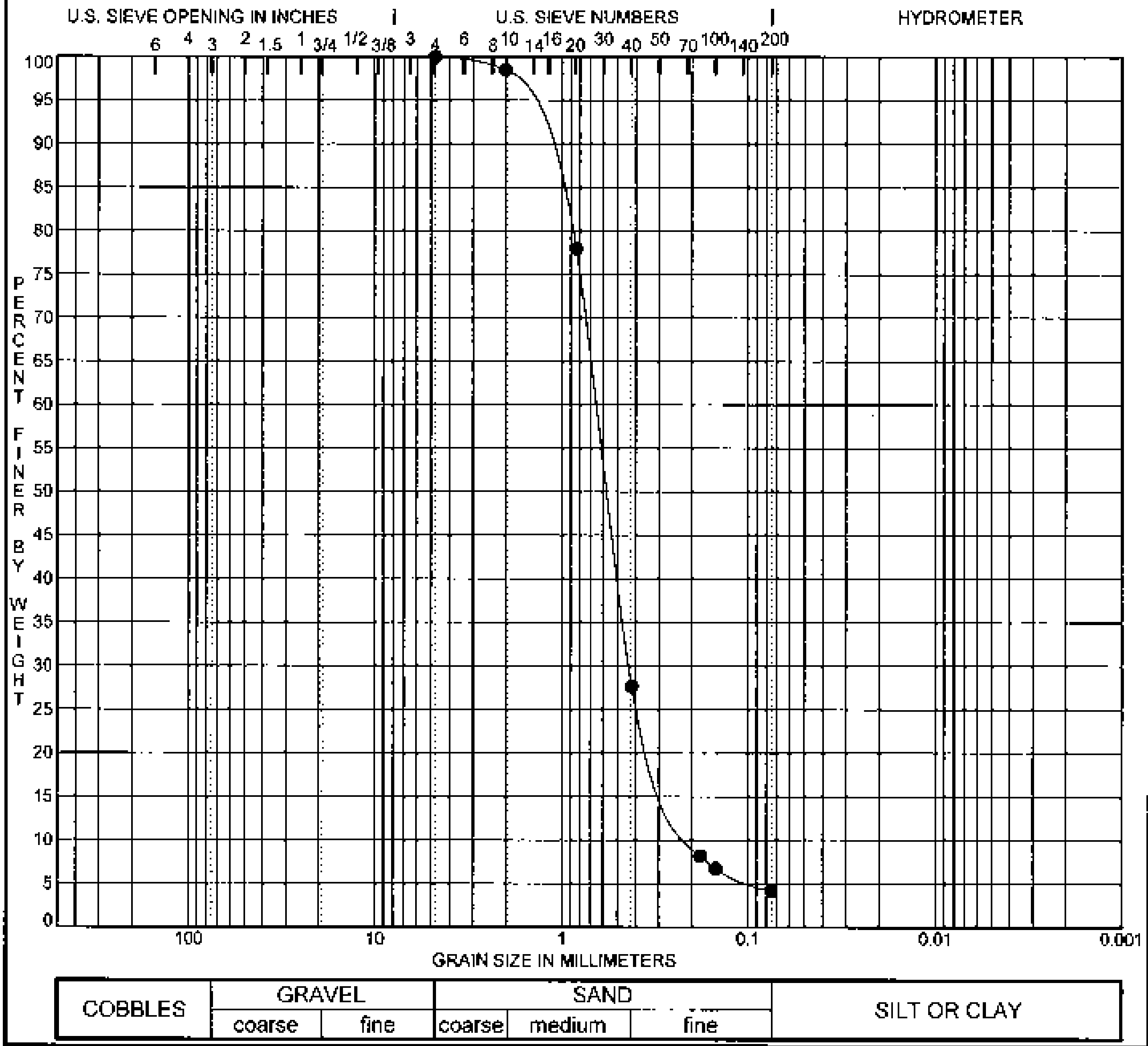
Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

F&ME CONSULTANTS

US ATTERBERG LIMITS G5044LAB.GPJ US LAB.GDT 3/3/11



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-1 (0284T) 50.0	Lt Brown F/M SAND (SP)	18.9				1.47	3.4

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 (0284T) 50.0	4.76	0.66	0.434	0.1947	0.0	95.8	4.2	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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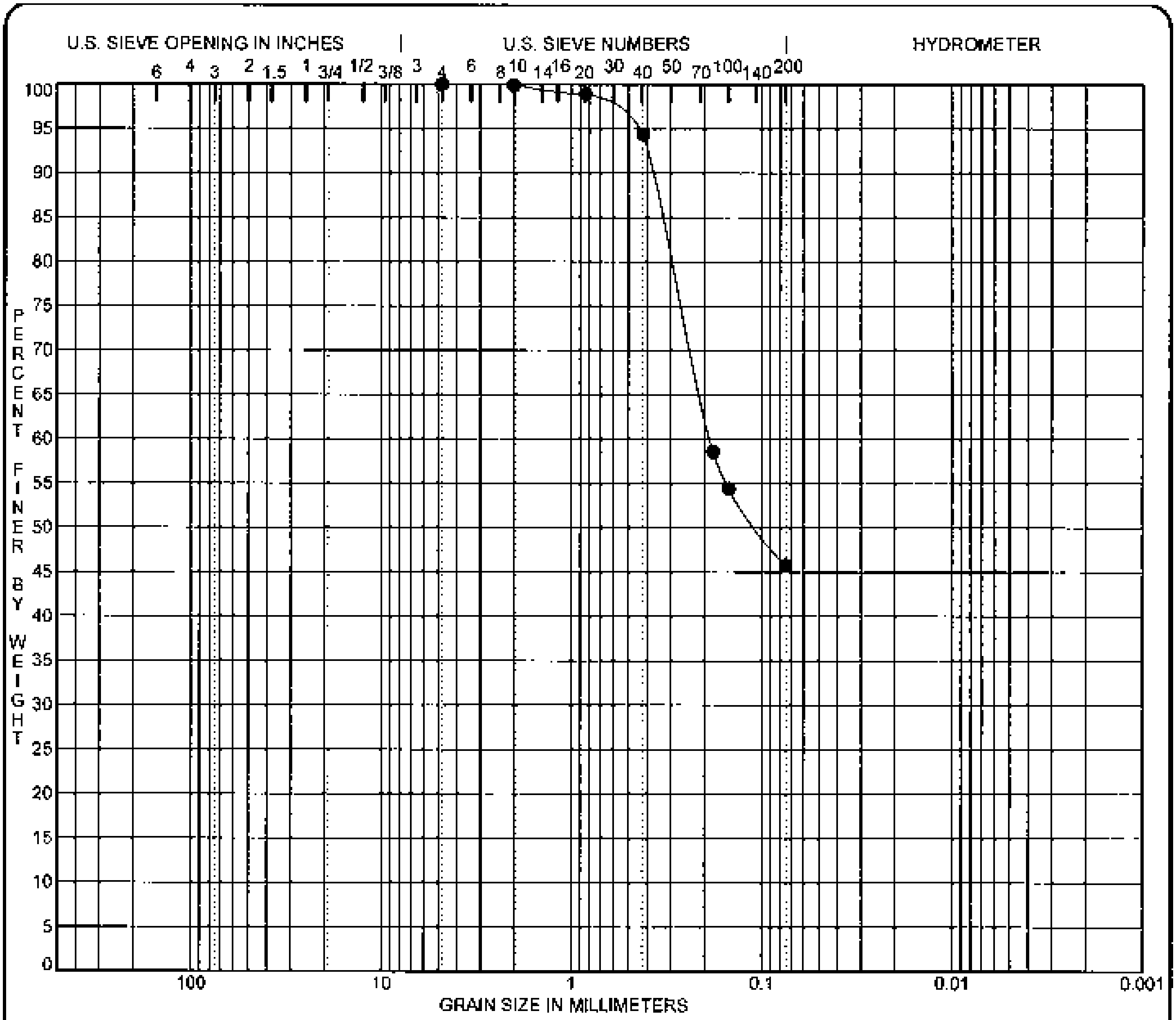
GRADATION CURVES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-1 (0284V) 80.0**	**White Silty F/M SAND (SM)**	**28.2**					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-1 (0284V) 80.0**	**4.76**	**0.19**			**0.0**	**54.3**	**45.7**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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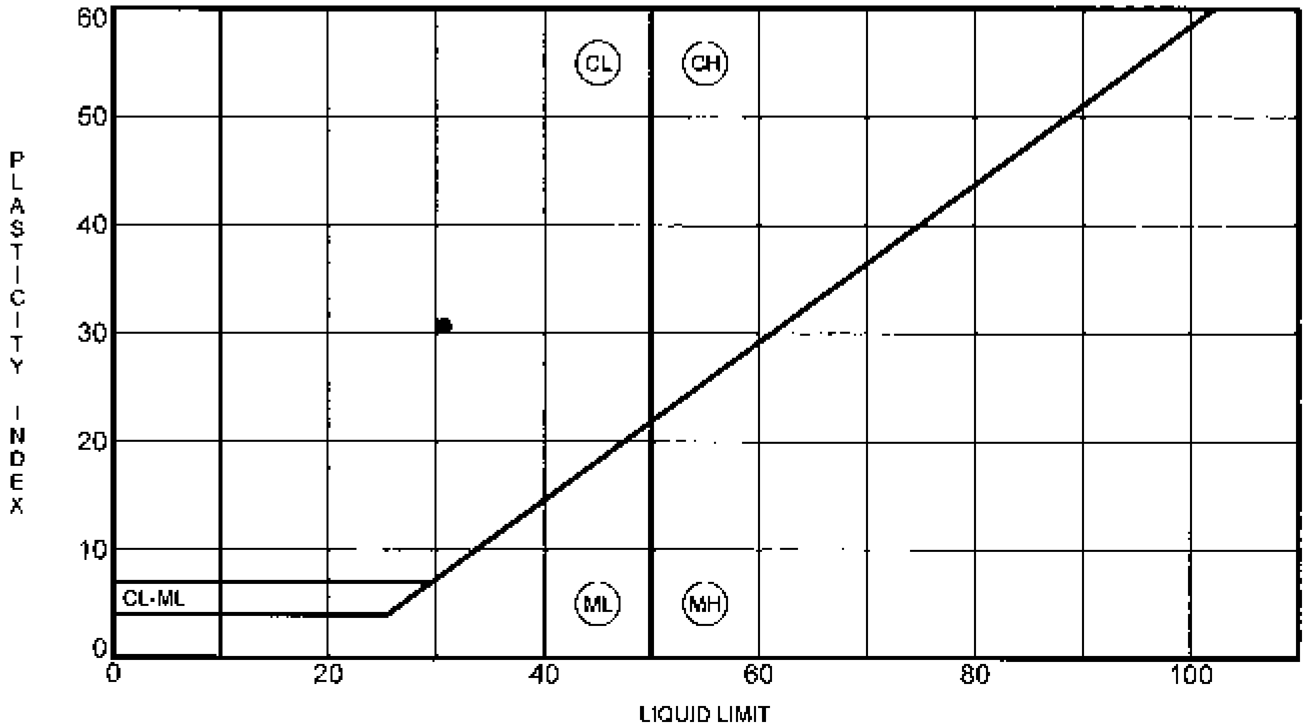
GRADATION CURVES



	Specimen Identification	LL	PL	PI	Fines	Classification
●	B-1 (0284W) 80.0	31	NP	31		White Silty F/M SAND (SM)

US ATTERBERG LIMITS G5044LAB.GPJ US LAB.GDT 3/8/11

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ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

F&ME CONSULTANTS
3112 Devine Street
Columbia, South Carolina 29205

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT: Urquhart Station Ash Pond Dike Investigation

PROJECT NO.: G5044.000

SAMPLE NUMBER: B-2 / 11-0285

DATE SAMPLE RECEIVED: 2/28/2011

DESCRIPTION OF SOIL: Various

TESTED BY: L. Guempel

DATE OF TESTING: 3/1/2011

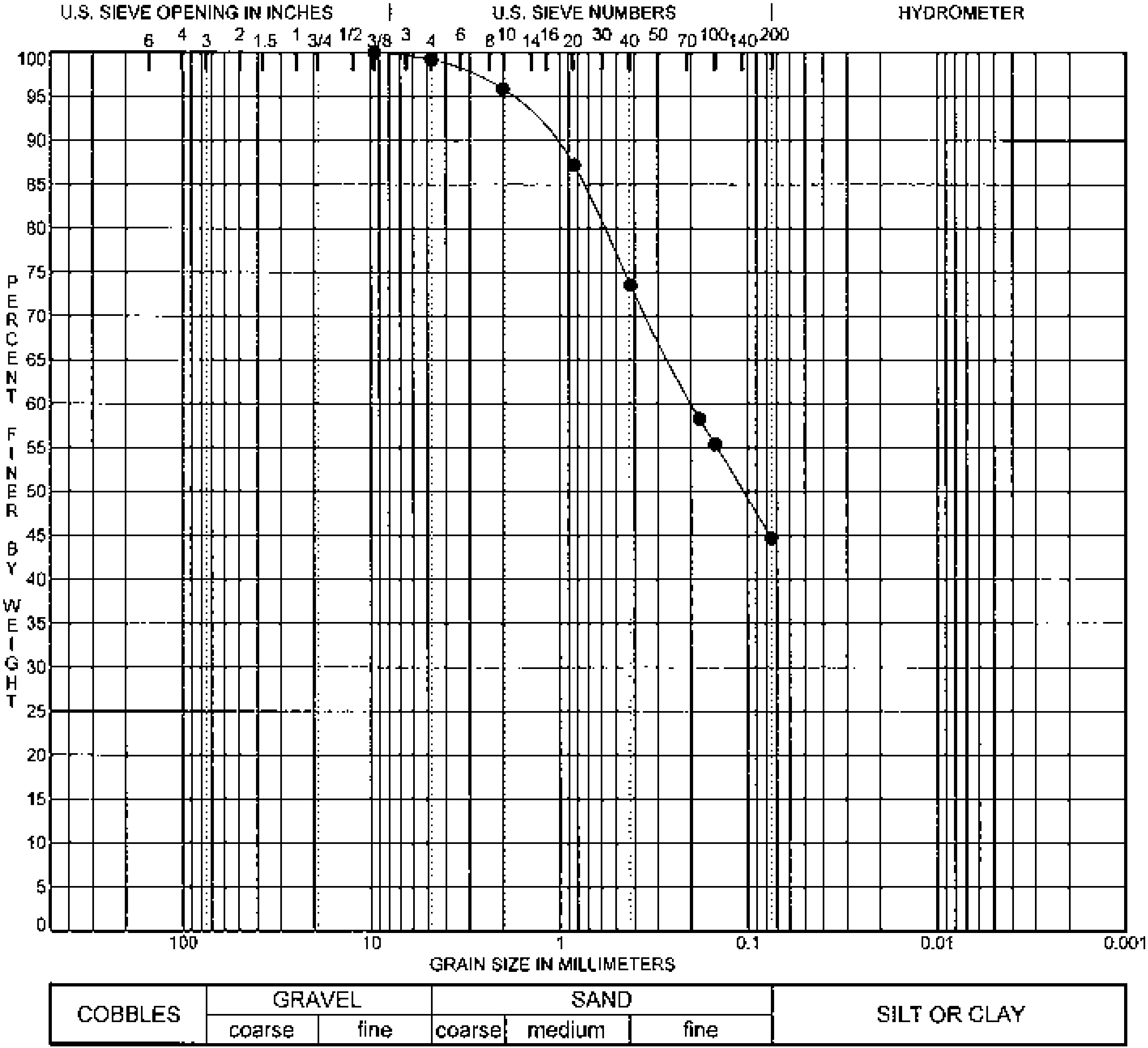
DATE OF WEIGHING: 3/2/2011

BORING NO.	B-2	B-2	B-2	B-2	B-2
SAMPLE NO.	11-0285A	11-0285D	11-0285G	11-0285I	11-0285K
SAMPLE DEPTH	12.0'-14.0'	14.0'-16.0'	16.0'-18.0'	18.0'-20.0'	23.5'-25.0'
WATER CONTENT, W%	26.7	29.7	34.3	32.8	33.9

BORING NO.	B-2	B-2	B-2	B-2	
SAMPLE NO.	11-0285M	11-0285P	11-0285R	11-0285T	
SAMPLE DEPTH	29.5'-31.0'	39.5'-41.0'	48.5'-50.0'	68.5'-70.0'	
WATER CONTENT, W%	52.7	19.7	21.4	21.5	

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-2 (0285B) 14.0	White/Brown Silty F/M SAND (SM)	26.7					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-2 (0285B) 14.0	9.52	0.20			0.8	54.5	44.7	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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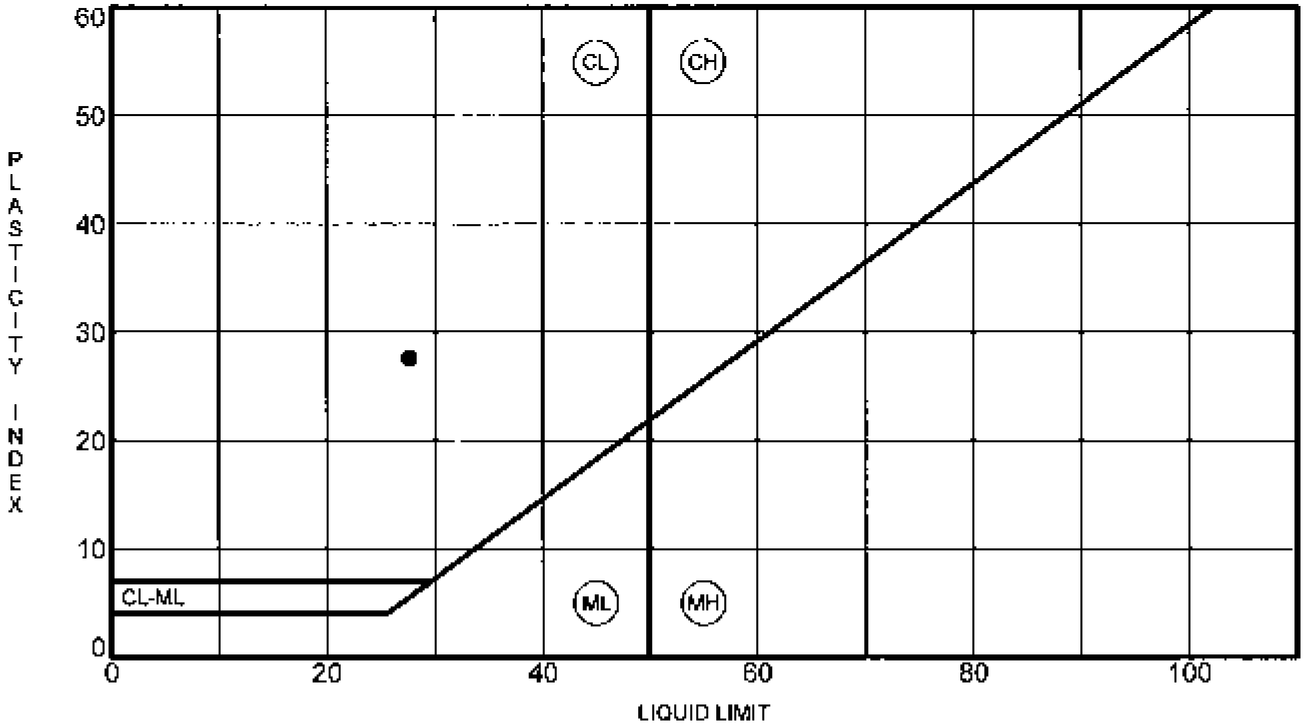
GRADATION CURVES



Specimen Identification		LL	PL	PI	Fines	Classification
● B-2 (0285C)	14.0	28	NP	28		White/Brown Silty F/M SAND (SM)

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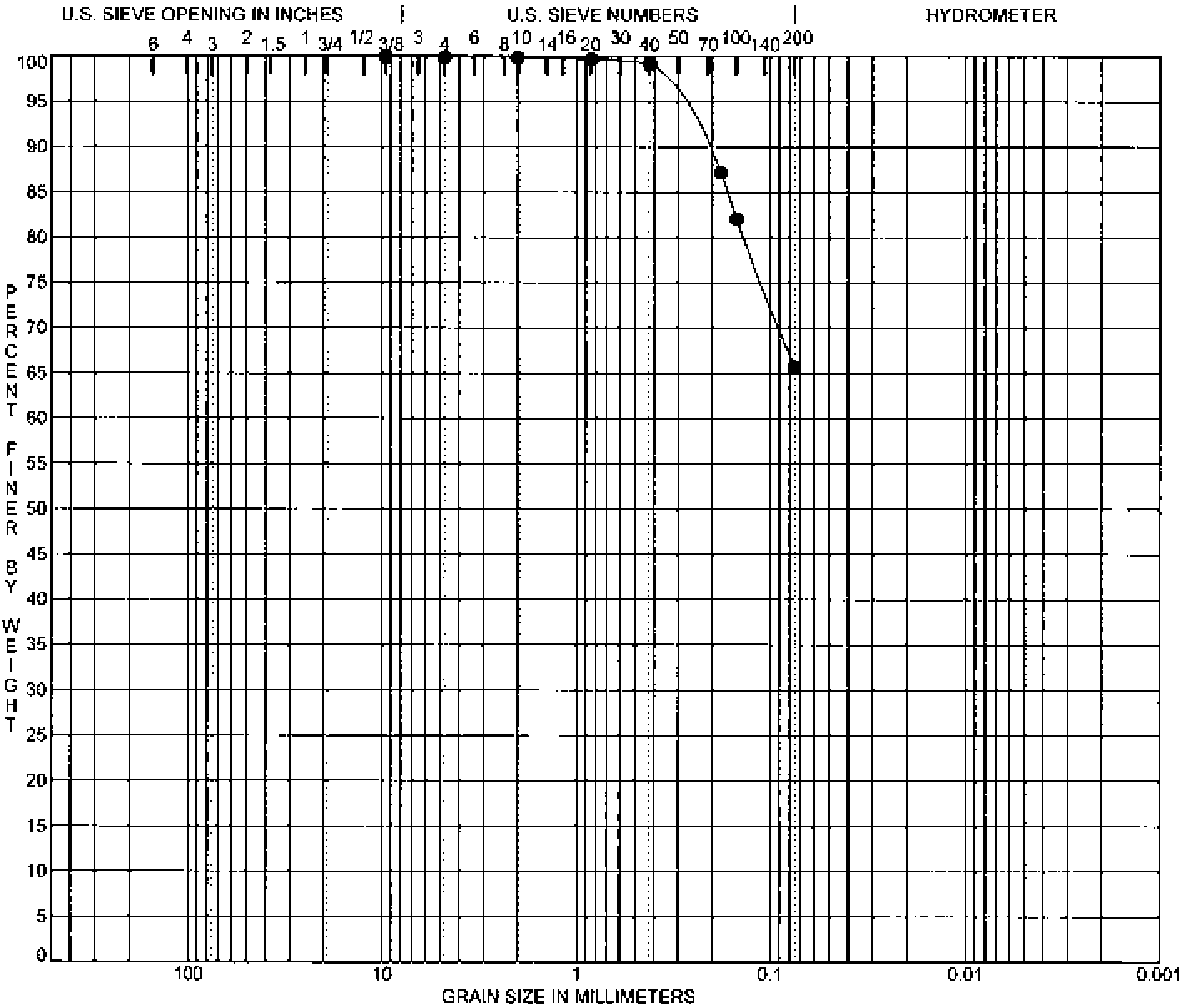
ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number. G5044.000



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-2 (0285E) 16.0	Dk Brown F Sandy SILT (ML)	29.7					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-2 (0285E) 16.0	9.52				0.1	34.2	65.7	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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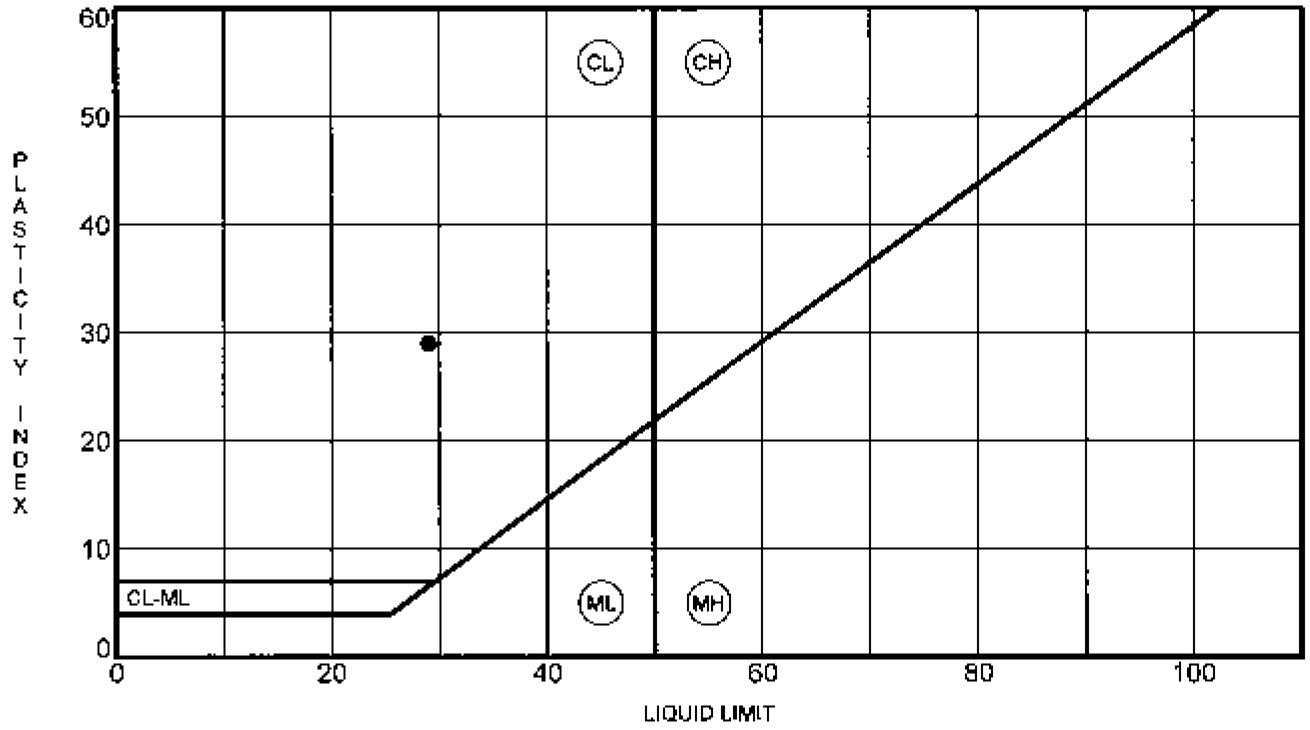
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2 (0285F)**	**16.0**	**29**	**NP**	**29**		**Dk Brown F Sandy SILT (ML)**

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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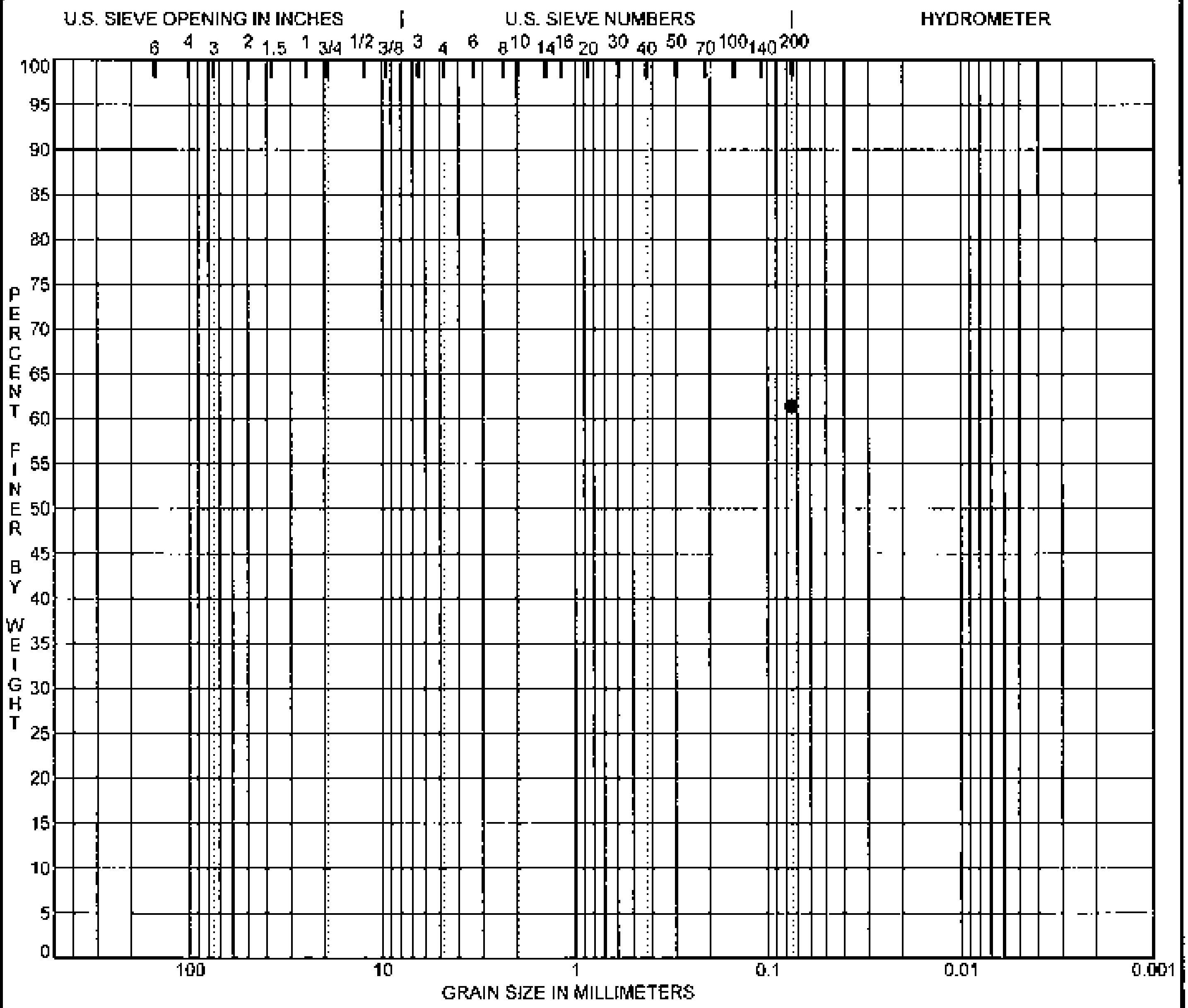
US ATTERBERG LIMITS G5044LAB.GPJ US LAB.GDT 3/8/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-2 (0285H) 18.0**	**Brown Sandy SILT (ML)**	**34.3**					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-2 (0285H) 18.0**	**0.08**				**0.0**	**0.0**	**61.4**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/8/11**

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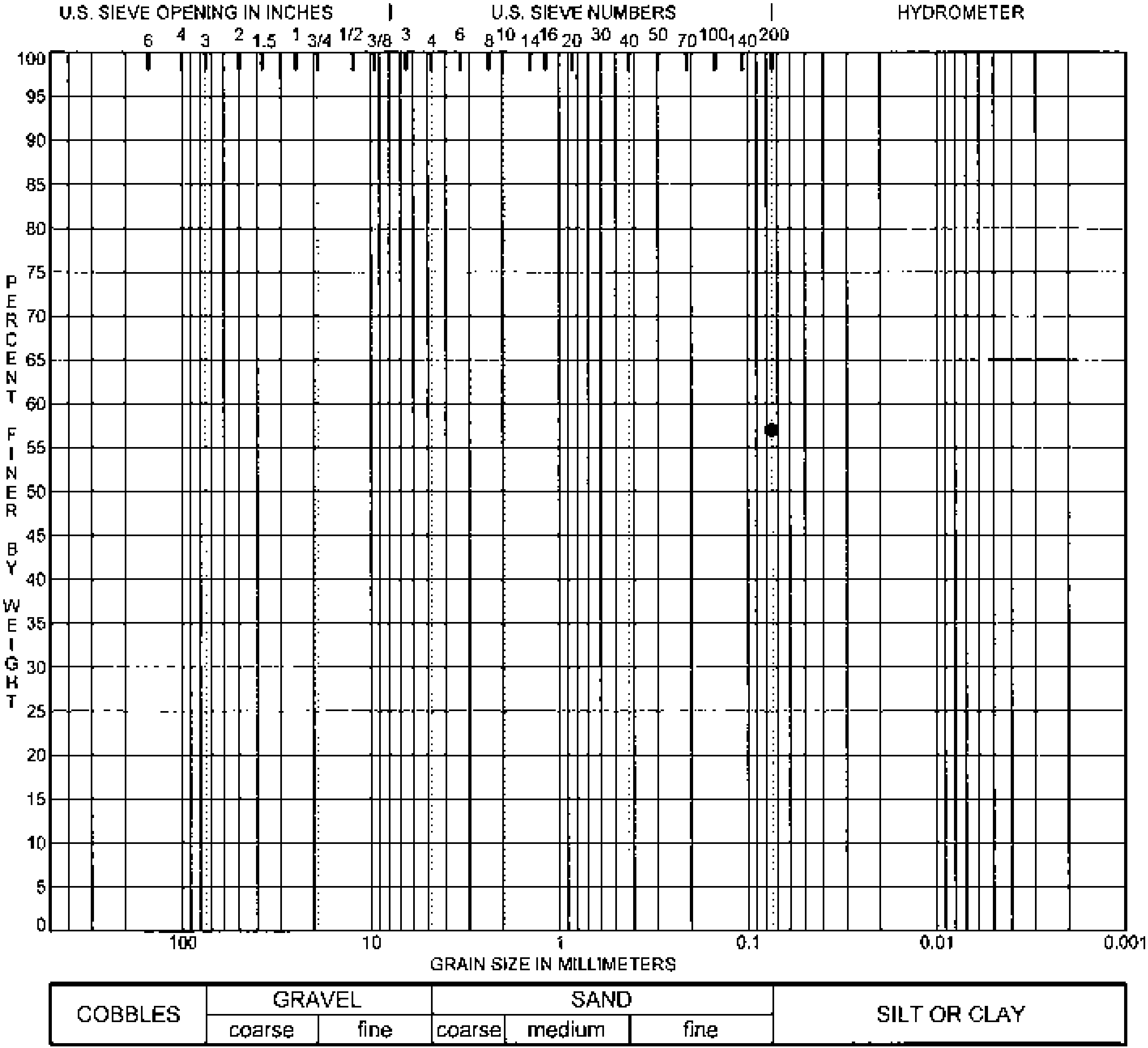
GRADATION CURVES



	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-2 (0285J) 20.0	Brown Sandy SILT (ML)	32.8					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2 (0285J) 20.0	0.08				0.0	0.0	57.0	

PROJECT **Urquhart Station Ash Pond Dike Investigation** JOB NO. **G5044.000**
LOCATION **Aiken County, South Carolina** DATE **3/8/11**

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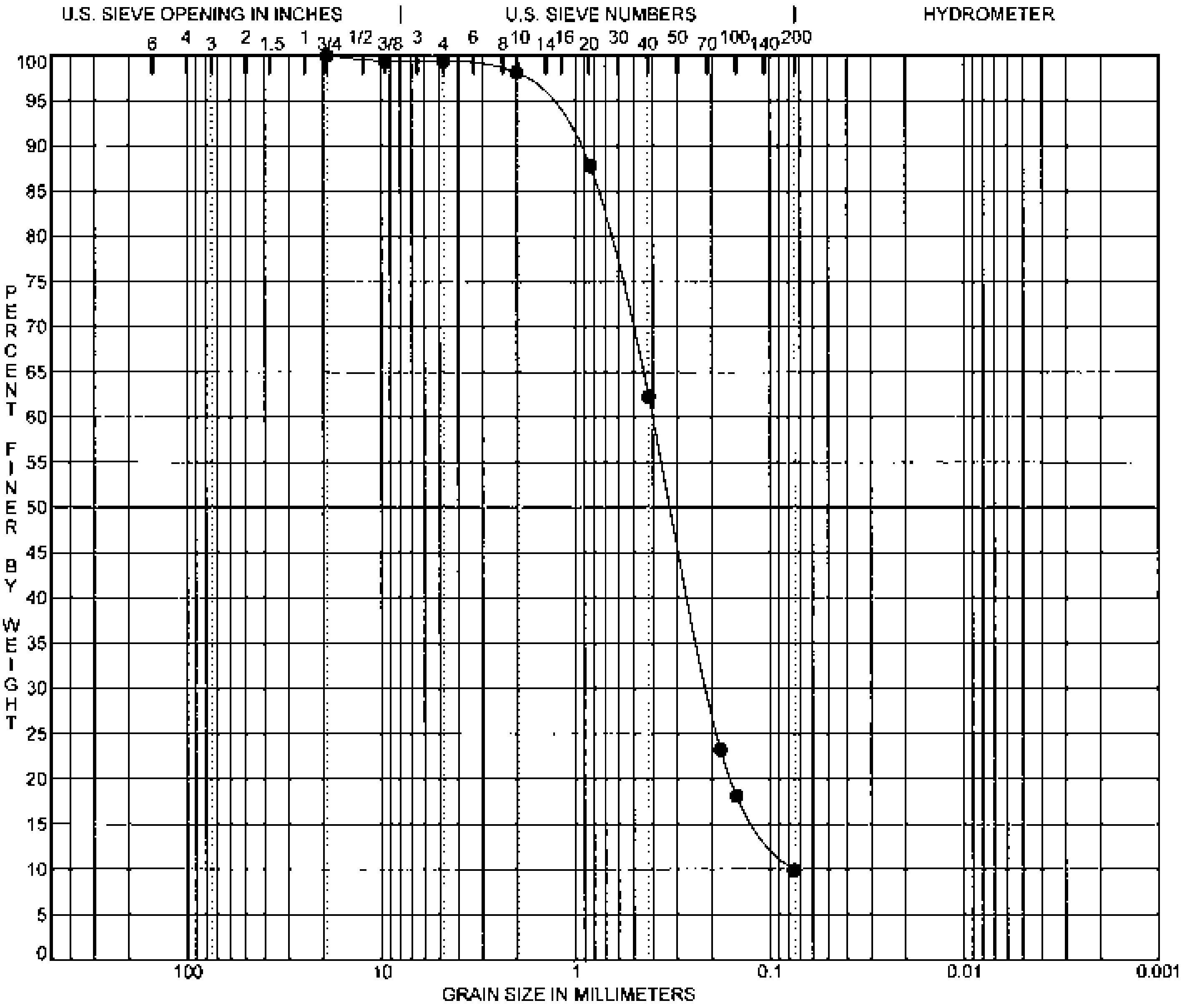
GRADATION CURVES



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **B-2 (0285L) 25.0**	**Dk Brown F/M SAND w/ Silt (SP-SM)**	**33.9**				**1.44**	**5.3**

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-2 (0285L) 25.0**	**19.10**	**0.40**	**0.208**	**0.0757**	**0.6**	**89.5**	**9.9**	

PROJECT **Urquhart Station Ash Pond Dike Investigation** JOB NO. **G5044.000**
LOCATION **Aiken County, South Carolina** DATE **3/8/11**

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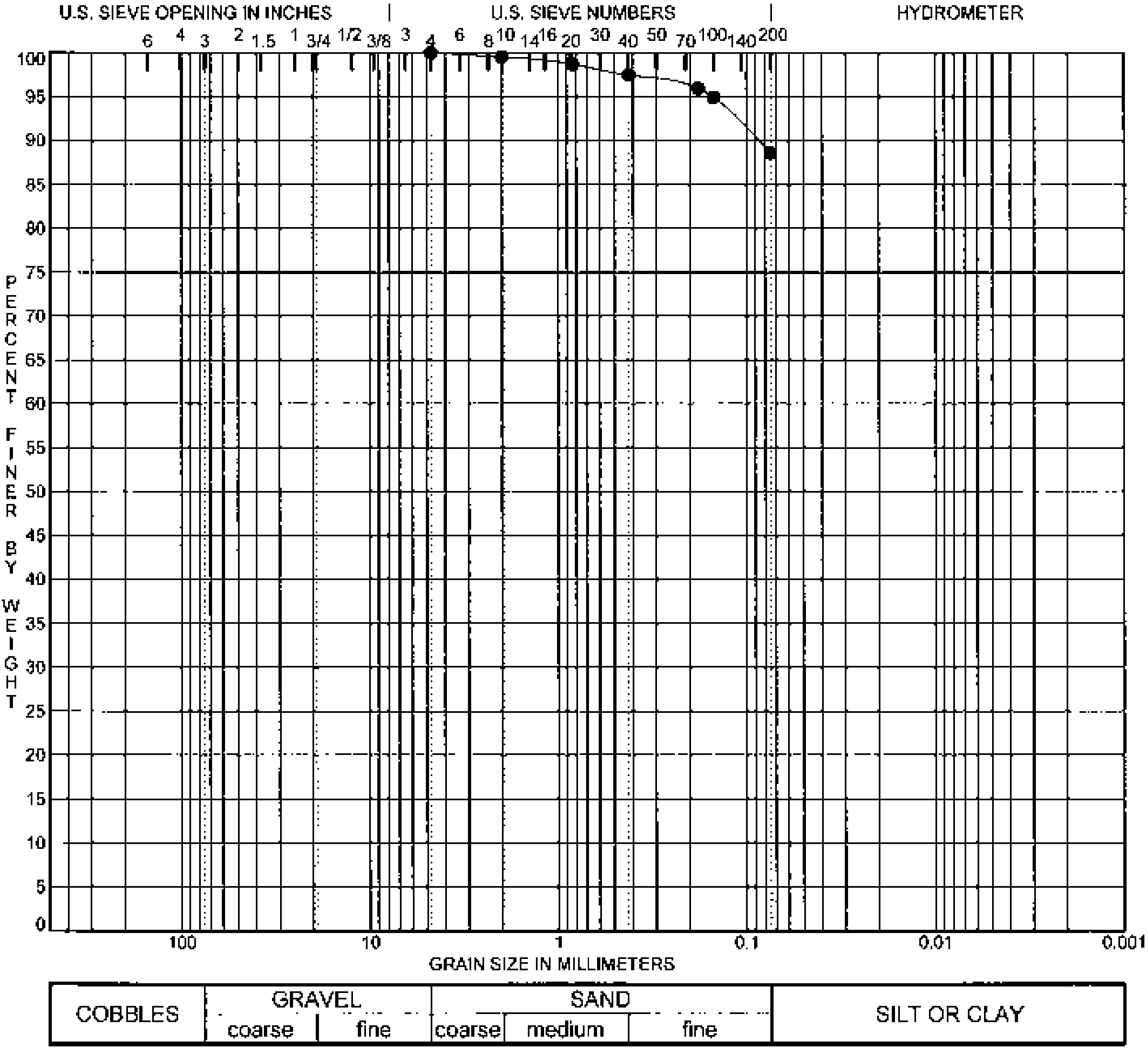
GRADATION CURVES



	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-2 (0285N) 31.0	Blue Gray SILT (ML)	52.7					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2 (0285N) 31.0	4.76				0.0	11.4	88.6	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/8/11**

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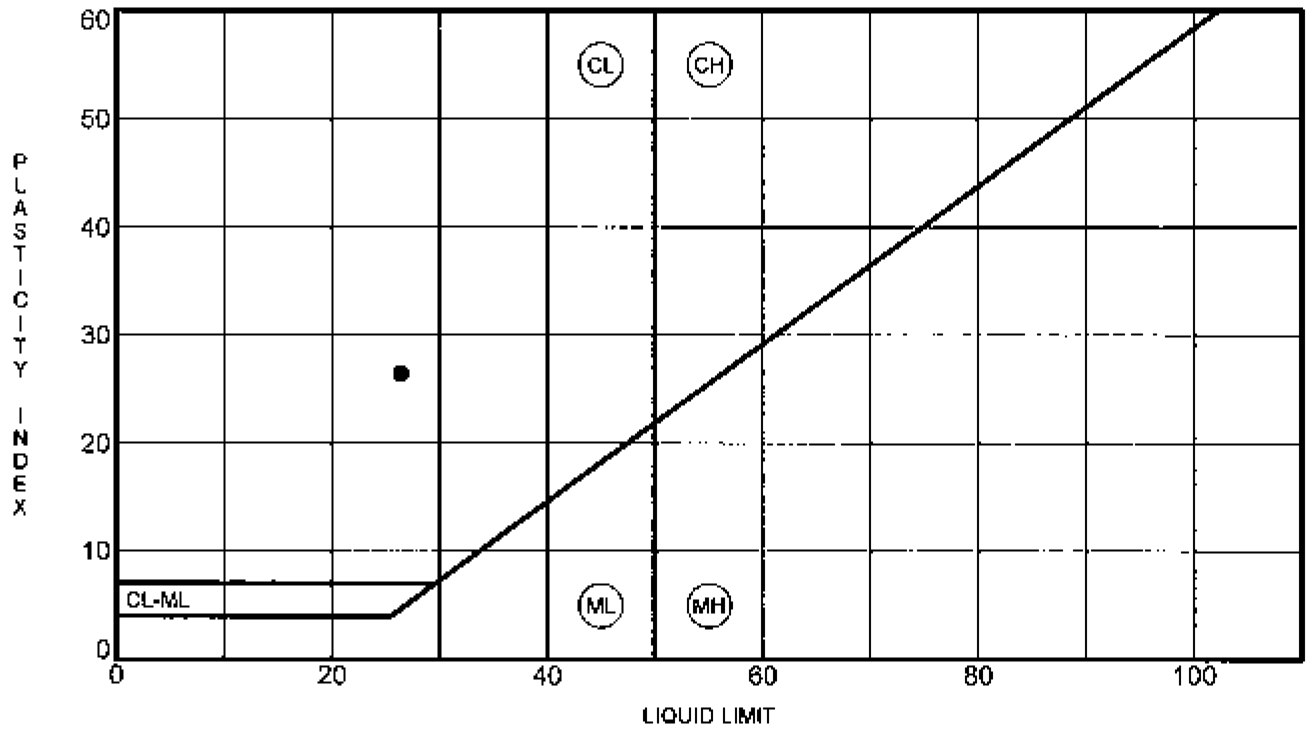
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2 (0285O)**	**31.0**	**26**	**NP**	**26**		**Blue Gray SILT (ML)**

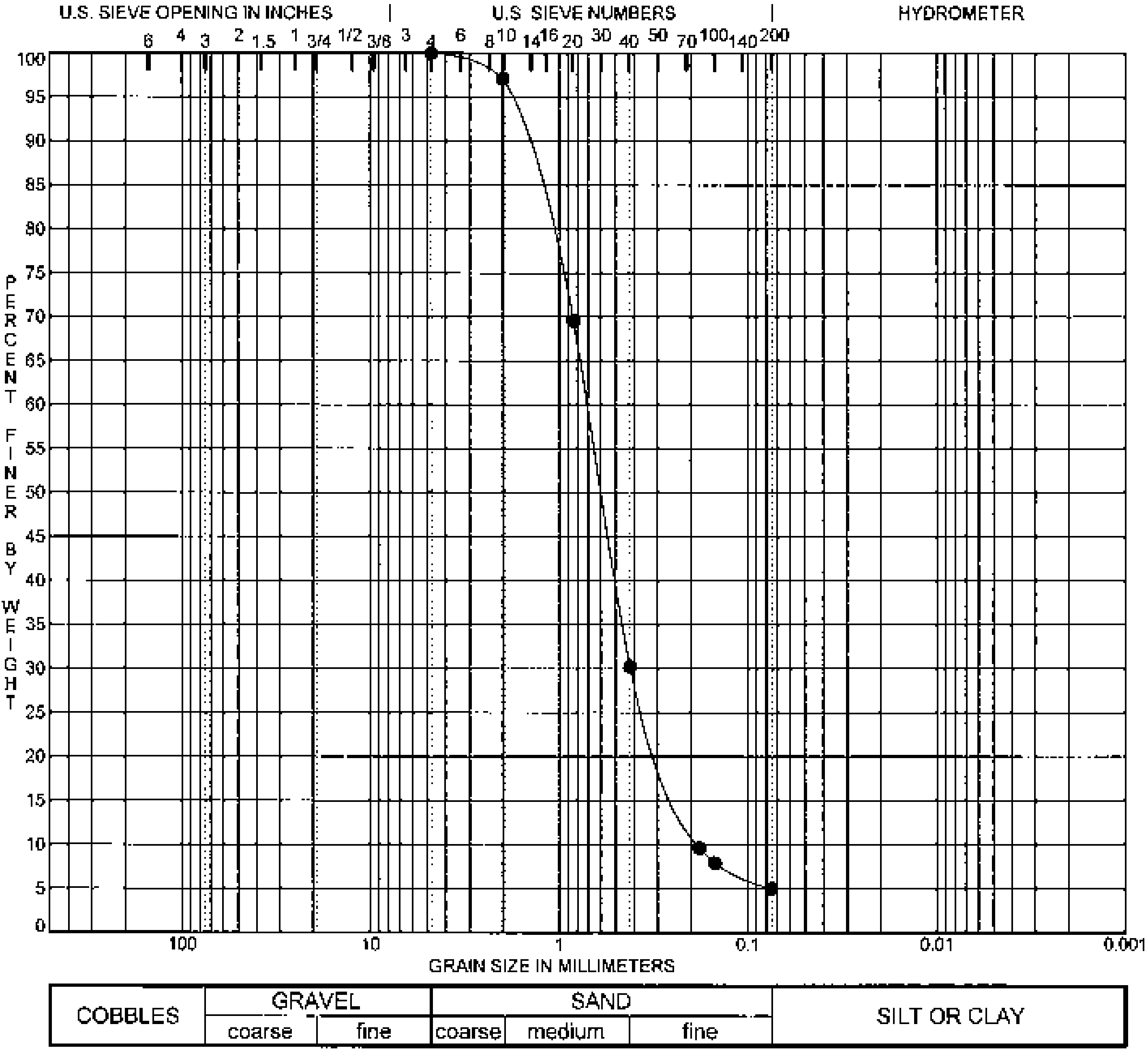
ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

F&ME CONSULTANTS



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **B-2 (0285Q) 41.0**	**Brown F/M SAND (SP)**	**19.7**				**1.33**	**3.9**

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-2 (0285Q) 41.0**	**4.76**	**0.71**	**0.416**	**0.1830**	**0.0**	**95.0**	**5.0**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/8/11**

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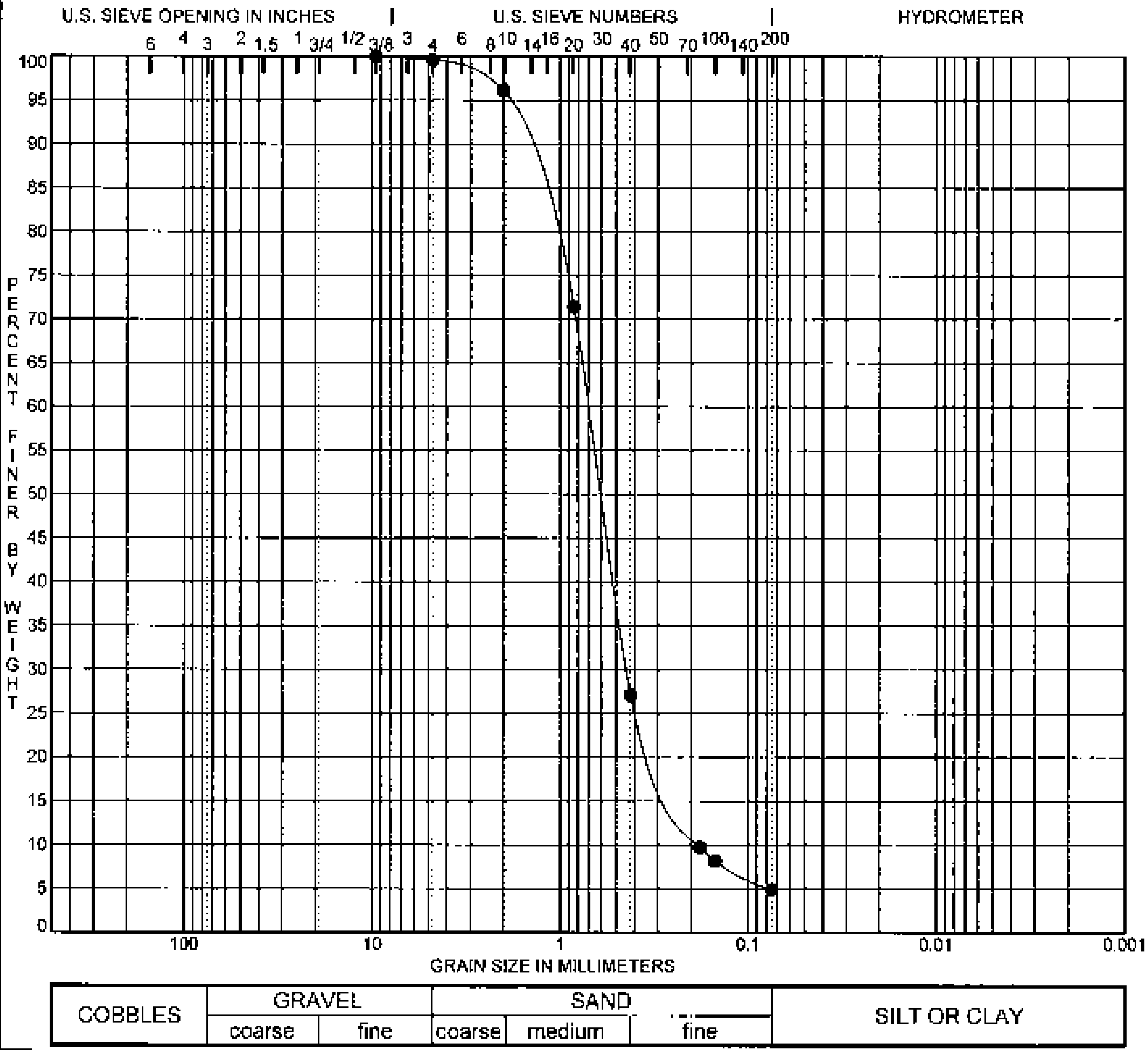
GRADATION CURVES



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-2 (0285S) 50.0	Brown F/M SAND (SP)	21.4				1.51	3.9

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-2 (0285S) 50.0	9.52	0.70	0.439	0.1822	0.4	94.7	4.9	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/8/11**

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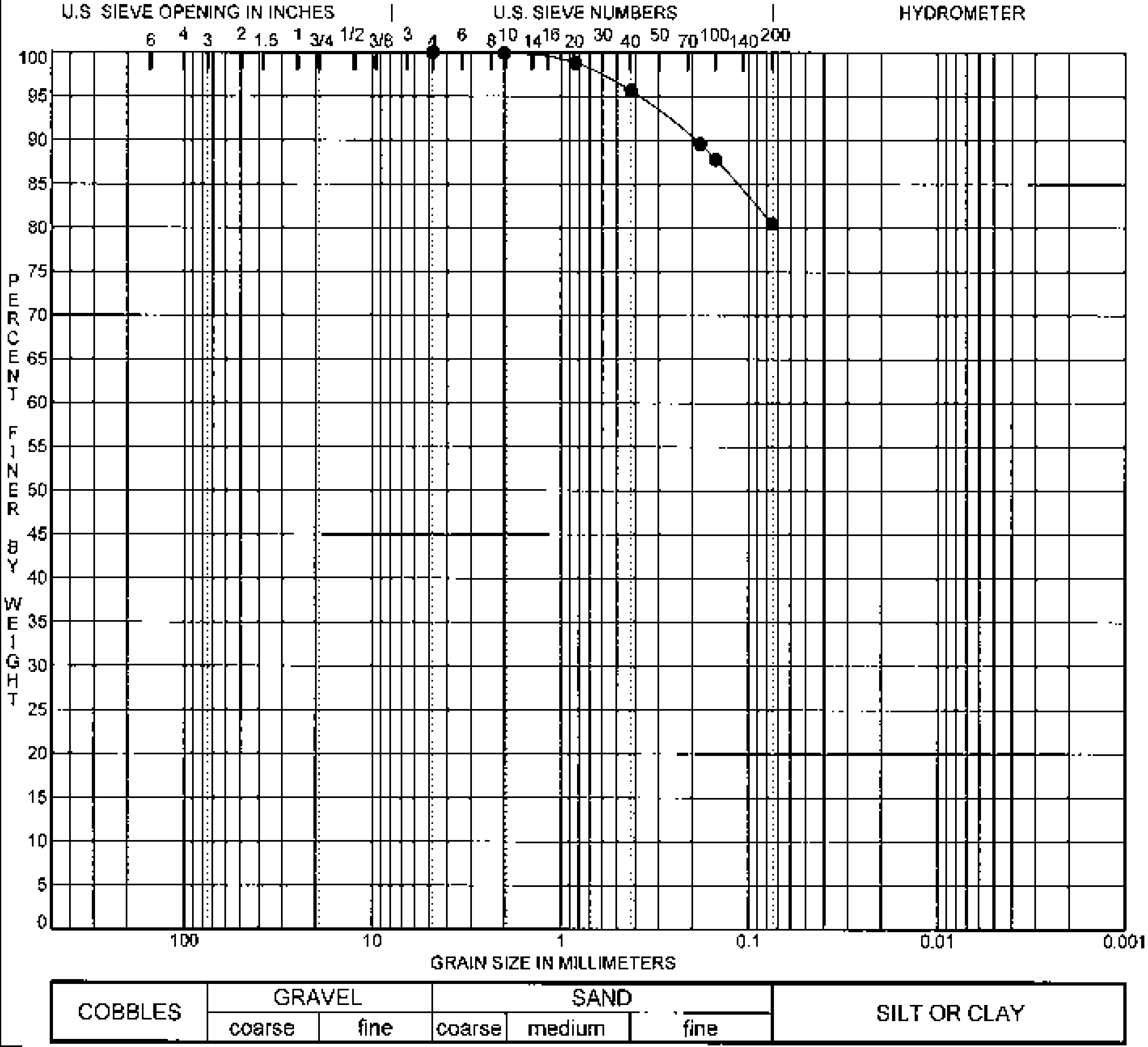

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-2 (0285U) 70.0	Orange/Yellow/Gray Lean CLAY w/Sand (CL)	21.5					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2 (0285U) 70.0	4.76				0.0	19.5	80.5	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/8/11**

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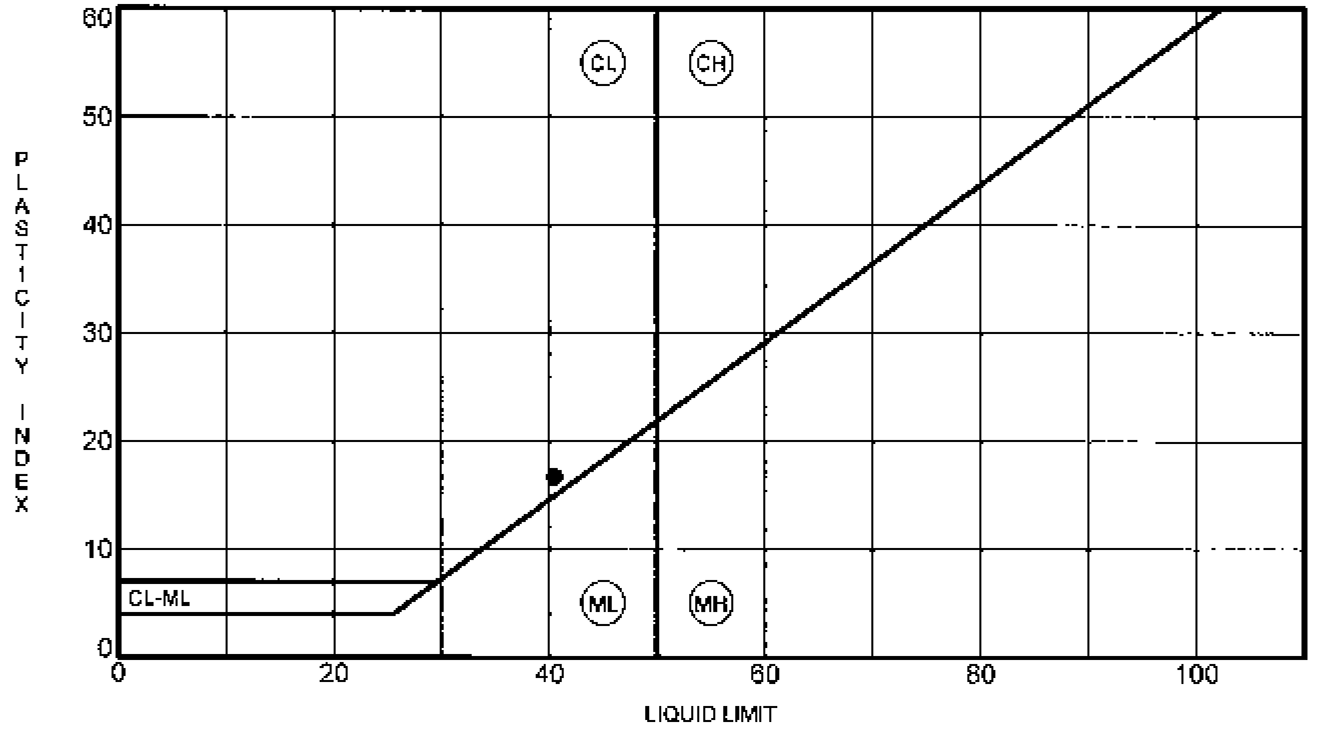

	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2 (0285V)**	**70.0**	**41**	**24**	**17**		**Orange/Yellow/Gray Lean CLAY w/Sand (CL)**

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ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

F&ME CONSULTANTS
3112 Devine Street
Columbia, South Carolina 29205

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT: Urquhart Station Ash Pond Dike Investigation **PROJECT NO.:** G5044.000

SAMPLE NUMBER: B-4 / 11-0291 **DATE SAMPLE RECEIVED:** 3/1/2011

DESCRIPTION OF SOIL: Various

TESTED BY: J. Hiers **DATE OF TESTING:** 3/5/2011

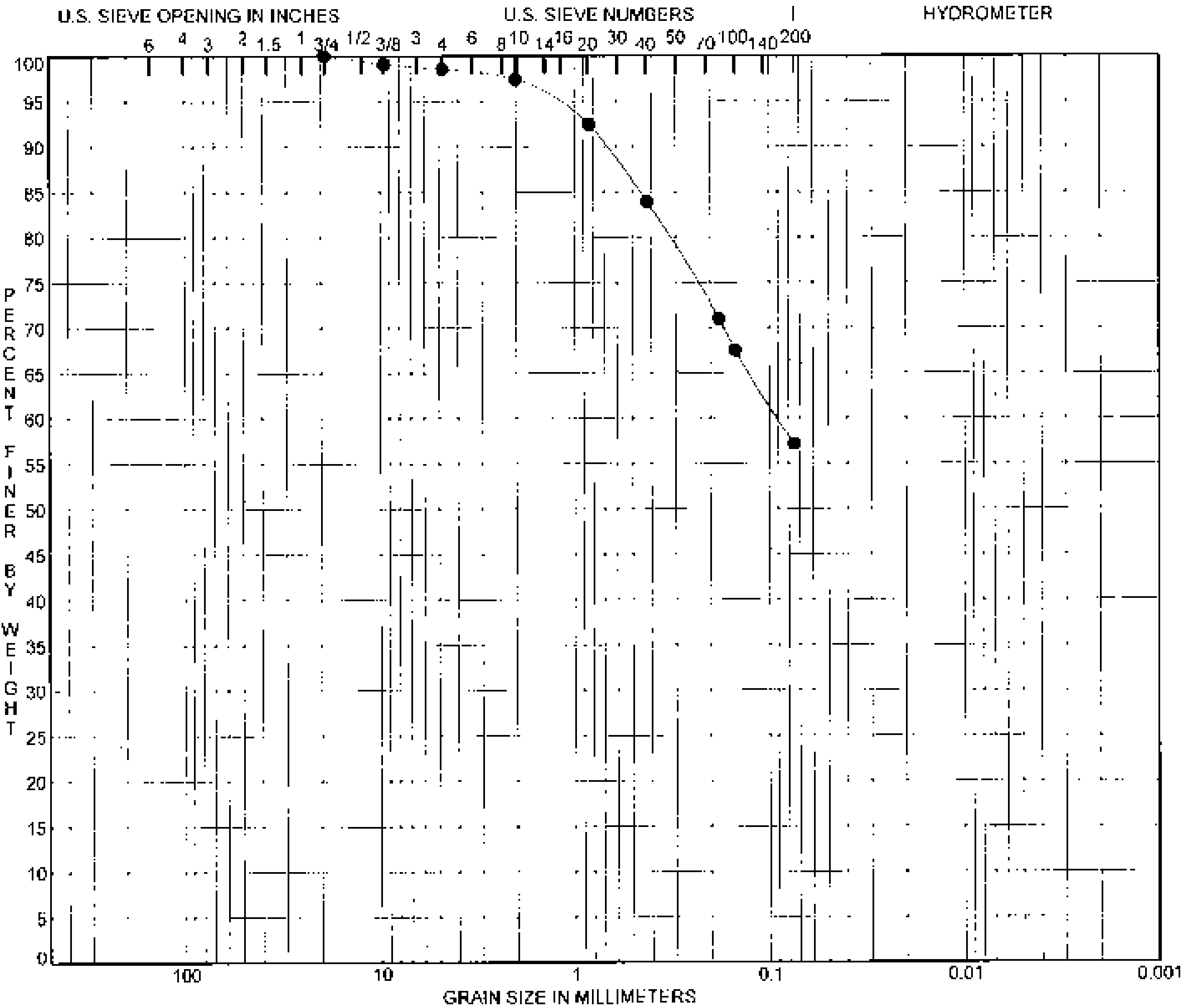
DATE OF WEIGHING: 3/7/2011

BORING NO.	B-4	B-4	B-4	B-4	B-4
SAMPLE NO.	11-0291A	11-0291D	11-0291G	11-0291J	11-0291L
SAMPLE DEPTH	2.0'-4.0'	6.0'-8.0'	10.0'--12.0'	18.0'-20.0'	28.5'-30.0'
WATER CONTENT, W%	13.31	14.09	14.51	12.93	32.06

BORING NO.	B-4				
SAMPLE NO.	11-0291O				
SAMPLE DEPTH	63.5'-65.0'				
WATER CONTENT, W%	28.57				

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-4 (0291B) 4.0	Brown F/M Sandy Silty CLAY (CL-ML)	13.3					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-4 (0291B) 4.0	19.10	0.09			1.4	41.4	57.1	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/9/11**

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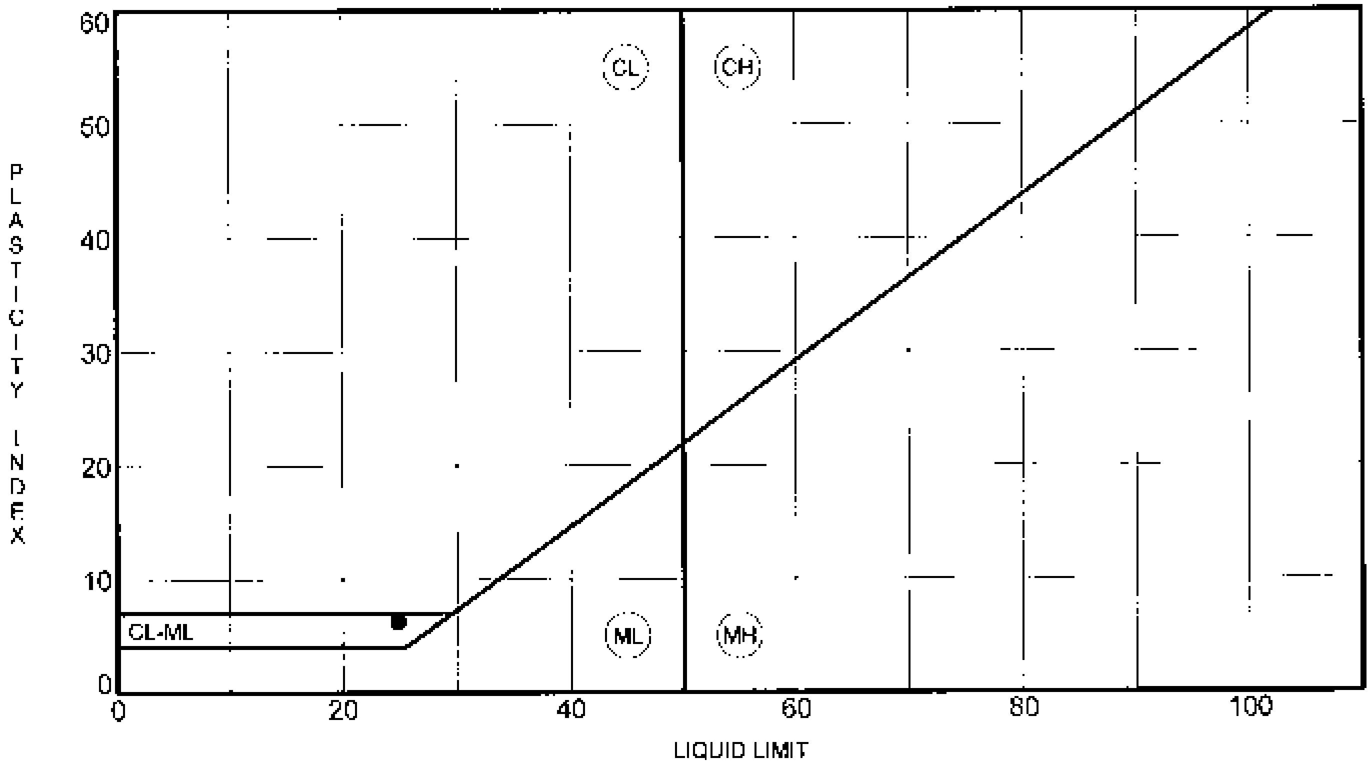

Specimen Identification		LL	PL	PI	Fines	Classification
● B-4 (0291C)	4.0	25	19	6		**Brown F/M Sandy Silty CLAY (CL-ML)**

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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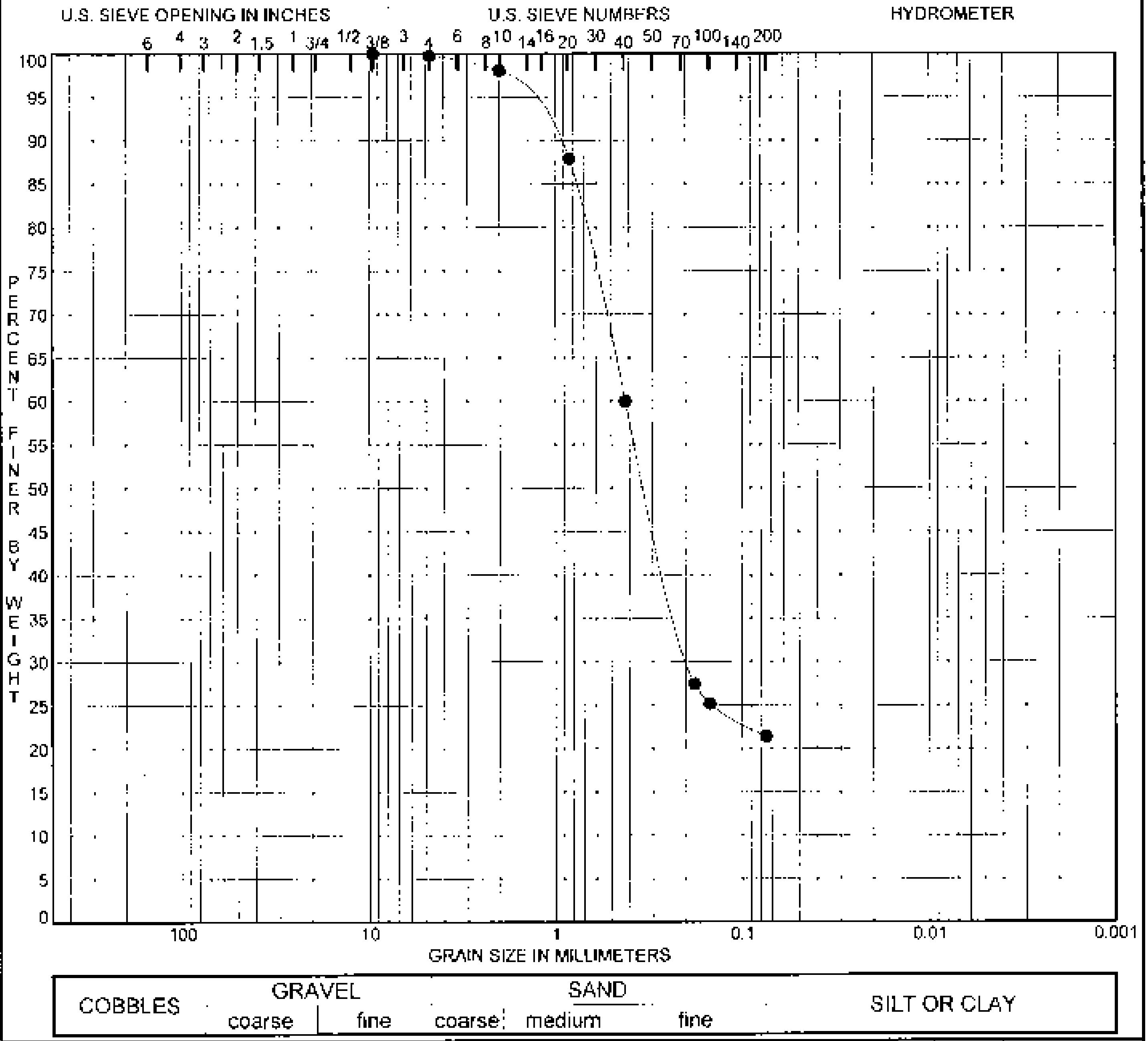

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-4 (0291E) 8.0	White Silty F/M SAND (SM)	14.1					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-4 (0291E) 8.0	9.52	0.42	0.192		0.2	78.3	21.4	

PROJECT Urquhart Station Ash Pond Dike Investigation
LOCATION Aiken County, South Carolina

JOB NO. G5044.000
DATE 3/9/11

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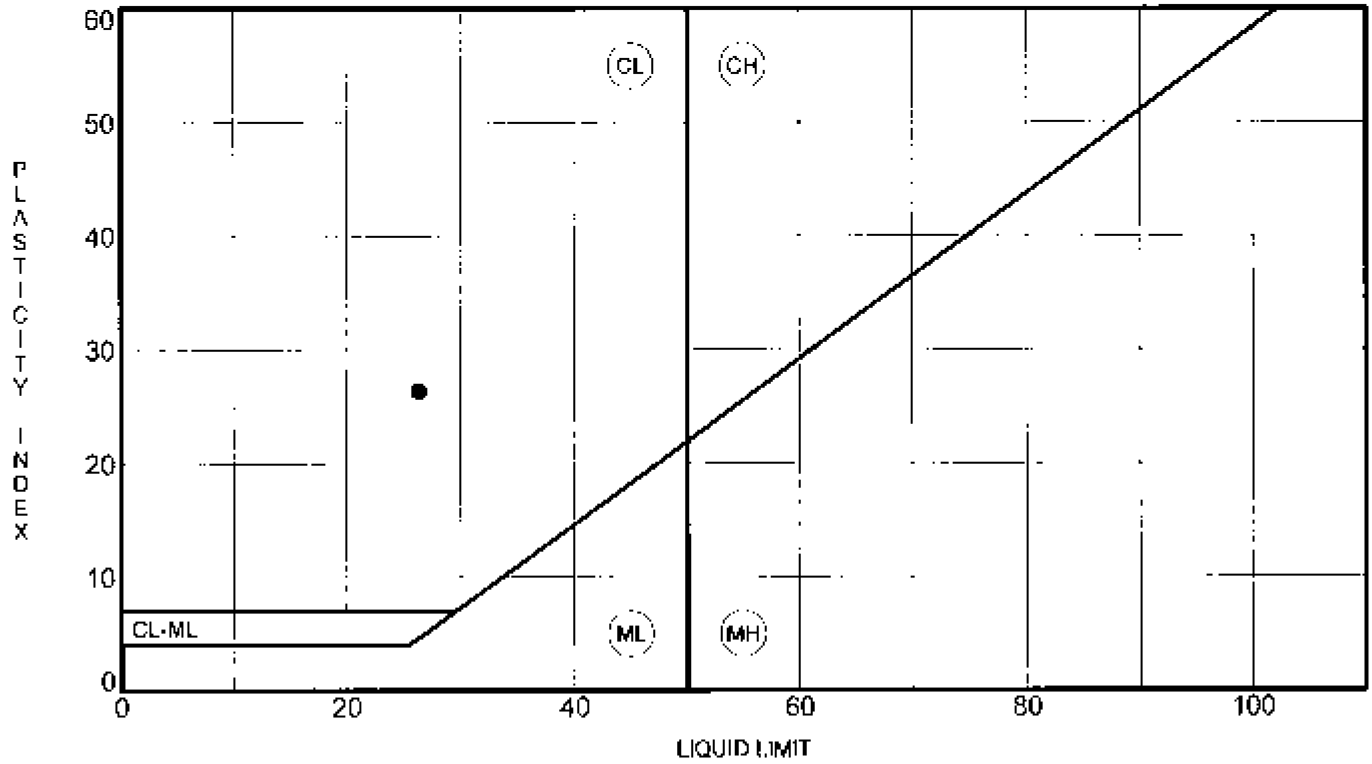

Specimen Identification		LL	PL	PI	Fines	Classification
● **B-4 (0291F)**	**8.0**	**26**	**NP**	**26**		**White Silty F/M SAND (SM)**

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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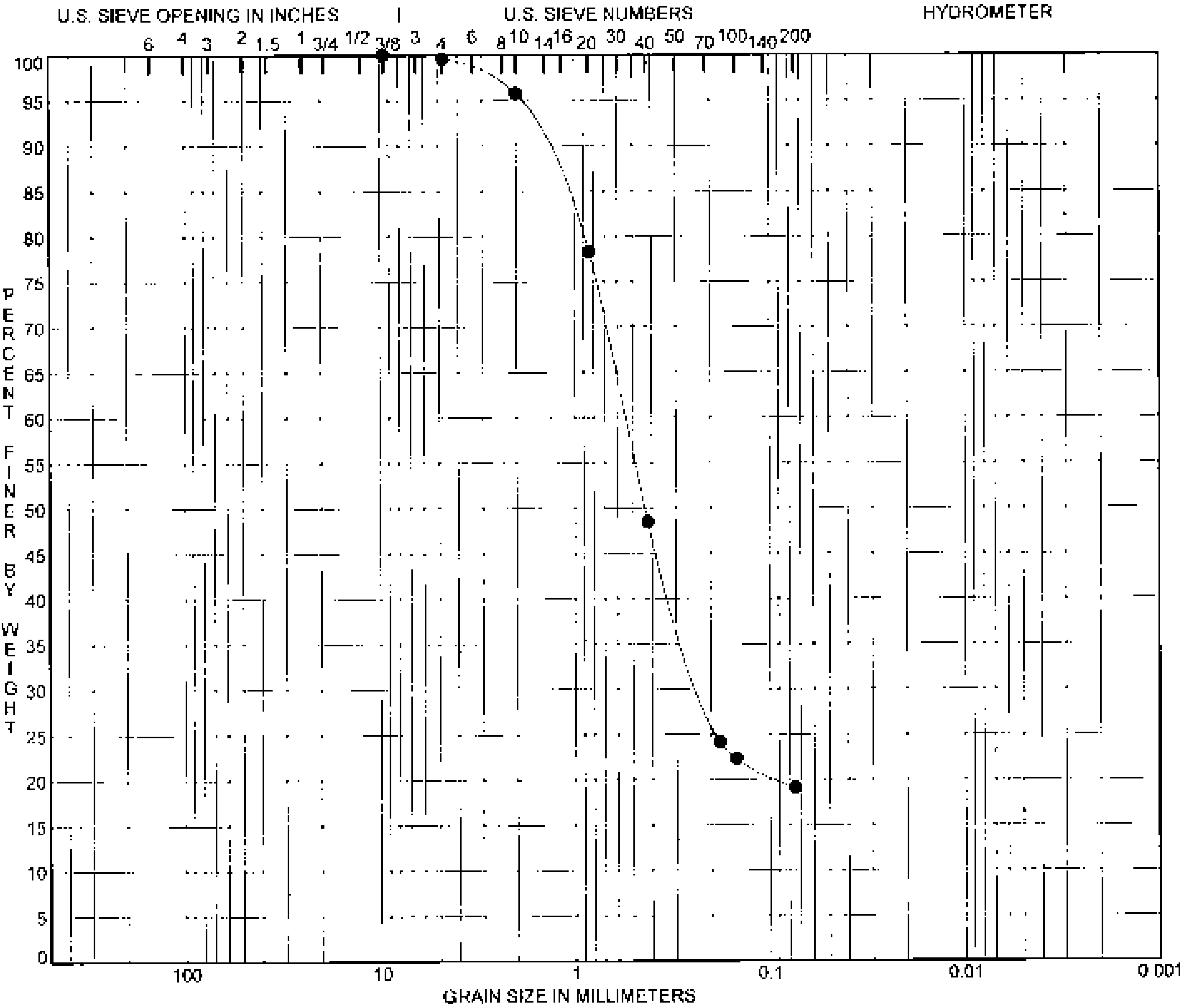
JS_ATTERBERG_LIMITS G5044LAB.GPJ JS_LAB.GDT 3/9/11



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-4 (0291H) 12.0	Brown Silty F/M SAND (SM)	14.5					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-4 (0291H) 12.0	9.52	0.55	0.221		0.4	80.4	19.1	

PROJECT Urquhart Station Ash Pond Dike Investigation
LOCATION Aiken County, South Carolina

JOB NO. G5044.000
DATE 3/9/11

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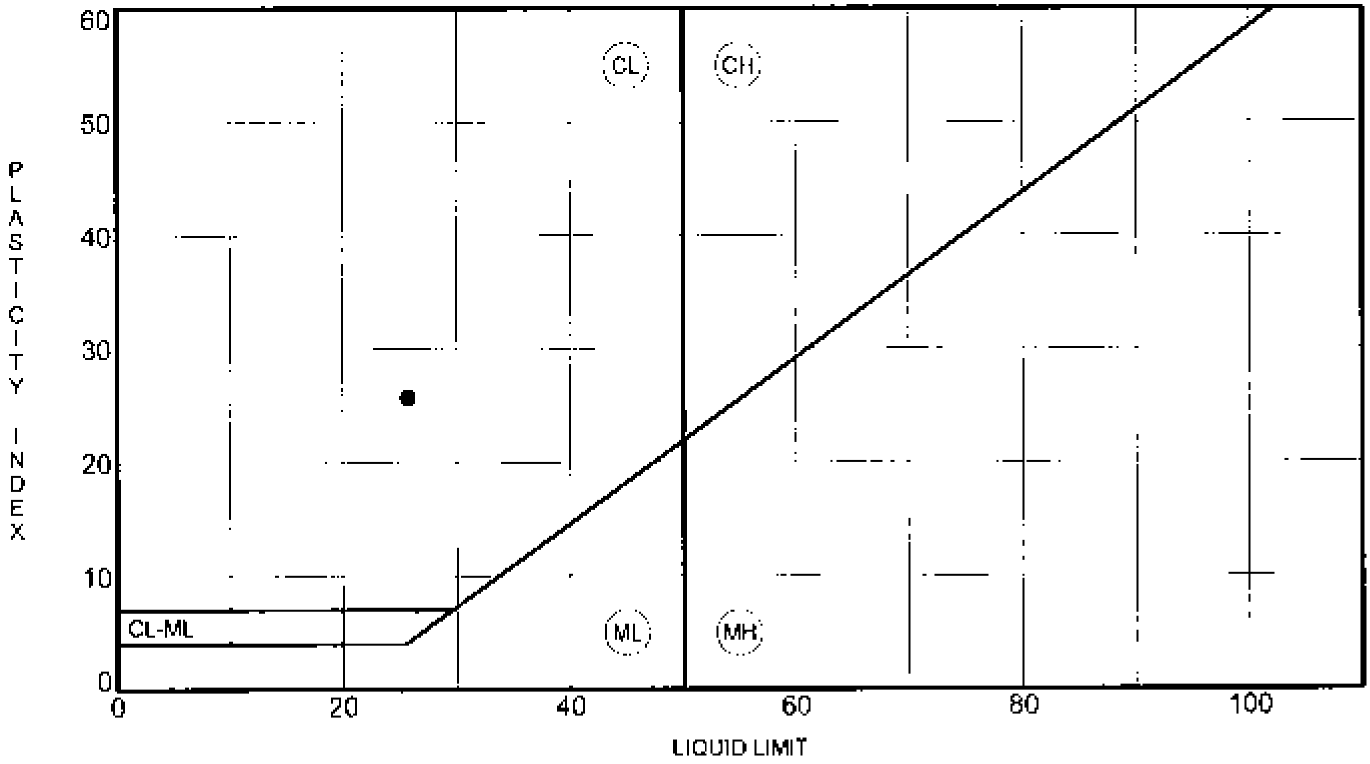
GRADATION CURVES



Specimen Identification		LL	PL	PI	Fines	Classification
● B-4 (0291I)	12.0	26	NP	26		Brown Silty F/M SAND (SM)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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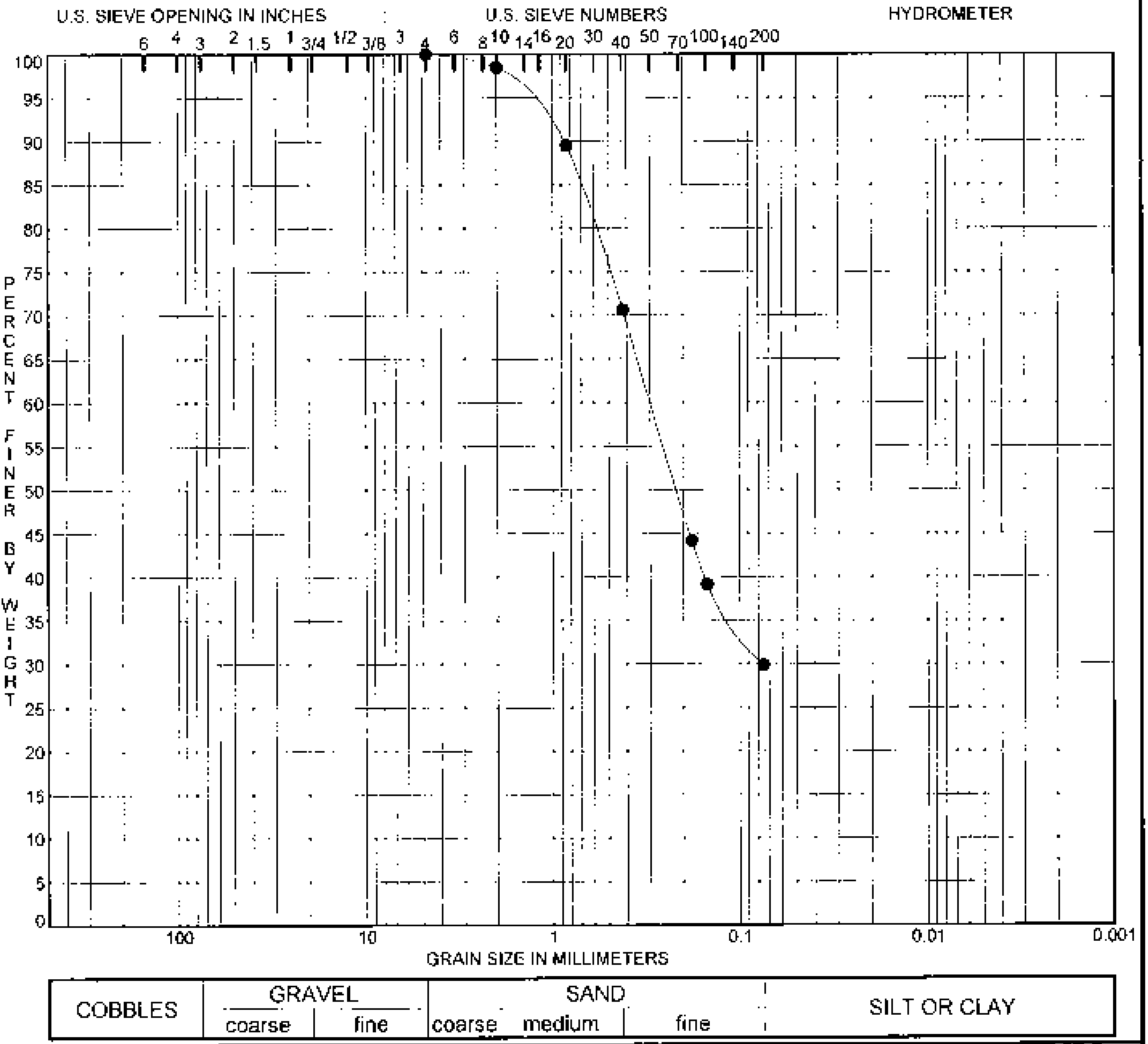
US ATTERBERG LIMITS G5044LAB.GPJ US LAB.GDT 3/9/11



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **B-4 (0291K) 20.0**	**Brown/Gray Silty F/M SAND (SM)**	**12.9**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-4 (0291K) 20.0**	**4.76**	**0.30**	**0.076**		**0.0**	**70.1**	**29.9**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/9/11**

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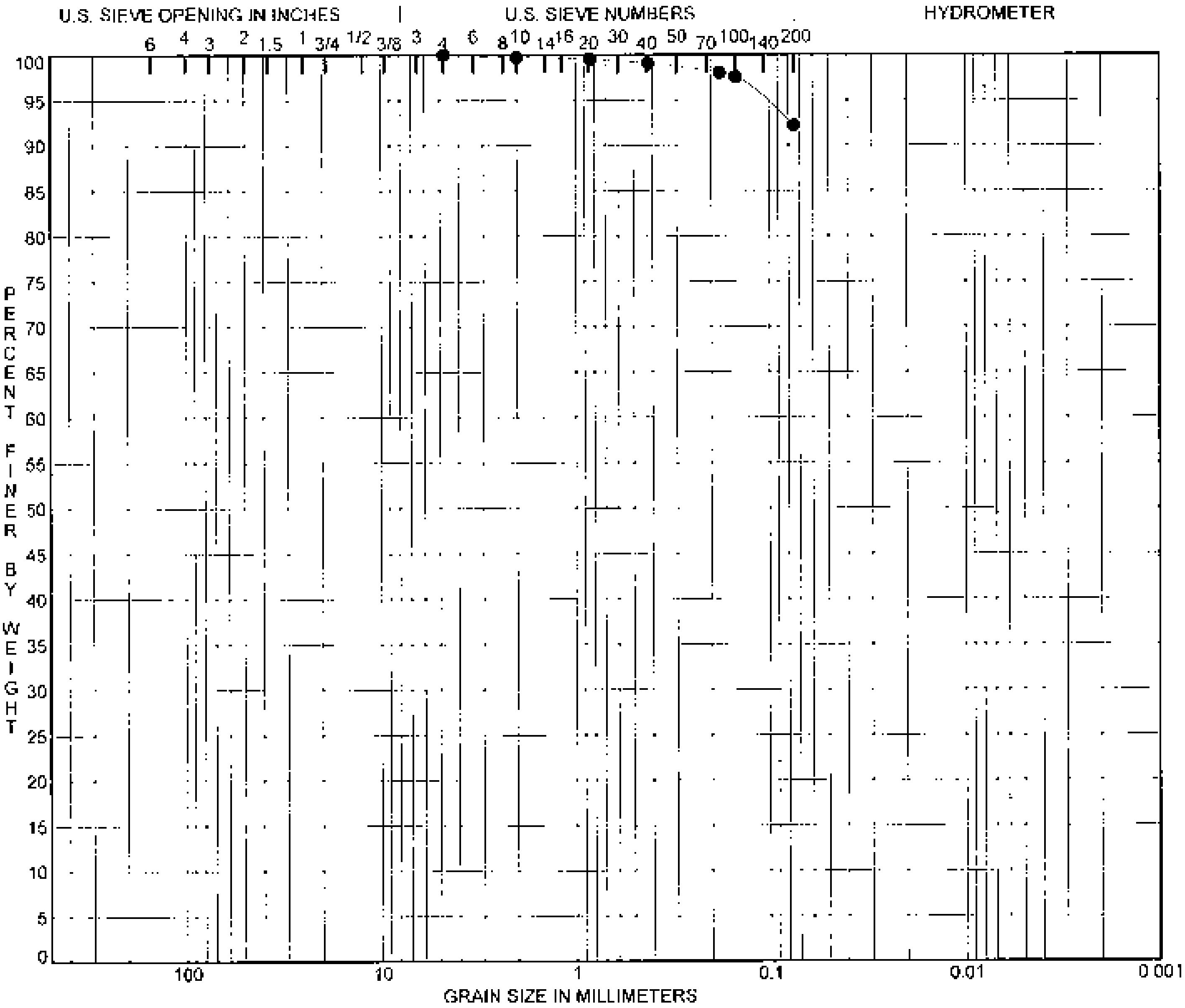

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-4 (0291M) 30.0	Gray SILT (ML)	32.1					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-4 (0291M) 30.0	4.76				0.0	7.8	92.2	

PROJECT Urquhart Station Ash Pond Dike Investigation
LOCATION Aiken County, South Carolina

JOB NO. G5044.000
DATE 3/9/11

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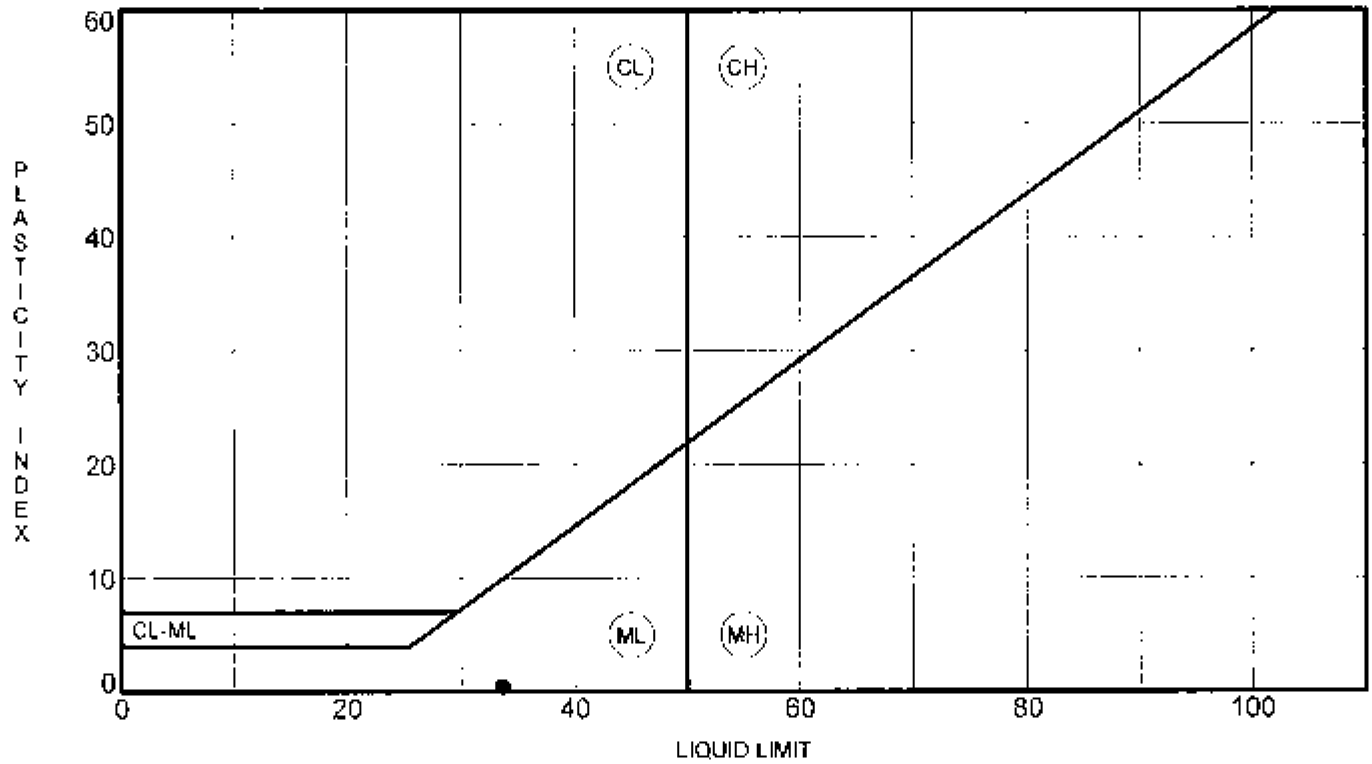
GRADATION CURVES



Specimen Identification		LL	PL	PI	Fines	Classification
● B-4 (0291N)	30.0	34	33	1		Gray SILT (ML)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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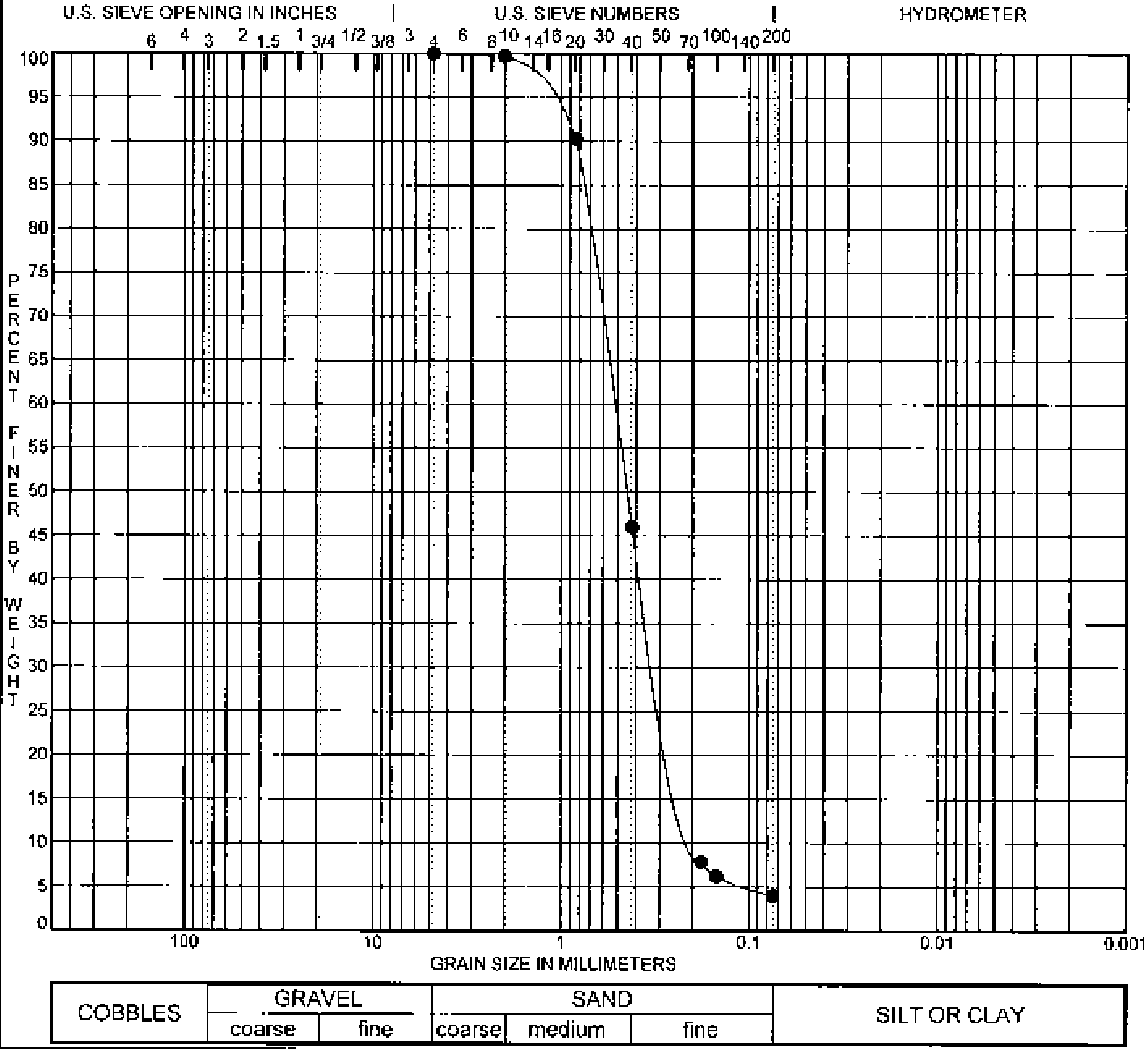

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-4 (0291P) 65.0	Brown F/M SAND (SP)	28.6				0.88	2.8

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4 (0291P) 65.0	4.76	0.52	0.294	0.1886	0.0	96.0	4.0	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**
JOB NO. **G5044.000**
DATE **3/9/11**

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F&ME CONSULTANTS
3112 Devine Street
Columbia, South Carolina 29205

MOISTURE CONTENT DETERMINATION
(AASHTO T265)

PROJECT: Urquhart Station Ash Pond Dike Investigation

PROJECT NO.: G5044.000

SAMPLE NUMBER: B-6 / 11-0286

DATE SAMPLE RECEIVED: 3/1/2011

DESCRIPTION OF SOIL: Various

TESTED BY: J. Hiers

DATE OF TESTING: 3/5/2011

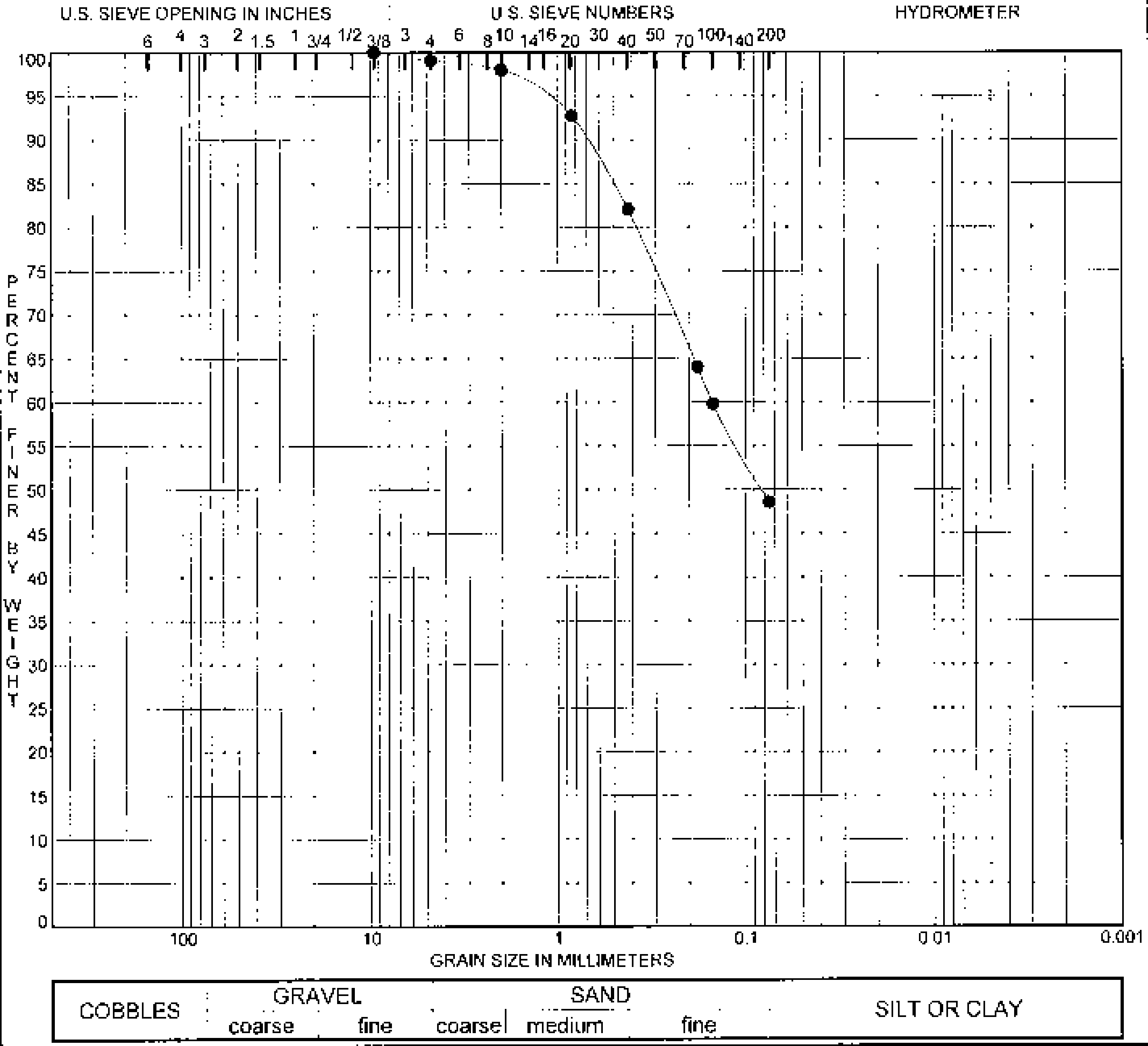
DATE OF WEIGHING: 3/7/2011

BORING NO.	B-6	B-6	B-6	B-6	
SAMPLE NO.	11-0286A	11-0286D	11-0286G	11-0286J	
SAMPLE DEPTH	6.0'-8.0'	10.0'-12.0'	16.0'-18.0'	38.5'-40.0'	
WATER CONTENT, W%	19.17	20.4	14.16	50.48	

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					

BORING NO.					
SAMPLE NO.					
SAMPLE DEPTH					
WATER CONTENT, W%					



Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-6 (0286B) 8.0	Orange Clayey F/M SAND (SC)	19.2					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-6 (0286B) 8.0	9.52	0.15			0.9	50.5	48.6	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/9/11**

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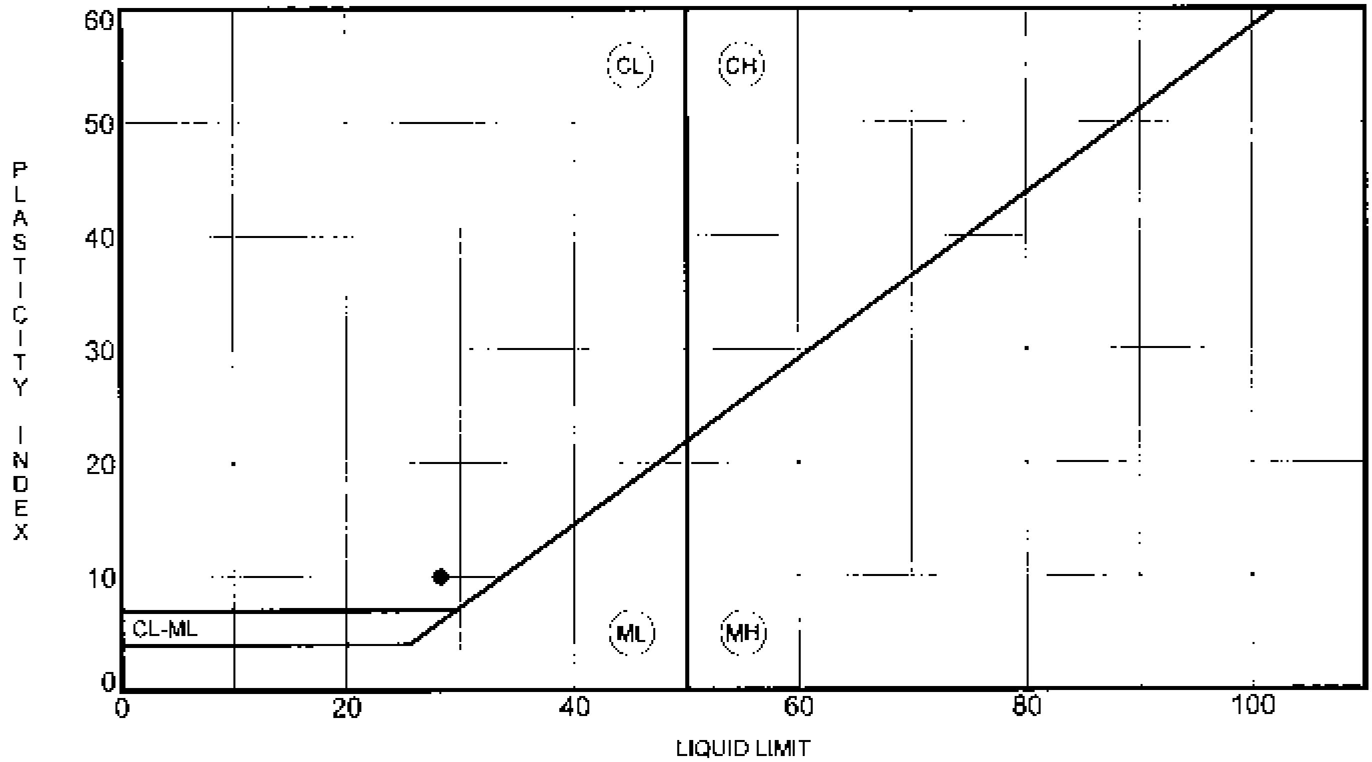

Specimen Identification		LL	PL	PI	Fines	Classification
● B-6 (0286C)	8.0	28	18	10		Orange Clayey F/M SAND (SC)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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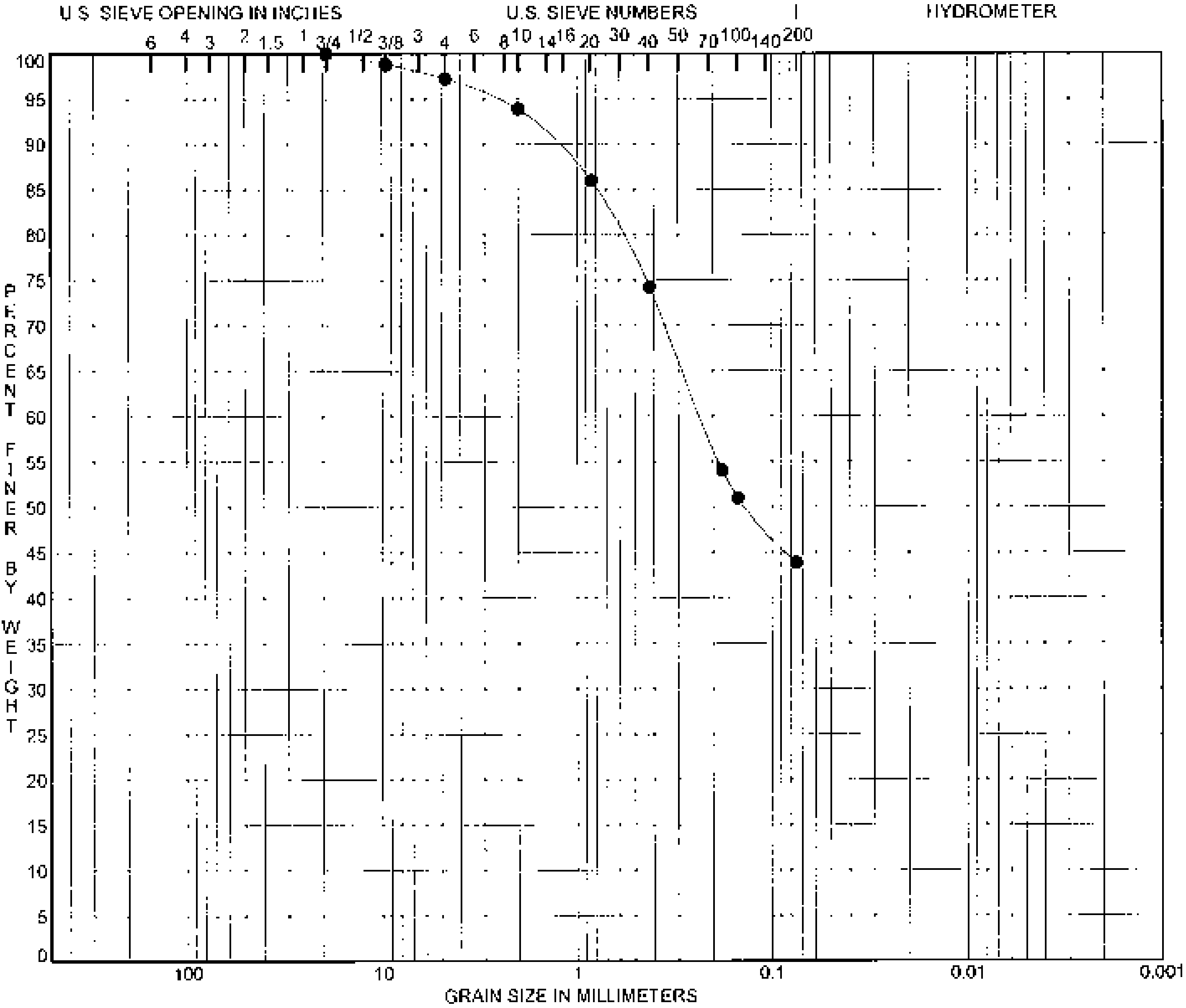

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **B-6 (0286E) 12.0**	**Orange Silty F/M SAND (SM)**	**20.4**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-6 (0286E) 12.0**	**19.10**	**0.23**			**2.8**	**53.4**	**43.9**	

PROJECT **Urquhart Station Ash Pond Dike Investigation**
LOCATION **Aiken County, South Carolina**

JOB NO. **G5044.000**
DATE **3/9/11**

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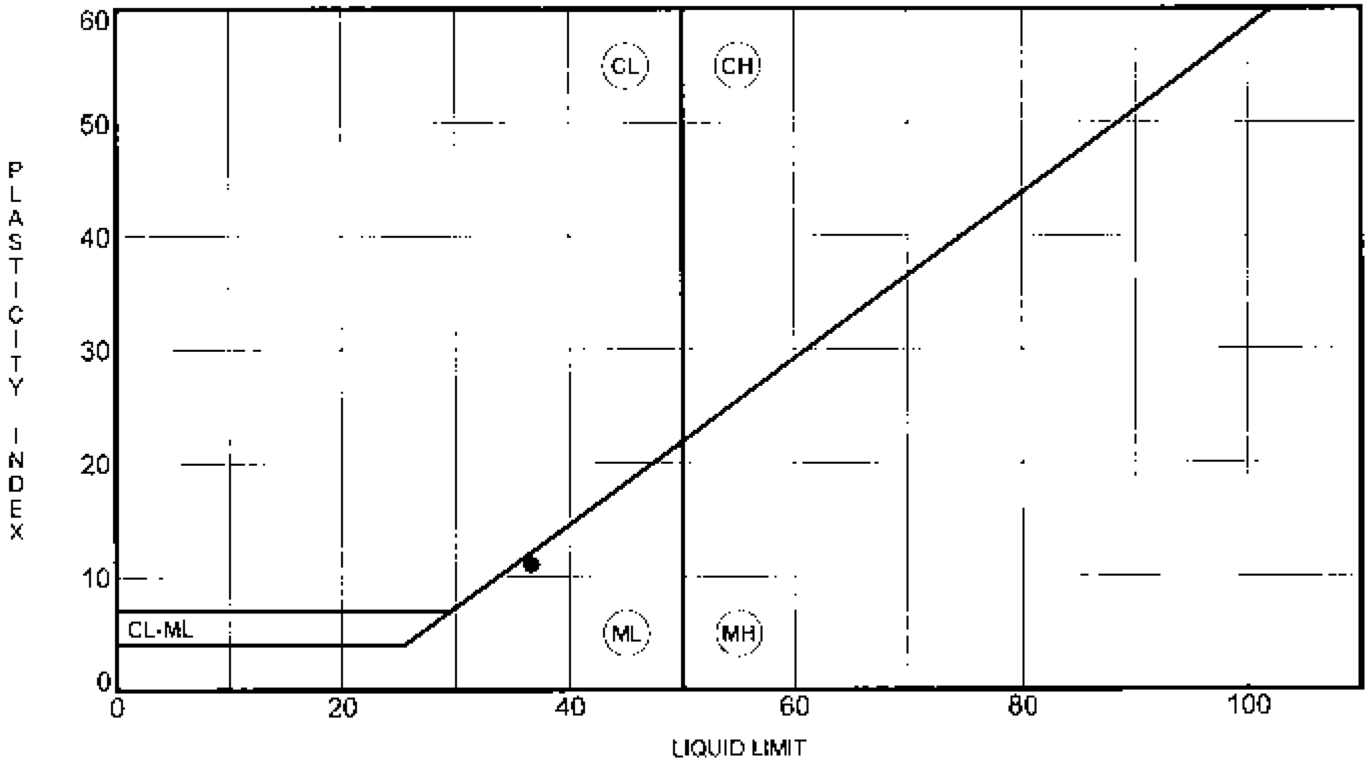
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-6 (0286F)	12.0	37	26	11		Orange Silty F/M SAND (SM)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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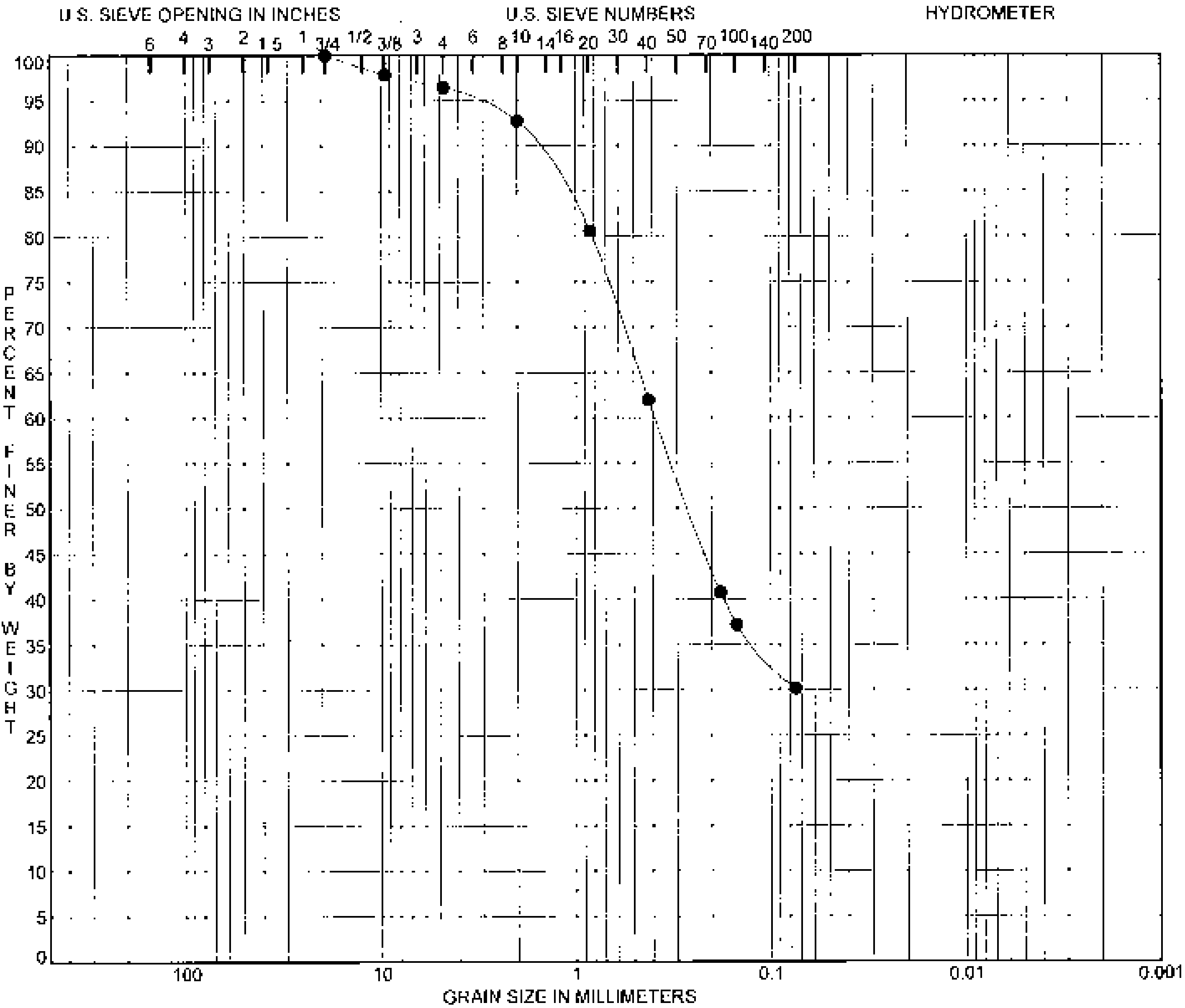

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-6 (0286H) 18.0	Brown Clayey F/M SAND (SC)	14.2					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 (0286H) 18.0	19.10	0.39			3.6	66.3	30.2	

PROJECT Urquhart Station Ash Pond Dike Investigation
LOCATION Aiken County, South Carolina

JOB NO. G5044.000
DATE 3/9/11

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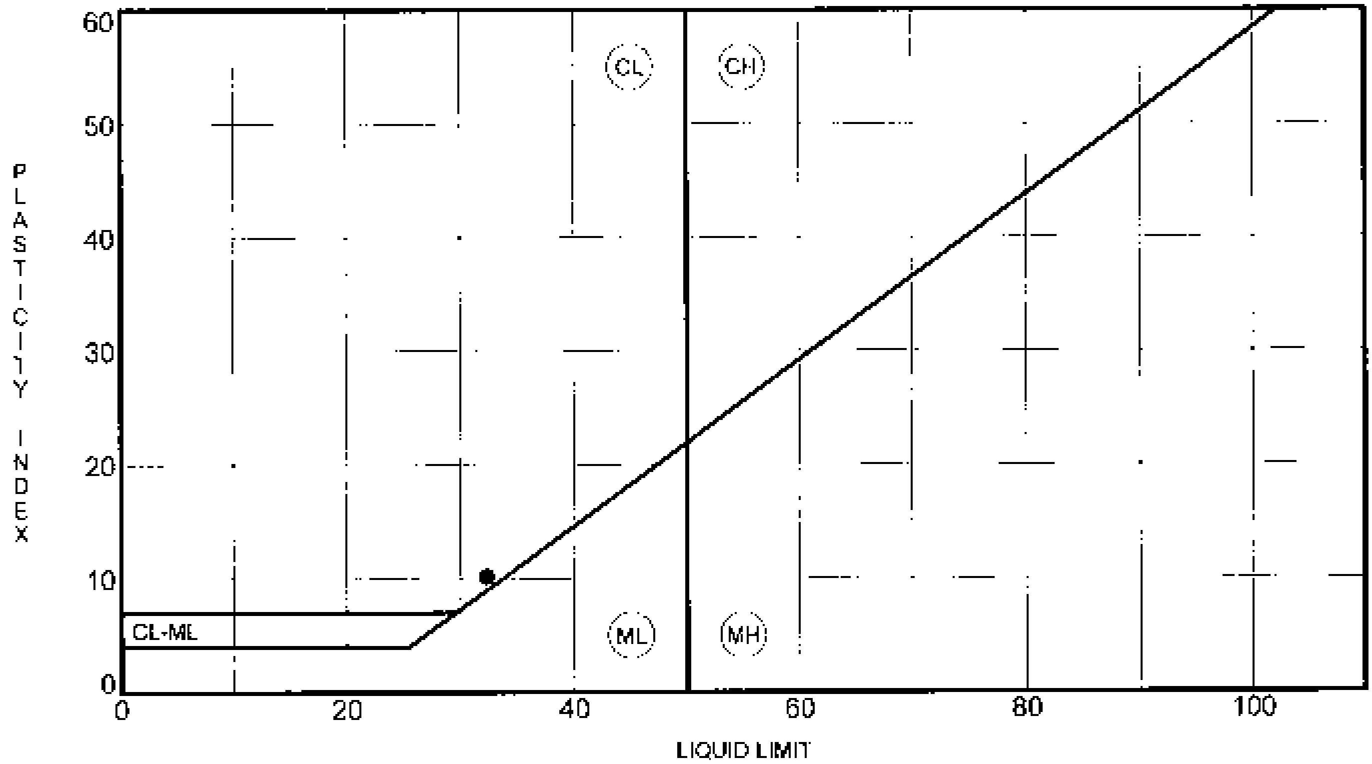
GRADATION CURVES



	Specimen Identification		LL	PL	PI	Fines	Classification
●	B-6 (0286I)	18.0	32	22	10		Brown Clayey F/M SAND (SC)

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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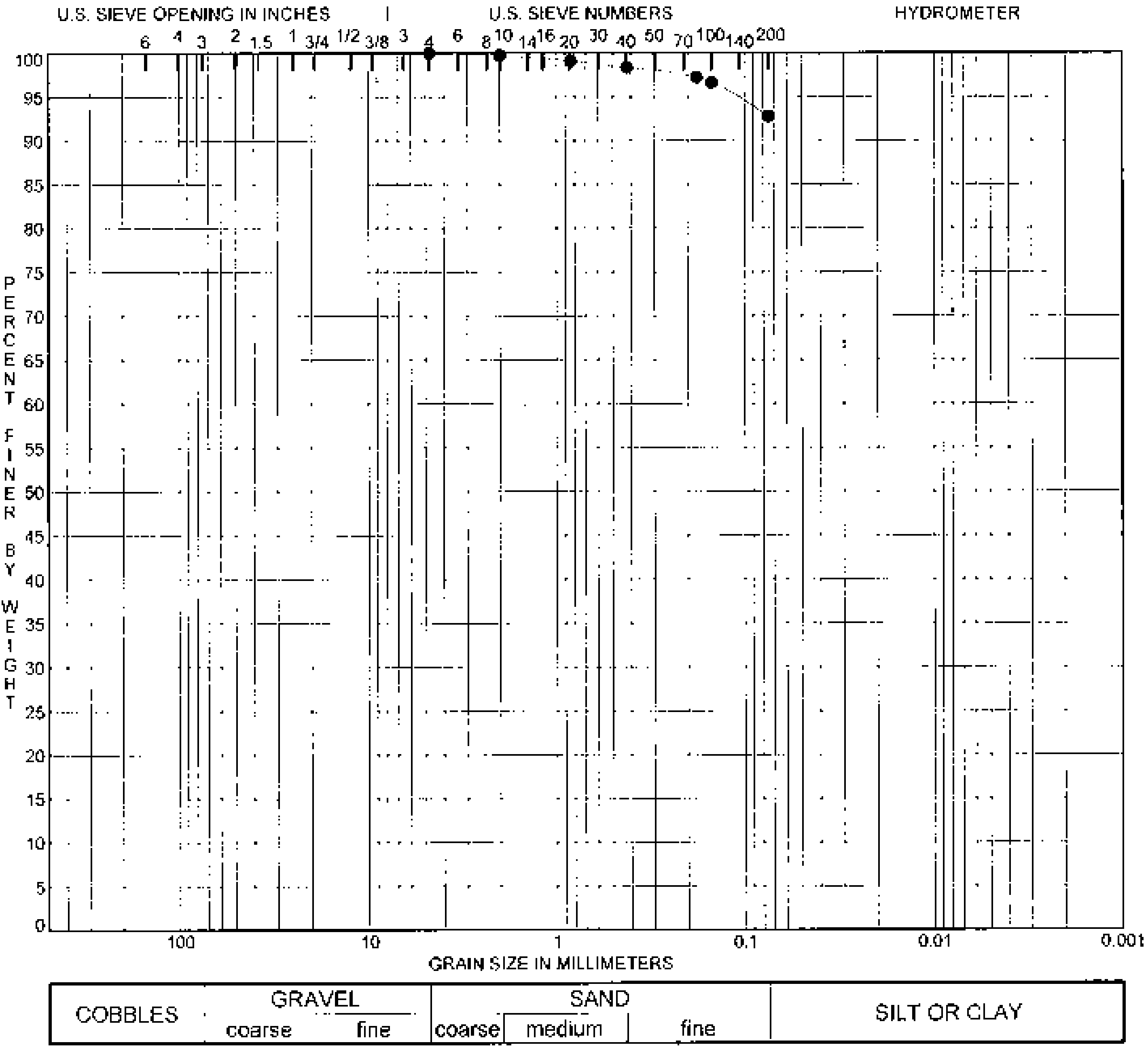

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● B-6 (0286K) 40.0	Gray SILT (ML)	50.5					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-6 (0286K) 40.0	4.76				0.0	7.2	92.8	

PROJECT Urquhart Station Ash Pond Dike Investigation
LOCATION Aiken County, South Carolina

JOB NO. G5044.000
DATE 3/9/11

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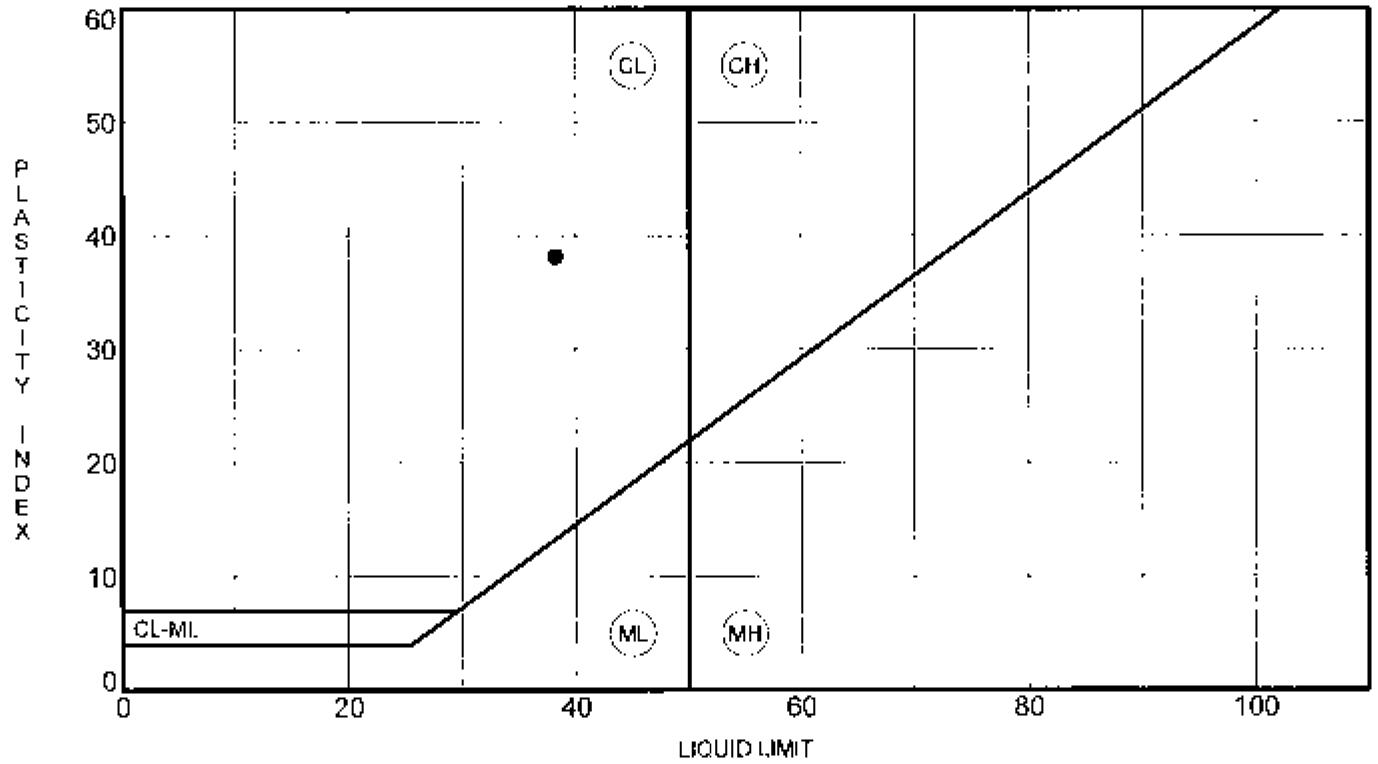
GRADATION CURVES



Specimen Identification		LL	PL	PI	Fines	Classification
● **B-6 (0286L)**	**40.0**	**38**	**NP**	**38**		**Gray Silt (ML)**

ATTERBERG LIMITS' RESULTS

Project: Urquhart Station Ash Pond Dike Investigation

Location: Aiken County, South Carolina

Number: G5044.000

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Appendix C

Liquefaction Analysis

LIQUEFACTION ANALYSIS - 2% P.E. in 50 YEARS

Calc. by: MSM
Project: Urquhart Station Ash Pond
Date: 3/8/2011

Soil Unit Weight (pcf) = 115
Depth to Groundwater (ft) = 26
Bouyant unit weight (pcf) = 52.6

Soil unit weight (pcf) = 125
Embankment height (ft) = 0
Atmospheric Press (kPa) = 100

a max = 26.40% g
Mw = 7.34

Layer Thickness = 2.0 ft

CPT-01

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
50.27	0.278	29	4813.84	26.62	3.148	159.68	150.72	0.5	37.91	0.57	2.13	0.81	39.2	1.5	59.2	0.099	1.06	0.105	0.932	3.34	3.15	0.170	0.62	0.917	12.04	0.80	10	2.5%	0.60
54.17	0.280	31	5187.10	26.81	3.253	170.69	155.75	0.5	40.20	0.53	2.09	0.80	41.6	1.4	59.9	0.100	1.06	0.106	0.922	3.57	3.25	0.173	0.61	0.921	12.97	0.78	10	2.5%	0.60
61.57	0.230	42	5895.69	22.02	3.832	231.26	183.46	0.5	41.82	0.39	2.02	0.74	43.5	1.3	57.7	0.098	1.06	0.103	0.832	4.83	3.83	0.180	0.57	0.938	14.75	0.72	11	0.2%	0.04
62.33	0.157	44	5968.60	15.03	3.937	242.27	188.49	0.5	41.71	0.26	1.96	0.73	43.5	1.2	54.2	0.095	1.06	0.100	0.816	5.06	3.94	0.180	0.56	0.947	14.93	0.71	11	0.2%	0.04
56.21	0.249	46	5382.29	23.84	4.042	253.29	193.53	0.5	36.87	0.46	2.10	0.72	38.7	1.5	56.3	0.097	1.06	0.102	0.800	5.29	4.04	0.180	0.57	0.941	13.46	0.70	9	2.8%	0.67
59.35	0.225	48	5683.06	21.55	4.147	264.30	198.57	0.5	38.45	0.40	2.06	0.71	40.3	1.4	55.6	0.096	1.06	0.101	0.783	5.52	4.15	0.179	0.57	0.942	14.21	0.69	10	2.5%	0.60
59.09	0.230	50	5658.04	22.02	4.252	275.31	203.60	0.5	37.72	0.41	2.07	0.70	39.7	1.4	55.5	0.096	1.06	0.101	0.767	5.75	4.25	0.178	0.57	0.941	14.15	0.69	10	2.5%	0.60
47.37	0.151	52	4535.97	14.46	4.358	286.32	208.64	0.5	29.42	0.34	2.14	0.69	31.4	1.5	48.0	0.090	1.06	0.095	0.751	5.98	4.36	0.177	0.54	0.958	11.35	0.68	8	2.8%	0.67
73.72	0.338	54	7059.19	32.37	4.463	297.33	213.68	0.5	46.26	0.48	2.02	0.68	48.3	1.3	63.9	0.104	1.06	0.110	0.735	6.21	4.46	0.175	0.63	0.909	17.66	0.67	12	0.1%	0.02
97.09	0.220	56	9296.92	21.07	4.568	308.35	218.72	0.5	60.78	0.23	1.79	0.68	62.9	1.1	69.0	0.110	1.06	0.117	0.718	6.44	4.57	0.174	0.67	0.882	18.60	0.66	12	0.1%	0.02
104.27	0.267	58	9984.86	25.57	4.673	319.36	223.75	0.5	64.62	0.26	1.78	0.67	66.8	1.1	72.9	0.116	1.06	0.123	0.702	6.67	4.67	0.172	0.71	0.855	19.98	0.65	13	0.1%	0.02
128.68	0.284	60	12322.42	27.20	4.778	330.37	228.79	0.5	79.28	0.23	1.67	0.66	81.5	1.0	83.0	0.133	1.06	0.141	0.686	6.90	4.78	0.170	0.83	0.772	24.66	0.65	16	0.1%	0.02
114.62	0.340	62	10976.38	32.56	4.884	341.38	233.83	0.5	69.55	0.31	1.77	0.65	71.8	1.1	78.1	0.124	1.06	0.131	0.669	7.13	4.88	0.168	0.78	0.804	21.96	0.64	14	0.2%	0.05
130.17	0.265	64	12465.49	25.38	4.989	352.40	238.86	0.5	78.38	0.21	1.67	0.65	80.7	1.0	81.8	0.131	1.06	0.138	0.653	7.36	4.99	0.165	0.84	0.763	24.94	0.63	16	0.1%	0.02
																												Total	3.98

CPT-02

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
21.16	0.476	29	2025.92	45.58	3.148	159.68	150.72	0.7	14.00	2.44	2.83	0.75	15.2	5.0	76.1	0.121	1.06	0.128	0.932	3.34	3.15	0.170	0.75	0.826	8.11	0.80	6	3.0%	0.72
55.18	0.490	31	5284.07	46.92	3.253	170.69	155.75	0.5	40.97	0.92	2.20	0.80	42.3	1.7	70.8	0.113	1.06	0.119	0.922	3.57	3.25	0.173	0.69	0.871	13.22	0.78	10	2.5%	0.60
68.65	0.158	42	6573.73	15.13	3.832	231.26	183.46	0.5	46.83	0.24	1.90	0.74	48.5	1.2	57.5	0.098	1.06	0.103	0.832	4.83	3.83	0.180	0.57	0.938	16.44	0.72	12	0.1%	0.02
55.46	0.143	44	5310.83	13.69	3.937	242.27	188.49	0.5	36.92	0.27	2.01	0.73	38.7	1.3	50.9	0.092	1.06	0.097	0.816	5.06	3.94	0.180	0.54	0.955	13.28	0.71	9	2.8%	0.67
47.60	0.146	46	4557.97	13.98	4.042	253.29	193.53	0.5	30.94	0.32	2.11	0.72	32.8	1.5	48.3	0.090	1.06	0.095	0.800	5.29	4.04	0.180	0.53	0.960	11.40	0.70	8	2.8%	0.67
56.10	0.123	48	5372.31	11.78	4.147	264.30	198.57	0.5	36.25	0.23	2.00	0.71	38.1	1.3	49.4	0.091	1.06	0.096	0.783	5.52	4.15	0.179	0.54	0.957	13.44	0.69	9	2.8%	0.67
143.77	0.361	50	13767.17	34.57	4.252	275.31	203.60	0.5	94.55	0.26	1.62	0.70	96.5	1.0	96.5	0.164	1.06	0.173	0.767	5.75	4.25	0.178	0.97	0.676	27.55	0.69	19	0.1%	0.02
115.62	0.335	52	11072.08	32.08	4.358	286.32	208.64	0.5	74.67	0.30	1.74	0.69	76.7	1.1	81.7	0.131	1.06	0.138	0.751	5.98	4.36	0.177	0.78	0.810	22.15	0.68	15	0.1%	0.02
116.14	0.300	54	11121.19	28.73	4.463	297.33	213.68	0.5	74.05	0.27	1.73	0.68	76.1	1.1	80.2	0.128	1.06	0.135	0.735	6.21	4.46	0.175	0.77	0.816	22.25	0.67	15	0.1%	0.02
104.85	0.270	56	10040.39	25.86	4.568	308.35	218.72	0.5	65.81	0.27	1.77	0.68	67.9	1.1	73.8	0.117	1.06	0.124	0.718	6.44	4.57	0.174	0.71	0.854	20.09	0.66	13	0.1%	0.02
90.40	0.294	58	8656.67	28.15	4.673	319.36	223.75	0.5	55.74	0.34	1.88	0.67	57.9	1.2	67.7	0.109	1.06	0.115	0.702	6.67	4.67	0.172	0.67	0.884	17.32	0.65	11	0.2%	0.05
115.53	0.294	60	11062.99	28.15	4.778	330.37	228.79	0.5	70.96	0.26	1.74	0.66	73.1	1.1	77.9	0.124	1.06	0.131	0.686	6.90	4.78	0.170	0.77	0.814	22.14	0.65	14	0.1%	0.02
106.73	0.270	62	10220.86	25.86	4.884	341.38	233.83	0.5	64.61	0.26	1.78	0.65	66.8	1.1	72.9	0.116	1.06	0.123	0.669	7.13	4.88	0.168	0.73	0.842	20.45	0.64	13	0.1%	0.02
82.09	0.230	64	7860.59	22.02	4.989	352.40	238.86	0.5	48.58	0.29	1.91	0.65	50.9	1.2	61.0	0.101	1.06	0.107	0.653	7.36	4.99	0.165	0.65	0.901	15.73	0.63	10	2.5%	0.60
69.77	0.232	66	6681.64	22.22	5.094	363.41	243.90	0.5	40.46	0.35	2.01	0.64	42.8	1.3	56.4	0.097	1.06	0.102	0.637	7.59	5.09	0.163	0.63	0.915	16.71	0.63	10	2.5%	0.60
81.13	0.248	68	7769.44	23.75	5.199	374.42	248.94	0.5	46.87	0.32	1.94	0.63	49.2	1.2	60.5	0.101	1.06	0.106	0.621	7.82	5.20	0.160	0.66	0.891	19.43	0.62	12	0.1%	0.02
78.99	0.209	70	7564.29	20.01	5.304	385.43	253.97	0.5	45.05	0.28	1.93	0.63	47.5	1.2	58.0	0.098	1.06	0.104	0.604	8.05	5.30	0.157	0.66	0.897	18.92	0.61	12	0.1%	0.02
102.64	0.136	72	9828.74	13.02	5.410	396.45	259.01	0.5	58.61	0.14	1.74	0.62	61.1	1.1	65.0	0.106	1.06	0.112	0.588	8.28	5.41	0.154	0.72	0.850	19.67	0.61	12	0.1%	0.02
																												Total	4.82

LIQUEFACTION ANALYSIS - 2% P.E. in 50 YEARS

CPT-03

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
79.98	0.750	28	7658.47	71.82	3.095	154.17	148.20	0.5	61.64	0.96	2.07	0.82	62.9	1.4	87.8	0.143	1.06	0.151	0.935	3.22	3.10	0.167	0.90	0.714	19.15	0.80	15	0.2%	0.05
127.50	0.531	51	12209.48	50.85	4.305	280.82	206.12	0.5	83.09	0.43	1.77	0.70	85.0	1.1	92.2	0.153	1.06	0.161	0.759	5.87	4.31	0.177	0.91	0.719	24.43	0.68	17	0.2%	0.05
108.99	0.404	53	10436.89	38.69	4.410	291.83	211.16	0.5	69.81	0.38	1.81	0.69	71.8	1.1	80.2	0.128	1.06	0.135	0.743	6.10	4.41	0.176	0.77	0.819	20.88	0.67	14	0.5%	0.12
129.21	0.464	55	12373.62	44.43	4.515	302.84	216.20	0.5	82.09	0.37	1.74	0.68	84.2	1.1	89.8	0.147	1.06	0.156	0.726	6.33	4.52	0.175	0.89	0.730	24.76	0.67	16	0.2%	0.05
96.41	0.351	57	9231.91	33.61	4.621	313.85	221.23	0.5	59.96	0.38	1.87	0.67	62.1	1.2	72.1	0.115	1.06	0.121	0.710	6.56	4.62	0.173	0.70	0.862	18.47	0.66	12	0.5%	0.12
101.28	0.293	59	9698.30	28.06	4.726	324.87	226.27	0.5	62.31	0.30	1.81	0.66	64.5	1.1	72.0	0.115	1.06	0.121	0.694	6.79	4.73	0.171	0.71	0.857	19.41	0.65	13	0.2%	0.05
126.21	0.344	61	12085.79	32.94	4.831	335.88	231.31	0.5	77.26	0.28	1.72	0.66	79.5	1.0	83.4	0.134	1.06	0.141	0.678	7.02	4.83	0.169	0.84	0.765	24.18	0.64	16	0.2%	0.05
123.65	0.457	63	11840.90	43.76	4.936	346.89	236.35	0.5	74.76	0.38	1.79	0.65	77.0	1.1	84.5	0.136	1.06	0.144	0.661	7.25	4.94	0.167	0.86	0.745	23.69	0.64	15	0.2%	0.05
116.38	0.293	65	11144.14	28.06	5.041	357.90	241.38	0.5	69.43	0.26	1.75	0.64	71.7	1.1	76.8	0.122	1.06	0.129	0.645	7.48	5.04	0.164	0.79	0.801	22.30	0.63	14	0.5%	0.12
125.11	0.410	67	11980.84	39.26	5.147	368.92	246.42	0.5	73.97	0.34	1.77	0.64	76.3	1.1	82.7	0.133	1.06	0.140	0.629	7.71	5.15	0.162	0.87	0.738	23.97	0.62	15	0.2%	0.05
120.32	0.505	69	11521.78	48.36	5.252	379.93	251.46	0.5	70.26	0.43	1.84	0.63	72.7	1.1	82.4	0.132	1.06	0.139	0.612	7.94	5.25	0.159	0.88	0.728	23.05	0.62	14	0.5%	0.12
120.99	0.413	71	11586.08	39.55	5.357	390.94	256.49	0.5	69.90	0.35	1.80	0.62	72.3	1.1	79.9	0.128	1.06	0.135	0.596	8.17	5.36	0.156	0.86	0.737	23.18	0.61	14	0.5%	0.12
122.88	0.527	73	11766.52	50.47	5.462	401.95	261.53	0.5	70.27	0.44	1.84	0.62	72.8	1.1	82.8	0.133	1.06	0.140	0.580	8.40	5.46	0.153	0.92	0.693	23.54	0.61	14	0.5%	0.12
																												Total	1.06

CPT-04

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
77.69	0.341	51	7439.27	32.65	4.305	280.82	206.12	0.5	49.86	0.46	1.98	0.70	51.8	1.3	65.9	0.107	1.06	0.113	0.759	5.87	4.31	0.177	0.64	0.904	18.61	0.68	13	0.1%	0.02
58.20	0.302	53	5573.41	28.92	4.410	291.83	211.16	0.5	36.35	0.55	2.14	0.69	38.4	1.5	58.5	0.099	1.06	0.104	0.743	6.10	4.41	0.176	0.59	0.930	13.94	0.67	9	2.0%	0.48
66.59	0.274	55	6376.38	26.24	4.515	302.84	216.20	0.5	41.31	0.43	2.04	0.68	43.4	1.4	58.9	0.099	1.06	0.105	0.726	6.33	4.52	0.175	0.60	0.926	15.95	0.67	11	0.1%	0.02
65.39	0.253	57	6261.73	24.23	4.621	313.85	221.23	0.5	39.99	0.41	2.04	0.67	42.1	1.4	57.3	0.098	1.06	0.103	0.710	6.56	4.62	0.173	0.60	0.929	15.66	0.66	10	1.0%	0.24
62.21	0.247	59	5957.15	23.65	4.726	324.87	226.27	0.5	37.44	0.42	2.08	0.66	39.6	1.4	55.9	0.096	1.06	0.102	0.694	6.79	4.73	0.171	0.59	0.931	14.90	0.65	10	1.0%	0.24
84.52	0.261	61	8093.60	24.99	4.831	335.88	231.31	0.5	51.01	0.32	1.91	0.66	53.2	1.2	63.6	0.104	1.06	0.110	0.678	7.02	4.83	0.169	0.65	0.897	16.19	0.64	10	1.0%	0.24
104.30	0.382	63	9987.61	36.58	4.936	346.89	236.35	0.5	62.71	0.38	1.85	0.65	65.0	1.1	74.6	0.119	1.06	0.125	0.661	7.25	4.94	0.167	0.75	0.827	19.98	0.64	13	0.1%	0.02
82.01	0.369	65	7853.20	35.34	5.041	357.90	241.38	0.5	48.24	0.47	2.00	0.64	50.5	1.3	65.5	0.106	1.06	0.112	0.645	7.48	5.04	0.164	0.68	0.876	19.64	0.63	12	0.2%	0.05
76.25	0.289	67	7301.57	27.67	5.147	368.92	246.42	0.5	44.16	0.40	2.00	0.64	46.5	1.3	60.5	0.101	1.06	0.106	0.629	7.71	5.15	0.162	0.66	0.895	18.26	0.62	11	0.2%	0.05
78.05	0.257	69	7473.77	24.61	5.252	379.93	251.46	0.5	44.74	0.35	1.97	0.63	47.1	1.3	59.6	0.100	1.06	0.105	0.612	7.94	5.25	0.159	0.66	0.893	18.69	0.62	12	0.2%	0.05
107.10	0.379	71	10256.06	36.29	5.357	390.94	256.49	0.5	61.60	0.37	1.86	0.62	64.0	1.1	73.6	0.117	1.06	0.124	0.596	8.17	5.36	0.156	0.79	0.794	20.52	0.61	13	0.1%	0.02
100.37	0.353	73	9611.36	33.80	5.462	401.95	261.53	0.5	56.95	0.37	1.89	0.62	59.4	1.2	69.9	0.112	1.06	0.118	0.580	8.40	5.46	0.153	0.77	0.811	19.23	0.61	12	0.2%	0.05
98.17	0.413	75	9401.17	39.55	5.567	412.97	266.57	0.5	55.05	0.44	1.93	0.61	57.6	1.2	70.3	0.112	1.06	0.119	0.564	8.63	5.57	0.150	0.79	0.794	18.81	0.60	11	0.2%	0.05
																												Total	1.54

CPT-05

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
121.52	0.465	39	11637.23	44.53	3.674	214.74	175.90	0.5	86.12	0.39	1.74	0.75	87.7	1.1	93.2	0.155	1.06	0.164	0.857	4.49	3.67	0.179	0.91	0.718	23.28	0.74	17	0.2%	0.05
76.79	0.490	41	7353.65	46.92	3.779	225.75	180.94	0.5	52.99	0.66	2.03	0.74	54.7	1.3	73.4	0.117	1.06	0.123	0.840	4.72	3.78	0.180	0.69	0.873	18.39	0.73	13	0.2%	0.05
116.81	0.422	43	11185.94	40.41	3.884	236.77	185.98	0.5	80.29	0.37	1.75	0.73	82.0	1.1	88.0	0.143	1.06	0.151	0.824	4.95	3.88	0.180	0.84	0.769	22.38	0.72	16	0.2%	0.05
99.95	0.455	45	9571.06	43.57	3.989	247.78	191.01	0.5	67.46	0.47	1.87	0.72	69.3	1.2	80.3	0.128	1.06	0.135	0.808	5.18	3.99	0.180	0.75	0.830	19.15	0.71	14	0.2%	0.05
91.63	0.277	47	8774.05	26.53	4.095	258.79	196.05	0.5	60.82	0.31	1.83	0.71	62.7	1.1	70.8	0.113	1.06	0.119	0.792	5.41	4.09	0.179	0.67	0.885	17.56	0.70	12	0.2%	0.05
92.92	0.305	49	8897.83	29.21	4.200	269.80	201.09	0.5	60.84	0.34	1.84	0.71	62.7	1.1	71.6	0.114	1.06	0.121	0.775	5.64	4.20	0.178	0.68	0.879	17.80	0.69	12	0.2%	0.05
116.37	0.574	51	11143.41	54.97	4.305	280.82	206.12	0.5	75.66	0.51	1.84	0.70	77.6	1.1	88.3	0.144	1.06	0.152	0.759	5.87	4.31	0.177	0.86	0.756	22.30	0.68	15	0.2%	0.05
96.96	0.312	53	9285.22	29.88	4.410	291.83	211.16	0.5	61.89	0.33	1.83	0.69	63.9	1.1	72.4	0.115	1.06	0.122	0.743	6.10	4.41	0.176	0.69	0.869	18.58	0.67	13	0.2%	0.05
101.34	0.498	55	9703.98	47.69	4.515	302.84	216.20	0.5	63.94	0.51	1.90	0.68	66.0	1.2	78.7	0.125	1.06	0.132	0.726	6.33	4.52	0.175	0.76	0.824	19.42	0.67	13	0.2%	0.05
71.11	0.255	57	6809.52	24.42	4.621	313.85	221.23	0.5	43.67	0.38	2.00	0.67	45.8	1.3	59.2	0.099	1.06	0.105	0.710	6.56	4.62	0.173	0.61	0.922	17.03	0.66	11	0.2%	0.05
123.88	0.566	59	11862.76	54.20	4.726	324.87	226.27	0.5	76.70	0.47	1.82	0.66	78.9	1.1	88.4	0.144	1.06	0.152	0.694	6.79	4.73	0.171	0.89	0.727	23.74	0.65	15	0.2%	0.05
97.60	0.322	61	9346.20	30.83	4.831	335.88	231.31	0.5	59.24	0.34	1.86	0.66	61.5	1.2	70.7	0.113	1.06	0.119	0.678	7.02	4.83	0.169	0.71	0.859	18.70	0.64	12	0.2%	0.05
105.10	0.387	63	10064.63	37.06	4.936	346.89	236.35	0.5	63.21	0.38	1.85	0.65	65.5	1.1	75.1	0.119	1.06	0.126	0.661	7.25	4.94	0.167	0.76	0.823	20.14	0.64	13	0.2%	0.05
120.65	0.411	65	11553.79	39.36	5.041	357.90	241.38	0.5	72.06	0.35	1.78	0.64	74.4	1.1	81.5	0.130	1.06	0.138	0.645	7.48	5.04	0.164	0.84	0.761	23.12	0.63	15	0.2%	0.05
																												Total	0.67

LIQUEFACTION ANALYSIS - 2% P.E. in 50 YEARS

CPT-06

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
85.01	0.248	43	8140.10	23.75	3.884	236.77	185.98	0.5	57.95	0.30	1.84	0.73	59.7	1.1	68.1	0.109	1.06	0.115	0.824	4.95	3.88	0.180	0.64	0.900	16.29	0.72	12	0.2%	0.05
65.41	0.228	45	6263.24	21.83	3.989	247.78	191.01	0.5	43.52	0.36	1.99	0.72	45.3	1.3	58.4	0.098	1.06	0.104	0.808	5.18	3.99	0.180	0.58	0.936	15.67	0.71	11	0.2%	0.05
63.40	0.236	47	6070.99	22.60	4.095	258.79	196.05	0.5	41.51	0.39	2.02	0.71	43.4	1.3	57.6	0.098	1.06	0.103	0.792	5.41	4.09	0.179	0.58	0.937	15.18	0.70	11	0.2%	0.05
61.42	0.289	49	5881.48	27.67	4.200	269.80	201.09	0.5	39.57	0.49	2.08	0.71	41.5	1.4	59.1	0.099	1.06	0.105	0.775	5.64	4.20	0.178	0.59	0.931	14.71	0.69	10	0.5%	0.12
57.53	0.212	51	5508.67	20.30	4.305	280.82	206.12	0.5	36.41	0.39	2.07	0.70	38.4	1.4	54.0	0.095	1.06	0.100	0.759	5.87	4.31	0.177	0.56	0.945	13.78	0.68	9	0.2%	0.05
58.76	0.202	53	5627.27	19.34	4.410	291.83	211.16	0.5	36.72	0.36	2.06	0.69	38.7	1.4	53.6	0.094	1.06	0.100	0.743	6.10	4.41	0.176	0.57	0.944	14.07	0.67	9	0.2%	0.05
51.65	0.191	55	4946.45	18.29	4.515	302.84	216.20	0.5	31.58	0.39	2.13	0.68	33.6	1.5	51.0	0.092	1.06	0.098	0.726	6.33	4.52	0.175	0.56	0.949	12.37	0.67	8	0.5%	0.12
54.39	0.154	57	5207.97	14.75	4.621	313.85	221.23	0.5	32.90	0.30	2.07	0.67	35.0	1.4	49.4	0.091	1.06	0.096	0.710	6.56	4.62	0.173	0.56	0.951	13.03	0.66	9	0.2%	0.05
143.26	0.393	59	13718.28	37.63	4.726	324.87	226.27	0.5	89.04	0.28	1.66	0.66	91.2	1.0	92.2	0.153	1.06	0.162	0.694	6.79	4.73	0.171	0.94	0.687	27.45	0.65	18	0.1%	0.02
159.48	0.448	61	15272.02	42.90	4.831	335.88	231.31	0.5	98.21	0.29	1.63	0.66	100.4	1.0	100.4	0.174	1.06	0.184	0.678	7.02	4.83	0.169	1.09	0.582	30.56	0.64	20	0.0%	0.00
119.17	0.302	63	11411.25	28.92	4.936	346.89	236.35	0.5	71.97	0.26	1.73	0.65	74.2	1.1	78.7	0.125	1.06	0.132	0.661	7.25	4.94	0.167	0.80	0.795	22.38	0.64	14	0.2%	0.05
																												Total	0.60

Reference: *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils*; Journal of Geotechncial and Geoenvironmental Engineering, Vol. 127, No. 10, October, 2001.

LIQUEFACTION ANALYSIS - 10% P.E. in 50 YEARS

Calc. by: MSM
Project: Urquhart Station Ash Pond
Date: 3/8/2011

Soil Unit Weight (pcf) = 115
Depth to Groundwater (ft) = 26
Bouyant unit weight (pcf) = 52.6

Soil unit weight (pcf) = 125
Embankment height (ft) = 0
Atmospheric Press (kPa) = 100

a max = 10.40% g
Mw = 7.34

Layer Thickness = 2.0 ft

CPT-01

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
50.27	0.278	29	4813.84	26.62	3.148	159.68	150.72	0.5	37.91	0.57	2.13	0.81	39.2	1.5	59.2	0.099	1.06	0.105	0.932	3.34	3.15	0.067	1.57	0.211	12.04	0.80	10		0.00
54.17	0.280	31	5187.10	26.81	3.253	170.69	155.75	0.5	40.20	0.53	2.09	0.80	41.6	1.4	59.9	0.100	1.06	0.106	0.922	3.57	3.25	0.068	1.55	0.220	12.97	0.78	10		0.00
61.57	0.230	42	5895.69	22.02	3.832	231.26	183.46	0.5	41.82	0.39	2.02	0.74	43.5	1.3	57.7	0.098	1.06	0.103	0.832	4.83	3.83	0.071	1.46	0.269	14.75	0.72	11		0.00
62.33	0.157	44	5968.60	15.03	3.937	242.27	188.49	0.5	41.71	0.26	1.96	0.73	43.5	1.2	54.2	0.095	1.06	0.100	0.816	5.06	3.94	0.071	1.41	0.303	14.93	0.71	11		0.00
56.21	0.249	46	5382.29	23.84	4.042	253.29	193.53	0.5	36.87	0.46	2.10	0.72	38.7	1.5	56.3	0.097	1.06	0.102	0.800	5.29	4.04	0.071	1.44	0.281	13.46	0.70	9		0.00
59.35	0.225	48	5683.06	21.55	4.147	264.30	198.57	0.5	38.45	0.40	2.06	0.71	40.3	1.4	55.6	0.096	1.06	0.101	0.783	5.52	4.15	0.070	1.44	0.284	14.21	0.69	10		0.00
59.09	0.230	50	5658.04	22.02	4.252	275.31	203.60	0.5	37.72	0.41	2.07	0.70	39.7	1.4	55.5	0.096	1.06	0.101	0.767	5.75	4.25	0.070	1.44	0.281	14.15	0.69	10		0.00
47.37	0.151	52	4535.97	14.46	4.358	286.32	208.64	0.5	29.42	0.34	2.14	0.69	31.4	1.5	48.0	0.090	1.06	0.095	0.751	5.98	4.36	0.070	1.36	0.357	11.35	0.68	8		0.00
73.72	0.338	54	7059.19	32.37	4.463	297.33	213.68	0.5	46.26	0.48	2.02	0.68	48.3	1.3	63.9	0.104	1.06	0.110	0.735	6.21	4.46	0.069	1.59	0.196	17.66	0.67	12		0.00
97.09	0.220	56	9296.92	21.07	4.568	308.35	218.72	0.5	60.78	0.23	1.79	0.68	62.9	1.1	69.0	0.110	1.06	0.117	0.718	6.44	4.57	0.068	1.71	0.154	18.60	0.66	12		0.00
104.27	0.267	58	9984.86	25.57	4.673	319.36	223.75	0.5	64.62	0.26	1.78	0.67	66.8	1.1	72.9	0.116	1.06	0.123	0.702	6.67	4.67	0.068	1.81	0.125	19.98	0.65	13		0.00
128.68	0.284	60	12322.42	27.20	4.778	330.37	228.79	0.5	79.28	0.23	1.67	0.66	81.5	1.0	83.0	0.133	1.06	0.141	0.686	6.90	4.78	0.067	2.10	0.076	24.66	0.65	16		0.00
114.62	0.340	62	10976.38	32.56	4.884	341.38	233.83	0.5	69.55	0.31	1.77	0.65	71.8	1.1	78.1	0.124	1.06	0.131	0.669	7.13	4.88	0.066	1.99	0.091	21.96	0.64	14		0.00
130.17	0.265	64	12465.49	25.38	4.989	352.40	238.86	0.5	78.38	0.21	1.67	0.65	80.7	1.0	81.8	0.131	1.06	0.138	0.653	7.36	4.99	0.065	2.12	0.073	24.94	0.63	16		0.00
																												Total	0.00

CPT-02

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
21.16	0.476	29	2025.92	45.58	3.148	159.68	150.72	0.7	14.00	2.44	2.83	0.75	15.2	5.0	76.1	0.121	1.06	0.128	0.932	3.34	3.15	0.067	1.91	0.103	8.11	0.80	6		0.00
55.18	0.490	31	5284.07	46.92	3.253	170.69	155.75	0.5	40.97	0.92	2.20	0.80	42.3	1.7	70.8	0.113	1.06	0.119	0.922	3.57	3.25	0.068	1.75	0.141	13.22	0.78	10		0.00
68.65	0.158	42	6573.73	15.13	3.832	231.26	183.46	0.5	46.83	0.24	1.90	0.74	48.5	1.2	57.5	0.098	1.06	0.103	0.832	4.83	3.83	0.071	1.46	0.270	16.44	0.72	12		0.00
55.46	0.143	44	5310.83	13.69	3.937	242.27	188.49	0.5	36.92	0.27	2.01	0.73	38.7	1.3	50.9	0.092	1.06	0.097	0.816	5.06	3.94	0.071	1.37	0.340	13.28	0.71	9		0.00
47.60	0.146	46	4557.97	13.98	4.042	253.29	193.53	0.5	30.94	0.32	2.11	0.72	32.8	1.5	48.3	0.090	1.06	0.095	0.800	5.29	4.04	0.071	1.35	0.367	11.40	0.70	8		0.00
56.10	0.123	48	5372.31	11.78	4.147	264.30	198.57	0.5	36.25	0.23	2.00	0.71	38.1	1.3	49.4	0.091	1.06	0.096	0.783	5.52	4.15	0.070	1.37	0.351	13.44	0.69	9		0.00
143.77	0.361	50	13767.17	34.57	4.252	275.31	203.60	0.5	94.55	0.26	1.62	0.70	96.5	1.0	96.5	0.164	1.06	0.173	0.767	5.75	4.25	0.070	2.46	0.048	27.55	0.69	19		0.00
115.62	0.335	52	11072.08	32.08	4.358	286.32	208.64	0.5	74.67	0.30	1.74	0.69	76.7	1.1	81.7	0.131	1.06	0.138	0.751	5.98	4.36	0.070	1.98	0.094	22.15	0.68	15		0.00
116.14	0.300	54	11121.19	28.73	4.463	297.33	213.68	0.5	74.05	0.27	1.73	0.68	76.1	1.1	80.2	0.128	1.06	0.135	0.735	6.21	4.46	0.069	1.96	0.097	22.25	0.67	15		0.00
104.85	0.270	56	10040.39	25.86	4.568	308.35	218.72	0.5	65.81	0.27	1.77	0.68	67.9	1.1	73.8	0.117	1.06	0.124	0.718	6.44	4.57	0.068	1.81	0.125	20.09	0.66	13		0.00
90.40	0.294	58	8656.67	28.15	4.673	319.36	223.75	0.5	55.74	0.34	1.88	0.67	57.9	1.2	67.7	0.109	1.06	0.115	0.702	6.67	4.67	0.068	1.70	0.157	17.32	0.65	11		0.00
115.53	0.294	60	11062.99	28.15	4.778	330.37	228.79	0.5	70.96	0.26	1.74	0.66	73.1	1.1	77.9	0.124	1.06	0.131	0.686	6.90	4.78	0.067	1.96	0.096	22.14	0.65	14		0.00
106.73	0.270	62	10220.86	25.86	4.884	341.38	233.83	0.5	64.61	0.26	1.78	0.65	66.8	1.1	72.9	0.116	1.06	0.123	0.669	7.13	4.88	0.066	1.86	0.115	20.45	0.64	13		0.00
82.09	0.230	64	7860.59	22.02	4.989	352.40	238.86	0.5	48.58	0.29	1.91	0.65	50.9	1.2	61.0	0.101	1.06	0.107	0.653	7.36	4.99	0.065	1.64	0.181	15.73	0.63	10		0.00
69.77	0.232	66	6681.64	22.22	5.094	363.41	243.90	0.5	40.46	0.35	2.01	0.64	42.8	1.3	56.4	0.097	1.06	0.102	0.637	7.59	5.09	0.064	1.59	0.207	16.71	0.63	10		0.00
81.13	0.248	68	7769.44	23.75	5.199	374.42	248.94	0.5	46.87	0.32	1.94	0.63	49.2	1.2	60.5	0.101	1.06	0.106	0.621	7.82	5.20	0.063	1.68	0.167	19.43	0.62	12		0.00
78.99	0.209	70	7564.29	20.01	5.304	385.43	253.97	0.5	45.05	0.28	1.93	0.63	47.5	1.2	58.0	0.098	1.06	0.104	0.604	8.05	5.30	0.062	1.67	0.174	18.92	0.61	12		0.00
102.64	0.136	72	9828.74	13.02	5.410	396.45	259.01	0.5	58.61	0.14	1.74	0.62	61.1	1.1	65.0	0.106	1.06	0.112	0.588	8.28	5.41	0.061	1.83	0.122	19.67	0.61	12		0.00
																												Total	0.00

LIQUEFACTION ANALYSIS - 10% P.E. in 50 YEARS

CPT-03

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
79.98	0.750	28	7658.47	71.82	3.095	154.17	148.20	0.5	61.64	0.96	2.07	0.82	62.9	1.4	87.8	0.143	1.06	0.151	0.935	3.22	3.10	0.066	2.30	0.057	19.15	0.80	15		0.00
127.50	0.531	51	12209.48	50.85	4.305	280.82	206.12	0.5	83.09	0.43	1.77	0.70	85.0	1.1	92.2	0.153	1.06	0.161	0.759	5.87	4.31	0.070	2.31	0.059	24.43	0.68	17		0.00
108.99	0.404	53	10436.89	38.69	4.410	291.83	211.16	0.5	69.81	0.38	1.81	0.69	71.8	1.1	80.2	0.128	1.06	0.135	0.743	6.10	4.41	0.069	1.95	0.099	20.88	0.67	14		0.00
129.21	0.464	55	12373.62	44.43	4.515	302.84	216.20	0.5	82.09	0.37	1.74	0.68	84.2	1.1	89.8	0.147	1.06	0.156	0.726	6.33	4.52	0.069	2.26	0.062	24.76	0.67	16		0.00
96.41	0.351	57	9231.91	33.61	4.621	313.85	221.23	0.5	59.96	0.38	1.87	0.67	62.1	1.2	72.1	0.115	1.06	0.121	0.710	6.56	4.62	0.068	1.78	0.132	18.47	0.66	12		0.00
101.28	0.293	59	9698.30	28.06	4.726	324.87	226.27	0.5	62.31	0.30	1.81	0.66	64.5	1.1	72.0	0.115	1.06	0.121	0.694	6.79	4.73	0.067	1.80	0.128	19.41	0.65	13		0.00
126.21	0.344	61	12085.79	32.94	4.831	335.88	231.31	0.5	77.26	0.28	1.72	0.66	79.5	1.0	83.4	0.134	1.06	0.141	0.678	7.02	4.83	0.067	2.13	0.073	24.18	0.64	16		0.00
123.65	0.457	63	11840.90	43.76	4.936	346.89	236.35	0.5	74.76	0.38	1.79	0.65	77.0	1.1	84.5	0.136	1.06	0.144	0.661	7.25	4.94	0.066	2.19	0.066	23.69	0.64	15		0.00
116.38	0.293	65	11144.14	28.06	5.041	357.90	241.38	0.5	69.43	0.26	1.75	0.64	71.7	1.1	76.8	0.122	1.06	0.129	0.645	7.48	5.04	0.065	1.99	0.089	22.30	0.63	14		0.00
125.11	0.410	67	11980.84	39.26	5.147	368.92	246.42	0.5	73.97	0.34	1.77	0.64	76.3	1.1	82.7	0.133	1.06	0.140	0.629	7.71	5.15	0.064	2.20	0.064	23.97	0.62	15		0.00
120.32	0.505	69	11521.78	48.36	5.252	379.93	251.46	0.5	70.26	0.43	1.84	0.63	72.7	1.1	82.4	0.132	1.06	0.139	0.612	7.94	5.25	0.063	2.23	0.061	23.05	0.62	14		0.00
120.99	0.413	71	11586.08	39.55	5.357	390.94	256.49	0.5	69.90	0.35	1.80	0.62	72.3	1.1	79.9	0.128	1.06	0.135	0.596	8.17	5.36	0.061	2.19	0.064	23.18	0.61	14		0.00
122.88	0.527	73	11766.52	50.47	5.462	401.95	261.53	0.5	70.27	0.44	1.84	0.62	72.8	1.1	82.8	0.133	1.06	0.140	0.580	8.40	5.46	0.060	2.33	0.052	23.54	0.61	14		0.00
																												Total	0.00

CPT-04

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
77.69	0.341	51	7439.27	32.65	4.305	280.82	206.12	0.5	49.86	0.46	1.98	0.70	51.8	1.3	65.9	0.107	1.06	0.113	0.759	5.87	4.31	0.070	1.61	0.187	18.61	0.68	13		0.00
58.20	0.302	53	5573.41	28.92	4.410	291.83	211.16	0.5	36.35	0.55	2.14	0.69	38.4	1.5	58.5	0.099	1.06	0.104	0.743	6.10	4.41	0.069	1.50	0.244	13.94	0.67	9		0.00
66.59	0.274	55	6376.38	26.24	4.515	302.84	216.20	0.5	41.31	0.43	2.04	0.68	43.4	1.4	58.9	0.099	1.06	0.105	0.726	6.33	4.52	0.069	1.52	0.234	15.95	0.67	11		0.00
65.39	0.253	57	6261.73	24.23	4.621	313.85	221.23	0.5	39.99	0.41	2.04	0.67	42.1	1.4	57.3	0.098	1.06	0.103	0.710	6.56	4.62	0.068	1.51	0.241	15.66	0.66	10		0.00
62.21	0.247	59	5957.15	23.65	4.726	324.87	226.27	0.5	37.44	0.42	2.08	0.66	39.6	1.4	55.9	0.096	1.06	0.102	0.694	6.79	4.73	0.067	1.51	0.246	14.90	0.65	10		0.00
84.52	0.261	61	8093.60	24.99	4.831	335.88	231.31	0.5	51.01	0.32	1.91	0.66	53.2	1.2	63.6	0.104	1.06	0.110	0.678	7.02	4.83	0.067	1.65	0.175	16.19	0.64	10		0.00
104.30	0.382	63	9987.61	36.58	4.936	346.89	236.35	0.5	62.71	0.38	1.85	0.65	65.0	1.1	74.6	0.119	1.06	0.125	0.661	7.25	4.94	0.066	1.91	0.104	19.98	0.64	13		0.00
82.01	0.369	65	7853.20	35.34	5.041	357.90	241.38	0.5	48.24	0.47	2.00	0.64	50.5	1.3	65.5	0.106	1.06	0.112	0.645	7.48	5.04	0.065	1.74	0.146	19.64	0.63	12		0.00
76.25	0.289	67	7301.57	27.67	5.147	368.92	246.42	0.5	44.16	0.40	2.00	0.64	46.5	1.3	60.5	0.101	1.06	0.106	0.629	7.71	5.15	0.064	1.67	0.171	18.26	0.62	11		0.00
78.05	0.257	69	7473.77	24.61	5.252	379.93	251.46	0.5	44.74	0.35	1.97	0.63	47.1	1.3	59.6	0.100	1.06	0.105	0.612	7.94	5.25	0.063	1.68	0.168	18.69	0.62	12		0.00
107.10	0.379	71	10256.06	36.29	5.357	390.94	256.49	0.5	61.60	0.37	1.86	0.62	64.0	1.1	73.6	0.117	1.06	0.124	0.596	8.17	5.36	0.061	2.01	0.086	20.52	0.61	13		0.00
100.37	0.353	73	9611.36	33.80	5.462	401.95	261.53	0.5	56.95	0.37	1.89	0.62	59.4	1.2	69.9	0.112	1.06	0.118	0.580	8.40	5.46	0.060	1.96	0.095	19.23	0.61	12		0.00
98.17	0.413	75	9401.17	39.55	5.567	412.97	266.57	0.5	55.05	0.44	1.93	0.61	57.6	1.2	70.3	0.112	1.06	0.119	0.564	8.63	5.57	0.059	2.01	0.086	18.81	0.60	11		0.00
																												Total	0.00

CPT-05

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
121.52	0.465	39	11637.23	44.53	3.674	214.74	175.90	0.5	86.12	0.39	1.74	0.75	87.7	1.1	93.2	0.155	1.06	0.164	0.857	4.49	3.67	0.071	2.32	0.058	23.28	0.74	17		0.00
76.79	0.490	41	7353.65	46.92	3.779	225.75	180.94	0.5	52.99	0.66	2.03	0.74	54.7	1.3	73.4	0.117	1.06	0.123	0.840	4.72	3.78	0.071	1.74	0.143	18.39	0.73	13		0.00
116.81	0.422	43	11185.94	40.41	3.884	236.77	185.98	0.5	80.29	0.37	1.75	0.73	82.0	1.1	88.0	0.143	1.06	0.151	0.824	4.95	3.88	0.071	2.14	0.075	22.38	0.72	16		0.00
99.95	0.455	45	9571.06	43.57	3.989	247.78	191.01	0.5	67.46	0.47	1.87	0.72	69.3	1.2	80.3	0.128	1.06	0.135	0.808	5.18	3.99	0.071	1.91	0.106	19.15	0.71	14		0.00
91.63	0.277	47	8774.05	26.53	4.095	258.79	196.05	0.5	60.82	0.31	1.83	0.71	62.7	1.1	70.8	0.113	1.06	0.119	0.792	5.41	4.09	0.071	1.69	0.158	17.56	0.70	12		0.00
92.92	0.305	49	8897.83	29.21	4.200	269.80	201.09	0.5	60.84	0.34	1.84	0.71	62.7	1.1	71.6	0.114	1.06	0.121	0.775	5.64	4.20	0.070	1.71	0.151	17.80	0.69	12		0.00
116.37	0.574	51	11143.41	54.97	4.305	280.82	206.12	0.5	75.66	0.51	1.84	0.70	77.6	1.1	88.3	0.144	1.06	0.152	0.759	5.87	4.31	0.070	2.18	0.070	22.30	0.68	15		0.00
96.96	0.312	53	9285.22	29.88	4.410	291.83	211.16	0.5	61.89	0.33	1.83	0.69	63.9	1.1	72.4	0.115	1.06	0.122	0.743	6.10	4.41	0.069	1.76	0.139	18.58	0.67	13		0.00
101.34	0.498	55	9703.98	47.69	4.515	302.84	216.20	0.5	63.94	0.51	1.90	0.68	66.0	1.2	78.7	0.125	1.06	0.132	0.726	6.33	4.52	0.069	1.93	0.102	19.42	0.67	13		0.00
71.11	0.255	57	6809.52	24.42	4.621	313.85	221.23	0.5	43.67	0.38	2.00	0.67	45.8	1.3	59.2	0.099	1.06	0.105	0.710	6.56	4.62	0.068	1.54	0.224	17.03	0.66	11		0.00
123.88	0.566	59	11862.76	54.20	4.726	324.87	226.27	0.5	76.70	0.47	1.82	0.66	78.9	1.1	88.4	0.144	1.06	0.152	0.694	6.79	4.73	0.067	2.26	0.061	23.74	0.65	15		0.00
97.60	0.322	61	9346.20	30.83	4.831	335.88	231.31	0.5	59.24	0.34	1.86	0.66	61.5	1.2	70.7	0.113	1.06	0.119	0.678	7.02	4.83	0.067	1.79	0.129	18.70	0.64	12		0.00
105.10	0.387	63	10064.63	37.06	4.936	346.89	236.35	0.5	63.21	0.38	1.85	0.65	65.5	1.1	75.1	0.119	1.06	0.126	0.661	7.25	4.94	0.066	1.92	0.102	20.14	0.64	13		0.00
120.65	0.411	65	11553.79	39.36	5.041	357.90	241.38	0.5	72.06	0.35	1.78	0.64	74.4	1.1	81.5	0.130	1.06	0.138	0.645	7.48	5.04	0.065	2.13	0.072	23.12	0.63	15		0.00
																												Total	0.00

LIQUEFACTION ANALYSIS - 10% P.E. in 50 YEARS

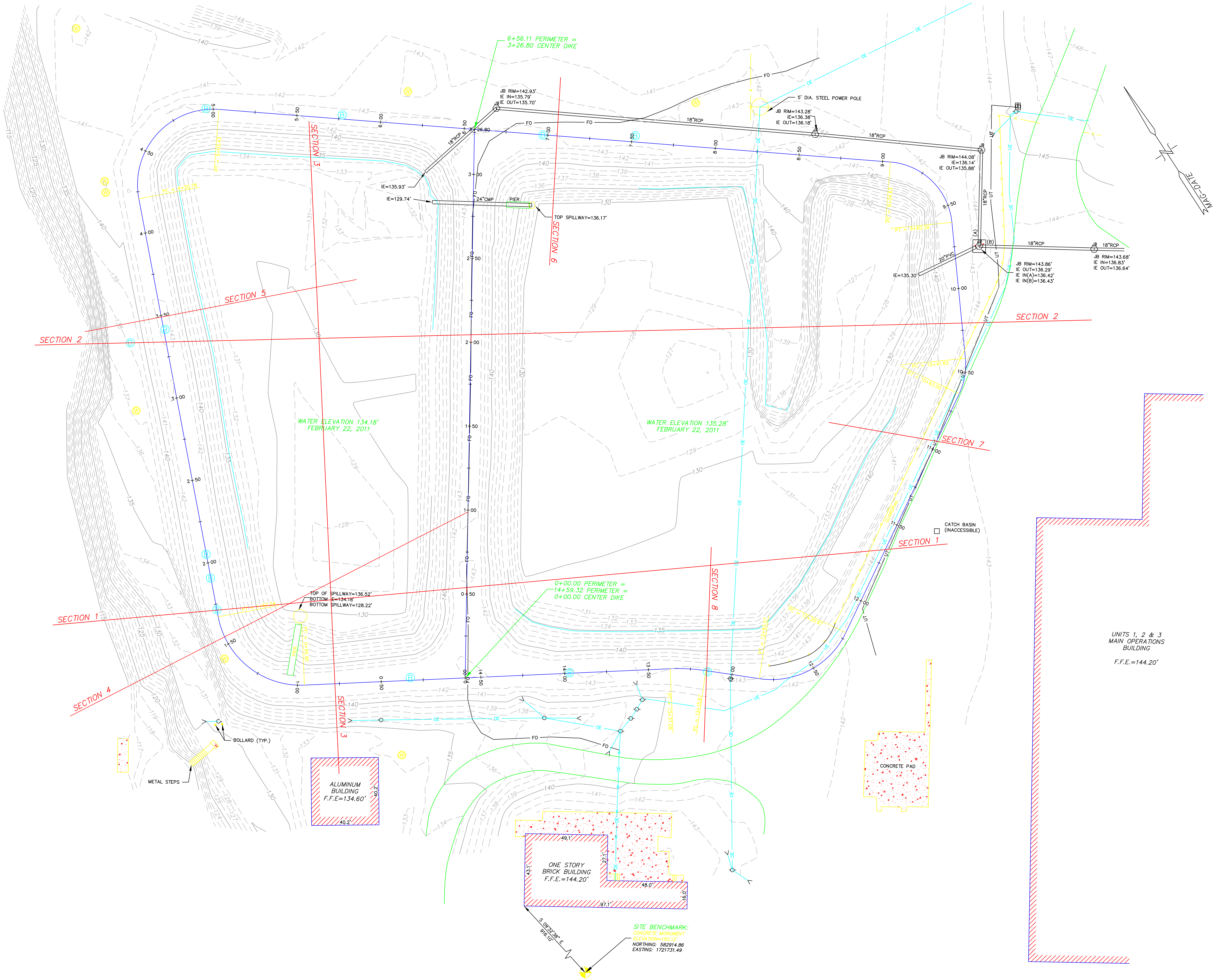
CPT-06

CPT Tip (tsf)	CPTsleeve (tsf)	CPT Test Depth (ft)	CPT Tip (kPa)	CPT Sleeve (kPa)	Effective Stress (ksf)	Total Stress (kPa)	Effective Stress (kPa)	n	Q	F	Ic	Cq	q c1n	Kcs	(qc1n)cs	CRR7.5	kM	CRR	rd*	Total* Stress (ksf)	Effective* Stress (ksf)	CSR eq	FS L	PL	N60	Cn	(N1)60	ev	Settlement (in)
85.01	0.248	43	8140.10	23.75	3.884	236.77	185.98	0.5	57.95	0.30	1.84	0.73	59.7	1.1	68.1	0.109	1.06	0.115	0.824	4.95	3.88	0.071	1.63	0.180	16.29	0.72	12		0.00
65.41	0.228	45	6263.24	21.83	3.989	247.78	191.01	0.5	43.52	0.36	1.99	0.72	45.3	1.3	58.4	0.098	1.06	0.104	0.808	5.18	3.99	0.071	1.47	0.261	15.67	0.71	11		0.00
63.40	0.236	47	6070.99	22.60	4.095	258.79	196.05	0.5	41.51	0.39	2.02	0.71	43.4	1.3	57.6	0.098	1.06	0.103	0.792	5.41	4.09	0.071	1.46	0.266	15.18	0.70	11		0.00
61.42	0.289	49	5881.48	27.67	4.200	269.80	201.09	0.5	39.57	0.49	2.08	0.71	41.5	1.4	59.1	0.099	1.06	0.105	0.775	5.64	4.20	0.070	1.49	0.248	14.71	0.69	10		0.00
57.53	0.212	51	5508.67	20.30	4.305	280.82	206.12	0.5	36.41	0.39	2.07	0.70	38.4	1.4	54.0	0.095	1.06	0.100	0.759	5.87	4.31	0.070	1.43	0.294	13.78	0.68	9		0.00
58.76	0.202	53	5627.27	19.34	4.410	291.83	211.16	0.5	36.72	0.36	2.06	0.69	38.7	1.4	53.6	0.094	1.06	0.100	0.743	6.10	4.41	0.069	1.44	0.292	14.07	0.67	9		0.00
51.65	0.191	55	4946.45	18.29	4.515	302.84	216.20	0.5	31.58	0.39	2.13	0.68	33.6	1.5	51.0	0.092	1.06	0.098	0.726	6.33	4.52	0.069	1.42	0.312	12.37	0.67	8		0.00
54.39	0.154	57	5207.97	14.75	4.621	313.85	221.23	0.5	32.90	0.30	2.07	0.67	35.0	1.4	49.4	0.091	1.06	0.096	0.710	6.56	4.62	0.068	1.41	0.321	13.03	0.66	9		0.00
143.26	0.393	59	13718.28	37.63	4.726	324.87	226.27	0.5	89.04	0.28	1.66	0.66	91.2	1.0	92.2	0.153	1.06	0.162	0.694	6.79	4.73	0.067	2.40	0.051	27.45	0.65	18		0.00
159.48	0.448	61	15272.02	42.90	4.831	335.88	231.31	0.5	98.21	0.29	1.63	0.66	100.4	1.0	100.4	0.174	1.06	0.184	0.678	7.02	4.83	0.067	2.77	0.033	30.56	0.64	20		0.00
119.17	0.302	63	11411.25	28.92	4.936	346.89	236.35	0.5	71.97	0.26	1.73	0.65	74.2	1.1	78.7	0.125	1.06	0.132	0.661	7.25	4.94	0.066	2.02	0.086	22.38	0.64	14		0.00
																												Total	0.00

Reference: *Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils* ; Journal of Geotechncial and Geoenvironmental Engineering, Vol. 127, No. 10, October, 2001.

Appendix D

Slope Stability Analysis



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GEOTECHNICAL · ENVIRONMENTAL · MATERIALS
COLUMBIA, SOUTH CAROLINA

SEAL NOT VALID UNLESS SIGNED

REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE

NOTES:

DRAWN BY: JFH
CHECKED BY: MSM
APPROVED BY: ZWA

DATE: March 7, 2011

PROJECT NAME:

Urquhart Station Ash Pond Containment Structure Evaluation

DRAWING NAME:

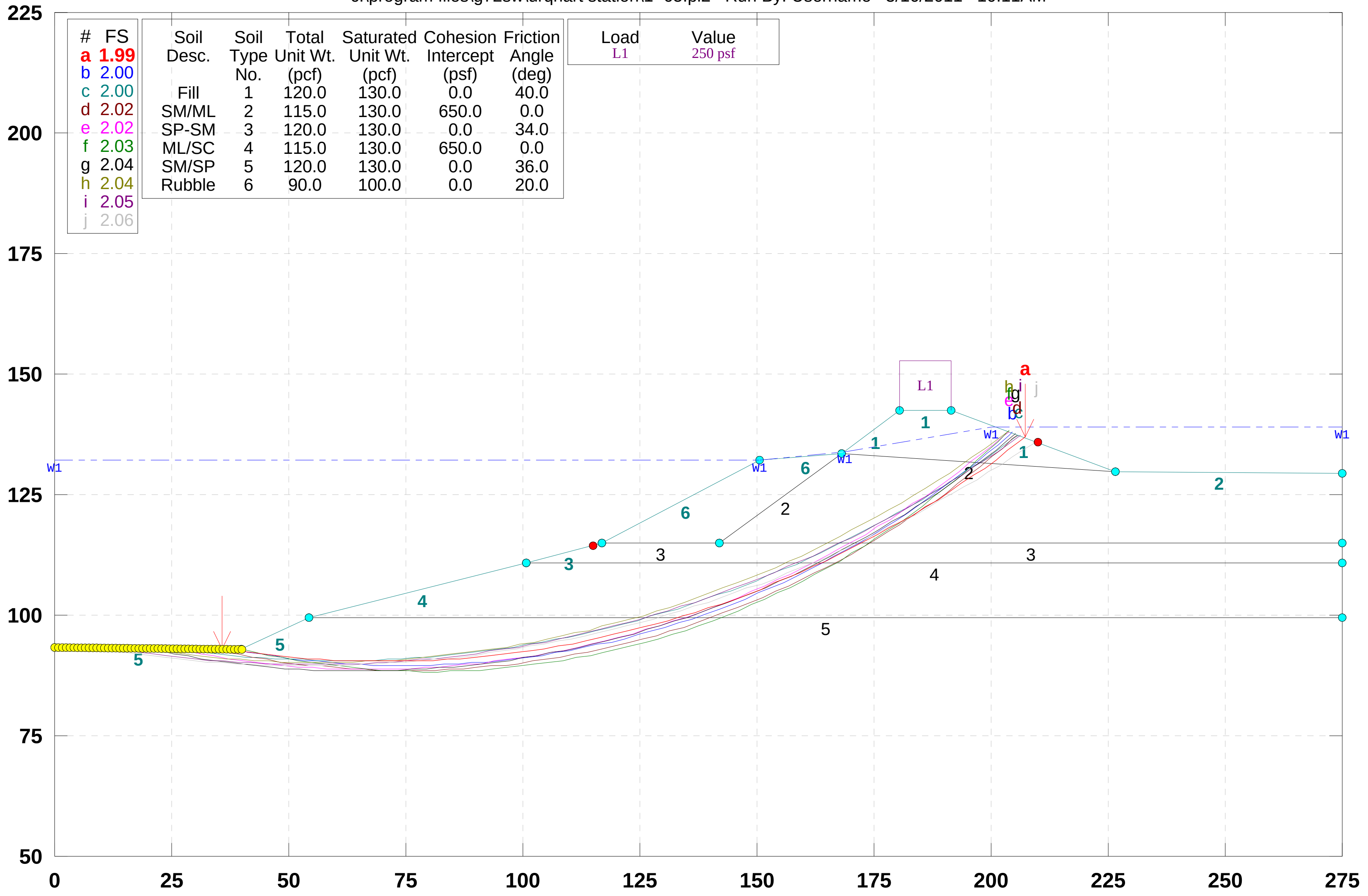
ANALYSIS SECTION LAYOUT PLAN

DRAWING NUMBER:

FIGURE 3

SCE&G Urquhart Station - 1+65 Section 4 - Max. Storage Pool - Steady Seepage

c:\program files\g72sw\urqhart station\1+65.pl2   Run By: Username   3/16/2011   10:11AM



#	FS
a	1.99
b	2.00
c	2.00
d	2.02
e	2.02
f	2.03
g	2.04
h	2.04
i	2.05
j	2.06

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	34.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	36.0
Rubble	6	90.0	100.0	0.0	20.0

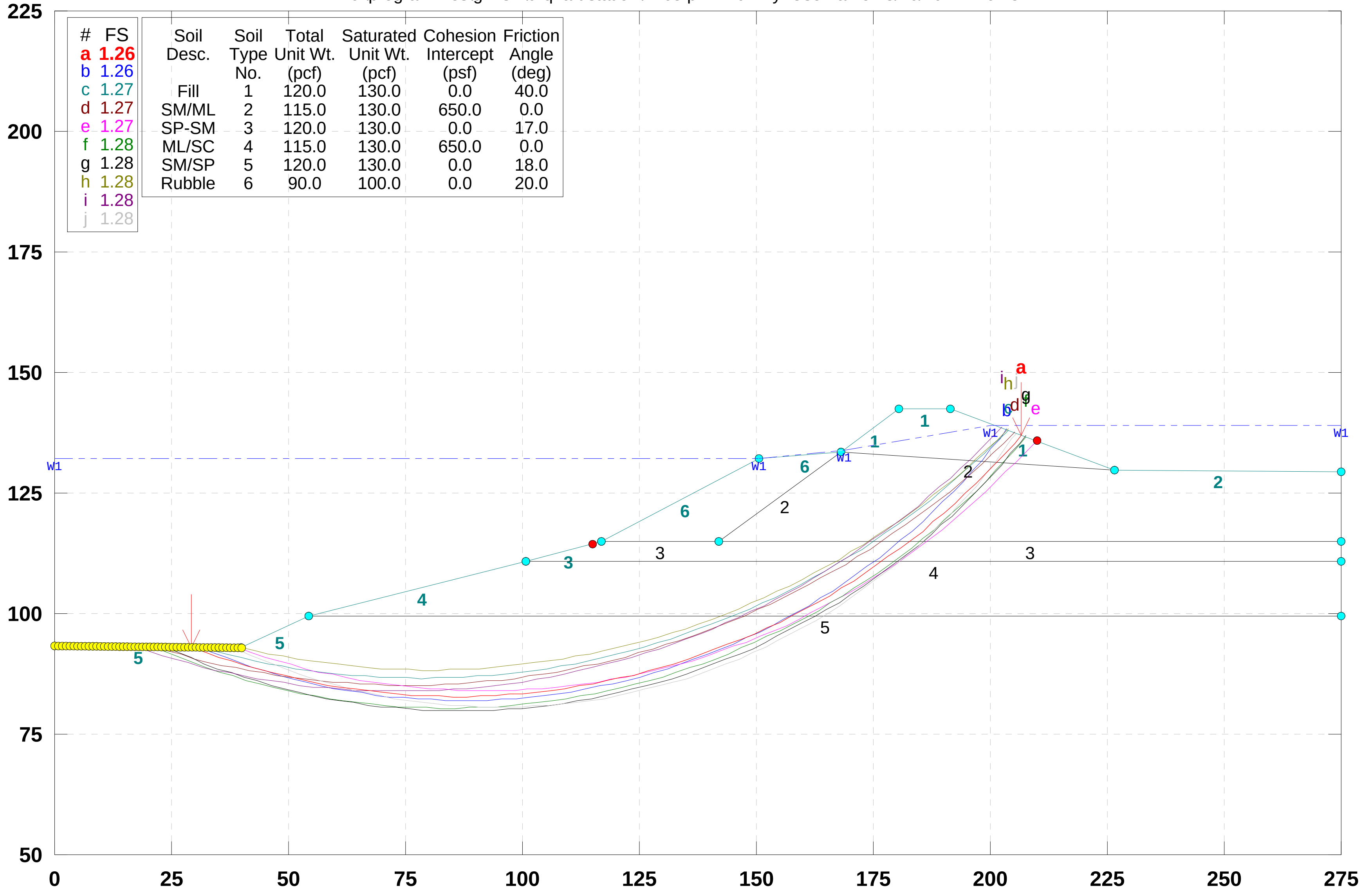
Load	Value
L1	250 psf

GSTABL7 v.2 FSmin=1.99

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 1+65 Section 4 - Liquefaction - Steady Seepage

c:\program files\g72sw\urqhart station\1+65.pl2   Run By: Username   3/16/2011   10:13AM



#	FS
a	1.26
b	1.26
c	1.27
d	1.27
e	1.27
f	1.28
g	1.28
h	1.28
i	1.28
j	1.28

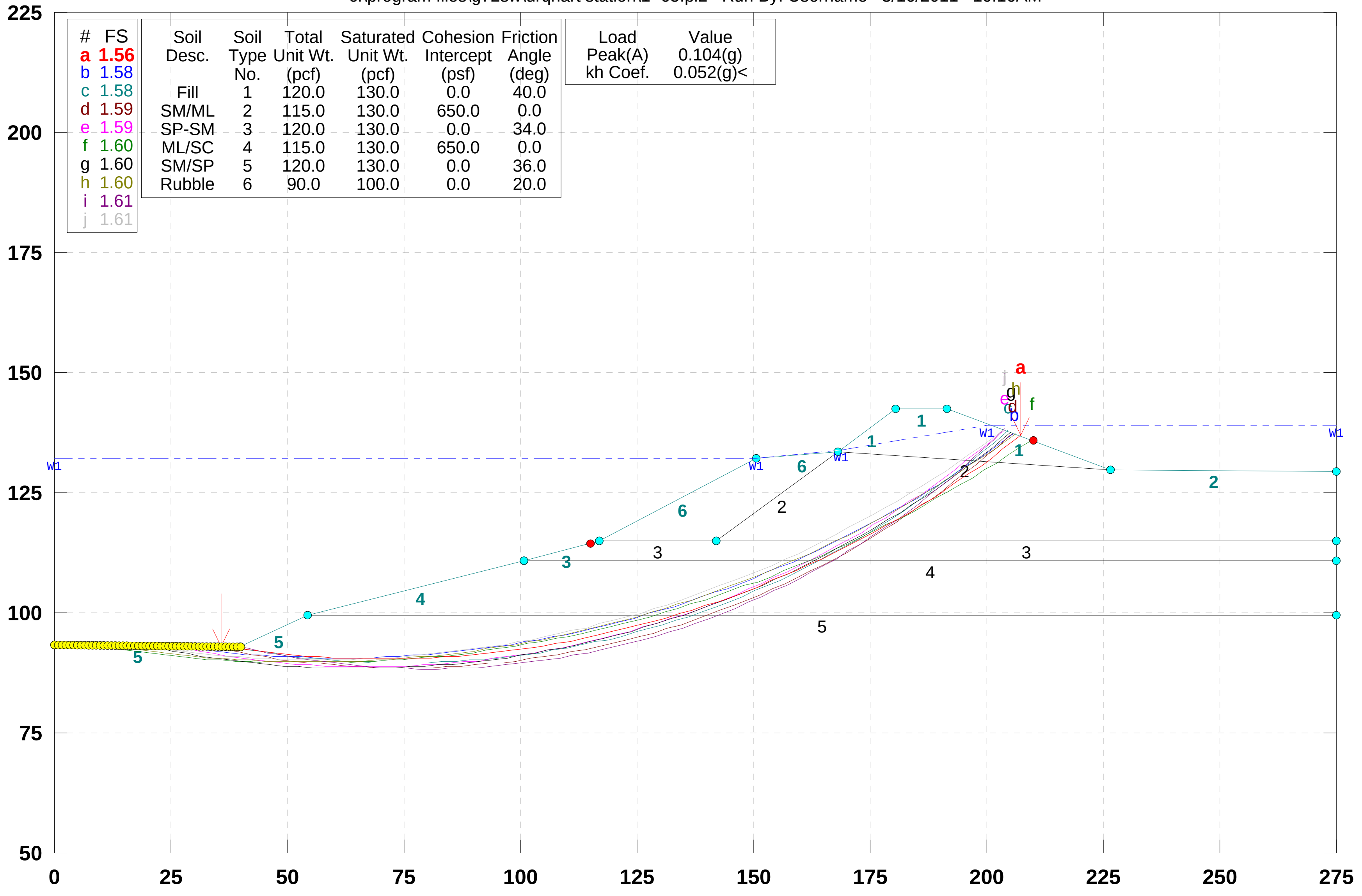
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	17.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	18.0
Rubble	6	90.0	100.0	0.0	20.0

GSTABL7 v.2 FSmin=1.26

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 1+65 Section 4 - FEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\1+65.pl2 Run By: Username 3/16/2011 10:16AM



#	FS
a	1.56
b	1.58
c	1.58
d	1.59
e	1.59
f	1.60
g	1.60
h	1.60
i	1.61
j	1.61

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	34.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	36.0
Rubble	6	90.0	100.0	0.0	20.0

Load	Value
Peak(A)	0.104(g)
kh Coef.	0.052(g)<

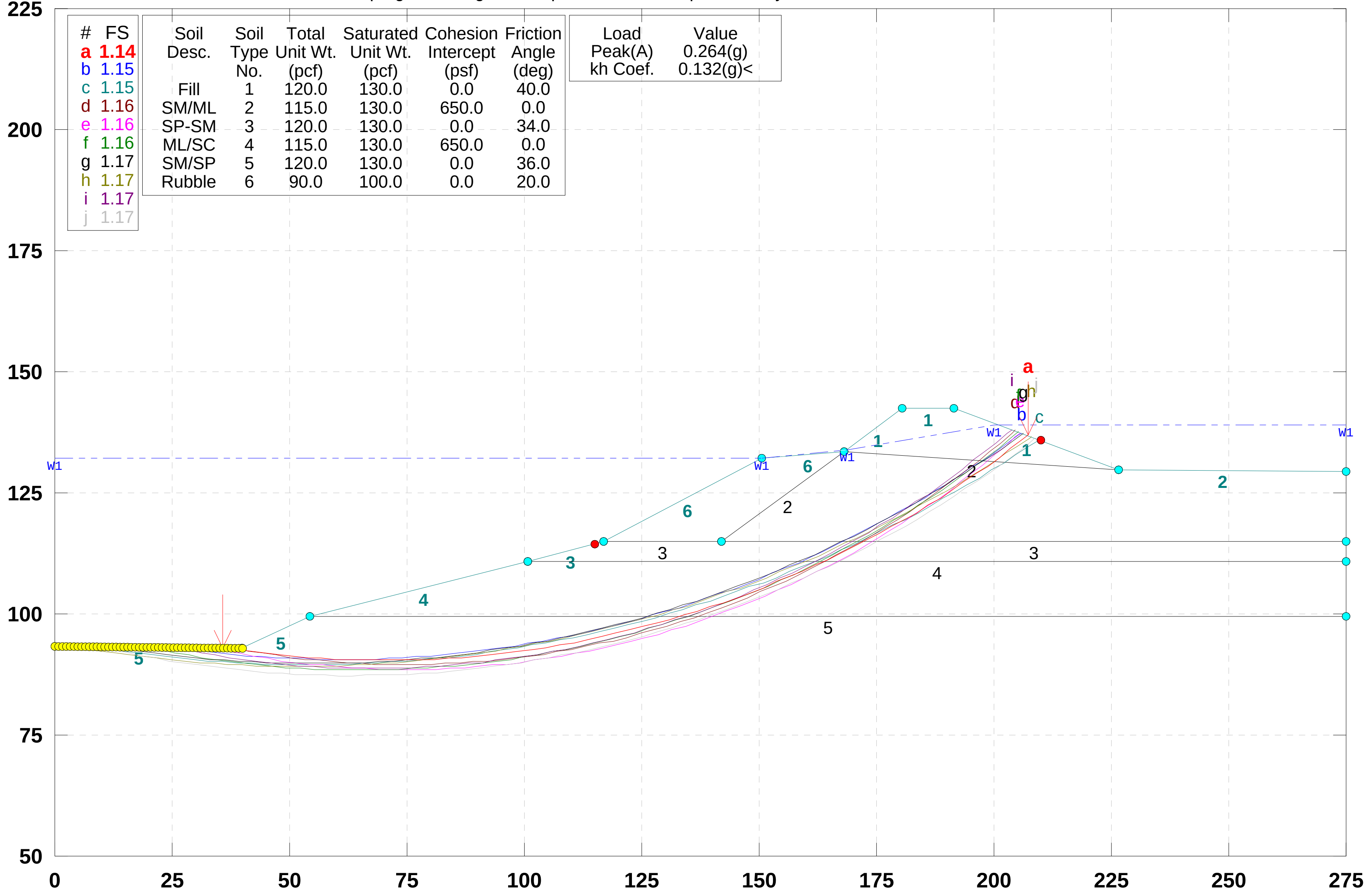
GSTABL7 v.2 FSmin=1.56

Safety Factors Are Calculated By The Modified Bishop Method

0

SCE&G Urquhart Station - 1+65 Section 4 - SEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\1+65.pl2 Run By: Username 3/16/2011 10:17AM



#	FS
a	1.14
b	1.15
c	1.15
d	1.16
e	1.16
f	1.16
g	1.17
h	1.17
i	1.17
j	1.17

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	34.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	36.0
Rubble	6	90.0	100.0	0.0	20.0

Load	Value
Peak(A)	0.264(g)
kh Coef.	0.132(g)<

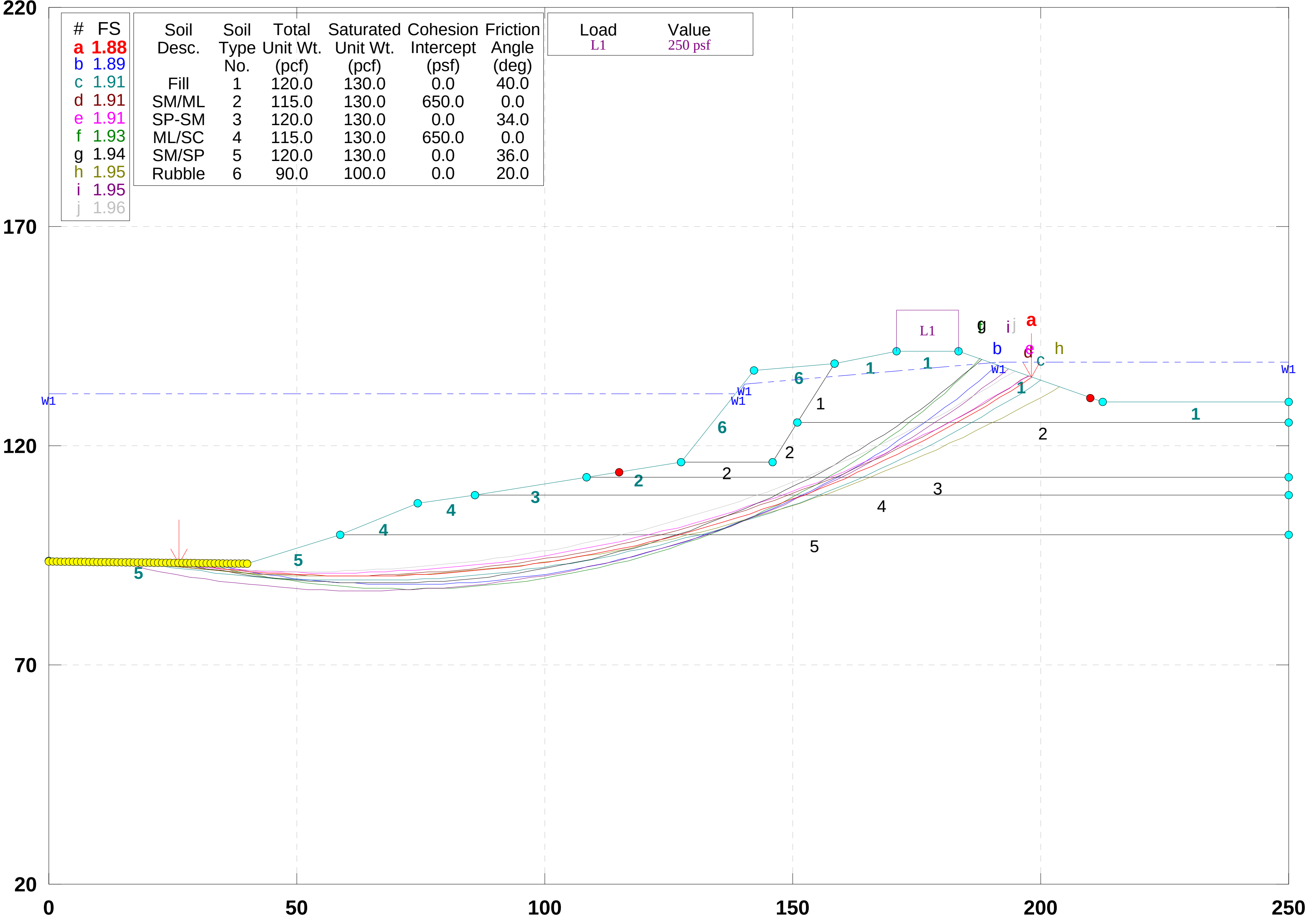
GSTABL7 v.2 FSmin=1.14

Safety Factors Are Calculated By The Modified Bishop Method

0

SCE&G Urquhart Station - 3+50 Section 5 - Max. Storage Pool - Steady Seepage

c:\program files\g72sw\urqhart station\3+50.pl2 Run By: Username 3/16/2011 10:20AM



#	FS
a	1.88
b	1.89
c	1.91
d	1.91
e	1.91
f	1.93
g	1.94
h	1.95
i	1.95
j	1.96

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	34.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	36.0
Rubble	6	90.0	100.0	0.0	20.0

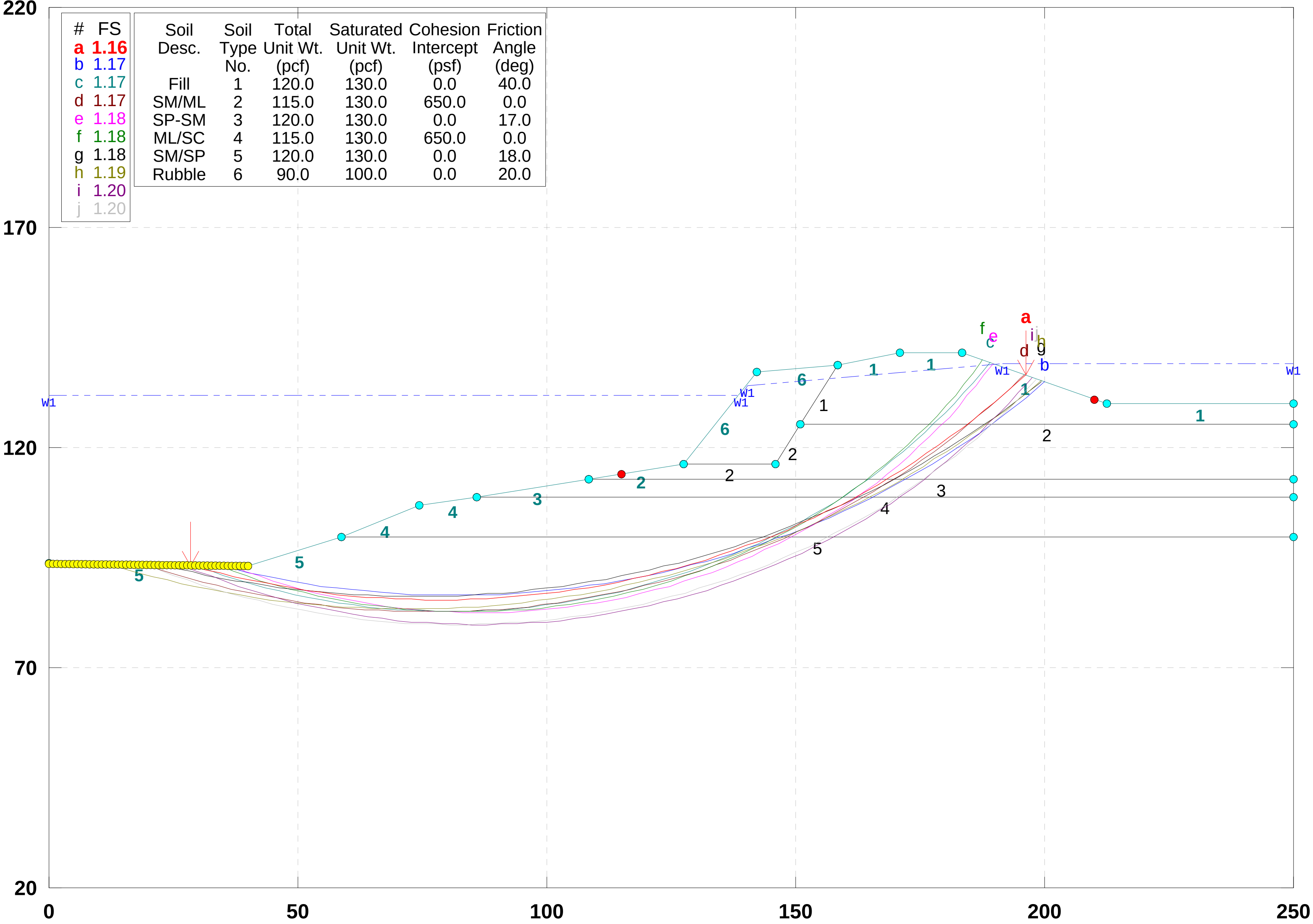
Load	Value
L1	250 psf

GSTABL7 v.2 FSmin=1.88

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 3+50 Section 5 - Liquefaction - Steady Seepage

c:\program files\g72sw\urqhart station\3+50.pl2 Run By: Username 3/16/2011 10:20AM



#	FS
a	1.16
b	1.17
c	1.17
d	1.17
e	1.18
f	1.18
g	1.18
h	1.19
i	1.20
j	1.20

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	17.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	18.0
Rubble	6	90.0	100.0	0.0	20.0

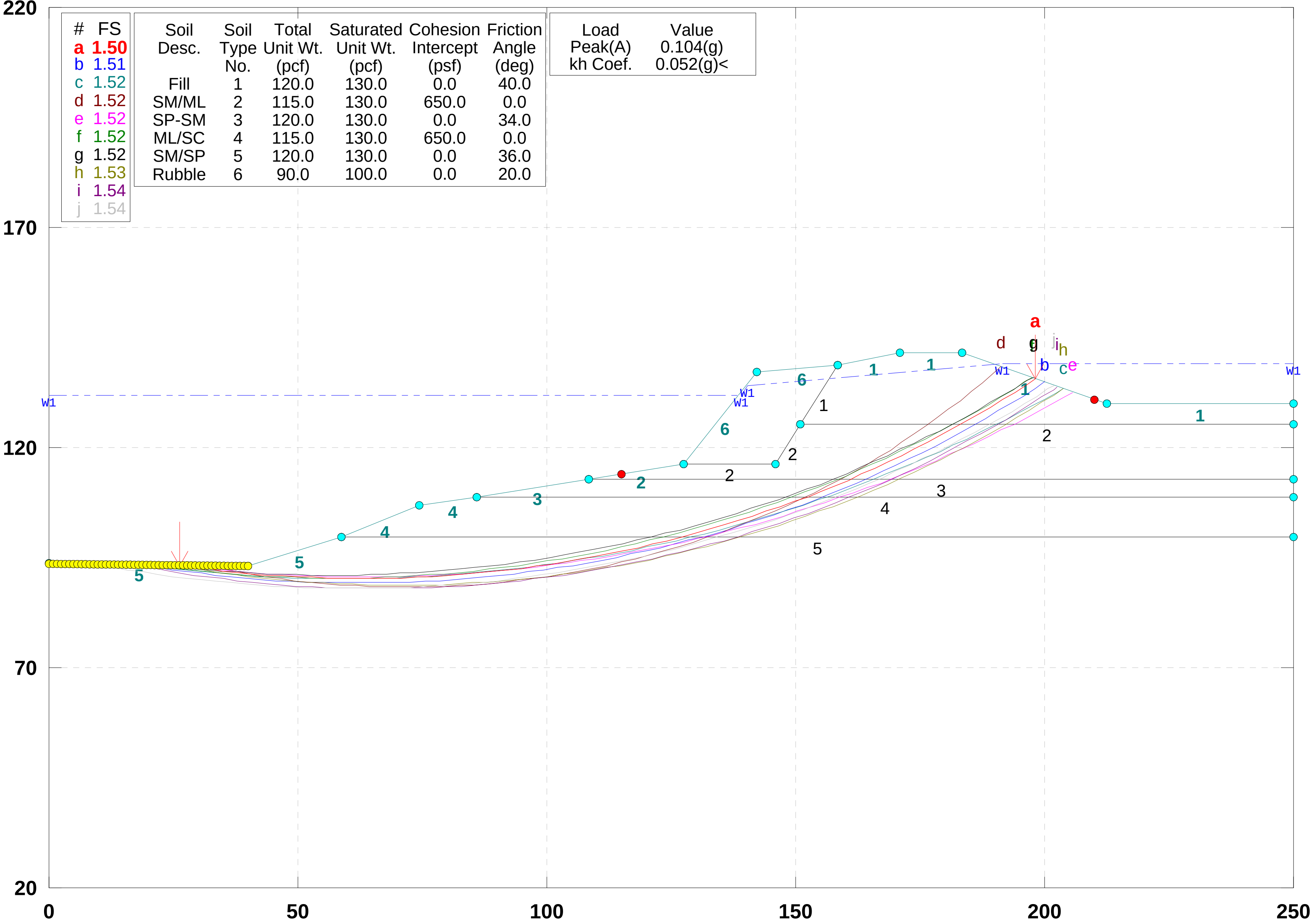
0

GSTABL7 v.2 FSmin=1.16

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 3+50 Section 5 - FEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\3+50.pl2 Run By: Username 3/16/2011 10:21AM



#	FS
a	1.50
b	1.51
c	1.52
d	1.52
e	1.52
f	1.52
g	1.52
h	1.53
i	1.54
j	1.54

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	34.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	36.0
Rubble	6	90.0	100.0	0.0	20.0

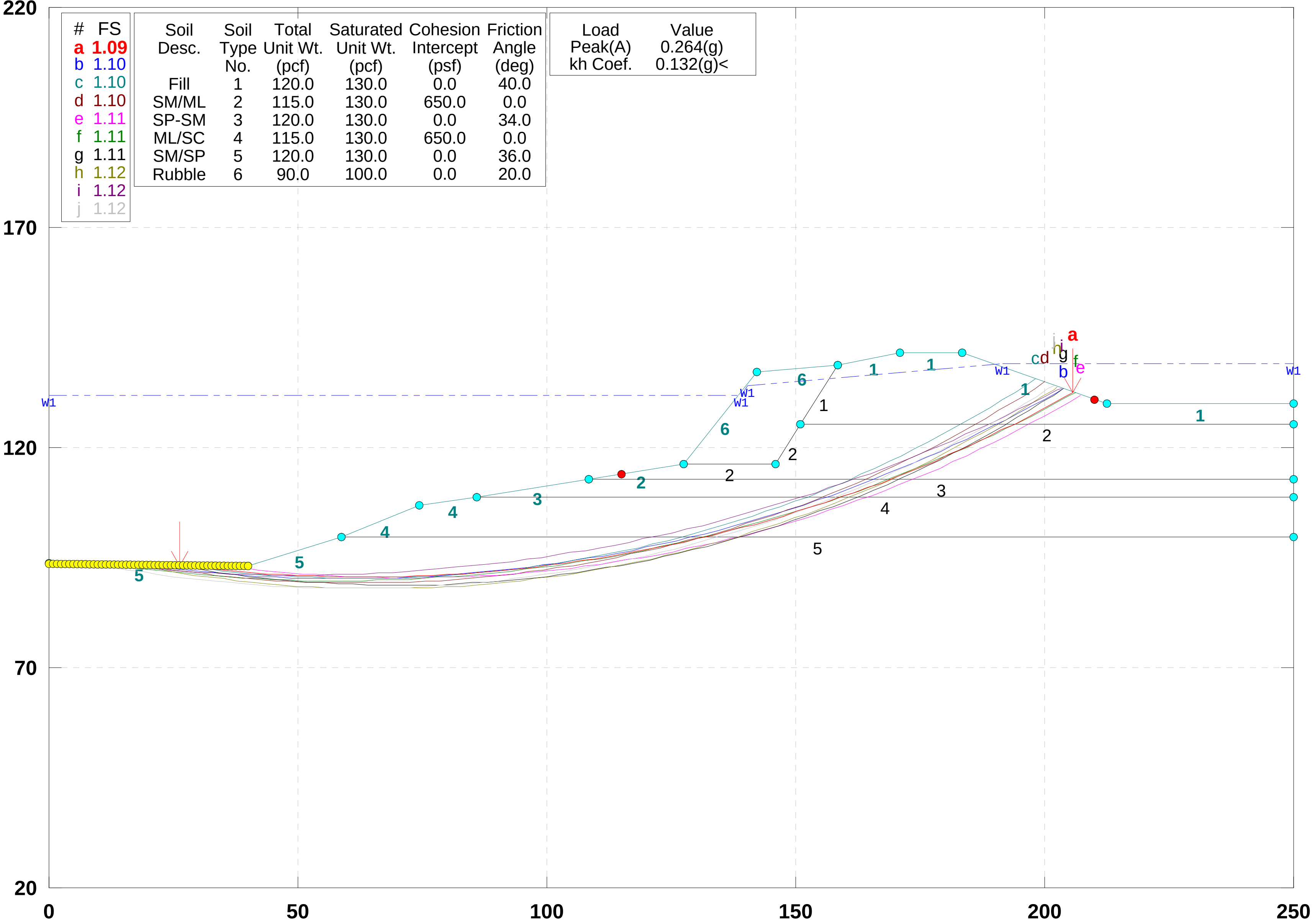
Load	Value
Peak(A)	0.104(g)
kh Coef.	0.052(g)<

GSTABL7 v.2 FSmin=1.50

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 3+50 Section 5 - SEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\3+50.pl2   Run By: Username   3/16/2011   10:22AM



#	FS
a	1.09
b	1.10
c	1.10
d	1.10
e	1.11
f	1.11
g	1.11
h	1.12
i	1.12
j	1.12

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
SP-SM	3	120.0	130.0	0.0	34.0
ML/SC	4	115.0	130.0	650.0	0.0
SM/SP	5	120.0	130.0	0.0	36.0
Rubble	6	90.0	100.0	0.0	20.0

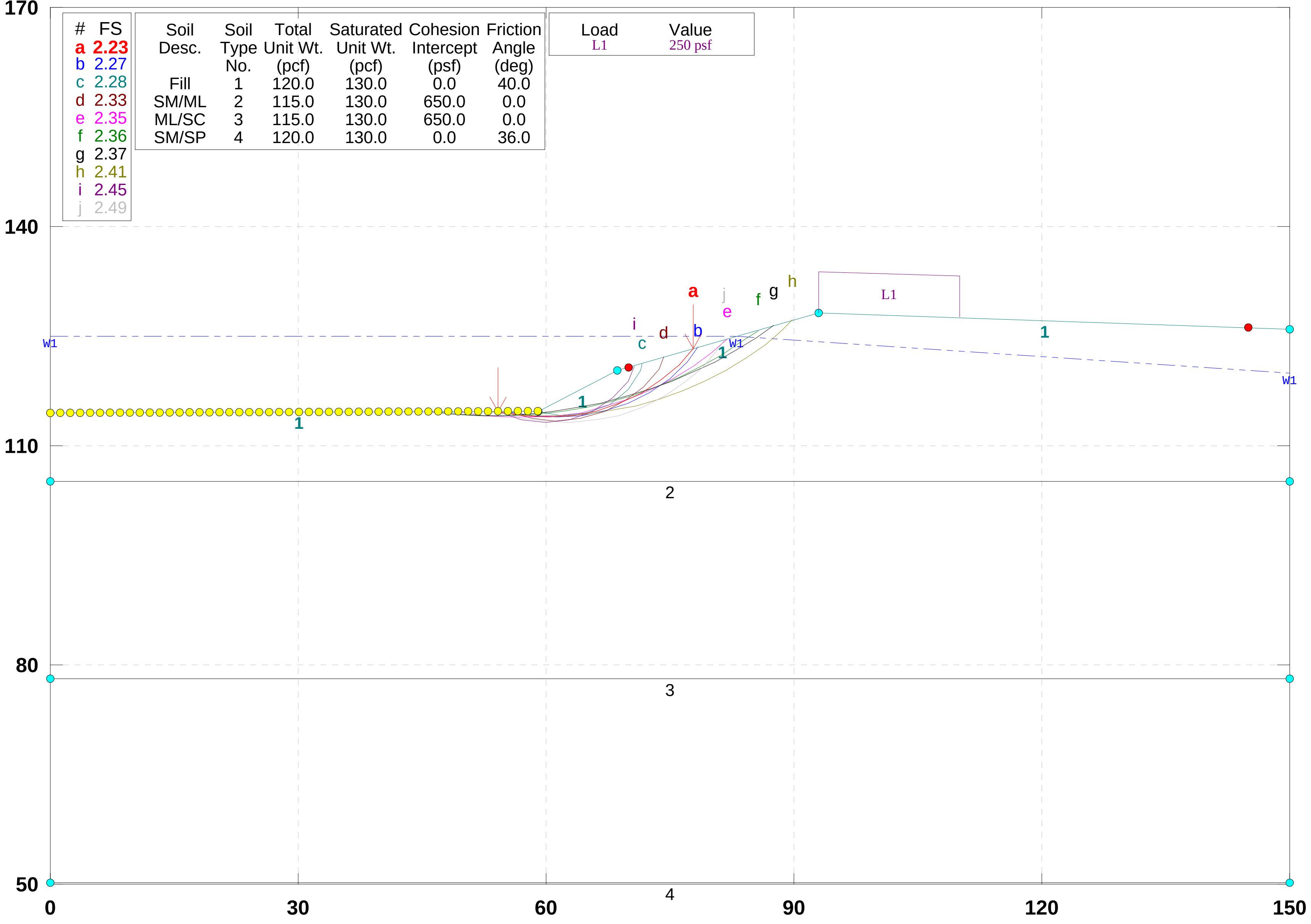
Load	Value
Peak(A)	0.264(g)
kh Coef.	0.132(g)<

GSTABL7 v.2 FSmin=1.09

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 7+25 Section 6 - Max. Storage Pool - Steady Seepage

c:\program files\g72sw\urqhart station\7+25.pl2 Run By: Username 3/16/2011 10:24AM



#	FS
a	2.23
b	2.27
c	2.28
d	2.33
e	2.35
f	2.36
g	2.37
h	2.41
i	2.45
j	2.49

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
ML/SC	3	115.0	130.0	650.0	0.0
SM/SP	4	120.0	130.0	0.0	36.0

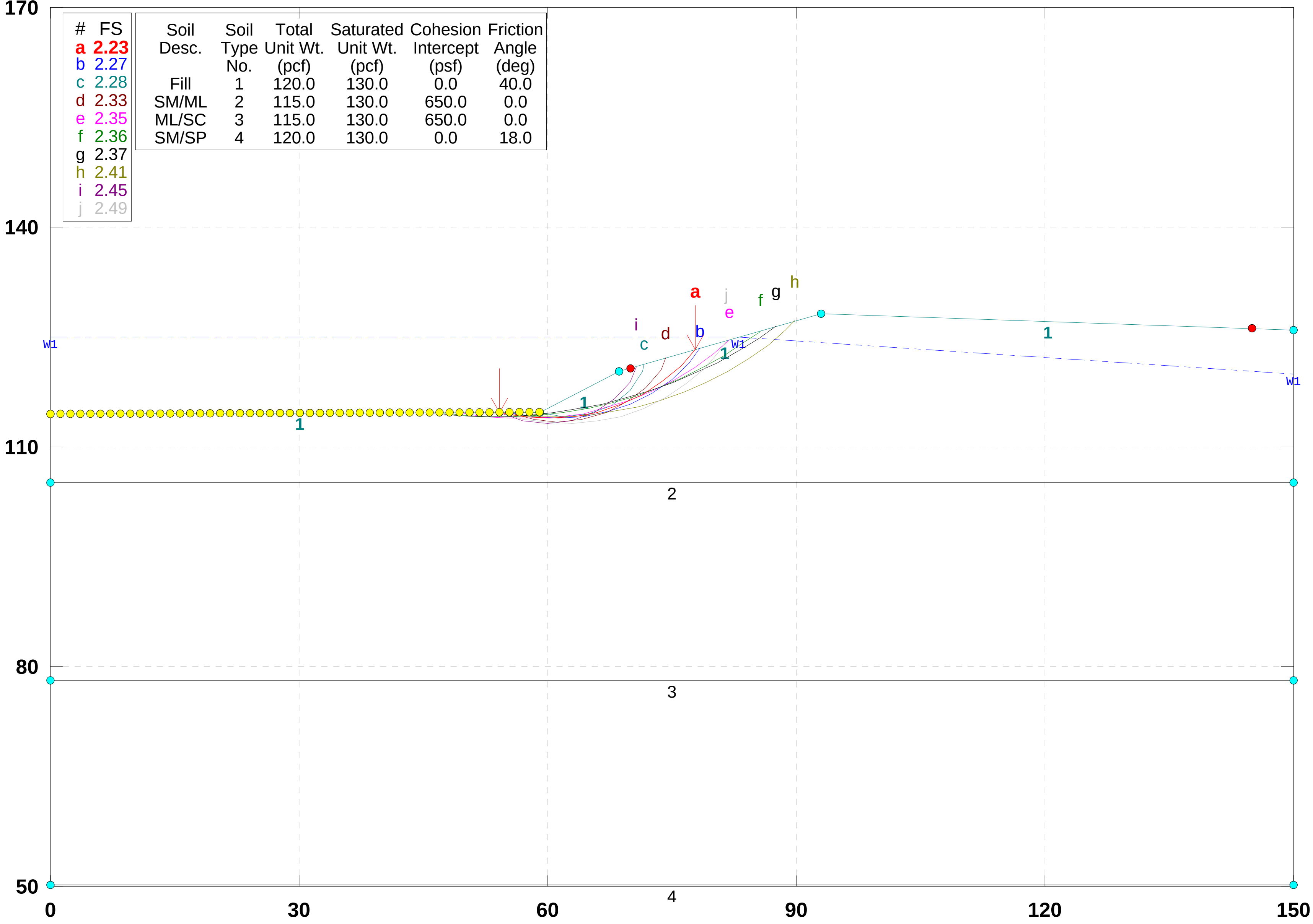
Load	Value
L1	250 psf

GSTABL7 v.2 FSmin=2.23

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 7+25 Section 6 - Liquefaction - Steady Seepage

c:\program files\g72sw\urqhart station\7+25.pl2 Run By: Username 3/16/2011 10:24AM



#	FS
a	2.23
b	2.27
c	2.28
d	2.33
e	2.35
f	2.36
g	2.37
h	2.41
i	2.45
j	2.49

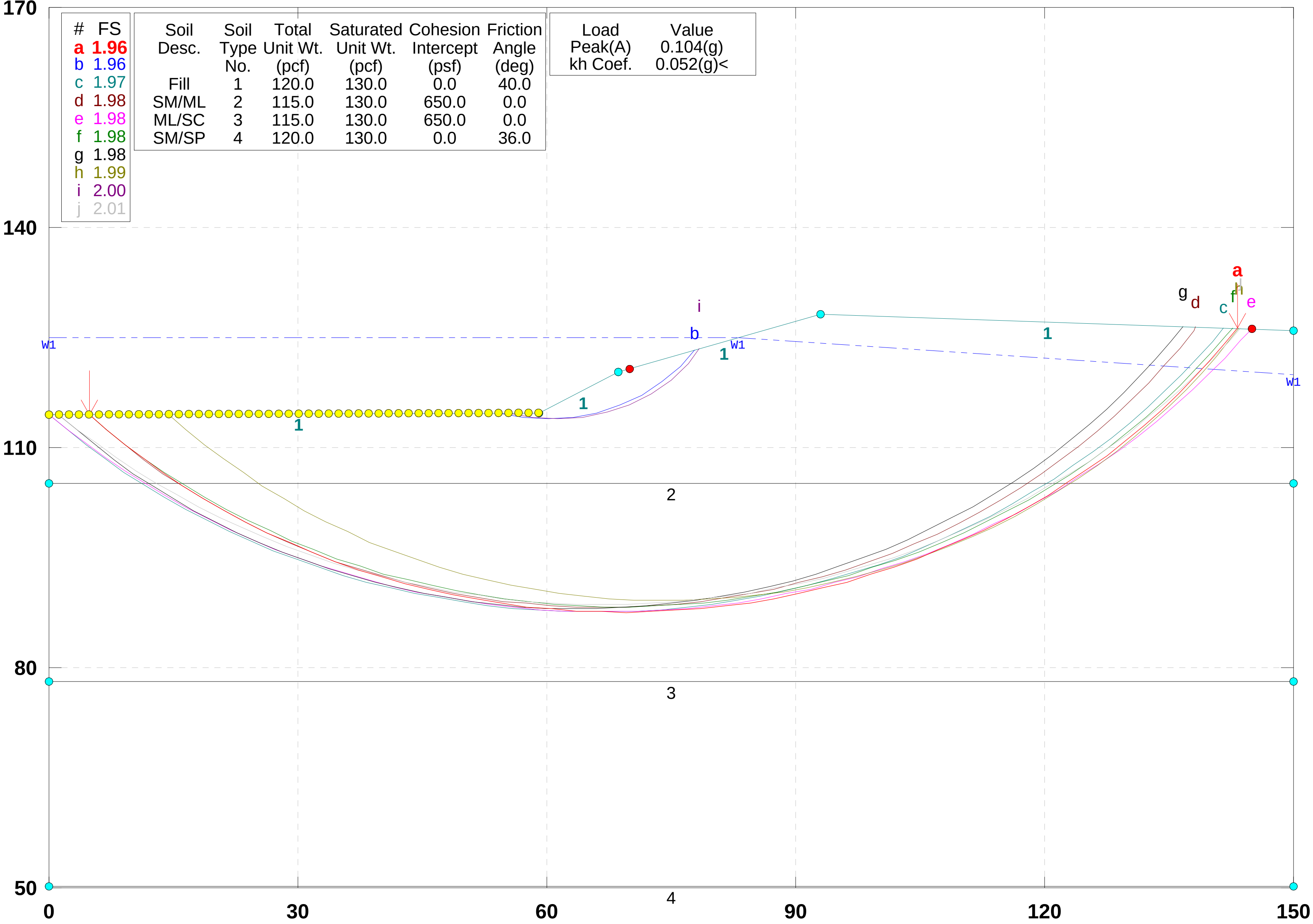
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
ML/SC	3	115.0	130.0	650.0	0.0
SM/SP	4	120.0	130.0	0.0	18.0

GSTABL7 v.2 FSmin=2.23

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 7+25 Section 6 - FEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\7+25.pl2   Run By: Username   3/16/2011   10:25AM



#	FS
a	1.96
b	1.96
c	1.97
d	1.98
e	1.98
f	1.98
g	1.98
h	1.99
i	2.00
j	2.01

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
ML/SC	3	115.0	130.0	650.0	0.0
SM/SP	4	120.0	130.0	0.0	36.0

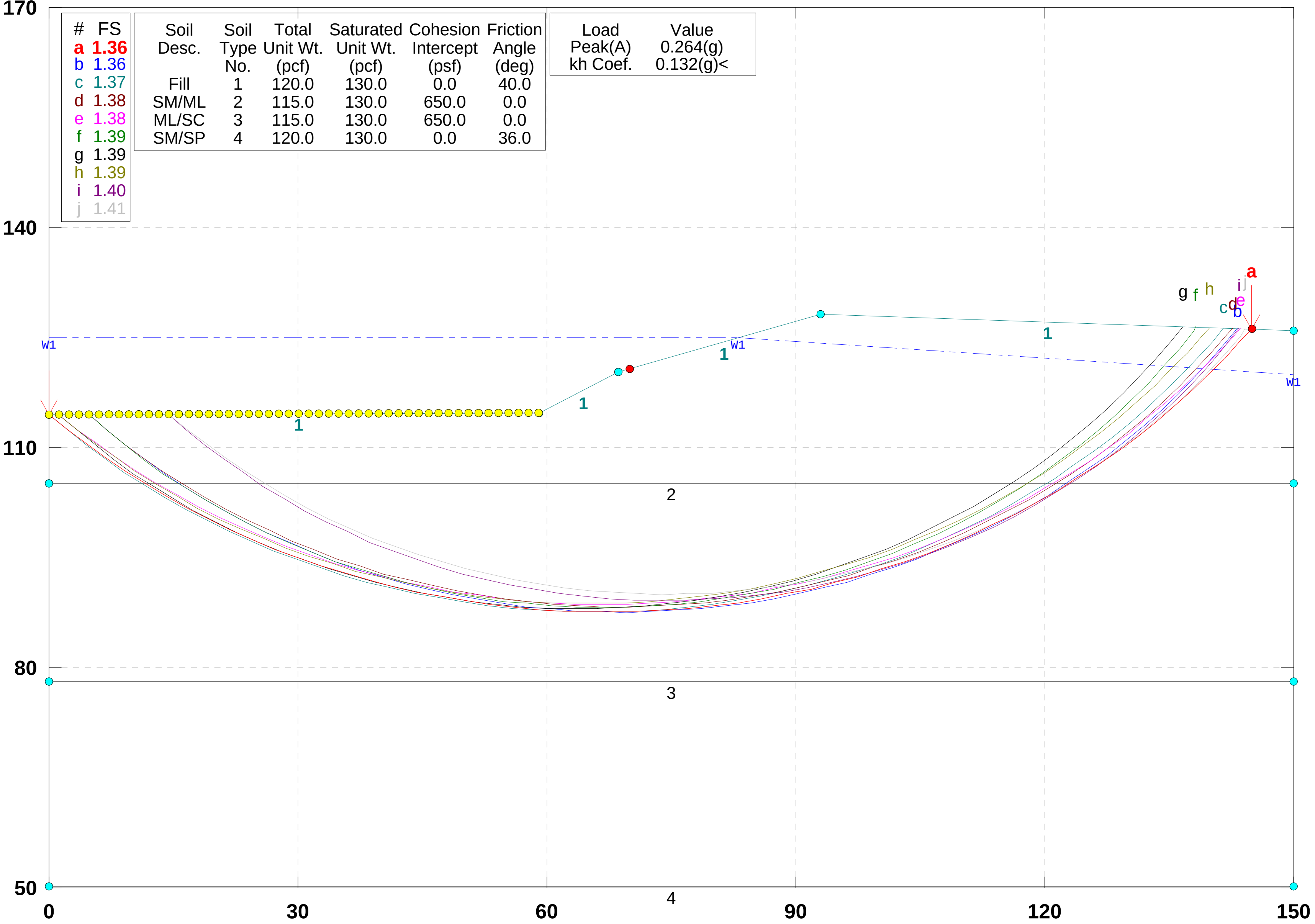
Load	Value
Peak(A)	0.104(g)
kh Coef.	0.052(g)<

GSTABL7 v.2 FSmin=1.96

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 7+25 Section 6 - SEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\7+25.pl2   Run By: Username   3/16/2011   10:26AM



#	FS
a	1.36
b	1.36
c	1.37
d	1.38
e	1.38
f	1.39
g	1.39
h	1.39
i	1.40
j	1.41

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
SM/ML	2	115.0	130.0	650.0	0.0
ML/SC	3	115.0	130.0	650.0	0.0
SM/SP	4	120.0	130.0	0.0	36.0

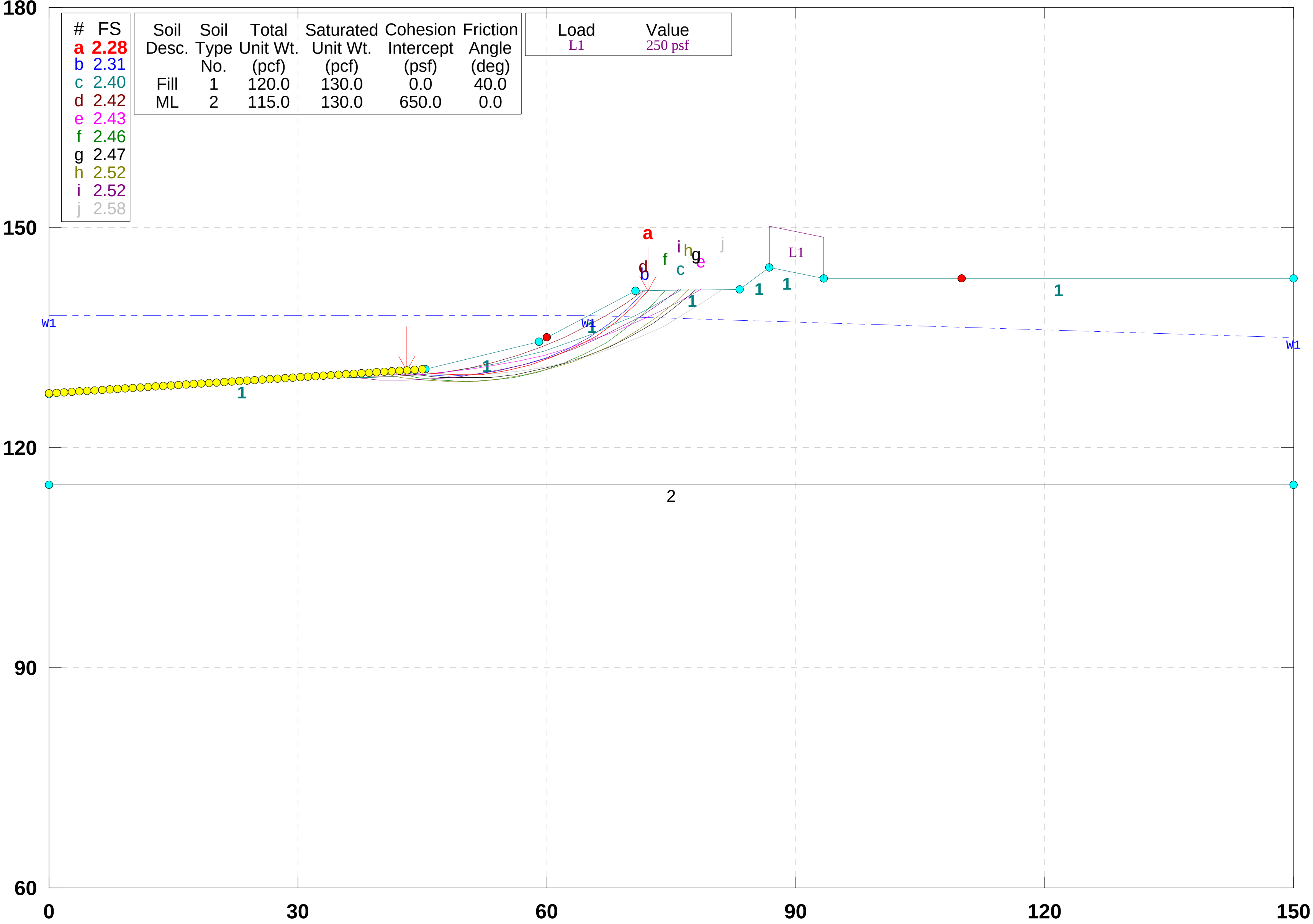
Load	Value
Peak(A)	0.264(g)
kh Coef.	0.132(g)<

GSTABL7 v.2 FSmin=1.36

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 11+00 Section 7- Max. Storage Pool - Steady Seepage

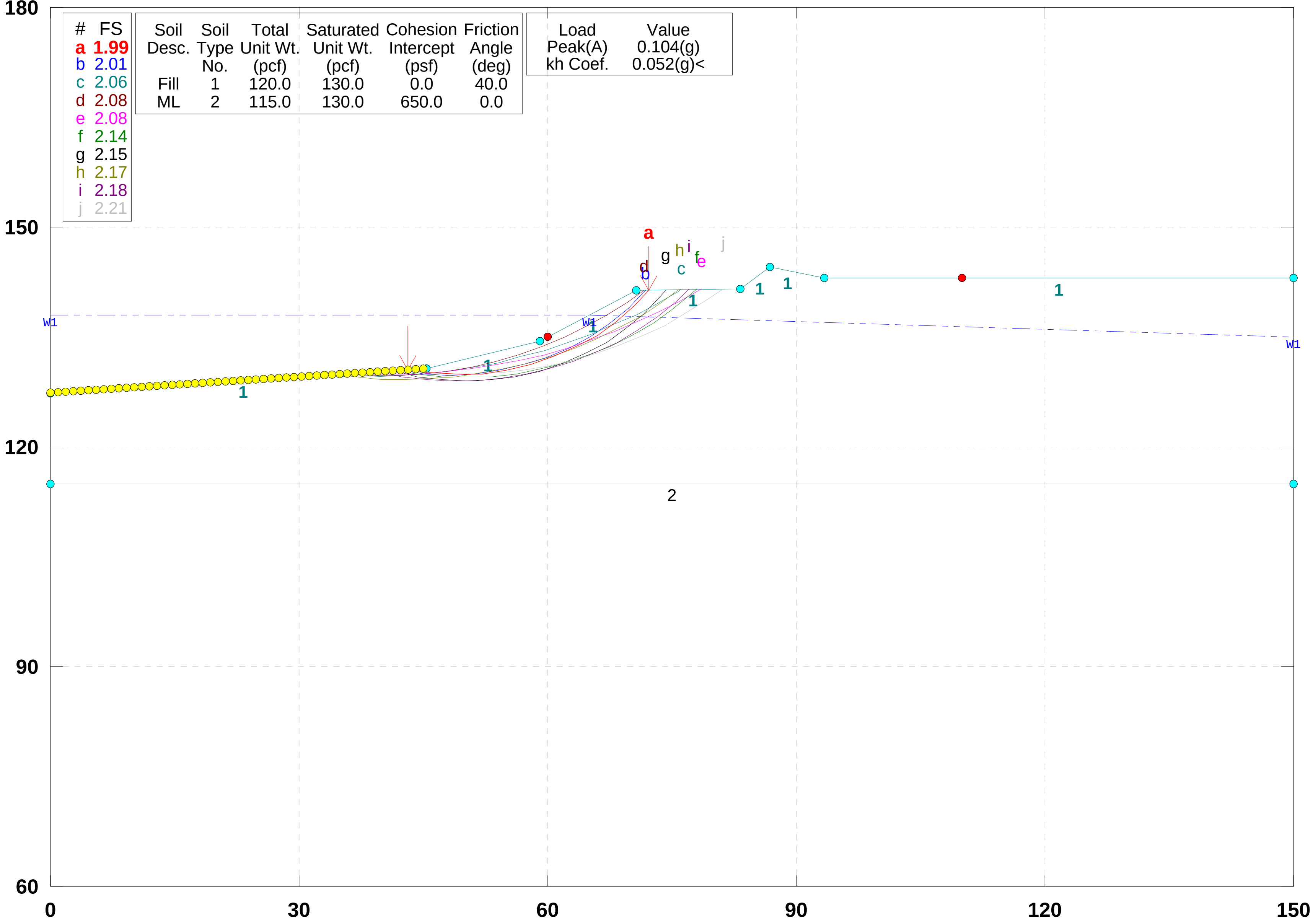
c:\program files\g72sw\urqhart station\11+00.pl2   Run By: Username   3/9/2011   03:44PM



GSTABL7 v.2 FSmin=2.28
Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 11+00 Section 7- FEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\11+00.pl2   Run By: Username   3/9/2011   03:44PM

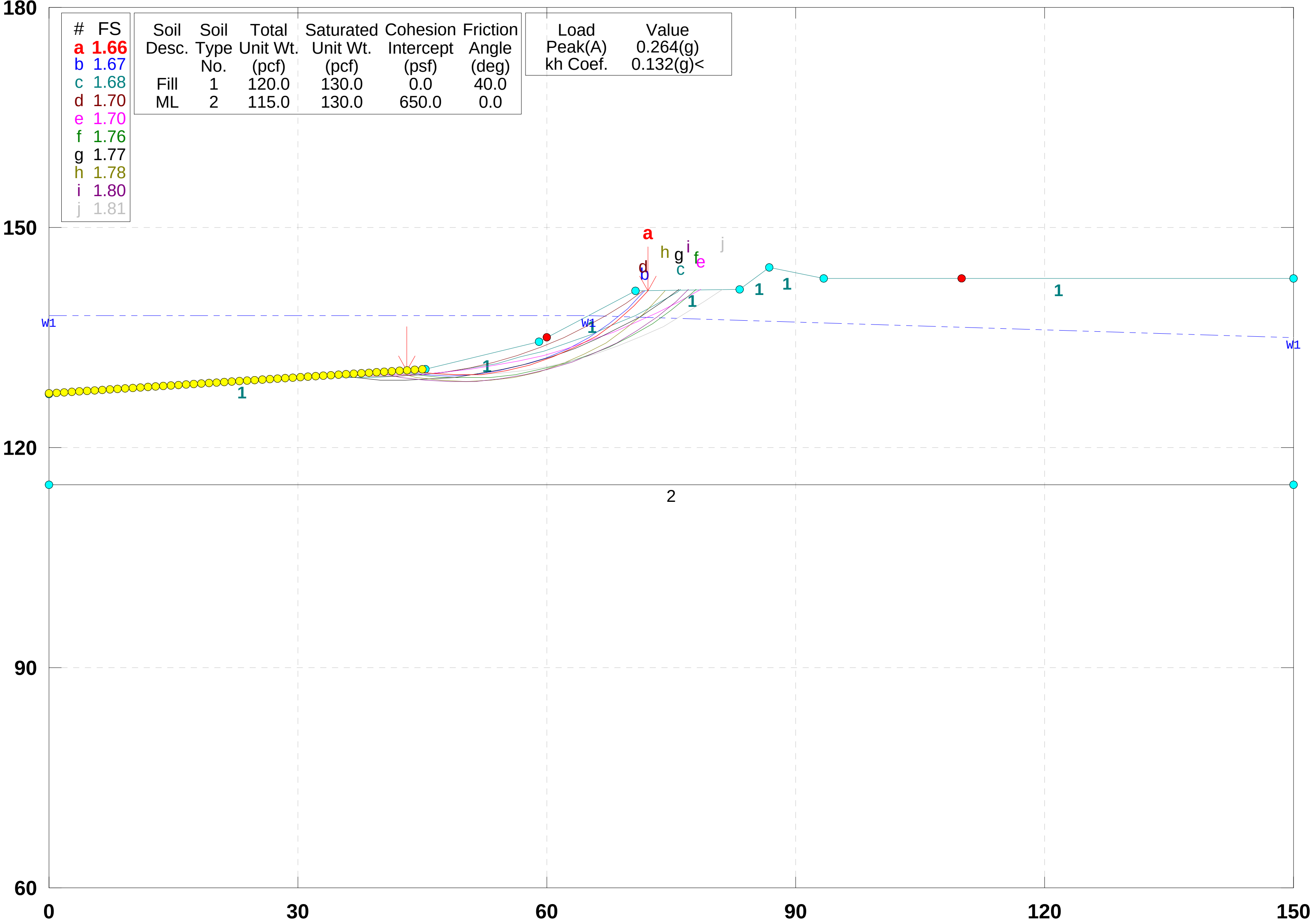


GSTABL7 v.2 FSmin=1.99

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 11+00 Section 7- SEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\11+00.pl2 Run By: Username 3/9/2011 03:45PM



#	FS
a	1.66
b	1.67
c	1.68
d	1.70
e	1.70
f	1.76
g	1.77
h	1.78
i	1.80
j	1.81

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
ML	2	115.0	130.0	650.0	0.0

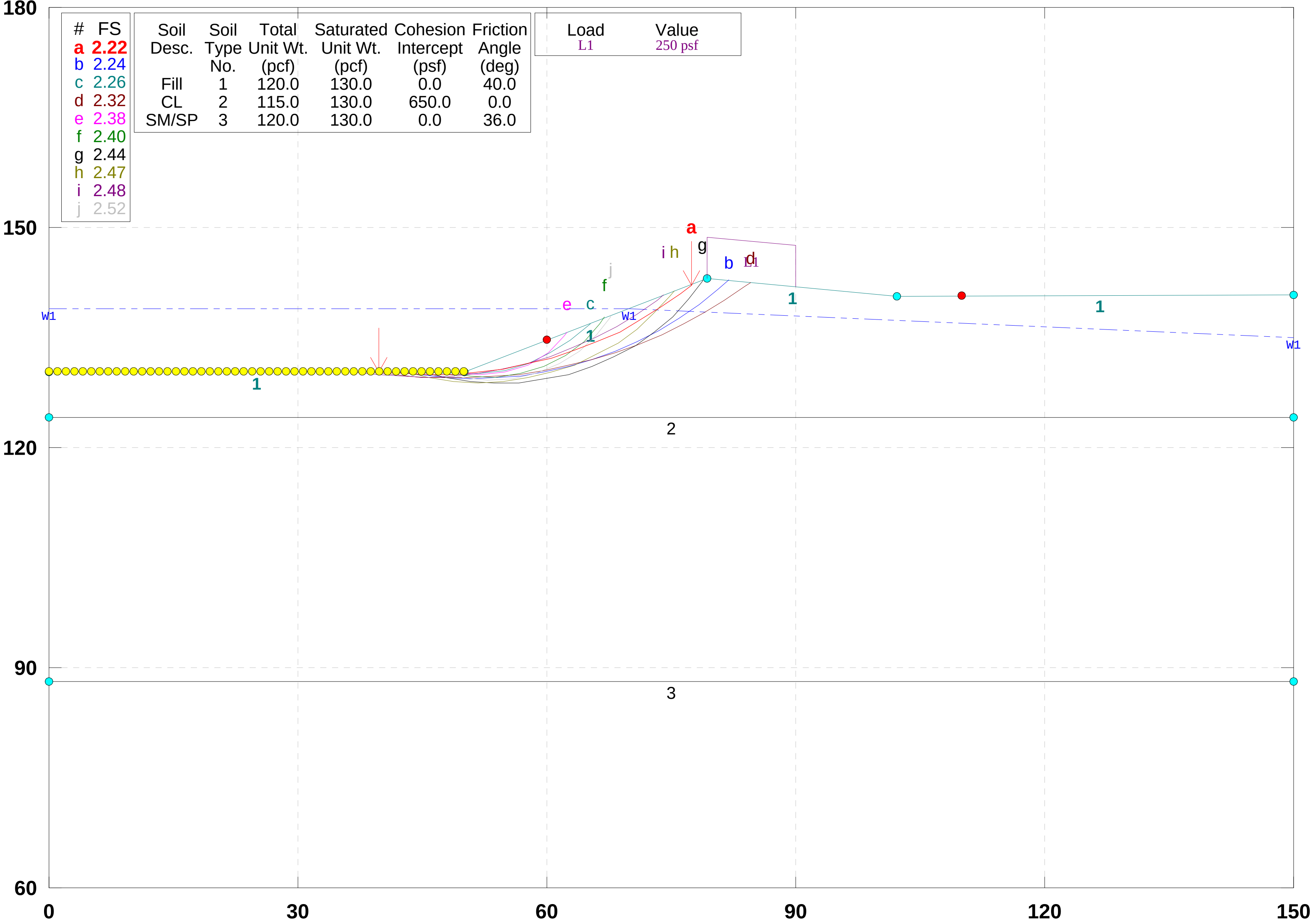
Load	Value
Peak(A)	0.264(g)
kh Coef.	0.132(g)<

GSTABL7 v.2 FSmin=1.66

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 13+15 Section 8- Max. Storage Pool - Steady Seepage

c:\program files\g72sw\urqhart station\13+15.pl2 Run By: Username 3/16/2011 10:28AM



#	FS
a	2.22
b	2.24
c	2.26
d	2.32
e	2.38
f	2.40
g	2.44
h	2.47
i	2.48
j	2.52

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
CL	2	115.0	130.0	650.0	0.0
SM/SP	3	120.0	130.0	0.0	36.0

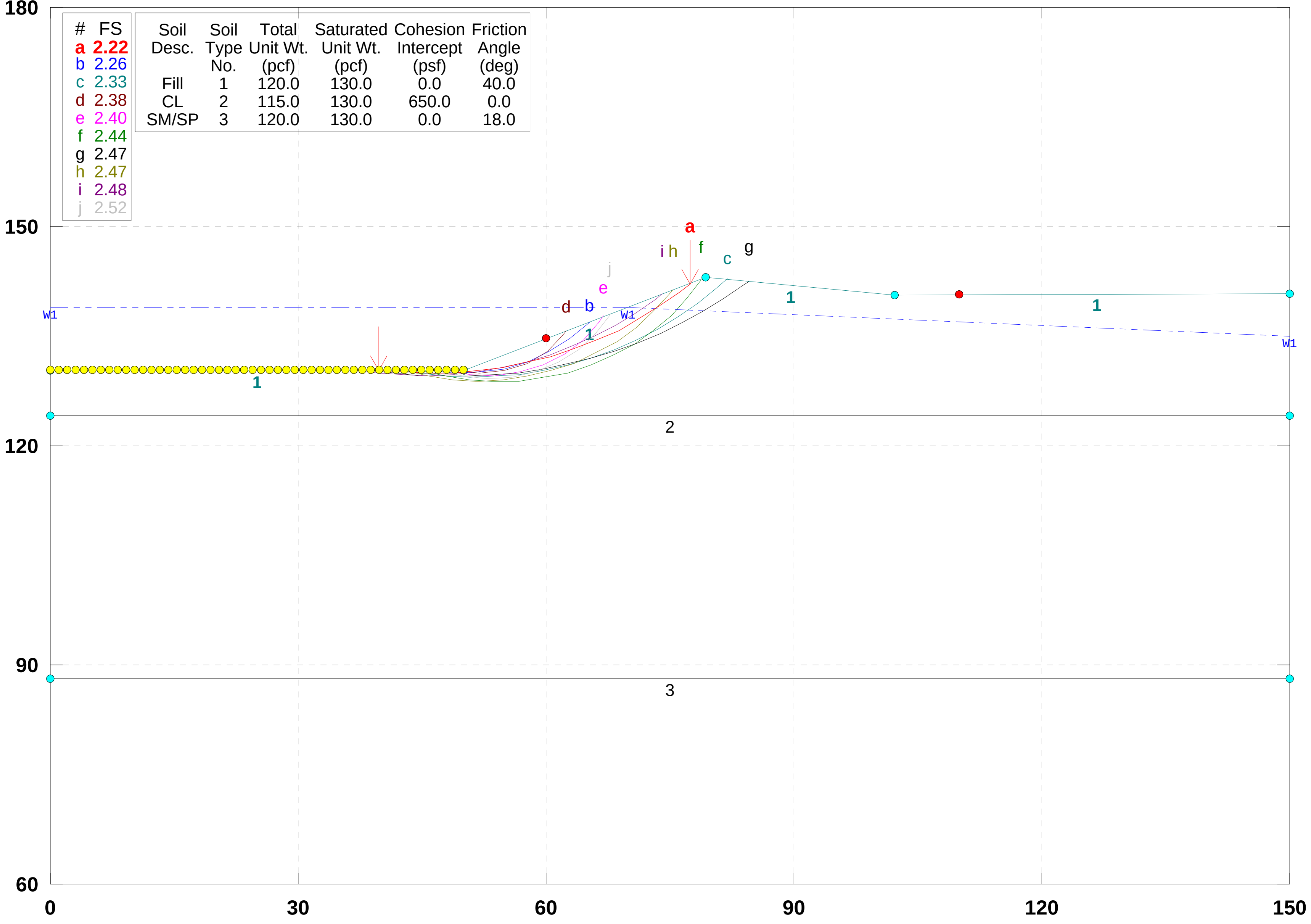
Load	Value
L1	250 psf

GSTABL7 v.2 FSmin=2.22

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 13+15 Section 8- Liquefaction - Steady Seepage

c:\program files\g72sw\urqhart station\13+15.pl2 Run By: Username 3/16/2011 10:30AM



#	FS
a	2.22
b	2.26
c	2.33
d	2.38
e	2.40
f	2.44
g	2.47
h	2.47
i	2.48
j	2.52

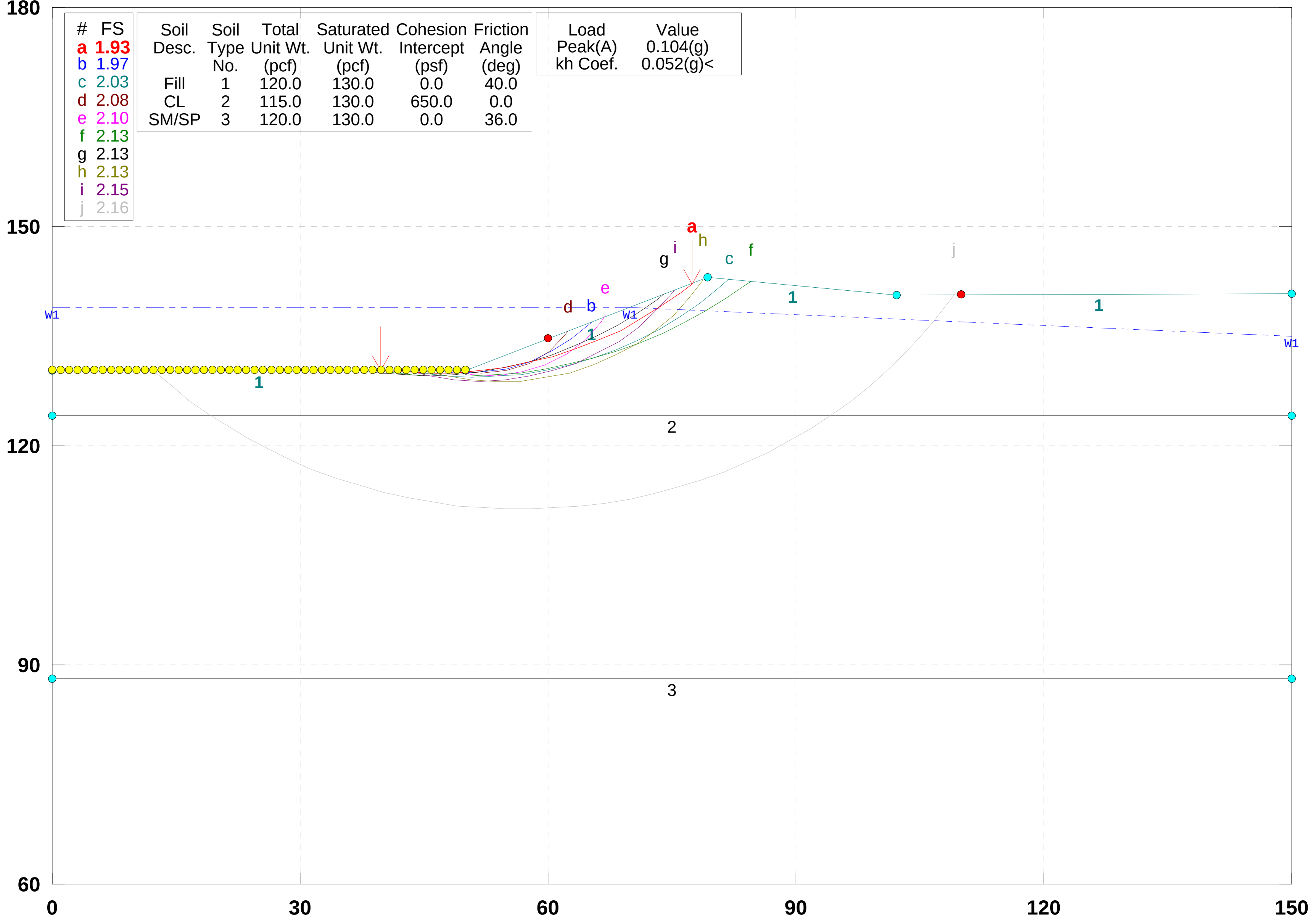
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
CL	2	115.0	130.0	650.0	0.0
SM/SP	3	120.0	130.0	0.0	18.0

GSTABL7 v.2 FSmin=2.22

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 13+15 Section 8- FEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\13+15.pl2 Run By: Username 3/16/2011 10:31AM



#	FS
a	1.93
b	1.97
c	2.03
d	2.08
e	2.10
f	2.13
g	2.13
h	2.13
i	2.15
j	2.16

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
CL	2	115.0	130.0	650.0	0.0
SM/SP	3	120.0	130.0	0.0	36.0

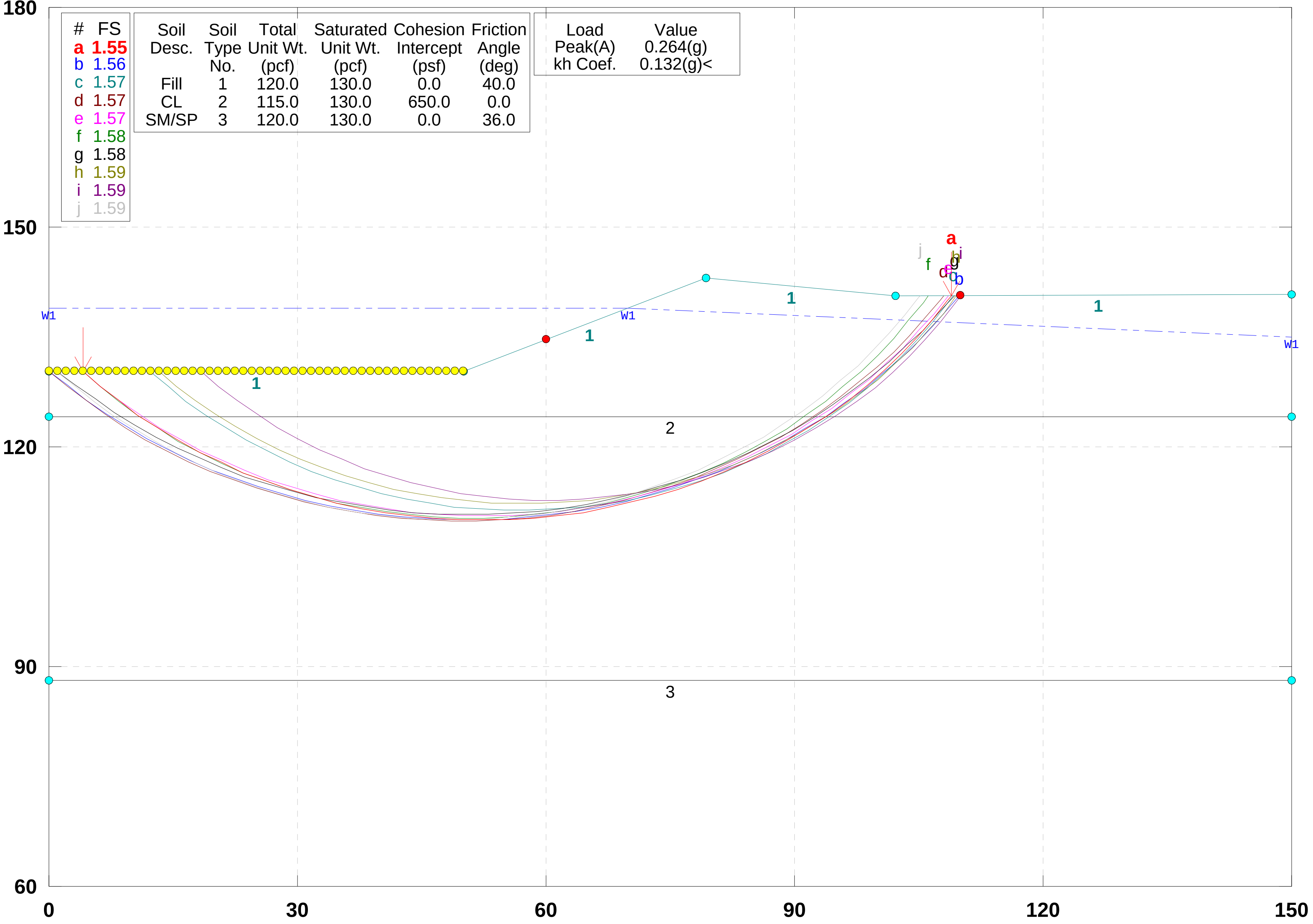
Load	Value
Peak(A)	0.104(g)
kh Coef.	0.052(g)<

GSTABL7 v.2 FSmin=1.93

Safety Factors Are Calculated By The Modified Bishop Method

SCE&G Urquhart Station - 13+15 Section 8- SEE Earthquake - Steady Seepage

c:\program files\g72sw\urqhart station\13+15.pl2 Run By: Username 3/16/2011 10:31AM



#	FS
a	1.55
b	1.56
c	1.57
d	1.57
e	1.57
f	1.58
g	1.58
h	1.59
i	1.59
j	1.59

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)
Fill	1	120.0	130.0	0.0	40.0
CL	2	115.0	130.0	650.0	0.0
SM/SP	3	120.0	130.0	0.0	36.0

Load	Value
Peak(A)	0.264(g)
kh Coef.	0.132(g)<

GSTABL7 v.2 FSmin=1.55

Safety Factors Are Calculated By The Modified Bishop Method

Appendix E

Geologic & Seismic Information

SOUTH CAROLINA GEOLOGY AND SEISMICITY

INTRODUCTION

The State of South Carolina is located in the Southeastern United States and is bounded on the north by the State of North Carolina, on the west and the south by the State of Georgia, and on the east by the Atlantic Ocean. The State is located between Latitudes 32° 4' 30" N and 35° 12' 00” N and between Longitudes 78° 0' 30" W and 83° 20' 00” W. The State is roughly triangular in shape and measures approximately 260 miles East-West and approximately 200 miles North-South at the states widest points. The South Carolina coastline is approximately 187 miles long. South Carolina is ranked 40th in size with an approximate area of 30,111 square miles.

The geology of South Carolina is similar to that of the neighboring states of Georgia, North Carolina, and Virginia. These states have in the interior the Appalachian Mountains with an average elevation of 3,000 feet followed by the Appalachian Piedmont that typically ranges in elevation from 300 feet to 1000 feet. Continuing eastward from these highlands is a “Fall Line” which serves to transition into the Atlantic Coastal Plain. The Atlantic Coastal Plain gently slopes towards the Atlantic Ocean with few elevations higher than 300 feet.

The 1886 earthquake that occurred in the Coastal Plain near Charleston, South Carolina dominates the seismic history of the southeastern United States. It is the largest historic earthquake in the southeastern United States with an estimated moment magnitude, MW, of 7.3. The damage area with a Modified Mercalli Intensity Scale of X, is an elliptical shape roughly 20 by 30 miles trending northeast between Charleston and Jedburg and including Summerville and roughly centered at Middleton Place. The intraplate epicenter of this earthquake and it’s magnitude is not unique in the Central and Eastern United States (CEUS). Other intraplate earthquakes include those at Cape Ann, Massachusetts (1755) with a MW of 5.9, and the New Madrid, Missouri (1811-1812) with MW of at least 7.7.

SOUTH CAROLINA GEOLOGY

South Carolina geology can be divided into three basic physiographic units: Blue Ridge Unit (Appalachian Mountains), Piedmont Unit, and the Coastal Plain Unit. The generalized locations of these physiographic units are shown in Figure 11-1.

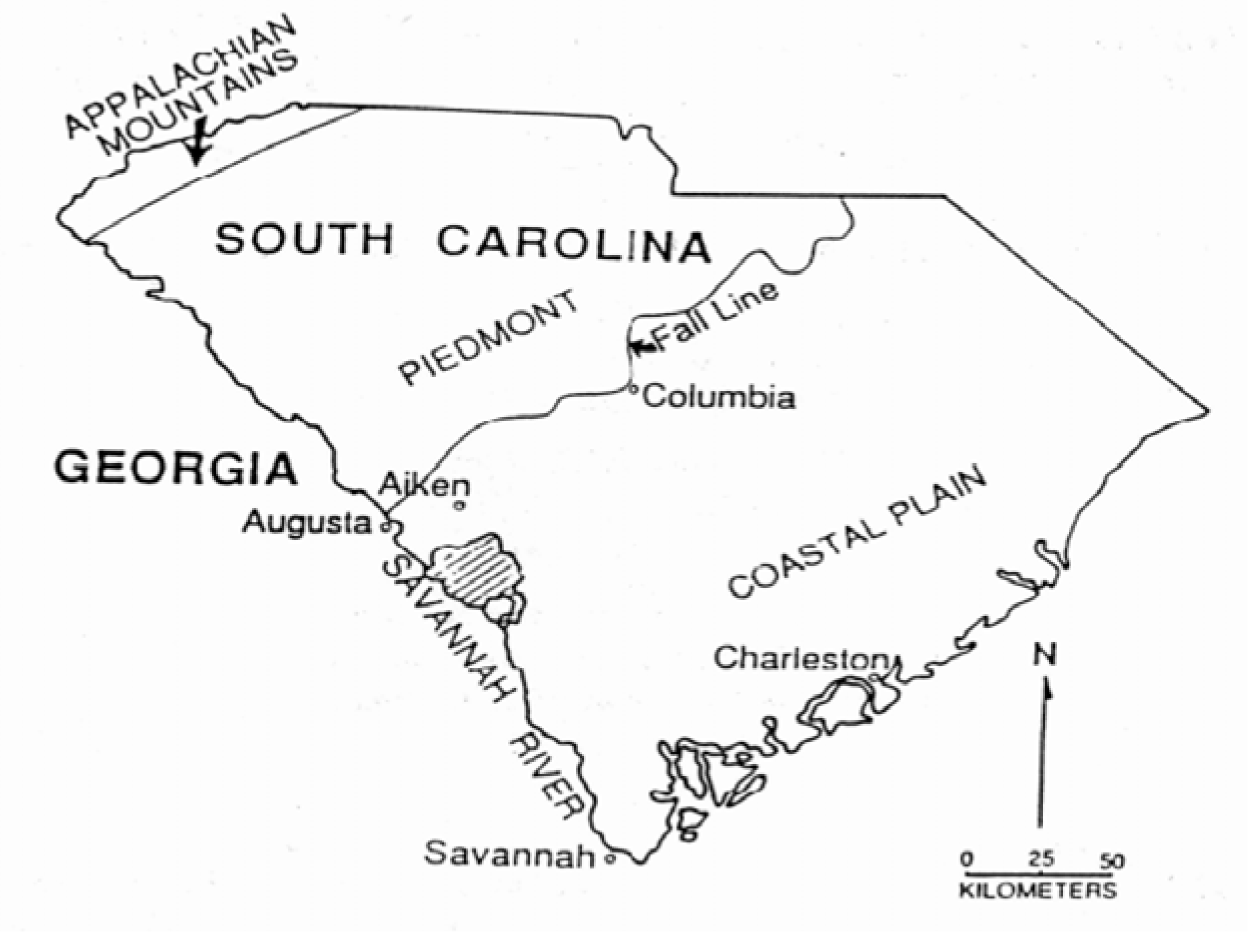


Figure 11-1, South Carolina Physiographic Units
(Snipes et al., 1993)

The Blue Ridge Unit (Appalachian Mountains) covers approximately 2 percent of the state and it is located in the northwestern corner of the state. The Piedmont Unit comprises approximately one-third of the state with the Coastal Plain Unit covering the remaining two-thirds of the state. The geologic formations are typically aligned from the South-Southwest to the North-Northeast and parallel the South Carolina Atlantic coastline as shown in the generalized geologic map in Figure 11-2. The physiographic units in Figure 11-2 are broken down by the geologic time of the surface formations. South Carolina formations span in age from late Precambrian through the Quaternary period. The descriptions of events that have occurred over geologic time in South Carolina are shown in Figure 11-3.

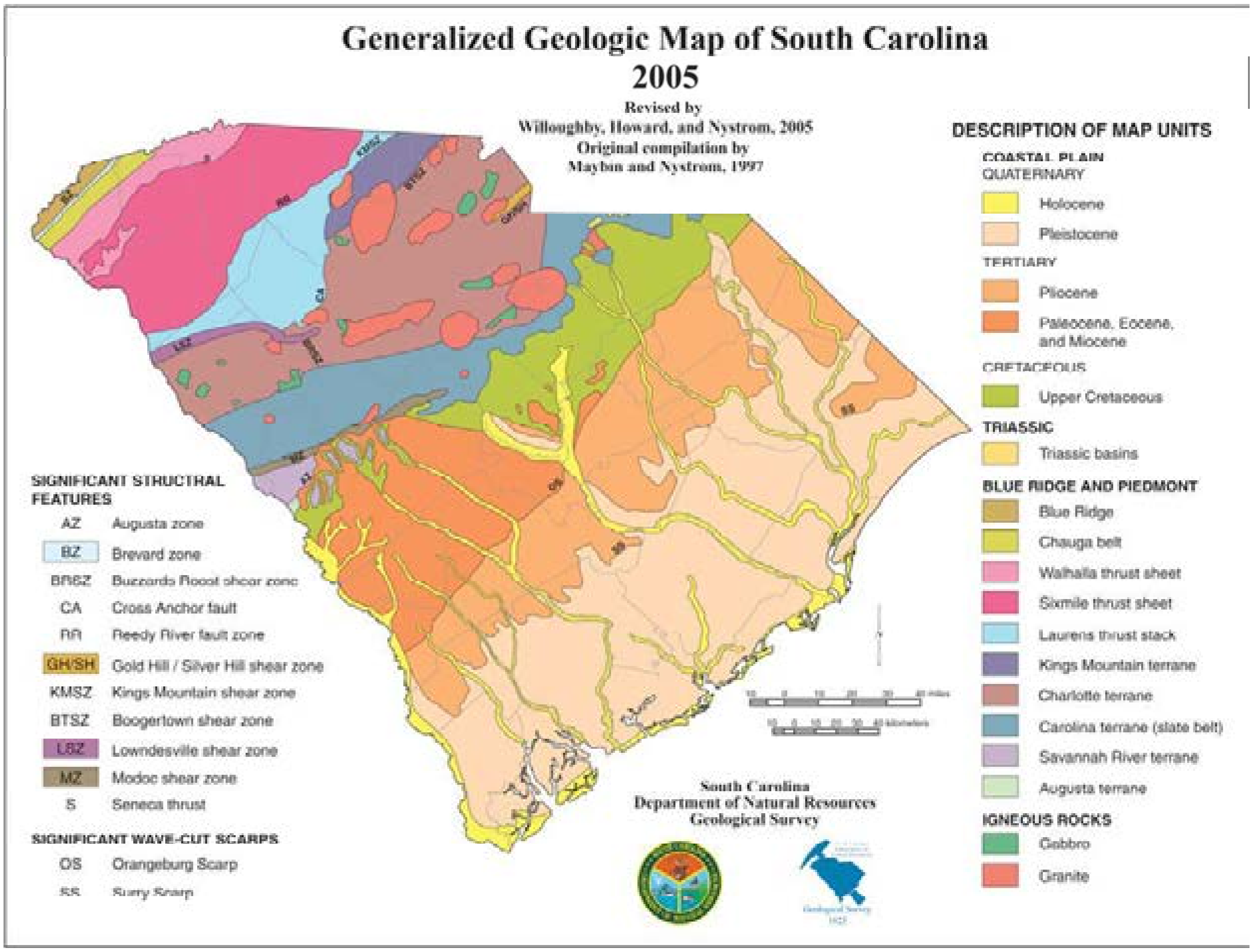


Figure 11-2, 2005 Generalized Geologic Map of South Carolina, (SCDNR)

A description of the geologic formations, age, and geologic features for the Blue Ridge, Piedmont, and Coastal Plain Physiographic Units are provided in the following sections.

“FALL LINE”

A “Fall Line” is an unconformity that marks the boundary between an upland region (bed rock) and a coastal plain region (sediment). In South Carolina the Piedmont Unit is separated from the Coastal Plain Unit by a “Fall Line” that begins near the Edgefield-Aiken County line and traverses to the northeast through Lancaster County. In addition to Columbia, SC many cities were built along the “Fall Line” as it runs up the east coast (Macon, Raleigh, Richmond, Washington D.C., and Philadelphia). The “Fall Line” generally follows the southeastern border of the Savannah River terrane formation and the Carolina terrane (slate belt) formation shown in Figure 11-2. Along the “Fall Line” between elevations 300 to 725, the Sandhills formations can be found which are the remnants of a prehistoric coastline. The Sandhills are unconnected bands of sand deposits that are remnants of coastal dunes that were formed during the Miocene epoch (5.3 to 23 MYA). The land to the southeast of the “Fall Line” is characterized by a gently downward sloping elevation (2 to 3 feet per mile) as it approaches the Atlantic coastline as shown in Figure 11-4. Several rivers such as the Pee Dee, Wateree, Lynches, Congaree, N. Fork Edisto, and S. Fork Edisto flow from the “Fall Line” towards the Atlantic coast as they cut through the Coastal Plain sediments.

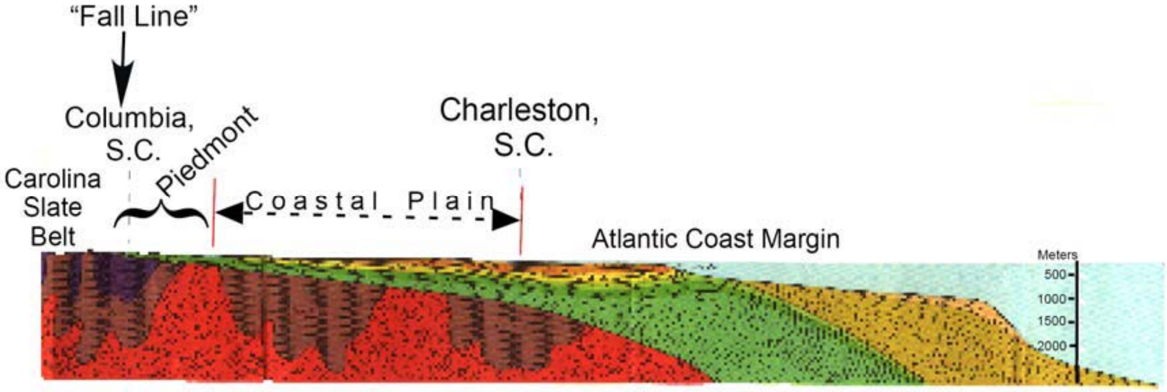


Figure 11-4, South Carolina “Fall Line”
(Odum et al., 2003)

COASTAL PLAIN UNIT

The Coastal Plain Unit is a compilation of wedge shaped formations that begin at the “Fall Line” and dip towards the Atlantic Ocean with ground surface elevations typically less than 300 feet. The Coastal Plain is underlain by Mesozoic/Paleozoic basement rock. This wedge of sediment is comprised of numerous geologic formations that range in age from late Cretaceous period to Recent. The sedimentary soils of these formations consist of unconsolidated sand, clay, gravel, marl, cemented sands, and limestone that were deposited over the basement rock. The marl and limestone are considered in geotechnical engineering as an IGM. The basement rock consists of granite, schist, and gneiss similar to the rocks of the Piedmont Unit. The thickness of the Coastal Plain sediments varies from zero at the “Fall Line” to more than 4,000 feet at the southern tip of South Carolina near Hilton Head Island. The thickness of the Coastal Plain sediments along the Atlantic coast varies from ~1300 feet at Myrtle Beach to ~4000 feet at

Hilton Head Island. The top of the basement beneath the Coastal Plain has been mapped during a SC Seismic Hazard Study that was prepared for SCDOT and the contours of the Coastal Plain sediment thickness in meters are shown in Figure 11-5.

The area is formed of older, generally well-consolidated layers of sands, silts, or clays that were deposited by marine or fluvial action during a period of retreating ocean shoreline. Predominantly, sediments lie in nearly horizontal layers; however, erosional episodes occurring between depositions of successive layers are often expressed by undulations in the contacts between the formations. Due to their age, sediments exposed at the ground surface are often heavily eroded. Ridges and hills are either capped by terrace gravels or wind-deposited sands. Younger alluvial soils may mask these sediments in swales or stream valleys.

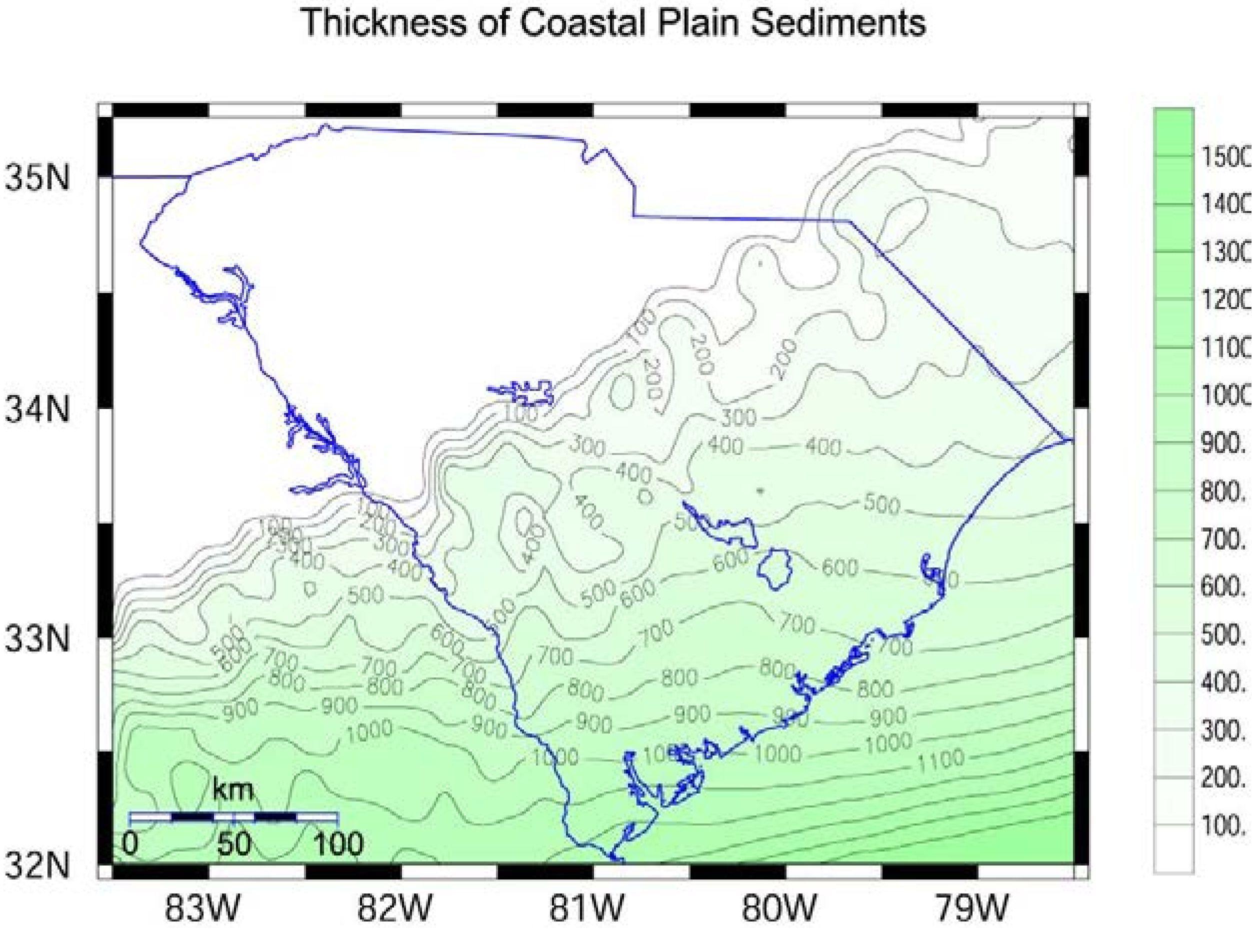


Figure 11-5, Contour Map of Coastal Plain Sediment Thickness, in meters (Chapman and Talwani, 2002)

This Coastal Plain Unit was formed during Quaternary, Tertiary, and late Cretaceous geologic periods. The Coastal Plain can be divided into the following three subunits:

- Upper Coastal Plain
- Middle Coastal Plain
- Lower Coastal Plain

The Lower Coastal Plain comprises approximately one-half of the entire Atlantic Coastal Plain of South Carolina. The Surry Scarp (-SS-) shown in Figure 11-2 separates the Lower Coastal Plain from the Middle Coastal Plain. The Surry Scarp is a seaward facing scarp with a toe elevation of 90 to 100 feet. The Middle Coastal Plain and the Upper Coastal Plain each compose approximately one fourth of the Coastal Plain area. The Orangeburg Scarp (-OS-) shown in Figure 11-2 separates the Middle Coastal Plain from the Upper Coastal Plain. The Orangeburg Scarp is also a seaward facing scarp with a toe elevation of 250 to 270 feet.

Lower Coastal Plain

The Lower Coastal Plain is typically identified as the area east of the Surry Scarp below elevation 100 feet. The vertical stratigraphic sequence overlying the basement rock consists of unconsolidated Cretaceous, Tertiary, and Quaternary sedimentary deposits. The surface deposits of the Lower Coastal Plain were formed during the Quaternary period that began approximately 1.6 MYA and extends to present day. The Quaternary period can be further subdivided into the Pleistocene epoch and the Holocene epoch. During the Pleistocene epoch (1.6 MYA to 10 thousand years ago) the surficial deposits that cover the underlying Coastal Plain formations were formed. This period specifically marks the formation of the Carolina Bays and scarps throughout the east coast due to sea level rise and fall. The Holocene epoch covers from 10 thousand years ago to present day. Barrier islands were formed and flood plains from major rivers were formed during the Holocene epoch. Preceding Quaternary period during the Eocene epoch (53 to 36.6 MYA) of the Tertiary period, limestone was deposited in the Lower Coastal Plain.

Middle Coastal Plain

The Middle Coastal Plain is typically identified as the area between the Orangeburg Scarp and the Surry Scarp and falls between elevation 100 feet and 270 feet. The vertical stratigraphic sequence overlying the basement rock consists of unconsolidated Cretaceous and Tertiary sedimentary deposits. The surface deposits of the Middle Coastal Plain were formed during the Pliocene epoch of the Tertiary period. During the Pliocene epoch (5.3 to 1.6 MYA) of the Tertiary period, the Orangeburg Scrap was formed as a result of scouring from the regressive cycles of the Ocean as it retreated. During the Eocene epoch (53 to 36.6 MYA) of the Tertiary period, limestone was deposited in the Middle Coastal Plain.

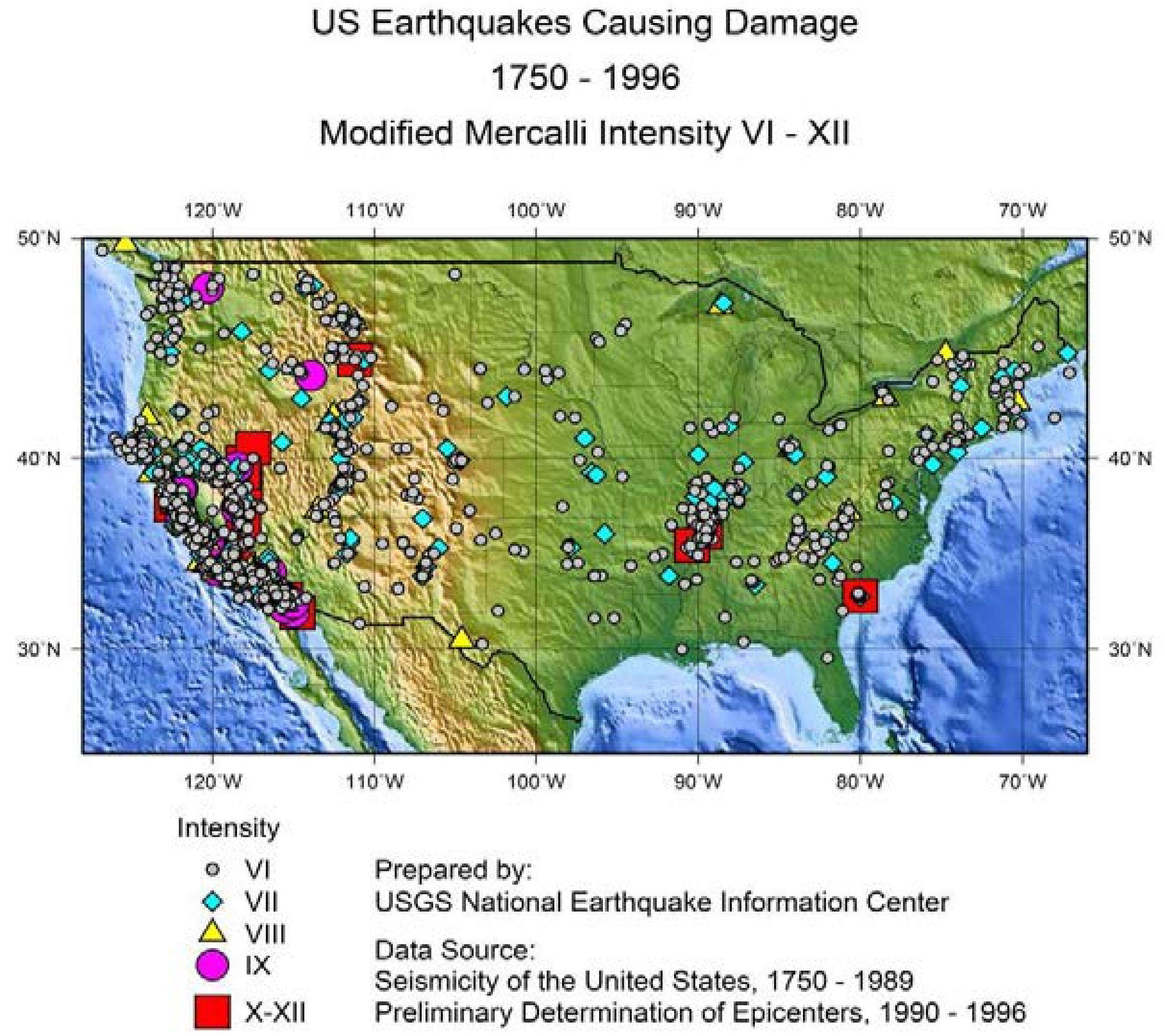
Upper Coastal Plain

The Upper Coastal Plain is typically identified as the area between the “Fall Line” and the Orangeburg Scarp and falls between elevations 270 feet and 300 feet. The Upper Coastal Plain was formed during the Tertiary and late Cretaceous periods. The Tertiary period began approximately 65 MYA and ended approximately 1.6 MYA. The Tertiary period can be further subdivided into the Pliocene epoch, Miocene epoch, Oligocene epoch, Eocene epoch, and Paleocene epoch. The Miocene epoch (23 to 5.3 MYA) is marked by the formation of the Sandhills dunes as a result of fluvial deposits over the Coastal Plain. During the early Tertiary period (65 to 23 MYA) fluvial deposits over the Coastal Plain consisted of marine sediments, limestone, and sand.

SOUTH CAROLINA SEISMICITY

Central and Eastern United States (CEUS) Seismicity

Even though seismically active areas in the United States are generally considered to be in California and Western United States, historical records indicate that there have been major earthquake events in Central and Eastern United States (CEUS) that have not only been of equal or greater magnitude but that have occurred over broader areas of the CEUS. The United States Geologic Survey (USGS) map shown in Figure 11-6 indicates earthquakes that have caused damage within the United States between 1750 and 1996. Of particular interest to South Carolina is the 1886 earthquake in Charleston, SC that has been estimated to have a MW of at least 7.3. Also of interest to the northwestern end of South Carolina is the influence of New Madrid seismic zone, near New Madrid, Missouri, where historical records indicate that between 1811 and 1812 there were several large earthquakes with a MW of at least 7.7.



Prepared by:
USGS National Earthquake Information Center

Data Source:
Seismicity of the United States, 1750 - 1989
Preliminary Determination of Epicenters, 1990 - 1996

Figure 11-6, U.S. Earthquakes Causing Damage 1750 – 1996 (USGS)

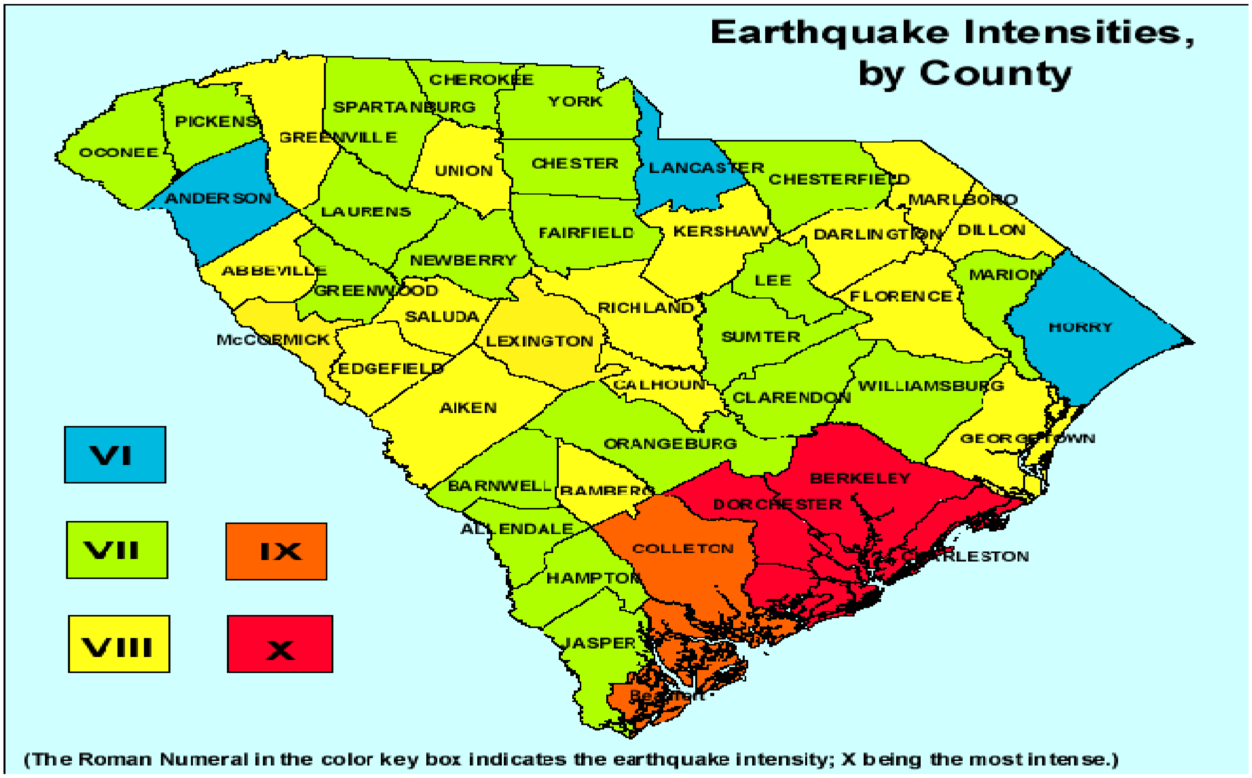
SC Earthquake Intensity

The Modified Mercalli Intensity Scale (MMIS) is a qualitative measure of the strength of ground shaking at a particular site that is used in the United States. Each earthquake large enough to be felt will have a range of intensities. Typically the highest intensities are measured near the earthquake epicenter and lower intensities are measured farther away. The MMIS is used to distinguish the ground shaking at geographic locations as opposed to the moment magnitude scale that is used to compare the energy released by earthquakes. Roman numerals are used to identify the MMIS of ground shaking with respect to shaking and damage felt at a geographic location as shown in Table 11-1.

Table 11-1, Modified Mercalli Intensity Scale (MMIS)

INTENSITY	**I**	**II – III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X+**
SHAKING	Not Felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very Light	Light	Moderate	Moderate / Heavy	Heavy	Very Heavy

Figure 11-7 shows a map developed by the South Carolina Geological Survey with earthquake intensities, by county, based on the MMIS. The intensities shown on this map are the highest likely under the most adverse geologic conditions that would be produced by a combination of the August 31, 1886, Charleston, S.C. earthquake (MW = 7.3) and the January 1, 1913, Union County, S.C., earthquake (MW = 5.5). This map is for informational purposes only and is not intended as a design tool, but reflects the potential for damage based on earthquakes similar to the Union and Charleston earthquake events.



(The Roman Numeral in the color key box indicates the earthquake intensity; X being the most intense.)

Figure 11-7, SC Earthquake Intensities By County (SCDNR)

SOUTH CAROLINA SEISMIC SOURCES

Sources of seismicity are not well defined in much of the Eastern United States. South Carolina seismic sources have therefore been defined based on seismic history in the Southeastern United States. The SC Seismic Hazard study (Chapman and Talwani, 2002) has identified two types of seismic sources: Non-Characteristic Earthquakes and Characteristic Earthquakes.

Non-Characteristic Earthquake Sources

Seismic histories were used to establish seismic area sources for analysis of non-characteristic background events. The study modified the Frankel et al., 1996 source area study to develop the seismic source areas shown in Figures 11-8 and 11-9.

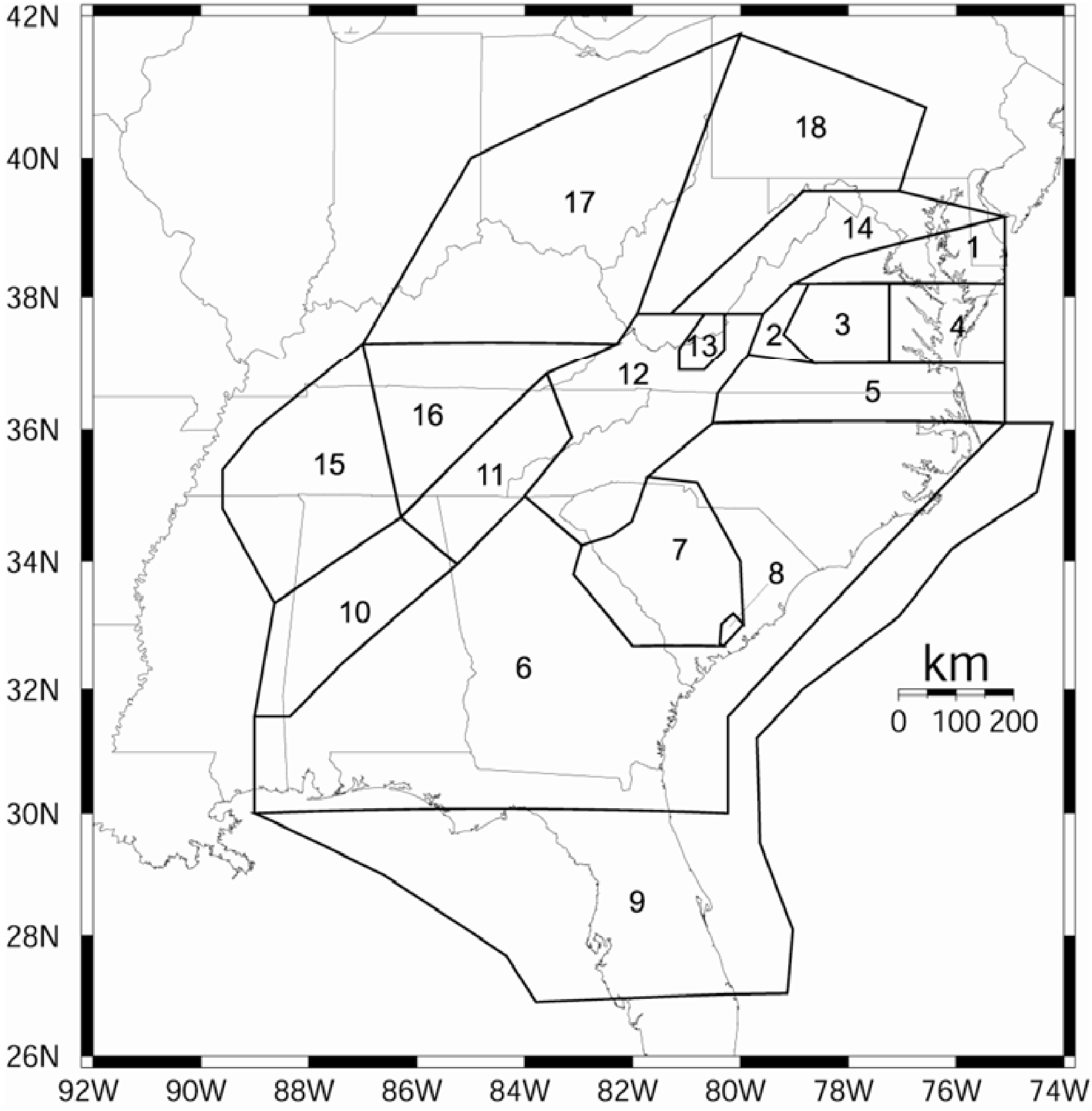


Figure 11-8, Source Areas for Non-Characteristic Earthquakes (Chapman and Talwani, 2002)

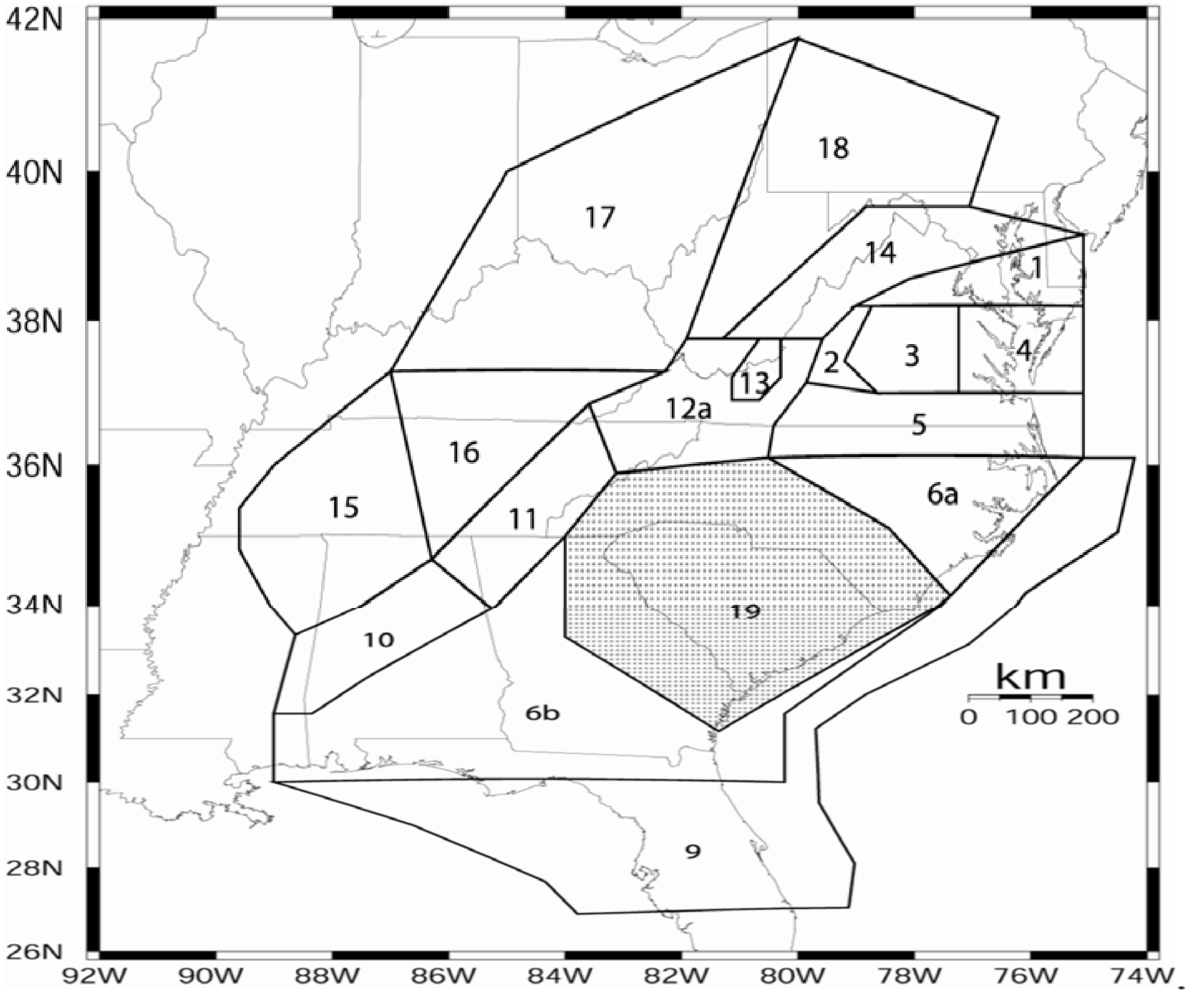


Figure 11-9, Alternative Source Areas for Non-Characteristic Earthquakes (Chapman and Talwani, 2002)

The source areas listed in Figures 11-8 and 11-9 are described in Table 11-2.

Table 11-2, Source Areas for Non-Characteristic Background Events (Chapman and Talwani, 2002)

Area No.	Description	Area (sq.miles)	Area No.	Description	Area (sq.miles)
1	Zone 1	8,133	**10**	Alabama	20,257
2	Zone 2	2,475	**11**	Eastern Tennessee	14,419
3	Central Virginia	7,713	**12**	Southern Appalachian	29,234
4	Zone 4	9,687	**12a**	Southern Appalachian N.	17,034
5	Zone 5	18,350	**13**	Giles County, VA	1,980
6	Piedmont and Coastal Plain	161,110	**14**	Central Appalachians	16,678
6a	Piedmont & CP NE	18,815	**15**	West Tennessee	29,667
6b	Piedmont & CP SW	95,854	**16**	Central Tennessee	20,630
7	SC Piedmont	22,248	**17**	Ohio – Kentucky	58,485
8	Middleton Place	455	**18**	West VA-Pennsylvania	34,049
9	Florida/Continental Margin	110,370	**19**	USGS Gridded Seis.-1996	---

Figure 11-10 shows additional historical seismic information obtained from the Virginia Tech catalog of seismicity in the Southeastern United States from 1600 to present that was used to model the non-characteristic background events in the source areas.

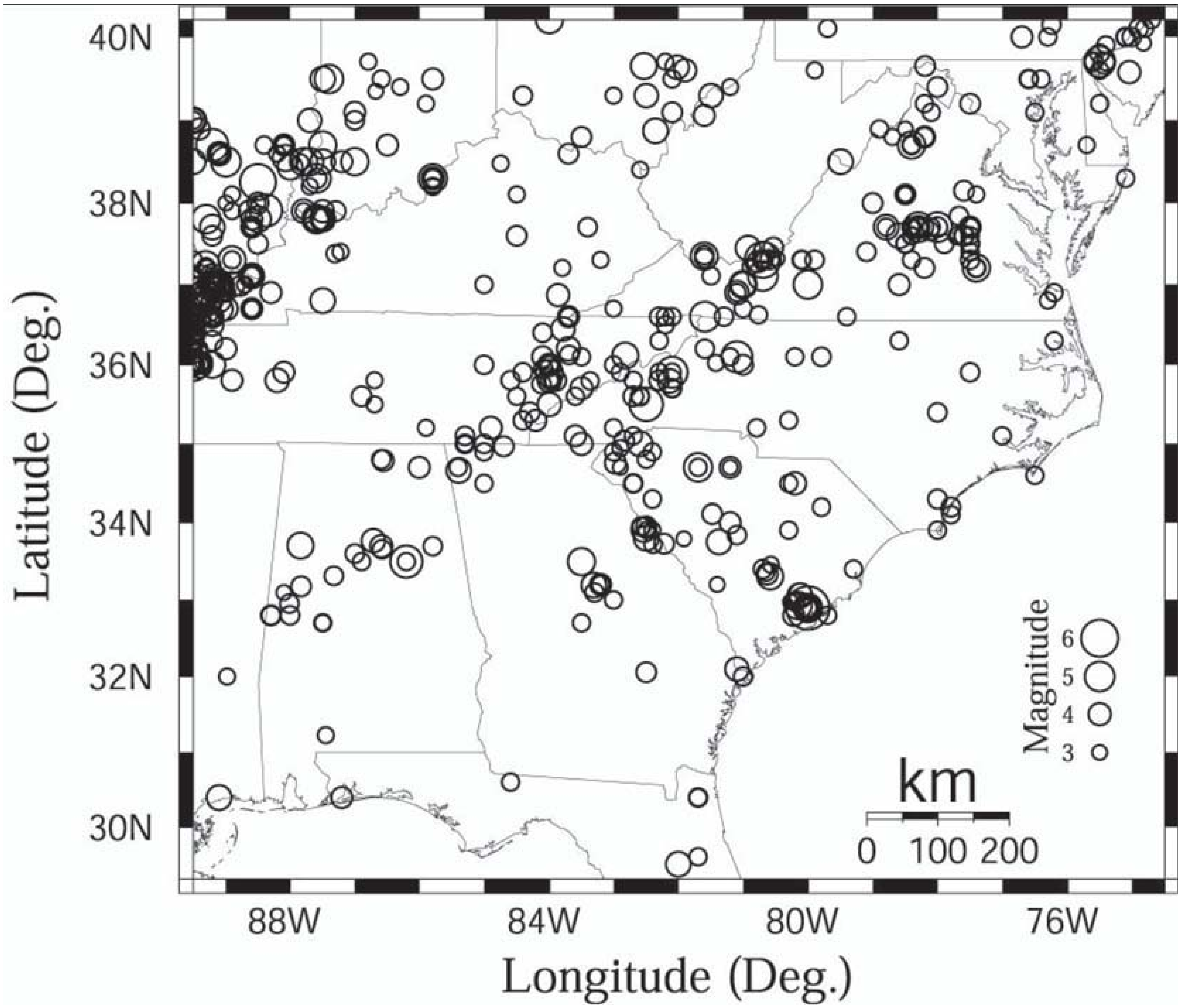


Figure 11-10, Southeastern U.S. Earthquakes (MW > 3.0 from 1600 to Present) (Chapman and Talwani, 2002)

Characteristic Earthquake Sources

The single most severe earthquake that has occurred in South Carolina's human history occurred in Charleston, South Carolina, in 1886. It was one of the largest, earthquakes to affect the Eastern United States in historical times. The MW of this earthquake has been estimated to range from 7.0 to 7.5. It is typically referred to have a MW of 7.3. The faulting source that was responsible for the 1886 Charleston earthquake remains uncertain to date.

Large magnitude earthquake events with the potential to occur in coastal South Carolina are considered characteristic earthquakes. These earthquakes are modeled as a combination of fault sources and a seismic Area Source. The SC Seismic Hazard study used the 1886 Earthquake fault source, also known as the Middleton Place seismic zone, and the "Zone of River Anomalies" (ZRA) fault source. For the 1886 Earthquake fault source it assumed that rupture occurred on the NE trending "Woodstock" fault and on the NW trending "Ashley River" fault. The 1886 Earthquake fault source is modeled as three independent parallel faults.

Recent studies (Marple and Talwani, 1993, 2000) suggest that the "Woodstock" fault may be a part of larger NE trending fault system that extends to North Carolina and possibly Virginia, referred to in the literature as the "East Coast Fault System". The ZRA fault source is the term used for the portion of the "East Coast Fault System" that is located within South Carolina. The ZRA fault system is modeled by a 145-mile long fault with a NE trend. The characteristic seismic Area Source is the same as is used in the 1996 National Seismic Hazard Maps. It models a network of individual faults no greater than 46 miles in length within the Lower Coastal Plain. The fault sources and area sources used to model the characteristic earthquake sources in the SC Seismic Hazard Study are shown in Figure 11-11.

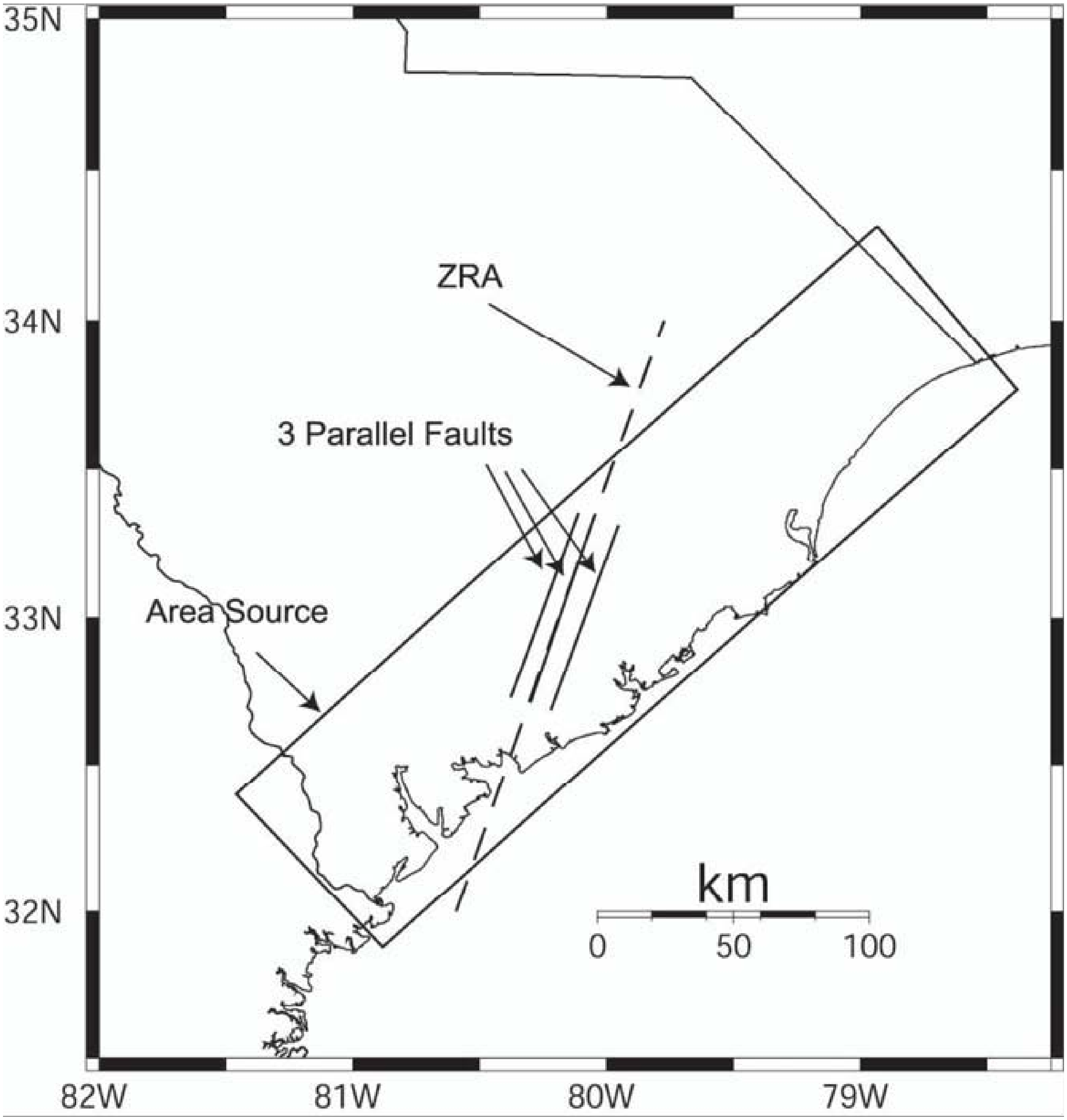
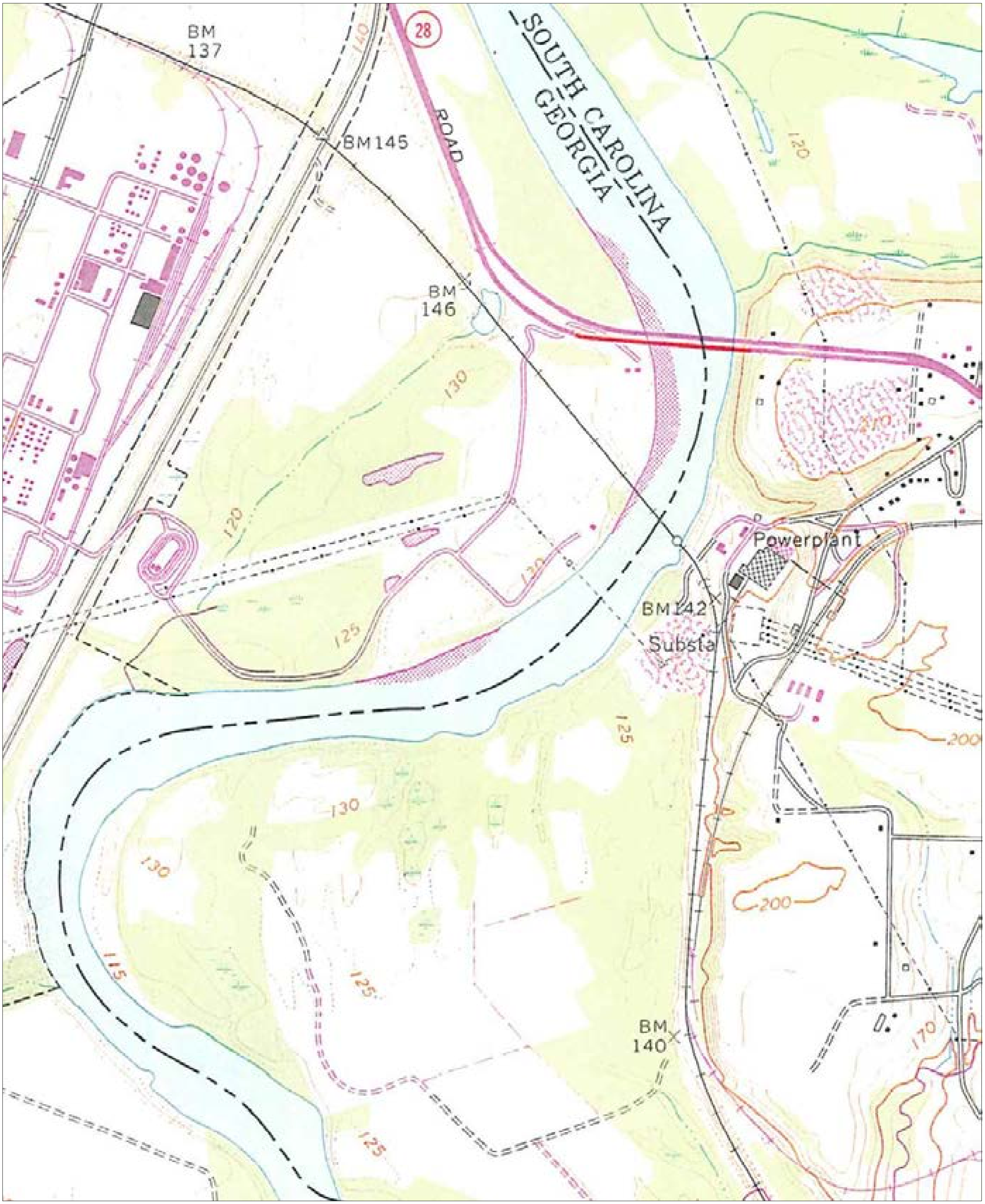


Figure 11-11, South Carolina Characteristic Earthquake Sources (Chapman and Talwani, 2002)

Appendix F

Historical Aerial and Topographic Maps



DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010
REVISIONS:
1
2
3
4
SCALE:
NONE

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COLUMBIA, SOUTH CAROLINA

1965 USGS AUGUSTA EAST QUADRANGLE

URQUHART STATION ASH POND DIKE INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE M1

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010

REVISIONS:
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SCALE:
NONE

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COLUMBIA, SOUTH CAROLINA

1943 AERIAL PHOTOGRAPH

URQUHART STATION ASH POND DIKE
INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS
PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE M2

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010
REVISIONS:
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SCALE:
NONE

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GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

1955 AERIAL PHOTOGRAPH

URQUHART STATION ASH POND DIKE
INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS
PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE M3

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010

REVISIONS:
1
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SCALE:
NONE

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GEOTECHNICAL - ENVIRONMENTAL - MATERIALS
COLUMBIA, SOUTH CAROLINA

1959 AERIAL PHOTOGRAPH

URQUHART STATION ASH POND DIKE
INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE M4

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010
REVISIONS:
1
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4
SCALE:
NONE

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COLUMBIA, SOUTH CAROLINA

1966 AERIAL PHOTOGRAPH

URQUHART STATION ASH POND DIKE
INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS
PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE M5

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010
REVISIONS:
1
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4
SCALE:
NONE

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COLUMBIA, SOUTH CAROLINA

1971 AERIAL PHOTOGRAPH

URQUHART STATION ASH POND DIKE
INVESTIGATION

AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS
PROJECT NUMBER:

G5044.00

DRAWING NUMBER:
FIGURE M6

DRWN. BY: WJG
CHKD. BY: ZWA
APPR. BY: ZWA

NOTES:

ORIGINAL:
MARCH 9, 2010
REVISIONS:
1
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SCALE:
NONE

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1979 AERIAL PHOTOGRAPH

URQUHART STATION ASH POND DIKE INVESTIGATION

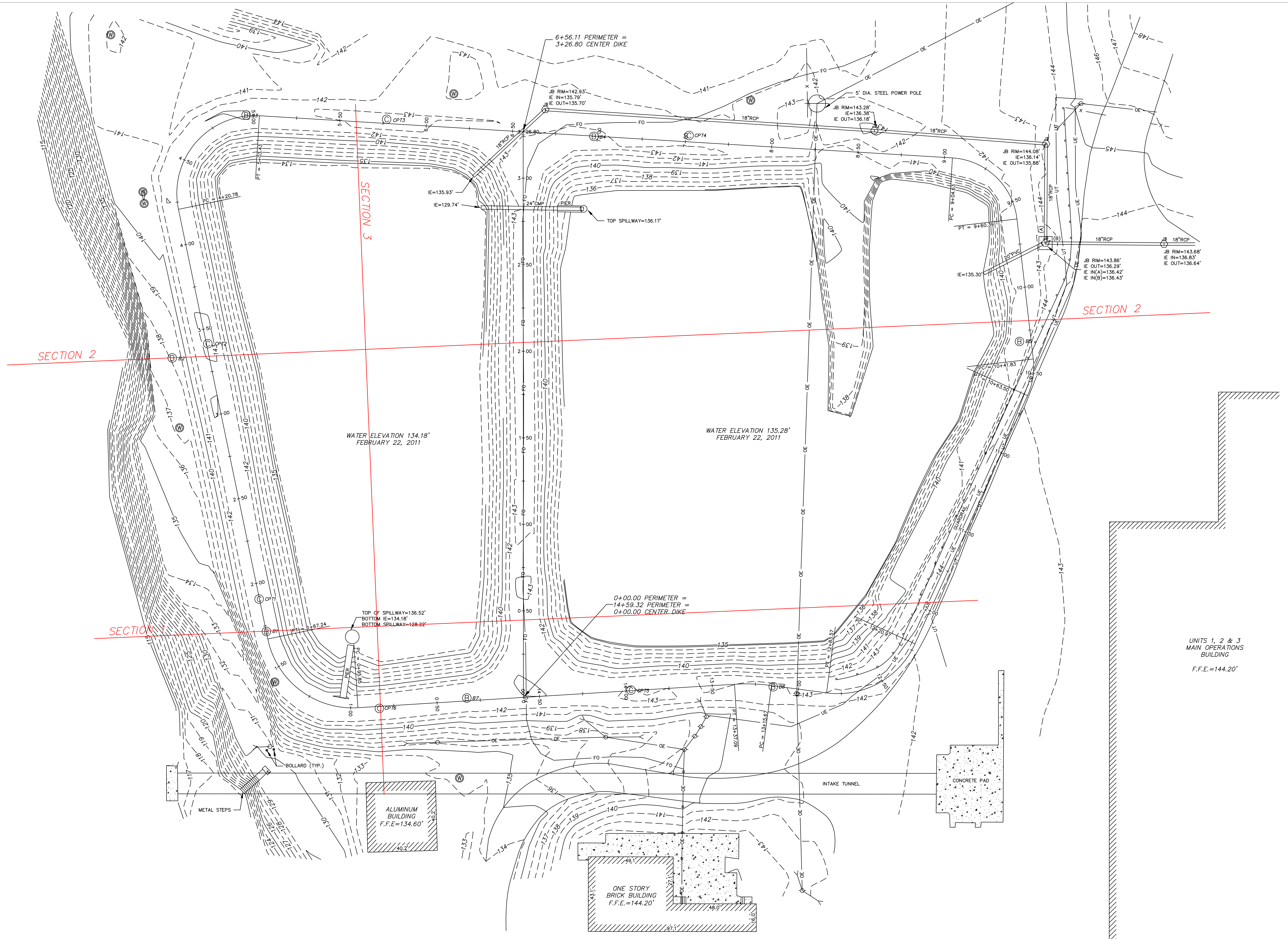
AIKEN COUNTY, SOUTH CAROLINA

F&ME CONSULTANTS PROJECT NUMBER:
G5044.00

DRAWING NUMBER:
FIGURE M7

Appendix G

Cross Sections 1, 2, & 3



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SEAL NOT VALID UNLESS SIGNED

REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE
NOTES:

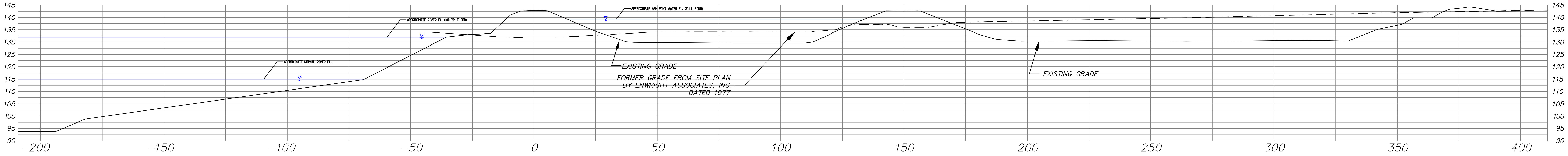
DRAWN BY:	CHECKED BY:	APPROVED BY:
JFH	MSM	ZWA

DATE: March 7, 2011

PROJECT NAME:
Urquhart Station Ash Pond Containment Structure Evaluation

DRAWING NAME:
ANALYSIS SECTION - MAP

DRAWING NUMBER:
FIGURE CS-M



SECTION 1

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REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE

NOTES:

DRAWN BY:	CHECKED BY:	APPROVED BY:
WJG	MSM	ZWA

DATE: March 9, 2011

PROJECT NAME:

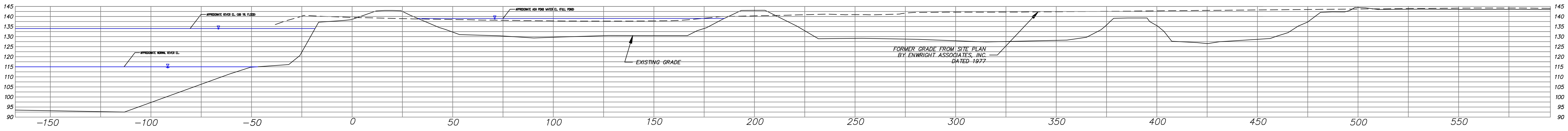
**Urquhart Station
Ash Pond
Containment
Structure
Evaluation**

DRAWING NAME:

**ANALYSIS
SECTION 1**

DRAWING NUMBER:

FIGURE CS-1



SECTION 2

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REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE

NOTES:

DRAWN BY: JFH

CHECKED BY: MSM

APPROVED BY: ZWA

DATE: March 7, 2011

PROJECT NAME:

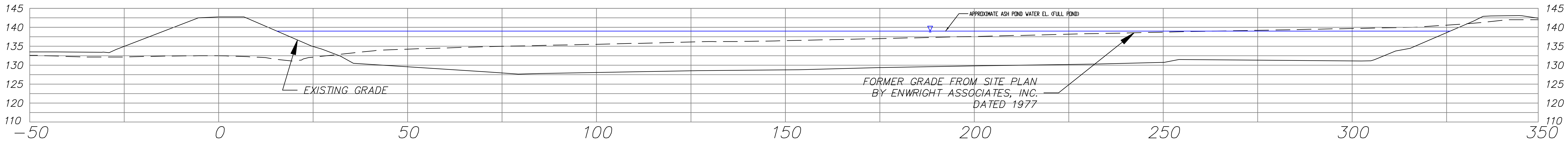
Urquhart Station Ash Pond Containment Structure Evaluation

DRAWING NAME:

ANALYSIS SECTION 2

DRAWING NUMBER:

FIGURE CS-2



SECTION 3

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REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE:
NONE

NOTES:

DRAWN BY:	CHECKED BY:	APPROVED BY:
JFH	MSM	ZWA

DATE:
March 7, 2011

PROJECT NAME:

**Urquhart Station
Ash Pond
Containment
Structure
Evaluation**

DRAWING NAME:

**ANALYSIS
SECTION 3**

DRAWING NUMBER:

FIGURE CS-3

Appendix H

Topographic Mapping

1. Topgraphic Only
2. Topographic with Stationing and 1977 Contours
3. Topographic with Borings, CPT & Cross Sections

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REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE:
NONE

NOTES:

DRAWN BY:	CHECKED BY:	APPROVED BY:
WJG	JRW	ZWA

DATE:
March, 9 2011

PROJECT NAME:

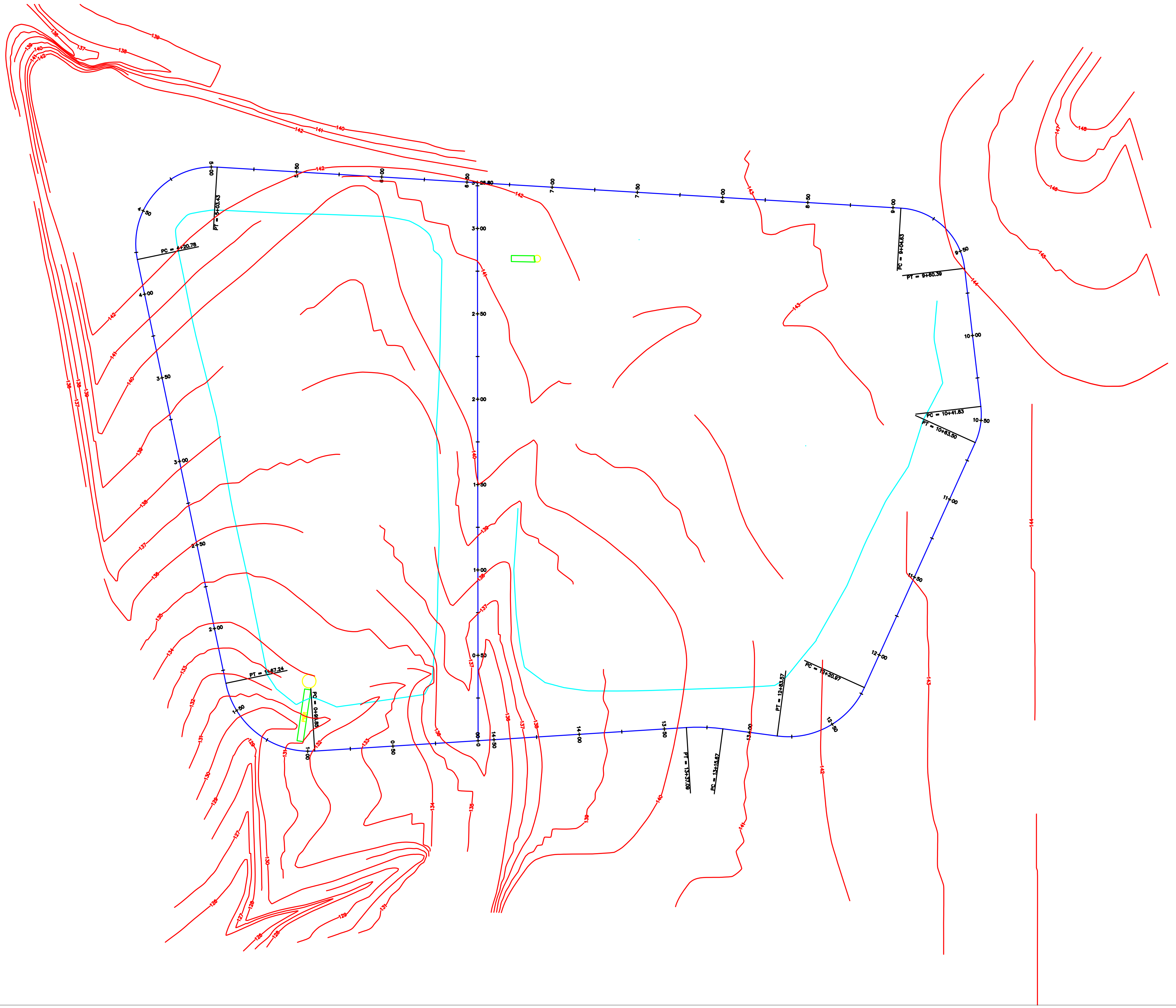
URQUHART STATION ASH POND DIKE INVESTIGATION

DRAWING NAME:

TOPOGRAPHICAL PLAN VIEW

DRAWING NUMBER:

FIGURE TM-1



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COLUMBIA, SOUTH CAROLINA

SEAL NOT VALID UNLESS SIGNED

REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE

NOTES:

DRAWN BY:	CHECKED BY:	APPROVED BY:
WJG	JRW	ZWA

DATE: March, 9 2011

PROJECT NAME:

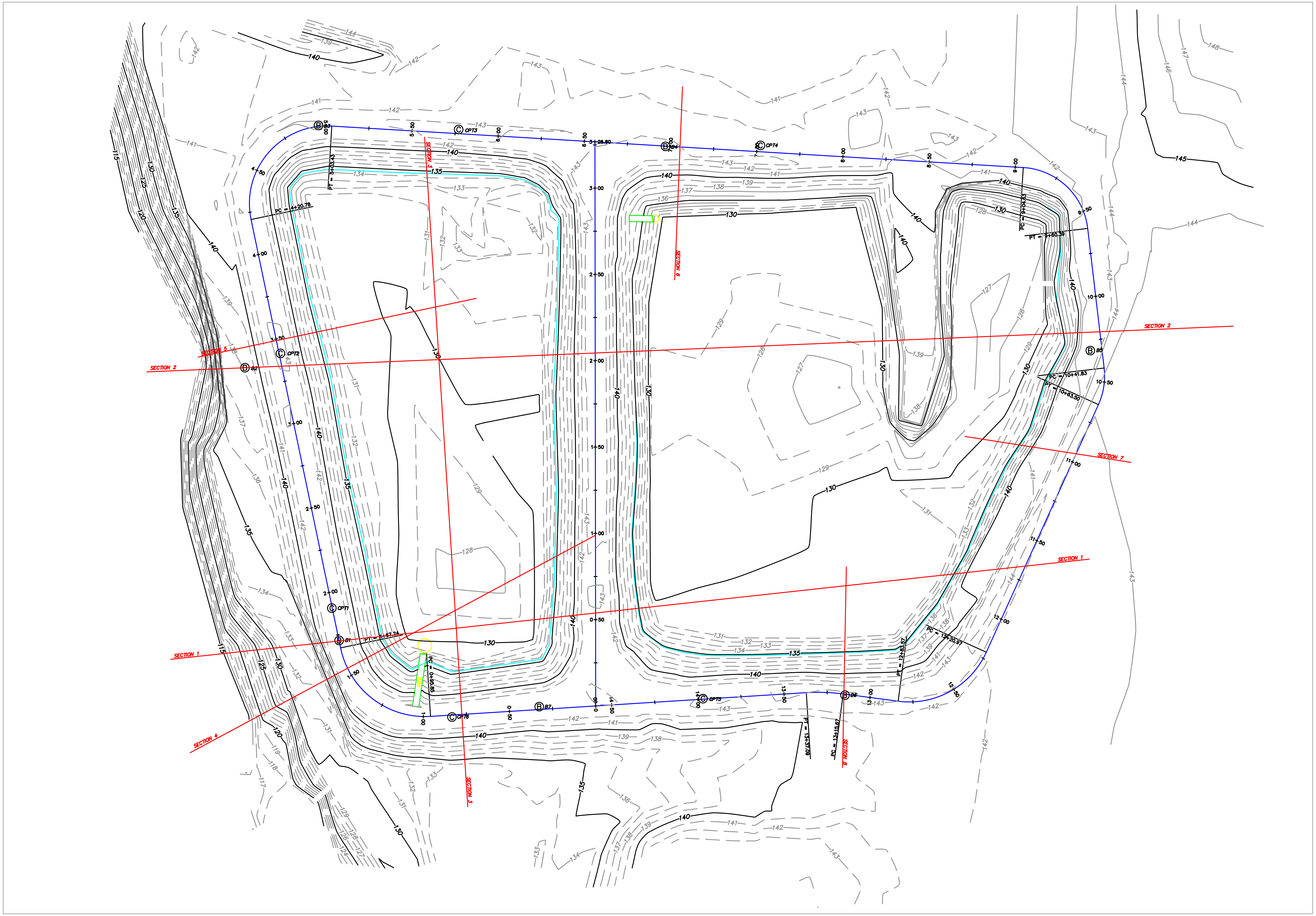
URQUHART STATION ASH POND DIKE INVESTIGATION

DRAWING NAME:

1977 TOPOGRAPHICAL PLAN VIEW W/ STATIONING

DRAWING NUMBER:

FIGURE TM-2



SEAL NOT VALID UNLESS SIGNED

REVISIONS

NO.	DESCRIPTION	DATE	BY

SCALE: NONE

NOTES:

DRAWN BY:	CHECKED BY:	APPROVED BY:
WJG	JRW	ZWA

DATE: March, 9 2011

PROJECT NAME:

Urquhart Station Ash Pond Containment Structure Evaluation

DRAWING NAME:

TOPOGRAPHICAL PLAN VIEW W/ BORINGS, CPT, AND X-SECTION

DRAWING NUMBER:

FIGURE TM-3

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APPENDIX A

Document 6

Dike Landfill Pond Inspections 2009

DIKE & LANDFILL INSPECTIONS

STATION: URQUHART

DATE OF INSPECTION: 1/8/09

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VRT
2. Pond Effluent Discharge	Initials VRT
3. Flow	Initials VRT
4. Erosion Damage on Dikes	Initials VRT
5. Seepage through Dikes	Initials VRT
6. Pond Elevations	Initials VRT
7. Pond Pumps	Initials VRT
8. Pond Flow Devices	Initials VRT
9. Pond Weirs	Initials VRT
10. Pond Outfalls	Initials VRT
11. Wastewater Treatment Equipment	Initials VRT
12. Other Pond Equipment	Initials VRT
13. Construction Activities	Initials VRT
14. Landfill Material within Permitted Boundaries	Initials VRT
15. Dust Control of Landfills	Initials VRT
16. Landfill Stormwater Collection	Initials VRT
17. Landfill Compaction	Initials VRT
18. Proper Sloping of Landfill	Initials VRT
19. Control of Landfill Erosion	Initials VRT
20. Authorized Scavenging	Initials VRT
21. Application of Final Cover	Initials VRT
22. Grading of Final Cover	Initials VRT
23. Progressive Stabilization of Final Cover	Initials VRT
24. Control of Final Cover Erosion	Initials VRT
25. Fire Protection Available	Initials VRT
26. Landfill Active	Initials VRT
27. Condition of Monitoring Wells	Initials VRT
28. Authorized Waste Being Placed into Landfill	Initials VRT
29. Authorized Operations per Permits	Initials VRT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.) No problems were encountered during the inspection of the dike & landfill. Coal Handling is working on erosion areas at this time.

Signature: Venita R Thomas Dated: 1/08/09

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 4/14/09

Area To Be Inspected | Conducted Inspection of Area

1. Pond's Condition Initials VLT
2. Pond Effluent Discharge Initials VLT
3. Flow Initials VLT
4. Erosion Damage on Dikes Initials VLT
5. Seepage through Dikes Initials VLT
6. Pond Elevations Initials VLT
7. Pond Pumps Initials VLT
8. Pond Flow Devices Initials VLT
9. Pond Weirs Initials VLT
10. Pond Outfalls Initials VLT
11. Wastewater Treatment Equipment Initials VLT
12. Other Pond Equipment Initials VLT
13. Construction Activities Initials VLT
14. Landfill Material within Permitted Boundaries Initials VLT
15. Dust Control of Landfills Initials VLT
16. Landfill Stormwater Collection Initials VLT
17. Landfill Compaction Initials VLT
18. Proper Sloping of Landfill Initials VLT
19. Control of Landfill Erosion Initials VLT
20. Authorized Scavenging Initials VLT
21. Application of Final Cover Initials VLT
22. Grading of Final Cover Initials VLT
23. Progressive Stabilization of Final Cover Initials VLT
24. Control of Final Cover Erosion Initials VLT
25. Fire Protection Available Initials VLT
26. Landfill Active Initials VLT
27. Condition of Monitoring Wells Initials VLT
28. Authorized Waste Being Placed into Landfill Initials VLT
29. Authorized Operations per Permits Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.) Work Order # M202481644 to fix erosion areas on landfill due to recent rain storms. Will have E/H Environmental to review erosion areas near Outfall 002 during inspection in May 2009.

Signature: Venita L. Thomas Dated: 4/14/09

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 7/6/09

	Area To Be Inspected	Conducted Inspection of Area
1.	Pond's Condition	Initials VLT
2.	Pond Effluent Discharge	Initials VLT
3.	Flow	Initials VLT
4.	Erosion Damage on Dikes	Initials VLT
5.	Seepage through Dikes	Initials VLT
6.	Pond Elevations	Initials VLT
7.	Pond Pumps	Initials VLT
8.	Pond Flow Devices	Initials VLT
9.	Pond Weirs	Initials VLT
10.	Pond Outfalls	Initials VLT
11.	Wastewater Treatment Equipment	Initials VLT
12.	Other Pond Equipment	Initials VLT
13.	Construction Activities	Initials VLT
14.	Landfill Material within Permitted Boundaries	Initials VLT
15.	Dust Control of Landfills	Initials VLT
16.	Landfill Stormwater Collection	Initials VLT
17.	Landfill Compaction	Initials VLT
18.	Proper Sloping of Landfill	Initials VLT
19.	Control of Landfill Erosion	Initials VLT
20.	Authorized Scavenging	Initials VLT
21.	Application of Final Cover	Initials VLT
22.	Grading of Final Cover	Initials VLT
23.	Progressive Stabilization of Final Cover	Initials VLT
24.	Control of Final Cover Erosion	Initials VLT
25.	Fire Protection Available	Initials VLT
26.	Landfill Active	Initials VLT
27.	Condition of Monitoring Wells	Initials VLT
28.	Authorized Waste Being Placed into Landfill	Initials VLT
29.	Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita L Thomas Dated: 7/6/09

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 10/6/09

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VLT
2. Pond Effluent Discharge	Initials VLT
3. Flow	Initials VLT
4. Erosion Damage on Dikes	Initials VLT
5. Seepage through Dikes	Initials VLT
6. Pond Elevations	Initials VLT
7. Pond Pumps	Initials VLT
8. Pond Flow Devices	Initials VLT
9. Pond Weirs	Initials VLT
10. Pond Outfalls	Initials VLT
11 Wastewater Treatment Equipment	Initials VLT
12. Other Pond Equipment	Initials VLT
13. Construction Activities	Initials VLT
14. Landfill Material within Permitted Boundaries	Initials VLT
15. Dust Control of Landfills	Initials VLT
16. Landfill Stormwater Collection	Initials VLT
17. Landfill Compaction	Initials VLT
18. Proper Sloping of Landfill	Initials VLT
19. Control of Landfill Erosion	Initials VLT
20. Authorized Scavenging	Initials VLT
21. Application of Final Cover	Initials VLT
22. Grading of Final Cover	Initials VLT
23. Progressive Stabilization of Final Cover	Initials VLT
24. Control of Final Cover Erosion	Initials VLT
25. Fire Protection Available	Initials VLT
26. Landfill Active	Initials VLT
27. Condition of Monitoring Wells	Initials VLT
28. Authorized Waste Being Placed into Landfill	Initials VLT
29. Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita L Thomas Dated: 10/6/09

14D-CHL-REV-8-4-99

DHEC'S NPDES ANNUAL DIKE/POND INSPECTION

Date of inspection: 9/29/09 Station: Urquhart

Pond Effluent Discharge Normal: ✓ Not Normal: ____

If not normal explain

Erosion Damage on Dike Yes ____ No ✓

If yes explain location, nature, and Corrective action:

Seepage thru Dike Yes ____ No ✓ (none seen)

If yes explain location of corrective action:

Pond Elevation Normal: ✓ Not Normal: ____

If not normal explain:

Dike/Pond Equipment condition Good ✓ Poor ____
(i.e. pumps, flow measuring devices, weirs, outfalls, etc.)

If poor explain:

Environmental/Safety Coordinator Technician

Venita L Thomas 9/29/09

APPENDIX A

Document 7

Dike Landfill Pond Inspections 2008

JANUARY 2008

DIKE & LANDFILL INSPECTIONS

STATION Urquhart

DATE OF INSPECTION 1/3/08

Area To Be Inspected	Conducted Inspection of Area
1 Pond's Condition	Initials VLT
2 Pond Effluent Discharge	Initials VLT
3. Flow	Initials VLT
4. Erosion Damage on Dikes	Initials VLT
5 Seepage through Dikes	Initials VLT
6. Pond Elevations	Initials VLT
7. Pond Pumps	Initials VLT
8. Pond Flow Devices	Initials VLT
9 Pond Weirs	Initials VLT
10 Pond Outfalls	Initials VLT
11 Wastewater Treatment Equipment	Initials VLT
12. Other Pond Equipment	Initials VLT
13. Construction Activities	Initials VLT
14. Landfill Material within Permitted Boundaries	Initials VLT
15. Dust Control of Landfills	Initials VLT
16. Landfill Stormwater Collection	Initials VLT
17. Landfill Compaction	Initials VLT
18 Proper Sloping of Landfill	Initials VLT
19. Control of Landfill Erosion	Initials VLT
20 Authorized Scavenging	Initials VLT
21. Application of Final Cover	Initials VLT
22. Grading of Final Cover	Initials VLT
23. Progressive Stabilization of Final Cover	Initials VLT
24 Control of Final Cover Erosion	Initials VLT
25. Fire Protection Available	Initials VLT
26. Landfill Active	Initials VLT
27 Condition of Monitoring Wells	Initials VLT
28. Authorized Waste Being Placed into Landfill	Initials VLT
29. Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number. note--(if concern/problem can not be handled by Plant personnel immediately contact Environmental/Safety Coordinator.)

Erosion at pond near Landfill. Work Order # M202223628 to order dirt & backfill erosion area at pond. (Low volume pond #1)

Signature: Venita L Thomas Dated 1/5/08

J4D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart DATE OF INSPECTION 4/3/08

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VLT
2. Pond Effluent Discharge	Initials VLT
3. Flow	Initials VLT
4. Erosion Damage on Dikes	Initials VLT
5. Seepage through Dikes	Initials VLT
6. Pond Elevations	Initials VLT
7. Pond Pumps	Initials VLT
8. Pond Flow Devices	Initials VLT
9 Pond Weirs	Initials VLT
10. Pond Outfalls	Initials VLT
11. Wastewater Treatment Equipment	Initials VLT
12. Other Pond Equipment	Initials VLT
13. Construction Activities	Initials VLT
14. Landfill Material within Permitted Boundaries	Initials VLT
15. Dust Control of Landfills	Initials VLT
16. Landfill Stormwater Collection	Initials VLT
17. Landfill Compaction	Initials VLT
18. Proper Sloping of Landfill	Initials VLT
19. Control of Landfill Erosion	Initials VLT
20. Authorized Scavenging	Initials VLT
21. Application of Final Cover	Initials VLT
22. Grading of Final Cover	Initials VLT
23. Progressive Stabilization of Final Cover	Initials VLT
24 Control of Final Cover Erosion	Initials VLT
25. Fire Protection Available	Initials VLT
26. Landfill Active	Initials VLT
27 Condition of Monitoring Wells	Initials VLT
28. Authorized Waste Being Placed into Landfill	Initials VLT
29. Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita L T Dated 4/3/08

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 7/3/08

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VRT
2. Pond Effluent Discharge	Initials VRT
3. Flow	Initials VRT
4. Erosion Damage on Dikes	Initials VRT
5. Seepage through Dikes	Initials VRT
6. Pond Elevations	Initials VRT
7. Pond Pumps	Initials VRT
8. Pond Flow Devices	Initials VRT
9. Pond Weirs	Initials VRT
10. Pond Outfalls	Initials VRT
11. Wastewater Treatment Equipment	Initials VRT
12. Other Pond Equipment	Initials VRT
13. Construction Activities	Initials VRT
14 Landfill Material within Permitted Boundaries	Initials VRT
15. Dust Control of Landfills	Initials VRT
16. Landfill Stormwater Collection	Initials VRT
17. Landfill Compaction	Initials VRT
18. Proper Sloping of Landfill	Initials VRT
19. Control of Landfill Erosion	Initials VRT
20. Authorized Scavenging	Initials VRT
21. Application of Final Cover	Initials VRT
22. Grading of Final Cover	Initials VRT
23. Progressive Stabilization of Final Cover	Initials VRT
24. Control of Final Cover Erosion	Initials VRT
25. Fire Protection Available	Initials VRT
26. Landfill Active	Initials VRT
27. Condition of Monitoring Wells	Initials VRT
28. Authorized Waste Being Placed into Landfill	Initials VRT
29. Authorized Operations per Permits	Initials VRT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita R Thomas Dated: 7/3/08

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 10/7/08

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VLT
2. Pond Effluent Discharge	Initials VLT
3. Flow	Initials VLT
4. Erosion Damage on Dikes	Initials VLT
5. Seepage through Dikes	Initials VLT
6. Pond Elevations	Initials VLT
7 Pond Pumps	Initials VLT
8. Pond Flow Devices	Initials VLT
9. Pond Weirs	Initials VLT
10. Pond Outfalls	Initials VLT
11. Wastewater Treatment Equipment	Initials VLT
12. Other Pond Equipment	Initials VLT
13. Construction Activities	Initials VLT
14 Landfill Material within Permitted Boundaries	Initials VLT
15. Dust Control of Landfills	Initials VLT
16. Landfill Stormwater Collection	Initials VLT
17. Landfill Compaction	Initials VLT
18. Proper Sloping of Landfill	Initials VLT
19. Control of Landfill Erosion	Initials VLT
20. Authorized Scavenging	Initials VLT
21. Application of Final Cover	Initials VLT
22. Grading of Final Cover	Initials VLT
23. Progressive Stabilization of Final Cover	Initials VLT
24. Control of Final Cover Erosion	Initials VLT
25. Fire Protection Available	Initials VLT
26. Landfill Active	Initials VLT
27. Condition of Monitoring Wells	Initials VLT
28. Authorized Waste Being Placed into Landfill	Initials VLT
29. Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita L Thomas Dated: 10/7/08

14D-CHL-REV-8-4-99

DHEC'S NPDES ANNUAL DIKE/POND INSPECTION

Date of inspection: 10/6/08 Station: URQUHART

Pond Effluent Discharge Normal: ______ Not Normal: ✓

If not normal explain Plant is discharging into the pond heavily due to complications with the gate in the hoppers

Erosion Damage on Dike Yes ______ No ✓

If yes explain location, nature, and Corrective action:

Seepage thru Dike Yes ______ No ✓

If yes explain location of corrective action:

Pond Elevation Normal: ______ Not Normal: ✓

If not normal explain: Elevation is getting higher due to excess amount of ash into the pond. Permit will be requested to dredge pond at the end of the month (Oct 2008). Note: Dredging work was completed November 2008. VLT 12/1/08

Dike/Pond Equipment condition Good ✓ Poor ______
(i.e. pumps, flow measuring devices, weirs, outfalls, etc.)

If poor explain:

Environmental/Safety Coordinator Technician

Venita L Thomas
10/6/08

APPENDIX A

Document 8

Dike Landfill Pond Inspections 2007

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart Station

DATE OF INSPECTION: 1/15/07

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials
2. Pond Effluent Discharge	Initials
3. Flow	Initials
4. Erosion Damage on Dikes	Initials
5. Seepage through Dikes	Initials
6. Pond Elevations	Initials
7. Pond Pumps	Initials
8. Pond Flow Devices	Initials
9 Pond Weirs	Initials
10. Pond Outfalls	Initials
11. Wastewater Treatment Equipment	Initials
12. Other Pond Equipment	Initials
13. Construction Activities	Initials
14. Landfill Material within Permitted Boundaries	Initials
15. Dust Control of Landfills	Initials
16. Landfill Stormwater Collection	Initials
17. Landfill Compaction	Initials
18. Proper Sloping of Landfill	Initials
19. Control of Landfill Erosion	Initials
20. Authorized Scavenging	Initials
21. Application of Final Cover	Initials
22. Grading of Final Cover	Initials
23. Progressive Stabilization of Final Cover	Initials
24. Control of Final Cover Erosion	Initials
25. Fire Protection Available	Initials
26. Landfill Active	Initials
27. Condition of Monitoring Wells	Initials
28. Authorized Waste Being Placed into Landfill	Initials
29. Authorized Operations per Permits	Initials

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Dal Jerome

Dated: 1/15/07

14D-CHL-REV 8-4-99

2nd Quarter

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 6/20/07

	Area To Be Inspected	Conducted Inspection of Area
1.	Pond's Condition	Initials VLT
2.	Pond Effluent Discharge	Initials VLT
3.	Flow	Initials VLT
4.	Erosion Damage on Dikes	Initials VLT
5.	Seepage through Dikes	Initials VLT
6.	Pond Elevations	Initials VLT
7.	Pond Pumps	Initials VLT
8.	Pond Flow Devices	Initials VLT
9.	Pond Weirs	Initials VLT
10.	Pond Outfalls	Initials VLT
11.	Wastewater Treatment Equipment	Initials VLT
12.	Other Pond Equipment	Initials VLT
13.	Construction Activities	Initials VLT
14.	Landfill Material within Permitted Boundaries	Initials VLT
15.	Dust Control of Landfills	Initials VLT
16.	Landfill Stormwater Collection	Initials VLT
17.	Landfill Compaction	Initials VLT
18.	Proper Sloping of Landfill	Initials VLT
19.	Control of Landfill Erosion	Initials VLT
20.	Authorized Scavenging	Initials VLT
21.	Application of Final Cover	Initials VLT
22.	Grading of Final Cover	Initials VLT
23.	Progressive Stabilization of Final Cover	Initials VLT
24	Control of Final Cover Erosion	Initials VLT
25.	Fire Protection Available	Initials VLT
26.	Landfill Active	Initials VLT
27.	Condition of Monitoring Wells	Initials VLT
28.	Authorized Waste Being Placed into Landfill	Initials VLT
29.	Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita L Thomas Dated: 6/21/07

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 7/12/07

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VLT
2. Pond Effluent Discharge	Initials VLT
3. Flow	Initials VLT
4. Erosion Damage on Dikes	Initials VLT
5. Seepage through Dikes	Initials VLT
6. Pond Elevations	Initials VLT
7. Pond Pumps	Initials VLT
8. Pond Flow Devices	Initials VLT
9. Pond Weirs	Initials VLT
10. Pond Outfalls	Initials VLT
11. Wastewater Treatment Equipment	Initials VLT
12. Other Pond Equipment	Initials VLT
13. Construction Activities	Initials VLT N/A
14. Landfill Material within Permitted Boundaries	Initials VLT
15. Dust Control of Landfills	Initials VLT Very Good
16. Landfill Stormwater Collection	Initials VLT
17. Landfill Compaction	Initials VLT
18. Proper Sloping of Landfill	Initials VLT
19. Control of Landfill Erosion	Initials VLT
20. Authorized Scavenging	Initials VLT
21. Application of Final Cover	Initials VLT
22. Grading of Final Cover	Initials VLT
23. Progressive Stabilization of Final Cover	Initials VLT
24. Control of Final Cover Erosion	Initials VLT
25. Fire Protection Available	Initials VLT
26. Landfill Active	Initials VLT
27. Condition of Monitoring Wells	Initials VLT
28. Authorized Waste Being Placed into Landfill	Initials VLT
29. Authorized Operations per Permits	Initials VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note—(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

No problems Were encountered.

Signature Venita L Thomas Dated 7/12/07

J4D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 10/25/07

	Area To Be Inspected	Conducted Inspection of Area
1.	Pond's Condition	Initials VLT
2.	Pond Effluent Discharge	Initials VLT
3.	Flow	Initials VLT
4.	Erosion Damage on Dikes	Initials L
5.	Seepage through Dikes	Initials N/A
6.	Pond Elevations	Initials ✓ VLT
7.	Pond Pumps	Initials ✓ VLT
8.	Pond Flow Devices	Initials ✓ VLT
9.	Pond Weirs	Initials ✓ VLT
10	Pond Outfalls	Initials ✓ VLT
11.	Wastewater Treatment Equipment	Initials ✓ VLT
12.	Other Pond Equipment	Initials ✓ VL
13.	Construction Activities	Initials ✓ VLT
14.	Landfill Material within Permitted Boundaries	Initials ✓ VLT
15.	Dust Control of Landfills	Initials ✓ VLT
16.	Landfill Stormwater Collection	Initials ✓ VLT
17.	Landfill Compaction	Initials ✓ VLT
18.	Proper Sloping of Landfill	Initials ✓ VLT
19.	Control of Landfill Erosion	Initials ✓ VLT
20.	Authorized Scavenging	Initials
21.	Application of Final Cover	Initials ✓ VLT
22.	Grading of Final Cover	Initials ✓ VLT
23	Progressive Stabilization of Final Cover	Initials ✓ VLT
24.	Control of Final Cover Erosion	Initials ✓ VLT
25	Fire Protection Available	Initials ✓ VLT
26.	Landfill Active	Initials ✓ VLT
27.	Condition of Monitoring Wells	Initials ✓ VLT
28.	Authorized Waste Being Placed into Landfill	Initials ✓ VLT
29.	Authorized Operations per Permits	Initials ✓ VLT

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Venita L Thomas Dated: 10/25/07

I4D-CHL-REV-8-4-99

DHEC'S NPDES ANNUAL DIKE/POND INSPECTION

Date of inspection: 10/22/07 Station: Urquhart

Pond Effluent Discharge [✓ Normal:] Not Normal:

If not normal explain

Erosion Damage on Dike Yes [✓ No]

If yes explain location, nature, and Corrective action:

Seepage thru Dike Yes [✓ No]

If yes explain location of corrective action:

Pond Elevation [✓ Normal:] Not Normal:

If not normal explain:

Dike/Pond Equipment condition [✓ Good] Poor
(i.e. pumps, flow measuring devices, weirs, outfalls, etc.)

If poor explain:

Environmental/Safety Coordinator Technician Venita Thomas / Venita L Thomas
10/22/07

APPENDIX A

Document 9

Dike Landfill Pond Inspections 2006

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION 2/28/06

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials KAP
2 Pond Effluent Discharge	Initials KAP
3. Flow	Initials KAP
4. Erosion Damage on Dikes	Initials KAP
5. Seepage through Dikes	Initials KAP
6. Pond Elevations	Initials KAP
7. Pond Pumps	Initials NA
8. Pond Flow Devices	Initials KAP
9 Pond Weirs	Initials KAP - WO to check Ash Ponds
10. Pond Outfalls	Initials KAP
11. Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP-NA
13. Construction Activities	Initials KAP - sloping landfill -
14 Landfill Material within Permitted Boundaries	Initials KAP
15. Dust Control of Landfills	Initials KAP
16. Landfill Stormwater Collection	Initials KAP
17 Landfill Compaction	Initials KAP - in work
18 Proper Sloping of Landfill	Initials KAP - In work
19. Control of Landfill Erosion	Initials KAP
20. Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22. Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials NA
24. Control of Final Cover Erosion	Initials NA
25. Fire Protection Available	Initials NA
26. Landfill Active	Initials KAP
27. Condition of Monitoring Wells	Initials KAP
28. Authorized Waste Being Placed into Landfill	Initials KAP
29 Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number. note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Dated: 2/28/06

J4D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 5/31/06

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials KAP
2. Pond Effluent Discharge	Initials KAP
3. Flow	Initials KAP
4. Erosion Damage on Dikes	Initials KAP
5. Seepage through Dikes	Initials KAP
6. Pond Elevations	Initials KAP
7 Pond Pumps	Initials NA
8. Pond Flow Devices	Initials KAP
9. Pond Weirs	Initials KAP
10. Pond Outfalls	Initials KAP
11 Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP
13. Construction Activities	Initials NA
14. Landfill Material within Permitted Boundaries	Initials KAP
15. Dust Control of Landfills	Initials KAP - see below
16. Landfill Stormwater Collection	Initials KAP
17. Landfill Compaction	Initials KAP - see below
18. Proper Sloping of Landfill	Initials KAP
19. Control of Landfill Erosion	Initials KAP - see below
20 Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22. Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials NA
24. Control of Final Cover Erosion	Initials NA
25. Fire Protection Available	Initials KAP
26. Landfill Active	Initials KAP
27. Condition of Monitoring Wells	Initials KAP
28. Authorized Waste Being Placed into Landfill	Initials KAP
29. Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.) Landfill is still a dust bowl. Every effort to water is being taken. Dry conditions are not helping. Compaction may be a problem. Working w/ CH Spv. to correct. Once the sloping project is complete - dirt/grass will be added to the [illegible] soon.

Signature: ______ Dated 5/31/06

14D-CHL-REV 8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 8/25/06

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials KAP
2. Pond Effluent Discharge	Initials KAP
3. Flow	Initials KAP
4. Erosion Damage on Dikes	Initials KAP
5 Seepage through Dikes	Initials KAP
6. Pond Elevations	Initials KAP
7. Pond Pumps	Initials NA
8 Pond Flow Devices	Initials KAP
9. Pond Weirs	Initials KAP
10. Pond Outfalls	Initials KAP
11. Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP
13. Construction Activities	Initials NA
14. Landfill Material within Permitted Boundaries	Initials KAP
15 Dust Control of Landfills	Initials KAP
16. Landfill Stormwater Collection	Initials KAP
17. Landfill Compaction	Initials KAP
18. Proper Sloping of Landfill	Initials KAP
19. Control of Landfill Erosion	Initials KAP
20 Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22. Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials NA
24. Control of Final Cover Erosion	Initials NA
25. Fire Protection Available	Initials NA
26. Landfill Active	Initials KAP
27. Condition of Monitoring Wells	Initials KAP
28. Authorized Waste Being Placed into Landfill	Initials KAP
29. Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: ______________________ Dated 8/25/06

14D-CHL-REV 8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 10/26/06

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials KAP
2. Pond Effluent Discharge	Initials KAP
3. Flow	Initials KAP
4. Erosion Damage on Dikes	Initials KAP
5. Seepage through Dikes	Initials KAP
6. Pond Elevations	Initials KAP
7 Pond Pumps	Initials KAP
8. Pond Flow Devices	Initials KAP
9. Pond Weirs	Initials KAP
10. Pond Outfalls	Initials KAP
11. Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP
13. Construction Activities	Initials NA
14 Landfill Material within Permitted Boundaries	Initials KAP
15. Dust Control of Landfills	Initials KAP
16. Landfill Stormwater Collection	Initials KAP
17. Landfill Compaction	Initials KAP
18. Proper Sloping of Landfill	Initials KAP
19. Control of Landfill Erosion	Initials KAP
20. Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22. Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials NA
24. Control of Final Cover Erosion	Initials NA
25. Fire Protection Available	Initials NA
26. Landfill Active	Initials KAP
27. Condition of Monitoring Wells	Initials KAP
28. Authorized Waste Being Placed into Landfill	Initials KAP
29. Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: ______________________ Dated: 10/26/06

14D-CHL-REV 8-4-99

DHEC'S NPDES ANNUAL DIKE/POND INSPECTION

Date of inspection: 10/26/06 Station: Urquhart

Pond Effluent Discharge Normal: X Not Normal: ____

If not normal explain

Erosion Damage on Dike Yes X No ____

If yes explain location, nature, and Corrective action:

Need to reseed ashpond dike

Seepage thru Dike Yes ____ No X

If yes explain location of corrective action:

Pond Elevation Normal: X Not Normal: ____

If not normal explain:

Dike/Pond Equipment condition Good X Poor ____
(i.e. pumps, flow measuring devices, weirs, outfalls, etc.)

If poor explain:

Environmental/Safety Coordinator Technician

APPENDIX A

Document 10

Dike Landfill Pond Inspections 2005

DIKE & LANDFILL INSPECTIONS

STATION Urquhart

DATE OF INSPECTION: 3/31/05

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials VAP
2. Pond Effluent Discharge	Initials VAP
3. Flow	Initials VAP
4. Erosion Damage on Dikes	Initials VAP
5. Seepage through Dikes	Initials VAP
6. Pond Elevations	Initials VAP
7. Pond Pumps	Initials NA
8. Pond Flow Devices	Initials VAP
9. Pond Weirs	Initials VAP
10. Pond Outfalls	Initials VAP
11. Wastewater Treatment Equipment	Initials VAP
12. Other Pond Equipment	Initials VAP
13. Construction Activities	Initials NA
14. Landfill Material within Permitted Boundaries	Initials VAP
15. Dust Control of Landfills	Initials VAP
16. Landfill Stormwater Collection	Initials VAP
17. Landfill Compaction	Initials VAP
18 Proper Sloping of Landfill	Initials VAP
19. Control of Landfill Erosion	Initials VAP
20. Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22. Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials NA
24. Control of Final Cover Erosion	Initials NA
25. Fire Protection Available	Initials NA
26. Landfill Active	Initials VAP
27. Condition of Monitoring Wells	Initials VAP
28. Authorized Waste Being Placed into Landfill	Initials VAP
29. Authorized Operations per Permits	Initials VAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Dated 3/31/05

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart DATE OF INSPECTION: 4/29/05

Area To Be Inspected	Conducted Inspection of Area
1 Pond's Condition	Initials KAP
2. Pond Effluent Discharge	Initials KAP
3. Flow	Initials KAP
4. Erosion Damage on Dikes	Initials KAP
5. Seepage through Dikes	Initials KAP
6. Pond Elevations	Initials KAP
7 Pond Pumps	Initials NA
8. Pond Flow Devices	Initials KAP
9 Pond Weirs	Initials KAP
10 Pond Outfalls	Initials KAP
11. Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP
13. Construction Activities	Initials NA
14. Landfill Material within Permitted Boundaries	Initials KAP
15. Dust Control of Landfills	Initials KAP
16. Landfill Stormwater Collection	Initials KAP
17. Landfill Compaction	Initials KAP
18. Proper Sloping of Landfill	Initials KAP
19. Control of Landfill Erosion	Initials KAP
20. Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22 Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials NA
24. Control of Final Cover Erosion	Initials NA
25 Fire Protection Available	Initials NA
26. Landfill Active	Initials KAP
27 Condition of Monitoring Wells	Initials KAP
28. Authorized Waste Being Placed into Landfill	Initials KAP
29. Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Dated: 4/29/05

14D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION Urquhart

DATE OF INSPECTION: 7/28/05

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials ✓ KAP
2. Pond Effluent Discharge	Initials ✓ KAP
3. Flow	Initials ✓ KAP
4. Erosion Damage on Dikes	Initials → Was written KAP
5. Seepage through Dikes	Initials KAP
6. Pond Elevations	Initials KAP
7. Pond Pumps	Initials NA
8. Pond Flow Devices	Initials KAP
9. Pond Weirs	Initials KAP
10. Pond Outfalls	Initials KAP
11. Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP
13. Construction Activities	Initials NA
14. Landfill Material within Permitted Boundaries	Initials KAP
15. Dust Control of Landfills	Initials KAP
16. Landfill Stormwater Collection	Initials KAP
17. Landfill Compaction	Initials KAP
18. Proper Sloping of Landfill	Initials KAP
19. Control of Landfill Erosion	Initials KAP
20. Authorized Scavenging	Initials NA
21. Application of Final Cover	Initials NA
22. Grading of Final Cover	Initials NA
23. Progressive Stabilization of Final Cover	Initials KAP
24. Control of Final Cover Erosion	Initials KAP
25. Fire Protection Available	Initials NA
26. Landfill Active	Initials KAP
27. Condition of Monitoring Wells	Initials → was written to department
28. Authorized Waste Being Placed into Landfill	Initials KAP
29. Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: Kimberly [illegible] Dated 7/28/05

J4D-CHL-REV-8-4-99

DIKE & LANDFILL INSPECTIONS

STATION: Urquhart

DATE OF INSPECTION: 10/31/05

Area To Be Inspected	Conducted Inspection of Area
1. Pond's Condition	Initials KAP
2. Pond Effluent Discharge	Initials KAP
3. Flow	Initials KAP
4. Erosion Damage on Dikes - None of concern	Initials KAP
5. Seepage through Dikes - None	Initials KAP
6. Pond Elevations	Initials KAP
7 Pond Pumps	Initials NA
8. Pond Flow Devices	Initials KAP
9 Pond Weirs	Initials KAP
10. Pond Outfalls	Initials KAP
11. Wastewater Treatment Equipment	Initials KAP
12. Other Pond Equipment	Initials KAP
13. Construction Activities	Initials NA
14. Landfill Material within Permitted Boundaries	Initials KAP
15. Dust Control of Landfills - needs watered	Initials KAP -
16. Landfill Stormwater Collection	Initials KAP
17. Landfill Compaction - no Reg limit	Initials KAP -
18 Proper Sloping of Landfill - need to go to 3:1	Initials KAP -
19. Control of Landfill Erosion	Initials KAP
20. Authorized Scavenging - none	Initials KAP
21. Application of Final Cover - NA	Initials NA
22. Grading of Final Cover - NA	Initials NA
23. Progressive Stabilization of Final Cover - NA	Initials NA
24. Control of Final Cover Erosion - NA	Initials NA
25. Fire Protection Available -	Initials KAP
26. Landfill Active	Initials KAP
27. Condition of Monitoring Wells - In work	Initials KAP
28. Authorized Waste Being Placed into Landfill	Initials KAP
29. Authorized Operations per Permits	Initials KAP

List Comments or Concerns/Problems and Corrective Action Plant Work Order Number: note--(if concern/problem can not be handled by Plant personnel Immediately contact Environmental/Safety Coordinator.)

Signature: ______________ Dated 10/31/05

14D-CHL-REV-8-4-99

DHEC'S NPDES ANNUAL DIKE/POND INSPECTION

Date of inspection: 10/31/05 Station: Urquhart

Pond Effluent Discharge Normal: X Not Normal:

If not normal explain

Erosion Damage on Dike Yes No X

If yes explain location, nature, and Corrective action:

Seepage thru Dike Yes No X

If yes explain location of corrective action:

Pond Elevation Normal: X Not Normal:

If not normal explain:

Dike/Pond Equipment condition Good X Poor
(i.e. pumps, flow measuring devices, weirs, outfalls, etc.)

If poor explain:

Environmental/Safety Coordinator Technician

APPENDIX B

Document 11

Dam Inspection Check List Form

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:
Date:
Unit Name:
Operator's Name:
Unit I.D.:
Hazard Potential Classification: High Significant Low
Inspector's Name:

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	QTRLY ANNUALLY		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	135.8		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?			20. Decant Pipes:	■	■
4. Open channel spillway elevation (operator records)?			Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	144.0		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?		✓	Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):	■	■
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

[illegible]

EPA FORM XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # INSPECTOR
Date

Impoundment Name
Impoundment Company
EPA Region
State Agency (Field Office) Addresss

Name of Impoundment
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New Update

	Yes	No
Is impoundment currently under construction?		
Is water or ccw currently being pumped into the impoundment?		

IMPOUNDMENT FUNCTION:

Nearest Downstream Town : Name
Distance from the impoundment
Impoundment

Location:	Longitude	Degrees	Minutes	Seconds
	Latitude	Degrees	Minutes	Seconds
	State	County		

Does a state agency regulate this impoundment? YES NO

If So Which State Agency?

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur);

LESS THAN LOW HAZARD POTENTIAL: Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

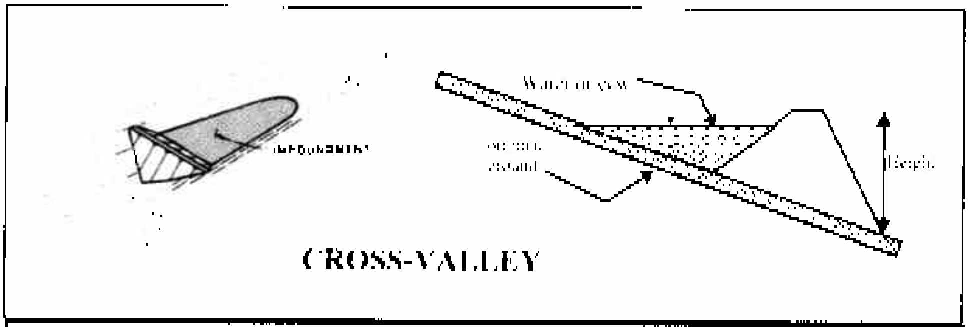
LOW HAZARD POTENTIAL: Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

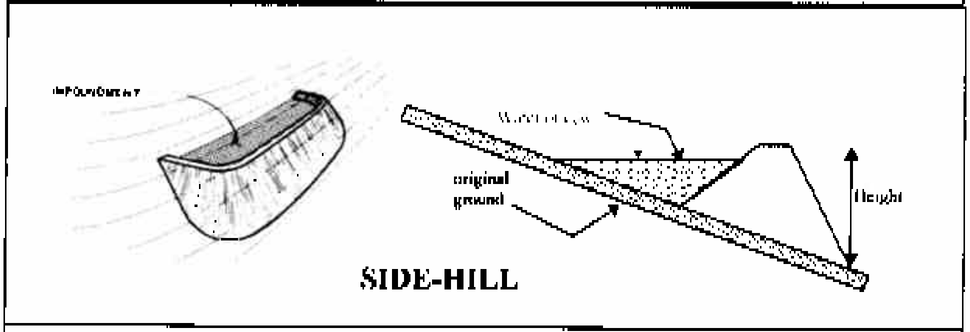
SIGNIFICANT HAZARD POTENTIAL: Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

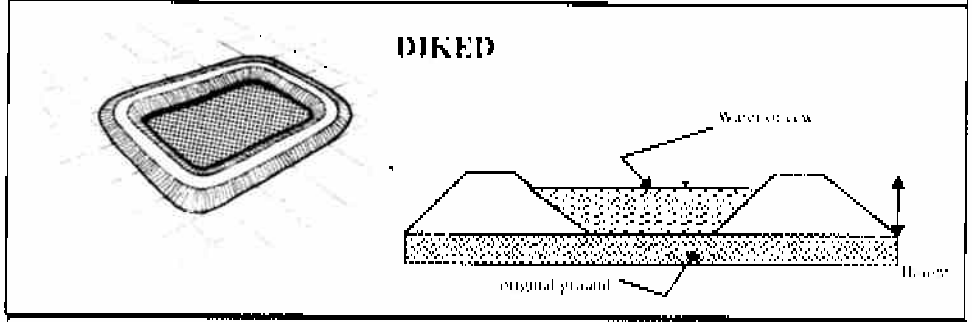
HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

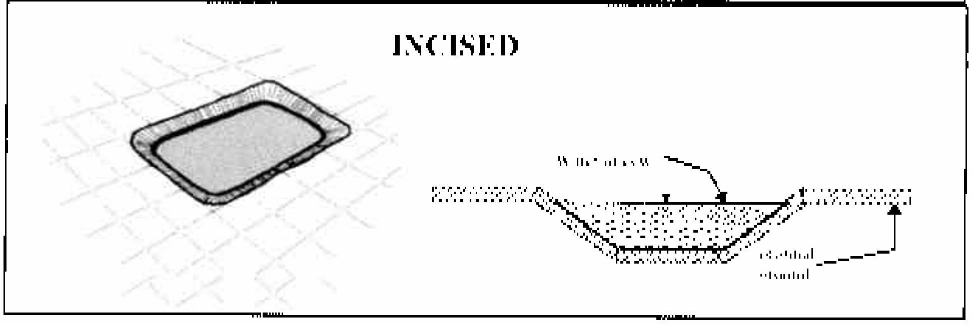
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

CONFIGURATION:









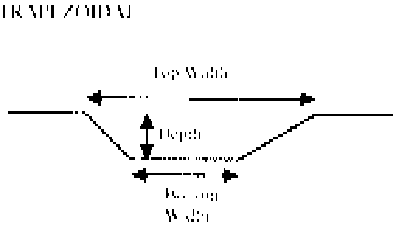
Cross-Valley
Side-Hill
Diked
Incised (form completion optional)
Combination Incised Diked

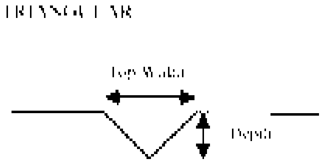
Embankment Height feet Embankment Material
Pool Area acres Liner
Current Freeboard feet Liner Permeability

TYPE OF OUTLET (Mark all that apply)

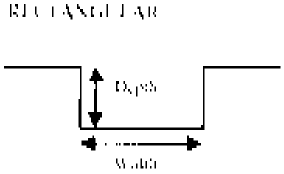
Open Channel Spillway

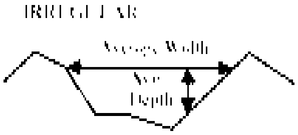
Trapezoidal
Triangular
Rectangular
Irregular





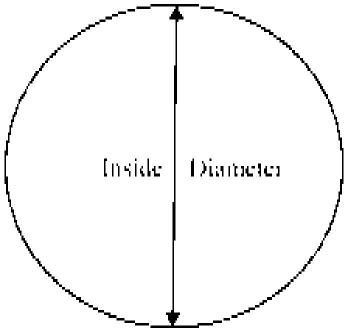
depth
bottom (or average) width
top width





Outlet

inside diameter



Material
corrugated metal
welded steel
concrete
plastic (hdpe, pvc, etc.)
other (specify)

Is water flowing through the outlet? YES NO

No Outlet

Other Type of Outlet (specify)

The Impoundment was Designed By

Has there ever been a failure at this site? YES NO

If So When?

If So Please Describe ;

Has there ever been significant seepages at this site? YES NO

If So When?

IF So Please Describe:

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES NO

If so, which method (e.g., piezometers, gw pumping,...)?

If so Please Describe :

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

NO

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

NO

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

NO