Luminant

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*Delivered via FedEx and Electronically via IHWPER@tceq.texas.gov*

January 21, 2022

Industrial and Hazardous Waste Permits Section - MC-130
Gulay Aki, P.E., Manager, Building-F
Waste Permits Division
TCEQ
12100 Park 35 Circle
Austin, TX 78753

RE: Coal Combustion Residuals (CCR) Registration Application
Coleto Creek Power Station
Solid Waste Registration No. 31911

Please find enclosed the CCR Registration Application materials for the Coleto Creek Power Station.

If you have any questions or require any additional information, please contact Eric Chavers at 903-389-6062 or by e-mail at eric.chavers@luminant.com.

Sincerely,

Renee Collins

Attachments: CCR Registration Application and Attachments

## Texas Commission on Environmental Quality

### Registration Application for Coal Combustion Residuals (CCR) Waste Management

# I. General Information

## 1. Reason for Submittal

Type of Registration Application

☒ New ☐ Major Amendment ☐ Minor Amendment

☐ Notice of Deficiency (NOD) Response ☐ Transfer ☐ Name Change

☐ Other

## 2. Application Fees

☒ $150 Application Fee

Payment Method

☐ Check ☒ Online through ePay portal <www3.tceq.texas.gov/epay/>

If paid online, enter ePay Trace Number: 582EA000467502

## 3. Facility Information

*Facility information must match regulated entity information on the Core Data Form.*

Applicant: ☐ Owner ☐ Operator ☒ Owner/Operator

Facility TCEQ Solid Waste Registration No: 31911

Facility EPA ID: TXD000836999

Regulated Entity Reference No. (if issued): RN100226919

Facility Name: COLETO CREEK POWER STATION

Facility (Area Code) Telephone Number: 361-788-5100

Facility physical street address (city, state, zip code, county): 45 FM 2987, FANNIN, TX, 77960, GOLIAD

Facility mailing address (city, state, zip code, county): 6555 Sierra Drive, Irving, TX 75039

Latitude (Degrees, Minutes Seconds): 28° 42’ 49”

Longitude (Degrees, Minutes Seconds): 97° 12’ 50”

## 4. Publicly Accessible Website

Provide the URL address of a publicly accessible website where the owner or operator of a CCR unit will post information.
https://www.luminant.com/ccr/

## 5. Facility Landowner(s) Information

Facility landowner(s) name: COLETO CREEK POWER, LLC

Facility landowner mailing address: 6555 Sierra Drive

City: Irving State: TX Zip Code: 75039

(Area Code) Telephone Number: 214-875-8338

Email Address (optional):

## 6. CCR Waste Management Unit(s)

☐ Landfill Unit(s) ☒ Surface Impoundment(s)

For each existing landfill, new landfill and lateral expansion, existing surface impoundment, and new surface impoundment and lateral expansion(s) provide information on type of waste, the registered unit(s) in which they are managed, and sampling and analytical methods.

Submit the following tables:

Table I.6. – CCR Waste Management Units;

Table I.6.A. – Waste Management Information;

Table I.6.B. – Waste Managed in Registered Units; and

Table I.6.C. – Sampling and Analytical Methods.

## 7. Description of Proposed Activities or Changes to Existing Facility

Provide a brief description of the proposed activities if application is for a new facility, or the proposed changes to an existing facility or registration conditions, if the application is for an amendment.

Coleto Creek Power, LLC operates the Coleto Creek Power Station located at 45 FM 2987 near the city of Fannin in Goliad County, Texas. The boiler uses coal as the primary fuel and fuel oil as a backup fuel to generate electricity. There are two streams of coal combustion residuals (CCR) generated at this plant. Bottom ash is collected from the boiler, combined with water, and transferred in slurry form for disposal in the facility's surface impoundment, referred to as Primary Ash Pond (PAP). Fly ash is collected from the boiler exhaust and transported pneumatically to two storage silos. From there, the fly ash is loaded into enclosed dry haul hoppers for off-site beneficial use. Off-spec fly ash is currently combined with water and pumped to the facility's surface impoundment for disposal. Limited amounts of bottom ash in the surface impoundment is recovered for beneficial reuse via excavation, screening, and placement in covered dump trucks for transport off site.

## 8. Primary Contact Information

Contact Name: Renee Collins  Title: Sr. Director Environmental Services

Contact mailing address: 6555 Sierra Drive
City: Irving  County: Dallas  State: TX  Zip Code: 75039
(Area Code) Telephone Number: 214-875-8338

Email Address (optional):

## 9. Notice Publishing

Party responsible for publishing notice:
☒ Applicant  ☐ Consultant  ☐ Agent in Service

Contact Name: Renee Collins  Title: Sr. Director, Environmental Services

Contact mailing address: 6555 Sierra Drive
City: Irving  County: Dallas  State: TX  Zip Code: 75039
(Area Code) Telephone Number: 214-875-8338

## 10. Alternative Language Notice

Is an alternative language notice required for this application? For determination, refer to Alternative Language Checklist on the Public Notice Verification Form (TCEQ-20244-Waste-NORI).

☐ Yes  ☒ No

## 11. Public Place Location of Application

Name of the Public Place: **Goliad Public Library**
Physical Address: **320 S. Commercial St**
City: **Goliad**  County: **Goliad**  State: **TX**  Zip Code: **77963**
(Area code) Telephone Number: **361-645-2291**

## 12. Ownership Status of the Facility

☐ Corporation  ☐ Limited Partnership

☐ Sole Proprietorship  ☐ General Partnership  ☒ Other (specify): Limited Liability Company

Does the Site Owner (Permittee/Registrant) own all the CCR units and all the facility property?

☒ Yes  ☐ No

## 13. Property / Legal Description Information

Provide a legal description and supporting documents of the property where the management of CCR waste will occur; including a survey plat and a boundary metes and bounds description (30 TAC §352.231(g)).

Submit the following documents:

a. Property Legal Description
b. Property Metes and Bounds Description
c. Metes and Bounds Drawings
d. On-Site Easements Drawings

See APPENDIX A for Property/Legal Description Information.

## 14. Operator Information

Identify the entity who will conduct facility operations, if the owner and operator are not the same.

Operator Name:

Operator mailing address:

City: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

## 15. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

## 16. Permits and Construction Approvals

| Permit or Approval | Received | Pending | Not Applicable |
|---|---|---|---|
| Hazardous Waste Management Program under the Texas Solid Waste Disposal Act | ☒ | ☐ | ☐ |
| Underground Injection Control Program under the Texas Injection Well Act | ☐ | ☐ | ☒ |
| National Pollutant Discharge Elimination System Program under the Clean Water Act and Waste Discharge Program under Texas Water Code, Chapter 26 | ☒ | ☐ | ☐ |
| Prevention of Significant Deterioration Program under the Federal Clean Air Act (FCAA). | ☒ | ☐ | ☐ |
| National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA | ☐ | ☐ | ☒ |
| Other (describe): | ☐ | ☐ | ☐ |

| | | | |
|---|---|---|---|
| Other (describe): | ☐ | ☐ | ☐ |
| Other (describe) | ☐ | ☐ | ☐ |

## 17. Legal Authority

The owner and operator of the facility shall submit verification of their legal status with the application. This shall be a one-page certificate of incorporation issued by the secretary of state. The owner or operator shall list all persons having over a 20% ownership in the facility.

See APPENDIX A for Certificate of Authority.

## 18. TCEQ Core Data Form

The TCEQ requires that a Core Data Form (TCEQ-10400) be submitted on all incoming applications, unless a Regulated Entity and Customer Reference Number has been issued by the TCEQ and no core data information has changed. For more information regarding the Core Data Form, call (512) 239-5175 or visit the TCEQ Website.

See APPENDIX A for TCEQ Core Data Form.

## 19. Other Governmental Entities Information

**Coastal Management Program**

Is the facility within the Coastal Management Program boundary?

☐ Yes ☒ No

**Local Government Jurisdiction (If Applicable)**
Within City Limits of: N/A
Within Extraterritorial Jurisdiction of: N/A

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing or disposal of municipal or industrial solid waste?

☐ Yes ☒ No If "Yes", provide a copy of the ordinance or order as an attachment.

## 20. Attachments

Does the application include the following?

| | | |
|---|---|---|
| General Maps | ☒ Yes | ☐ No |
| General Topographic Map | ☒ Yes | ☐ No |
| Facility Layout Map | ☒ Yes | ☐ No |
| Surrounding Features Map | ☒ Yes | ☐ No |
| Process Flow Diagram | ☒ Yes | ☐ No |
| Land Ownership Map | ☒ Yes | ☐ No |
| Land Ownership List | ☒ Yes | ☐ No |
| Pre-printed Mailing Labels | ☒ Yes | ☐ No |

Maps and drawings shall be legible and easily readable by eye without magnification. Scales and paper size shall be chosen based on the type of map submitted, the land area covered, and the amount of detail to be shown. See instructions for details regarding maps and drawings to be submitted in application.

See APPENDIX A for Attachments detailed in Item 20.

## 21. Verification of Compliance

Does the owner and operator verify that the design, construction, and operation of CCR landfill(s) and surface impoundment(s) meets the requirements of 30 TAC §352.231(f) (30 TAC §352.2; 40 CFR §257.52, and 40 CFR §§257.3-1 – 257.3-3).

☒ Yes ☐ No

# II. Location Restrictions and Geology

See Instructions and Technical Guidance

## 22. Location Restrictions

Submit certifications and technical reports demonstrating compliance of CCR unit(s) with applicable location restrictions (30 TAC 352, Subchapter E) and comply with 30 TAC §352.231(d) and 30 TAC §352.4 for submission of engineering and geoscientific information.

A. **Placement above the uppermost aquifer** (30 TAC §352.601) (40 CFR §257.60). For those CCR units whose base is less than five feet above the upper limit of the uppermost aquifer, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.60(a) – (c).

B. **Wetlands** (30 TAC §352.611) (40 CFR §257.61). For CCR units located in wetlands, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.61(a) – (c).

C. **Fault areas** (30 TAC §352.621) (40 CFR §257.62). For CCR units located within 200 feet of the outermost damage zone of a fault, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.62(a) – (c).

D. **Seismic impact zones** (30 TAC §352.631) (40 CFR §257.63). For CCR units located in a seismic impact zone, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.63(a) – (c).

E. **Unstable areas** (30 TAC §352.641) (40 CFR §257.64). For CCR units located in unstable areas, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.64(a) – (d).

Location Restriction Demonstration report for the Primary Ash Pond located in APPENDIX B.

## 23. Geology Summary Report

Submit a summary of the geologic conditions at the facility, including the relation of the geologic condition to each CCR unit. The summary must include enough information and data and include sources and references for the information. Include all groundwater monitoring data required by 40 CFR Part 257, Subpart D, (30 TAC §352.241, §352.601, §352.621, §352.631, and §352.641) and submitted in accordance of 30 TAC §352.4.

**Note:** Previously prepared documents may be submitted but must be supplemented or updated as necessary to provide the requested information (30 TAC §352.241(b)).

For Geology Summary, please refer to "Groundwater Hydrogeologic Monitoring Plan" reports for the Primary Ash Pond located in APPENDIX E. The Geology and Hydrogeology summary is located in Section 2 of the report.

All groundwater monitoring data summarized in "2020 Annual Groundwater Monitoring and Corrective Action Report" for the Primary Ash Pond located in APPENDIX E

# III. Fugitive Dust Control Plan

## 24. Fugitive Dust Control Plan

**A. Submit a copy of the CCR Fugitive Dust Control Plan** (30 TAC §352.801) (40 CFR §257.80(b)), or the most recently amended plan. The initial plan or subsequent amended plan must be certified by a qualified Texas licensed professional engineer (Texas P.E.) that the plan meets the requirements of 30 TAC Chapter 352.

**B. Submit the most recent Annual CCR Fugitive Dust Control Report** (30 TAC §352.801) (40 CFR §257.80(c)) and include the report information.

CCR Fugitive Dust Control Plan and 2021 Annual CCR Fugitive Dust Control Report are located in APPENDIX C.

# IV. Landfill Criteria – N/A

See Instructions and Technical Guidance – No. 30 Coal Combustion Residuals Landfill

## 25. Landfill(s) for CCR Waste

Provide the following information below if there is a landfill; if there is more than one landfill, separate information is required for each landfill.

**A. Landfill Characteristics**

Describe the design, installation, construction, and operation of the landfill and submit a completed Table IV.A. – Landfill Characteristics.

**B. Liner Design**

1. For existing landfills, provide attachments describing how the facility will comply with 30 TAC 352, Subchapter F (Design Criteria).
2. For new landfills or lateral expansions of existing landfills, submit pages describing how the facility will comply with 30 TAC §352.261 and 30 TAC §352.701.
3. Complete Table IV.B. - Landfill Liner System and specify the type of liner used for the landfill.
4. Provide attachments describing the design, installation, and operation of the liner and leak detection system. The description must demonstrate that the liner and leak detection system will prevent discharge to the land, groundwater, and surface water. Submit a quality assurance project plan (QAPP) to ensure that each analysis is performed appropriately.

### C. Leachate Collection and Removal

Submit design information and description of leachate collection and removal system in accordance with 30 TAC §352.701.

Complete Table IV.C. - Landfill Leachate Collection System

### D. Design of Liner and Leachate Collection and Removal System.

For a new landfill or lateral expansion of a CCR landfill, provide a qualified Texas P.E. certification and technical report that the design of the liner and the leachate collection and removal system meets the requirements of 30 TAC §352.711.

### E. Run-on and Run-off Controls

At time of application, attach pages describing how the facility will comply with the run-on and run-off system plan for an existing, new, or lateral expansion of a CCR landfill information. Provide a qualified Texas P.E. certification and technical report that the run-on and run-off control system plans meet the requirements of 30 TAC §352.811.

### F. Inspection for Landfills

At time of application, attach pages describing how the facility will comply 30 TAC §352.841 and complete Table IV.D. – Inspection Schedule for Landfills. For existing CCR landfills, provide the most recent inspection report. All CCR landfills and any lateral expansions of a CCR landfill must be inspected for any structural weakness, malfunction, deterioration conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit, or any other conditions which may cause harm to human health and environment at a frequency specified in 40 CFR §257.84(a) and (b).

# V. Surface Impoundment Criteria

See Instructions and Technical Guidance – No. 31 Coal Combustion Residuals Surface Impoundment

## 26. Surface Impoundment(s) for CCR Waste

Provide the following information below if there is a surface impoundment; if there is more than one surface impoundment, separate information is required for each surface impoundment.

### A. General Surface Impoundment(s) Characteristics

Provide information about the characteristics of the surface impoundment(s): incised, surface area (acres), storage volume (acres-feet), and depth (feet).

For all surface impoundment(s), include the following information:

1. Complete Table V.A. - Surface Impoundments Characteristics. List the surface impoundment(s) to be registered as a CCR unit(s), the wastes managed in each unit, and the rated capacity or size of each unit.
2. Describe the surface impoundment(s) and provide a plan view drawing with cross-sections, if available.

   See “History of Construction and Initial Hazard Potential Assessment, Structural Integrity Assessment, and Safety Factor Assessment” in APPENDIX D, section 2.3 for a summary description of the impoundment. For drawings, see Figures 2-4 and 2-5A.

3. Specify the minimum freeboard to be maintained and the basis of the design to prevent overtopping resulting from normal or abnormal operation; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment; and human error. Show that adequate freeboard will be available to prevent overtopping from a 100-year, 24-hour storm.

   The "Inflow Design Flood Control System Plan" located in APPENDIX D indicates maximum elevation set at 136.1' to allow sufficient freeboard for design storm and wave action. See last paragraph of section 2.0.

4. Waste Flow
   Describe the means that will be used to immediately shut off the flow of waste to the impoundment in the event of liner failure or to prevent overtopping.

   All inflows that enter the surface impoundment are pumped into the unit under controlled conditions. There are no gravity or uncontrolled inflows. Pumps will be immediately removed from service to shut off flows to the impoundment.

5. Dike Construction ☒ Yes ☐ No

   N/A-Section not required per TCEQ due to Structural Stability Assessment requirement.

   If Yes, submit the dike certification (located at the end of the application).

   The structural integrity of the dike system must be certified by a qualified Texas P.E. before the registration is issued. If the impoundment is not being used, the dike system must be certified before it can be put into use. The certification must be sealed by a qualified Texas P.E., along with the engineering firm's name and registration number (30 TAC §352.4).

   A report shall accompany the dike certification which summarizes the activities, calculations, and laboratory and field analyses performed in support of the dike certification. Describe the design basis used in construction of the dikes. A QAPP should be included in the report to ensure that each analysis is performed appropriately and include:

   (1) Slope Stability Analysis

   (2) Hydrostatic and Hydrodynamic Analysis

   (3) Storm Loading

   (4) Rapid Drawdown

   Earthen dikes should have a protective cover to minimize wind and water erosion and to preserve the structural integrity of the dike. Describe the protective cover used and describe its installation and maintenance procedures.

## B. Liner Design

For surface impoundment(s), provide information about how the facility will comply with 30 TAC §352.711 for existing CCR surface impoundments. For new and lateral expansion of CCR surface impoundments provide information on how the facility will comply with 30 TAC §352.261, and 30 TAC §352.721, see Instructions and Technical Guidance No. 31 Coal Combustion Residuals Surface Impoundment. The qualified Texas P.E. must certify that the design of the liner complies with the requirements of 30 TAC Chapter 352 and 40 CFR Part 257, Subpart D, where required.

Is the CCR surface impoundment unlined? ☒ Yes ☐ No

If "Yes", the CCR unit is subject to the closure requirements under 30 TAC Chapter 352 and 40 CFR §257.101(a) to retrofit or close. A notification must be prepared stating that an assessment of corrective measures has been initiated.

On November 30, 2020, Coleto Creek Power, LLC (CCP) submitted a request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) for the Primary Ash Pond located at the Coleto Creek Power Plant near Fannin, Texas. CCP is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the Primary Ash Pond may continue to receive CCR and non-CCR wastestreams after April 11, 2021, and complete closure no later than October 17, 2028. On January 11, 2022, EPA issued a letter stating the site-specific alternative deadline demonstration was deemed complete thus tolling the cease receipt date until a final decision is issued on the demonstration. The "Coleto Creek CCR Surface Impoundment Demonstration for a Site-Specific Alternative to the Initiation of Closure" report submitted can be found in APPENDIX D.

1. Complete Table V.B. - Surface Impoundment Liner System for each surface impoundment to be registered.
2. Describe the design, installation and operation of liner and leak detection components. The description must demonstrate that the liner and leak detection system will prevent discharge to the land and surface water. Submit a QAPP report to ensure that each analysis is performed appropriately.

   See Section 2 in the "History of Construction and Initial Hazard Potential Assessment, Structural Integrity Assessment, and Safety Factor Assessment" report in APPENDIX D.

3. For new or laterally expansions of existing surface impoundments, provide a subsurface soil investigation report that must include:
   a. A description of all borings drilled, at the unit location, to test soils and characterize groundwater;
   b. A unit map drawn to scale showing the surveyed locations and elevations of the borings, including location of permanent identification markers ((30 TAC §352.731) and (40 CFR §257.73(a)(1));
   c. Cross-sections prepared from the borings depicting the generalized strata at the unit;
   d. Boring logs, including a description of materials encountered, and any discontinuities such as fractures, fissures, slickensides, lenses or seams;
   e. A description of the geotechnical data and the geotechnical properties of the subsurface soil materials, including the suitability of the soils and strata for the intended uses; and
   f. A demonstration that all geotechnical tests were performed in accordance with industry practices and recognized procedures.

### C. Hazard Potential Classification

Provide the current hazard potential classification assessment and associated documentation, as required by 30 TAC §352.731 or §352.741 and 40 CFR §257.73(a)(2) or §257.74(a)(2). The qualified Texas P.E. must certify that the initial hazard potential classification and any subsequent periodic classification was conducted in accordance with the requirements of 30 TAC Chapter 352, where required.

Hazard Potential Classification: **LOW**

See "Hazard Potential Classification Assessment" located in APPENDIX D.

### D. Emergency Action Plan for High or Significantly High Hazard Potential

Provide the current Emergency Action Plan that has been certified by a qualified Texas P.E. and includes the following requirements from 30 TAC 352, Subchapter F and 40 CFR §257.73(a)(3)(i)(A) - (E) or 40 CFR §257.74 (a)(3)(i)(A) - (E). The qualified Texas P.E. must certify that the written Emergency Action Plan and any subsequent amendment of the plan complies with the requirements of 30 TAC 352, Subchapter F, where required.

Complete Table V.J. - Inspection of Surface Impoundments

N/A

**E. Inflow Design Flood Control System Plan**

Describe how the surface impoundment(s) system will manage stormwater run-on away from the surface impoundment(s) (30 TAC §352.821 and 40 CFR §257.82(a) and (c)). Stormwater run-on must be diverted away from a surface impoundment, based on the hazard potential. Where dikes are used to divert run-on, they must be protected from erosion. Include all analyses used to calculate run-on volumes. Provide the inflow design flood control system plan. Provide qualified Texas P.E. certification that the initial and periodic inflow design flood control system plans meet the requirements of 30 TAC §352.821, where required.

See “Inflow Design Flood Control System Plan” located in APPENDIX D.

**F. History of Construction for Existing CCR Surface Impoundment(s), or the Design and Construction Plans for New and Lateral Expansions**

Provide information on the history of construction for each existing CCR surface impoundment (30 TAC §352.731 and 40 CFR §257.73(c)) or the design and construction plans for new and lateral expansions of each CCR surface impoundment (30 TAC §352.741) and (40 CFR §257.74(c)).

See “History of Construction” report located in APPENDIX D.

**G. Structural Stability Assessment**

Provide the most recent structural stability assessment of the surface impoundments. Include the combined capacity of all surface impoundment spillways with calculations; the peak discharge the unit must meet for all combined spillways; probable maximum flood-high hazard, 1,000-yr-significant high hazard, 100-yr-low hazard; identify if there were any structural stability deficiencies in last assessment; identify how these deficiencies were managed and corrected; and qualified Texas P.E. certification. The structural stability assessment must include all information required in 30 TAC §352.731 for existing surface impoundments or 30 TAC §352.741 for new or laterally expanding surface impoundments.

See “Structural Stability Assessment” located in APPENDIX D.

**H. Safety Factor Assessment**

The current safety factor assessment must be submitted with the application. It must include documentation that demonstrates whether the calculated factors of safety for each CCR surface impoundment achieve the minimum safety factors specified in 30 TAC 352, Subchapter F and 40 CFR §257.73(e)(1)(i) - (iv) and 40 CFR §257.74(e)(1)(i) - (iv) for the critical cross-section of the embankment. The critical cross-section is the cross-section anticipated to be the most susceptible to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations and certified by a qualified Texas P.E.

See “Safety Factor Assessment” located in APPENDIX D.

# VI. Groundwater Monitoring and Corrective Action (30 TAC 352, Subchapter H)

See Instructions and Technical Guidance – No. 32 Coal Combustion Residuals Groundwater Monitoring and Corrective Action

## 27. Groundwater Monitoring System

**A.** Complete Table VI.A. - Unit Groundwater Detection Monitoring System.

**B.** Provide a map showing location of wells, groundwater elevations, and groundwater flow direction.

See Figures 4 thru 7 in the "Groundwater Hydrogeologic Monitoring Plan" in APPENDIX E.

**C.** Provide attachments describing how the facility will comply with the requirements in 30 TAC §352.911 and provide a certification by a qualified Texas P.E or qualified Texas P.G. that the groundwater monitoring system design and construction meet the requirements of 30 TAC Chapter 352.

See Appendix A in the "Groundwater Hydrogeologic Monitoring Plan" located in APPENDIX E for the monitoring system certification.

**D.** Provide a figure showing the geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

See Figures 2 and 3 in the "Groundwater Hydrogeologic Monitoring Plan" in APPENDIX E.

**E.** For a multiunit groundwater monitoring system, demonstrate that the groundwater monitoring system will be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system for each CCR unit by providing at minimum the following information:

1. Number, spacing, and orientation of each CCR unit;
2. Hydrogeologic setting; and
3. Site history.

**F.** Has there been any sampling concentrations of one or more constituents listed in Appendix IV detected at statistically significant levels above the groundwater protection standard (GWPS)? ☐ Yes ☒ No

**G.** Provide information on how monitoring wells have been constructed and cased in a manner that maintains the integrity of the monitoring well borehole and to prevent contamination of samples and the groundwater.

Groundwater monitoring well construction logs are located in Appendix B of the "Groundwater Hydrogeologic Monitoring Plan" found in APPENDIX E.

## 28. Groundwater Monitoring Sampling and Analysis Program

Provide a sampling and analysis plan that includes procedures and techniques; sampling and analytical methods that are appropriate for groundwater sampling; and that address the requirements of 30 TAC §352.931 and 40 CFR §257.93. Provide a P.E or P.G. certification that describes the statistical method selected to evaluate the groundwater monitoring data and certifies that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. Refer to TG-32 for information and guidance.

See "Groundwater Monitoring Plan", "Statistical Analysis Plan", and "Statistical Method Certification" in APPENDIX E.

## 29. CCR Unit(s) in a Detection Monitoring Program

Does the facility have CCR unit(s) in a Detection Monitoring Program?

☐ Yes ☒ No

If "Yes", Submit the following information:

**A.** Submit Table VI.C. – Facility CCR Units Under Detection Monitoring.

**B.** Provide a Background Evaluation Report.

**C.** Provide a report with the results of semiannual monitoring events.

1. Has a statistically significant increase (SSI) been detected for one or more of the constituents listed in Appendix III at any monitoring well?

   ☐ Yes ☐ No

2. Has a notification to the executive director been sent within 14 days?

   ☐ Yes ☐ No

3. Date assessment monitoring program will start:

4. Do you plan to provide an alternative source demonstration (ASD)?

   ☐ Yes ☐ No

## 30. CCR Unit(s) in an Assessment Monitoring Program

Does the facility have CCR unit(s) in an Assessment Monitoring Program?

☒ Yes ☐ No

If "Yes", Submit information related for units.

**A.** Complete Table VI.D. – CCR Units Under Assessment Monitoring.

**B.** Provide, for each well in assessment monitoring status, the recorded concentrations lab sheets and results in a tabulated form.

See summary Tables 3 and 4 for all results in tabulated form in the "2020 Annual Groundwater Monitoring and Corrective Action Report" in APPENDIX E.

Have the concentrations of all constituents listed in Appendices III and IV been at or below background values, using the statistical procedures in 30 TAC §352.931 and 40 CFR §257.93(g), for two consecutive sampling events for the CCR unit(s)? ☐ Yes ☒ No

If answer to above is yes, detection monitoring may resume. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit and obtain written approval from the executive director.

**C.** Are there any concentrations of any constituent in Appendices III and IV above background values? ☒ Yes ☐ No

1. Has a notification to the executive director been sent within 14 days?

   ☒ Yes ☐ No

**D.** Date assessment of corrective measures will be initiated (must be within **90 days** of finding a statistically significant level above the GWPS) for the CCR unit(s): Not required due to no SSLs to date. Unit is in assessment monitoring but has not triggered assessment of corrective measure to date.

**E.** Will you provide an ASD (see TG-32 for an acceptable submittal)? ☐ Yes ☒ No

**F.** Date assessment of corrective measures will be initiated if ASD is not accepted? Not required.

**G.** Complete Table VI.D-2. - Groundwater Detection Monitoring Parameters

**Note**: Refer to TG-32 regarding establishing a GWPS for each constituent in Appendix IV detected in the groundwater and attach as table.

**H.** Have you completed the assessment of corrective measures? ☐ Yes ☒ No
If "Yes", date assessment of corrective measures was completed:
If "No", date assessment of corrective measures will be completed: Not required
Expected date of submittal of amendment (see note below):
Provide completed assessment of corrected measures materials.

**Note**: Within **30 days** of completing the assessment of corrective measures, and before remedy implementation, the owner or operator shall submit an application for amendment to the registration. In some circumstances, the assessment of corrective measures and selected remedy may be approved as part of the initial application for the CCR unit registration.

**I.** Have you selected a remedy? ☐ Yes ☐ No N/A

Provide public meeting documentation under 30 TAC §352.961 and a report under 30 TAC §352.971 and 40 CFR §257.97.

# VII. Closure and Post-Closure Care

## See Instructions and Technical Guidance

Submit a full closure plan and post-closure plan and all information describing how the owner or operator will comply with 30 TAC 352, Subchapter J and 40 CFR §§257.100 - 257.104. The owner of property on which an existing disposal facility is located, following the closure of a unit, must also submit documentation that a notation has been placed in the deed to the facility that will in perpetuity notify any potential purchasers of the property that the land has been used to manage CCR wastes and its use is restricted (30 TAC §352.1221 and 40 CFR §257.102(i)). For CCR units, closed after October 19, 2015, that were closed before submission of the application, the applicant should submit documentation to show that notices required under 30 TAC 352, Subchapter K and 40 CFR §257.105 or §257.106 have been filed.

See "Closure Plan" and "Post-Closure Plan" in APPENDIX F. Also included in the appendix is a "Closure Plan Addendum" that was prepared to meet the requirements of the site-specific alternative deadline to initiate closure.

## 31. Closure Plan

This section applies to the owners and operators of all CCR units required to be registered. The applicant must close the facility in a manner that minimizes need for further maintenance and controls, or eliminates, to the extent necessary to protect human health and the environment, the post-closure release of CCR waste, chemical constituents of concern, leachate, contaminated rainfall, or waste decomposition products to the groundwater, surface waters, or to the atmosphere.

The type of unit to be closed can determine the level of detail sufficient for a closure plan. CCR units which have been certified closed after October 19, 2015, must provide documentation to demonstrate compliance with state and federal regulations.

For each unit to be registered, complete Table VII.A.1. - Unit Closure and list the CCR Unit components to be decontaminated, possible methods of decontamination, and possible methods of disposal of wastes and waste residues generated during unit closure. All ancillary components must be decontaminated, and the generated waste disposed of appropriately.

Information about CCR units closed or to be closed under alternative closure requirements must be provided in Table VII.A.2. - CCR Units Under Alternative Closure Notification.

Guidance on design of a closure cap and final cover for non-hazardous industrial solid wastes landfills is provided in EPA publication 530-SW-85-014, TCEQ Technical Guidance No. 3 and TCEQ publication, RG-534, "Guidance for Liner Construction and Testing for a Municipal Solid Waste Landfill".

## 32. Post-Closure Care Plan

Provide a post-closure care plan that complies with the requirements of 30 TAC §352.1241.

See "Post-Closure Plan" in APPENDIX F.

Post-closure care of each CCR unit must continue for at least 30 years after the date of completing closure of the unit and must consist of monitoring and reporting of the groundwater monitoring systems, in addition to the maintenance and monitoring of CCR unit. Continuation of certain security requirements may be necessary after the date of closure. Post-closure use of property on or in which waste remains after closure must never be allowed to disrupt the integrity of the containment system. In addition, submit the following information:

- The name, address, and phone number of the person or office to contact about the CCR unit during the post-closure period; and

  Luminant-Environmental Services
  Renee Collins-Senior Environmental Director
  6555 Sierra Drive
  Irving, TX 75039
  214-875-8338
  CCRPostClosurePlan@Luminant.com

- A discussion of the future use of the land associated with each unit.

Following closure of the Primary Ash Pond, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 CFR 257.102(i). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements per 40 CFR 257.104(d)(1)(iii).

Landfills and surface impoundments which have been certified closed after October 19, 2015, must be included in post-closure care plans, unless they have been determined to have been closed by waste removal equivalent to the closure standards in 30 TAC §352.1221 and 40 CFR §257.102 or 30 TAC §352.1231 and 40 CFR §257.103. If such a demonstration has been made pursuant to 40 CFR §257.102 or §257.103, but an equivalency determination has not been made, please submit a copy of the demonstration documentation. If an equivalency determination has been made, applicant should submit a copy of this determination.

# VIII. Financial Assurance

## 33. Post-Closure Care Cost Estimate

Financial assurance for post-closure care (30 TAC §352.1101) applies to owners or operators of all CCR units, except CCR units from which the owner or operator intends to remove wastes and perform clean closure. Provide a written cost estimate in current dollars of the total cost of the 30-year (or longer, if applicable under 30 TAC §352.1101(d)) post-closure care period to perform post-closure care requirements as prescribed in 30 TAC §352.1241. The cost estimate must be based on the costs of hiring a third party to conduct post-closure care maintenance.

Complete Table VIII.A.1 – Post-Closure Cost Summary for Existing Registered Units

See Post-Closure Care Estimate Memo from Golder in APPENDIX G. Coleto Creek Power Station cost estimates are summarized in Table 7.

Complete Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units

## 34. Financial Assurance Mechanism

The financial assurance for post-closure care is required in accordance with 30 TAC §352.1101. The applicant shall demonstrate the financial assurance within 90 days after approval of the registration with a financial mechanism acceptable to TCEQ in compliance with 30 TAC §352.1101(c) and 30 TAC §37, Subchapters A through D, except as indicated in 30 TAC §352.1111, in an amount no less than the amount specified in the approved Post-Closure Care Cost Summary. Provide a description of the proposed financial assurance mechanism.

Vistra Corporation currently uses AEGIS Insurance Services Endorsement No. 60 (TCEQ Endorsement for Closure, Post-Closure or Corrective Action) as an approved financial assurance mechanism at other Vistra owned facilities. Applicant intends to add post-closure coverage amounts detailed in Table VIII.A.1. to current policy.

Complete Table VIII.B. - Post-Closure Period, for the authorized post-closure period, to meet the requirements of 30 TAC §352.1241(a) through (c).

**Signature Page**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision 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, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

**Applicant** Signature: ______________________________ Date: _____________

Name and Official Title (type or print): ____________________________________

**Owner or Operator** Signature: [signature] Date: 1/21/2022

Name and Official Title (type or print): Renee Collins, Sr. Director

To be completed by the owner or operator if the application is signed by an authorized representative for the operator

I, ________________________ hereby designate ____________________________
(operator) (authorized representative)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a CCR waste management registration. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any registration which might be issued based upon this application.

________________________________________________
Printed or Typed Name of Applicant or Principal Executive Officer

________________________________________________
Signature

(Note: Application Must Bear Signature & Seal of Notary Public)

**Subscribed and sworn** to before me by the said Renee Collins on this 21st day of January, 2022.

My commission expires on the 29th day of August, 2025

(Seal) Notary Public in and for Dallas County, Texas

NOTARY PUBLIC STATE OF TEXAS
TISH GOODSPEED
My Notary ID # 129536082
Expires August 29, 2025

Tish Goodspeed

**Registration Application for Coal Combustion Residuals Waste Management**

(See instructions for P.E/P.G. seal requirements.)

| **Attachments and Tables** | **Attachment No.** |
|---|---|
| General Information | Appendix A |
| Property/Legal Description | |
| Legal Authority | |
| Delegation of Signature Authority | |
| TCEQ Core Data Form | |
| Attachments | |
| Location Restrictions & Geology | Appendix B |
| Location Restrictions Demonstration | |
| Fugitive Dust Control Plan | Appendix C |
| CCR Fugitive Dust Control Plan | |
| 2021 Annual CCR Fugitive Dust Control Report | |
| Surface Impoundment Design and Operating Criteria | Appendix D |
| Alternative Closure Plan Demonstration – §257.103(f)(2) | |
| Hazard Potential Classification Assessment | |
| Inflow Design Flood Control Plan | |
| History of Construction Report | |
| Structural Stability Assessment | |
| Safety Factor Assessment | |
| Groundwater Monitoring and Corrective Action | Appendix E |
| Groundwater Hydrogeologic Monitoring Plan | |
| Groundwater Monitoring Plan | |
| Statistical Analysis Plan | |
| Statistical Method Certification | |
| 2020 Groundwater Monitoring and Corrective Action Report | |
| Closure and Post-Closure Care | Appendix F |
| Closure Plan | |
| Closure Plan Addendum No.1 | |
| Post-Closure Plan | |
| Financial Assurance | Appendix G |
| Post-Closure Care Estimate Memo | |

**Tables**

| Tables | Submitted | Not Applicable |
|---|---|---|
| **Table I.6. - CCR Waste Management Units** | ☒ | ☐ |
| **Table I.6.A. - Waste Management Information** | ☒ | ☐ |
| **Table I.6.B. - Wastes Managed in Registered Units** | ☒ | ☐ |
| **Table I.6.C. - Sampling and Analytical Methods** | ☒ | ☐ |
| **Table IV.A. - Landfill Characteristics** | ☐ | ☒ |
| **Table IV.B. - Landfill Liner System** | ☐ | ☒ |
| **Table IV.C. - Landfill Leachate Collection System** | ☐ | ☒ |
| **Table IV.D. - Inspection Schedule of Landfills** | ☐ | ☒ |
| **Table V.A. - Surface Impoundments Characteristics** | ☒ | ☐ |
| **Table V.B. - Surface Impoundment Liner System** | ☒ | ☐ |
| **Table V.J. - Inspection of Surface Impoundments** | ☒ | ☐ |
| **Table VI.A. - Unit Groundwater Detection Monitoring System** | ☐ | ☐ |
| **Table VI.C. - CCR Units Under Detection Monitoring** | ☐ | ☒ |
| **Table VI.D. - CCR Units Under Assessment Monitoring** | ☒ | ☐ |
| **Table VI.D-2. - Groundwater Detection Monitoring Parameters** | ☒ | ☐ |
| **Table VII.A.1. - Unit Closure** | ☒ | ☐ |
| **Table VII.A.2. - CCR Units Under Alternative Closure Notification** | ☒ | ☐ |
| **Table VIII.A.1. - Post-Closure Cost Summary for Existing Registered Units** | ☒ | ☐ |
| **Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units** | ☐ | ☒ |
| **Table VIII.B. - Post-Closure Period** | ☐ | ☒ |
| **Engineering Certification(s) - Dike Construction** | ☐ | ☒ |

**Additional Attachments as Applicable - Select all those apply and add as necessary**

☒ TCEQ Core Data Form(s) **Appendix A**
☒ Signatory Authority Delegation **Appendix A**
☐ Fee Payment Receipt
☐ Confidential Documents
☒ Certificate of Fact (Certificate of Incorporation) **Appendix A**
☐ Assumed Name Certificate

**Table I.6. – CCR Waste Management Units**

| CCR Unit No.[1] | Unit Name | N.O.R. No.[1] | Unit Description[3] | Capacity | Unit Status[2] |
|---|---|---|---|---|---|
| 001 | Primary Ash Pond | 001 | Surface Impoundment | 2,700 acre-feet | Active |
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1 Registered Unit No. and N.O.R. No. cannot be reassigned to new units or used more than once.
2 Unit Status options: Active, Closed, Inactive (built but not managing waste), Proposed (not yet built), Never Built, Transferred, Post-Closure.
3 If a unit has been transferred, the applicant should indicate which facility/permit it has been transferred to in the Unit Description column.

## Table I.6.A. – Waste Management Information

| Waste No.[1] | Waste Type(s) | Source | Volume (tons/year) |
|---|---|---|---|
| 1 | Fly Ash | Coal Combustion Byproduct | 57,000 produced<br>425 disposed |
| 2 | Bottom Ash | Coal Combustion Byproduct | 13,000 produced<br>400 disposed |
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1 Assign waste number sequentially. Do not remove waste number wastes which are no longer generated.

**Table I.6.B. – Wastes Managed in Registered Units**

| Waste No.[1] | Waste | TCEQ Waste Form Codes and Classification Codes |
|---|---|---|
| 1 | Fly Ash | TWC-20173192, TX Form Code-319, Class 2 |
| 2 | Bottom Ash | TWC-20183192, TX Form Code-319, Class 2 |
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1 from Table I.6.A., first column

**Table I.6.C – Sampling and Analytical Methods**

| Waste No.[1] | Sampling Location | Sampling Method | Frequency | Parameter | Test Method | Desired Accuracy Level |
|---|---|---|---|---|---|---|
| 1 | Fly Ash | Grab | <5 years | TCLP Metals | SW1311/7470A<br>SW1311/6020B | See below [2] |
| 2 | Bottom Ash | Grab | <5 years | TCLP Metals | SW1311/7470A<br>SW1311/6020B | See below [2] |
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1 from Table I.6.A., first column

2 Analytical protocol will meet EPA quality control and accuracy specifications as published in the SW-846 Methods. The laboratory will be TCEQ accredited.

## Table IV.A. – Landfills Characteristics

| Registered Unit No. | Landfill | N.O.R. No. | Waste Nos.[1] | Rated Capacity | Dimensions[2] | Distance from lowest liner to groundwater | Action Leakage Rate (if required) | Unit will manage CCR Waste and non-CCR Waste (state all that apply) |
|---|---|---|---|---|---|---|---|---|
| N/A | | | | | | | | |
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1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width and depth, also include the surface acreage for the unit.

**Table IV.B. – Landfill Liner System**

| Registered Unit No.* | Landfill | Geomembrane Liner Material | Geomembrane Liner Permeability (cm/sec) | Geomembrane Liner Thickness | Soil Liner Material | Soil Liner Permeability (cm/sec) | Soil Liner Thickness |
|---|---|---|---|---|---|---|---|
| N/A | | | | | | | |
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* This number should match the Registration Unit No. given on Table IV.A.

**Table IV.C. – Landfill Leachate Collection System**

| Registered Unit No. | Landfill Name | Drainage Media | Collection Pipes (including risers) | Filter Fabric | Geofabric | Sump Material |
|---|---|---|---|---|---|---|
| N/A | | | | | | |
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## Table IV.D. – Inspection Schedule of Landfills

| Facility Unit(s) and Basic Elements | Possible Error, Malfunction, or Deterioration | Frequency of Inspection |
|---|---|---|
| N/A | | |
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## Table V.A. – Surface Impoundment Characteristics

| Registered Unit No. | Surface Impoundment Name | N.O.R. No. | Waste Nos.[1] | Rated Capacity | Dimensions[2] | Distance from lowest liner to groundwater | Action Leakage Rate (if required) | Unit will manage CCR Waste and non-CCR Waste (state all that apply) |
|---|---|---|---|---|---|---|---|---|
| 001 | Primary Ash Pond | 001 | 1, 2 | 2,700 acre-feet | 2,450 feet W x 3,375 feet L x 20 feet D<br>190 acres | >5 Feet | n/a | Fly Ash, Bottom Ash |
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1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width and depth, also include the surface acreage for the unit.

**Table V.B. – Surface Impoundment Liner System**

| Registered Unit No.* | Surface Impoundment Name | Geomembrane Liner Material | Geomembrane Liner Permeability (cm/sec) | Geomembrane Liner Thickness | Soil Liner Material | Soil Liner Permeability (cm/sec) | Soil Liner Thickness |
|---|---|---|---|---|---|---|---|
| 001 | Primary Ash Pond | None | None | None | In-situ clay | <1.0 x $10^{-7}$ cm/sec | Avg 9’, ranges 4’-20’ |
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* This number should match the Registration Unit No. given on Table V.A.

**Table V.J. – Inspection Schedule of Surface Impoundments**

| Facility Unit(s) and Basic Elements | Possible Error, Malfunction, or Deterioration | Frequency of Inspection |
|---|---|---|
| 010-Ash Landfill 1 | Inspect for any appearances of actual or potential structural weakness and other conditions which are disrupting of have the potential to disrupt the operation and safety of the CCR unit | Weekly Inspection per 40 CFR 257.84(a) |
| Embankments | Surface cracking, animal burrows, misalignments, slides, vegetative cover, rutting, erosion, seepage, slope protection/chutes | Weekly Inspection |
| Capped Areas | Animal burrows, vegetative cover, rutting, surface cracking | Weekly Inspection |
| Active Work Area | Contact water, dusting | Weekly Inspection |
| Groundwater Monitoring Wells | Deterioration of pads, bollards, missing locks, compromise of casing integrity | Semi-Annual Inspection |
| | | |
| 010-Ash Landfill 1 | | Annually per 40 CFR 257.84(b) |
| | Inspect for any changed in geometry of the structure since the previous annual inspection. | Annual Inspection |
| | Estimate the approximate volume of CCR contained in the unit at the time of the inspection. | Annual Inspection |
| | Inspect for any appearance of actual or potential structural weakness of the CCR unit, and any conditions that are disrupting or have the potential to disrupt the operation and safety of the unit. | Annual Inspection |
| | Inspect for any other change(s) which have affected the stability or operation of the CCR unit since the previous inspection | Annual Inspection |
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Registration No. New
Registrant: Coleto Creek Power, LLC

Table VI.A. - Unit Groundwater Detection Monitoring Systems

| Waste Management Unit/Area Name[1] | **WMU 001 - Primary Ash Pond** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Well Number(s): | MW-4 | MW-5 | MW-6 | MW-8 | MW-9 | MW-10 | MW-11 | BV-5 | BV-21 |
| Hydrogeologic Unit Monitored | Houston Group | Houston Group | Houston Group | Houston Group | Houston Group | Houston Group | Houston Group | Houston Group | Houston Group |
| Type (e.g., point of compliance, background, observation, etc.) | POC | POC | POC | POC | POC | POC | POC | POC | POC |
| Up or Down Gradient | Down | Down | Down | Up | Down | Down | Down | B? | Up |
| Casing Diameter and Material | 4" PVC | 4" PVC | 4" PVC | 4" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC |
| Screen Diameter and Material | 4" PVC | 4" PVC | 4" PVC | 4" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC | 2" PVC |
| Screen Slot Size (in.) | 0.016" | 0.016" | 0.016" | 0.016" | 0.010" | 0.010" | 0.010" | 0.010" | 0.010" |
| Top of Casing Elevation (Ft, Mean Sea Level *[MSL]* ) | 137.71 | 122.31 | 119.22 | 134.72 | 132.3 | 130.4 | 118.66 | 135.8 | 131.17 |
| Grade or Surface Elevation (Ft, MSL) | 134.3 | 119.57 | 116.35 | 131.78 | 129.3 | 127.6 | 115.8 | 133 | 128.4 |
| Well Depth (Ft, Below Grade Surface *[BGS]* ) | 70.1 | 59.27 | 61.15 | 56.88 | 60 | 60 | 49 | 40 | 40 |
| Well Depth (Ft, Below Top of Casing *[BTOC]* ) | 73.51 | 62.01 | 64.02 | 59.82 | 63 | 62.8 | 51.86 | 42.8 | 42.77 |
| Screen Interval | | | | | | | | | |
| From (Ft, BGS) | 50.5 | 39.47 | 41.25 | 36.98 | 40 | 40 | 29 | 30 | 30 |
| To (Ft, BGS) | 70.1 | 59.27 | 61.15 | 56.88 | 60 | 60 | 49 | 40 | 40 |
| Screen Interval | | | | | | | | | |
| From (Ft, BTOC) | 53.91 | 42.21 | 44.12 | 39.92 | 43 | 42.8 | 31.86 | 32.8 | 32.77 |
| To (Ft, BTOC) | 73.51 | 62.01 | 64.02 | 59.82 | 63 | 62.8 | 51.86 | 42.8 | 42.77 |

1 From Tables in Section I.; *MSL* : Mean Sea Level; *BGS* : Below Grade Surface; *BTOC* : Below Top of Casing

NOTE-Data from Table 3 from Groundwater Hydrogeologic Monitoring Plan 10/17/2017

## Table VI.C. – CCR Units Under Detection Monitoring

| N.O.R. Unit No. | Unit Description[1,2] | Well(s) | Constituent(s) | Date of SSI Determination | Date of Assessment Monitoring Notification[3] |
|---|---|---|---|---|---|
| N/A | | | | | |
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1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.
2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.
3 Enter month, day, and year.

## Table VI.D. – CCR Units Under Assessment Monitoring

| N.O.R. Unit No. | Unit Description[1,2] | Well(s) | Constituent(s) | Date of SSI Determination | Date of Assessment Monitoring Notification[3] |
|---|---|---|---|---|---|
| 001 | Primary Ash Pond | MW-6, MW-9, MW-10 | B | 2/12/2018 | Notification made 5/9/18 |
| 001 | Primary Ash Pond | MW-4, MW-5, MW-6, MW-9, MW-10, MW-11 | Cl, F, SO4, pH | 2/12/2018 | ASD Successful for all constituents except Boron (4/11/18) |
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1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.
2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.
3 Enter month, day, and year

**Table VI.D-2. – Groundwater Detection Monitoring Parameters**

| Parameter | Sampling Frequency | Analytical Method | Practical Quantification Limit (units) | Concentration Limit[1] |
|---|---|---|---|---|
| | | | | |
| Boron | Semi-Annual | SW6020A | 0.03 mg/L | 1.26 |
| Calcium | Semi-Annual | SW6020A | 3.0 mg/L | 143 |
| Chloride | Semi-Annual | E300 | 1.0 mg/L | 118 |
| Fluoride | Semi-Annual | E300 | 0.4 mg/L | 0.61 |
| Sulfate | Semi-Annual | E300 | 3.0 mg/L | 148 |
| Total Dissolved Solids | Semi-Annual | M2540C | 10.0 mg/L | 766 |
| pH | Semi-Annual | Field Measured | s.u. | 6.51<br>7.33 |
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1 The concentration limit is the basis for determining whether a release has occurred from the CCR unit/area.

## Table VII.A.1. – Unit Closure

For each unit to be registered, list the unit components to be decontaminated, the possible methods of decontamination, and the possible methods of disposal of wastes and waste residues generated during unit closure.

| Equipment or CCR Unit | Possible Methods of Decontamination[1] | Possible Methods of Disposal[1] |
|---|---|---|
| 001-Primary Ash Pond Piping | Removal | Landfill |
| 001-Primary Ash Pond | Close in Place | No Disposal |
| | | |
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1 Applicants may list more than one appropriate method.

## Table VII.A.2. – CCR Units Under Alternative Closure Notification

| Registered Unit No. | N.O.R. Unit No. | Unit Description[1,2] | Date of Receipt of Last Waste[3] | Date of Closure Notification[3] |
|---|---|---|---|---|
| 001 | 001 | Surface Impoundment | 7/17/2027 | 11/30/2020 |
| | | | | |
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1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.
2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.
3 Enter month, day, and year.

**Table VIII.A.1. – Post-Closure Cost Summary for Existing Registered Units**

| Unit | Cost |
|---|---|
| 001-Primary Ash Pond | $3,117,987 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Total Existing Unit Post-Closure Cost Estimate | $3,117,987<br>(in 2021 Dollars)[1] |
| | |

**Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units**

| Unit | Cost |
|---|---|
| | |
| | |
| | |
| | |
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| | |

1 As units are added or deleted from these tables through future registration amendments, the remaining itemized unit costs should be updated for inflation when re-calculating the revised total cost in current dollars.

**Table VIII.B. – Post-Closure Period**

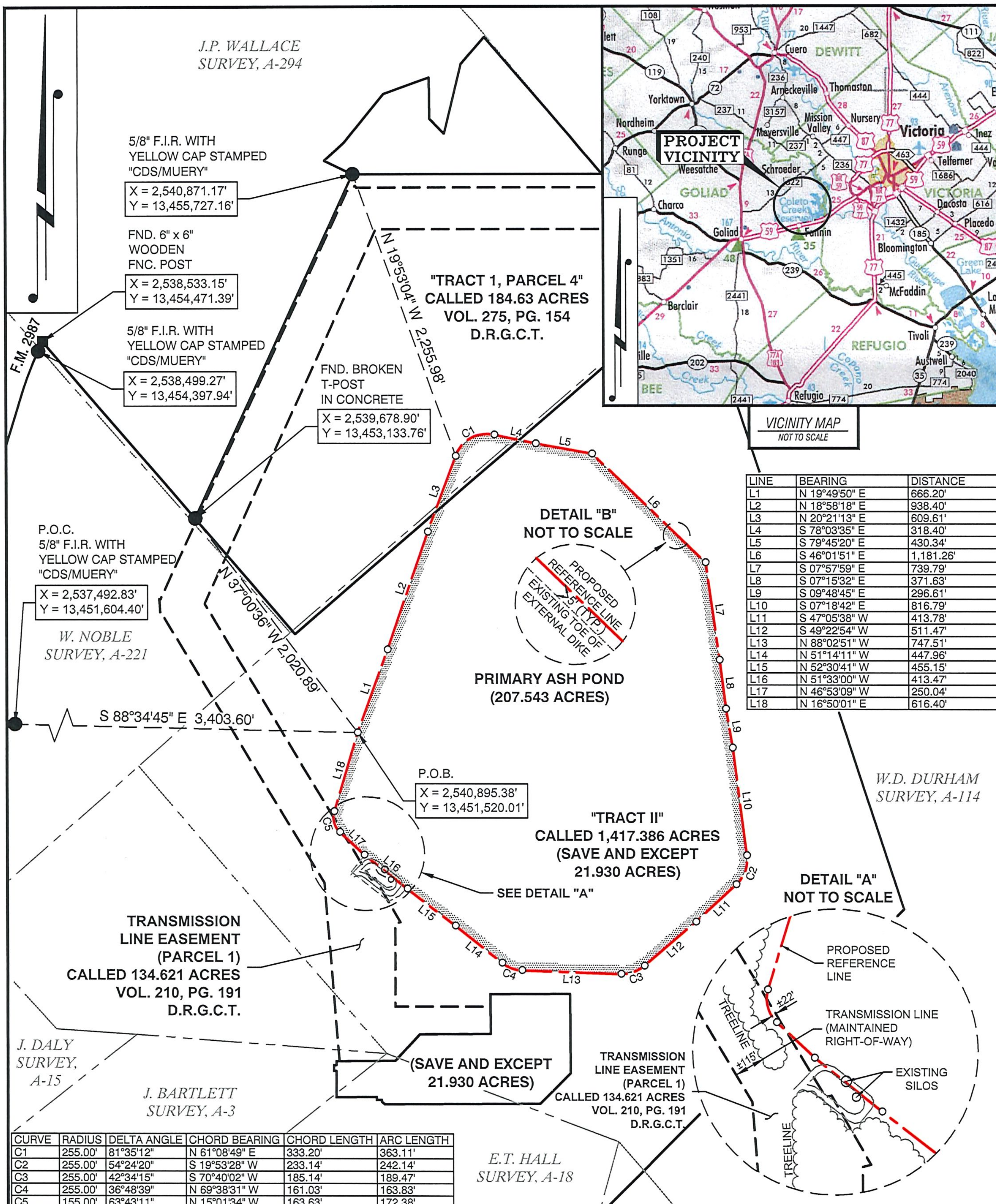
| Unit Name | Date Certified Closed | Authorized Post-Closure Period (Yrs.) | Earliest Date Post-Closure Ends (See Note 1) |
|---|---|---|---|
| **[Unit Example 1]** | **[1/1/1995]** | 30 years | **[1/1/2025]** |
| **[Unit Example 2]** | **[1/1/1990]** | 30 years | **[1/1/2020]** |
| **[Unit Example 3]** | **[1/1/1984]** | 30 years | **[1/1/2014]** |

Note 1 – Post-Closure Care shall continue beyond the specified date until the Executive Director has approved the applicant's request to reduce or terminate the post-closure period, consistent with 30 TAC §352.1241 – Post-Closure Care Requirements.

N/A

# APPENDIX A – GENERAL INFORMATION

**Property/Legal Description**
**Legal Authority**
**Delegation of Signature Authority**
**TCEQ Core Data Form**
**Attachments**




| LINE | BEARING | DISTANCE |
|---|---|---|
| L1 | N 19°49'50" E | 666.20' |
| L2 | N 18°58'18" E | 938.40' |
| L3 | N 20°21'13" E | 609.61' |
| L4 | S 78°03'35" E | 318.40' |
| L5 | S 79°45'20" E | 430.34' |
| L6 | S 46°01'51" E | 1,181.26' |
| L7 | S 07°57'59" E | 739.79' |
| L8 | S 07°15'32" E | 371.63' |
| L9 | S 09°48'45" E | 296.61' |
| L10 | S 07°18'42" E | 816.79' |
| L11 | S 47°05'38" W | 413.78' |
| L12 | S 49°22'54" W | 511.47' |
| L13 | N 88°02'51" W | 747.51' |
| L14 | N 51°14'11" W | 447.96' |
| L15 | N 52°30'41" W | 455.15' |
| L16 | N 51°33'00" W | 413.47' |
| L17 | N 46°53'09" W | 250.04' |
| L18 | N 16°50'01" E | 616.40' |

| CURVE | RADIUS | DELTA ANGLE | CHORD BEARING | CHORD LENGTH | ARC LENGTH |
|---|---|---|---|---|---|
| C1 | 255.00' | 81°35'12" | N 61°08'49" E | 333.20' | 363.11' |
| C2 | 255.00' | 54°24'20" | S 19°53'28" W | 233.14' | 242.14' |
| C3 | 255.00' | 42°34'15" | S 70°40'02" W | 185.14' | 189.47' |
| C4 | 255.00' | 36°48'39" | N 69°38'31" W | 161.03' | 163.83' |
| C5 | 155.00' | 63°43'11" | N 15°01'34" W | 163.63' | 172.38' |

NOTES:
RECORD INFORMATION SHOWN HEREON WAS PROVIDED BY CLIENT.

SURVEY ABSTRACTS NOT FIELD VERIFIED AND SHOULD BE CONSIDERED APPROXIMATE.

ALL BEARINGS AND DISTANCES CONTAINED HEREIN ARE GRID, BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), US SURVEY FEET, NORTH AMERICAN DATUM OF 1983 (2011).

A LEGAL DESCRIPTION OF EVEN DATE WITH SEAL AND SIGNATURE ACCOMPANIES THIS PLAT.

THIS PLAT IS BASED UPON A FIELD SURVEY PERFORMED ON 12/07/2021.

LEGEND

| | |
|---|---|
| — — | REFERENCE CENTERLINE |
| —— | PROPERTY LINE |
| — — — | SURVEY / ABSTRACT LINE |
| — x — | FENCE |
| | TREELINE |
| FNC. | FENCE |
| FND. | FOUND |
| F.I.P. | FOUND IRON PIPE |
| P.O.B. | POINT OF BEGINNING |
| P.O.C. | POINT OF COMMENCEMENT |
| P.O.T. | POINT OF TERMINATION |
| D.R.G.C.T. | DEED RECORDS OF GOLIAD COUNTY, TEXAS |

I CERTIFY THAT THIS PLAT REPRESENTS A SURVEY PERFORMED UNDER MY DIRECTION.

STATE OF TEXAS REGISTERED PROFESSIONAL LAND SURVEYOR JAKE T. RODRIGUE 6685

12/10/21

JAKE T. RODRIGUE, R.P.L.S.
STATE OF TEXAS R.P.L.S. NO. 6685

| | |
|---|---|
| DRAWN BY: PGD | APPROVED BY: JTR |
| DATE: 12/09/21 | JOB NO: 2021.1223 |
| DRAWING NAME: PRIMARY ASH POND_PLAT.DWG | |
| SHEET NO: 1 OF 3 | |

PROJECTION: TEXAS SOUTH CENTRAL ZONE 4204
GEO. DATUM: NAD83 (2011) VERT. DATUM: NAVD88
GRID UNITS: US SURVEY FEET

SCALE: 1" = 1000'
1000' 500' 0' 1000'

# POND BOUNDARY SURVEY

## COLETO CREEK POWER LLC

PRIMARY ASH POND
COLETO CREEK POWER PLANT
SITUATED IN
J.P. WALLACE SURVEY, A-294 & W.D. DURHAM SURVEY, A-114
GOLIAD COUNTY TEXAS

T. BAKER SMITH
A CENTURY OF SOLUTIONS
12825 Trinity Drive, Stafford, TX 77477
(281)240-0113 - tbsmith.com
TX. REG. # 101102-01

| REV. NO: FV1 | REV. DATE: 12/10/21 | REV. BY: PGD |
|---|---|---|

REVISION DESCRIPTION:
INITIAL FINAL ISSUE

12/10/2021 - P:\Y-2021\2021.1223\DWG\DELIVERABLES\FINAL V1\PRIMARY ASH POND_PLAT.DWG

T. BAKER SMITH, LLC
PROFESSIONAL CONSULTANTS SINCE 1913

TX. REG. #101102-01
12825 Trinity Dr., Stafford, TX 77477
Main Line: 281.240.0113 • Toll Free: 1.866.357.1050 • Fax: 281.240.0245 • Online: www.tbsmith.com

**EXHIBIT "A"**
**FIELD NOTES FOR**
**PRIMARY ASH POND**

Being a reference line description for the boundary of the existing **PRIMARY ASH POND** and being out of the J.P. Wallace Survey, Abstract No. 294 and the W.D. Durham Survey, Abstract No. 114 in Goliad County, Texas, said reference line being situated upon, over, through and across a called 184.63 acre tract "Tract I, Parcel 4" as referenced to a prior instrument: Volume 275, Page 154 of the Deed Records of Goliad County, Texas (D.R.G.C.T.) and a called 1,417.386 acre tract "Tract II" (save and except 21.930 acres) consisting of the following tracts: a portion of a called 1,236.71 acres as described in Volume 285, Page 411, D.R.G.C.T., all of a called 218.98 acres as described in Volume 270, Page 925, D.R.G.C.T., a portion of a called 144.24 acres and all of a called 0.82 acres as described in Volume 270, Page 925, D.R.G.C.T., a portion of a called 37.74 acres, all of a called 1.11 acres, and all of a called 0.26 acres as described in Volume 273, Page 614, D.R.G.C.T., all of a called 0.14 acres as described in Volume 275, Page 151, D.R.G.C.T., a portion of a called 124.89 acres and all of a called 0.45 acres, all of a called 188.77 acres and all of a called 0.11 acres as described in Volume 274, Page 717, D.R.G.C.T., and a portion of a called 200.90 acres as described in Volume 273, Page 609, D.R.G.C.T. (The previous six tracts also being described in Volume 359, Page 433, D.R.G.C.T.). Said reference line being situated five (5) feet outside of the existing toe of the external dike of said **PRIMARY ASH POND** and being more particularly described by metes and bounds as follows:

**COMMENCING** at a 5/8" iron rod with yellow cap stamped "CDS/MUERY" found in the westerly boundary line of "Tract II" and the easterly right-of-way line of Farm to Market 2987 for the **POINT OF COMMENCEMENT** of the herein described reference line;

**THENCE** S 88°34'45" E, over and across "Tract II", a distance of 3,403.60 feet to the **POINT OF BEGINNING** of the herein described reference line, from which a broken t-post in concrete found at a westerly corner of "Tract I, Parcel 4" bears N 37°00'36" W, a distance of 2,020.89 feet;

**THENCE** continuing across "Tract II", the following courses and distances:

N 19°49'50" E, a distance of 666.20 feet;
N 18°58'18" E, a distance of 938.40 feet;

**THENCE** N 20°21'13" E, at 145.84 feet passing the southeast line of "Tract I, Parcel 4", and continuing over and across "Tract I, Parcel 4" and "Tract II" for a total distance of 609.61 feet to the point of curvature of a curve to the right, from which a 5/8" iron rod with yellow cap stamped "CDS/MUERY" found at a northerly corner of "Tract II" bears N 19°53'04" W, a distance of 2,255.98 feet;

**THENCE** with said curve to the right, having a radius of 255.00 feet, a delta angle of 81°35'12", a chord bearing of N 61°08'49" E and a chord length of 333.20 feet, with an arc length of 363.11 feet to the point of tangency;

**THENCE** S 78°03'35" E, at 193.27 feet passing the southeast line of "Tract I, Parcel 4", and continuing over and across "Tract I, Parcel 4" and "Tract II" for a total distance of 318.40 feet;

**THENCE** continuing across "Tract II", the following courses and distances:

S 79°45'20" E, a distance of 430.34 feet;
S 46°01'51" E, a distance of 1,181.26 feet;
S 07°57'59" E, a distance of 739.79 feet;
S 07°15'32" E, a distance of 371.63 feet;
S 09°48'45" E, a distance of 296.61 feet;
S 07°18'42" E, a distance of 816.79 feet to the point of curvature of a curve to the right;

**THENCE** with said curve to the right, having a radius of 255.00 feet, a delta angle of 54°24'20", a chord bearing of S 19°53'28" W and a chord length of 233.14 feet, with an arc length of 242.14 feet to the point of tangency;

T. BAKER SMITH, LLC
PROFESSIONAL CONSULTANTS SINCE 1913

TX. REG. #101102-01
12825 Trinity Dr., Stafford, TX 77477
Main Line: 281.240.0113 • Toll Free: 1.866.357.1050 • Fax: 281.240.0245 • Online: www.tbsmith.com

**THENCE** continuing across "Tract II", the following courses and distances:

S 47°05'38" W, a distance of 413.78 feet;
S 49°22'54" W, a distance of 511.47 feet to the point of curvature of a curve to the right;

**THENCE** with said curve to the right, having a radius of 255.00 feet, a delta angle of 42°34'15", a chord bearing of S 70°40'02" W and a chord length of 185.14 feet, with an arc length of 189.47 feet to the point of tangency;

**THENCE** N 88°02'51" W, continuing across "Tract II" a distance of 747.51 feet to the point of curvature of a curve to the right;

**THENCE** with said curve to the right, having a radius of 255.00 feet, a delta angle of 36°48'39", a chord bearing of N 69°38'31" W and a chord length of 161.03 feet, with an arc length of 163.83 feet to the point of tangency;

**THENCE** continuing across "Tract II", the following courses and distances:

N 51°14'11" W, a distance of 447.96 feet;
N 52°30'41" W, a distance of 455.15 feet;
N 51°33'00" W, a distance of 413.37 feet;
N 46°53'09" W, a distance of 250.04 feet to the point of curvature of a curve to the right;

**THENCE** with said curve to the right, having a radius of 155.00 feet, a delta angle of 63°43'11", a chord bearing of N 15°01'34" W and a chord length of 163.63 feet, with an arc length of 172.38 feet to the point of tangency;

**THENCE** N 16°50'01" E, continuing across "Tract II" a distance of 616.40 feet to the point of **POINT OF BEGINNING** and containing 207.543 acres, more or less, as depicted on the attached plat of survey;

A plat of even date accompanies this legal description on page 1.

Basis of Bearings: State Plane Coordinate System, Texas South Central Zone, NAD 83 (2011) Datum.

Prepared December 9, 2021, Revised December 10, 2021

STATE OF TEXAS REGISTERED JAKE T. RODRIGUE 6685 PROFESSIONAL LAND SURVEYOR

12/10/21

Jake T. Rodrigue, R.P.L.S.
Texas Registered Professional Land Surveyor No. 6685

Corporations Section
P.O.Box 13697
Austin, Texas 78711-3697

Rolando B. Pablos
Secretary of State

# Office of the Secretary of State

## CERTIFICATE OF FILING
## OF

Coleto Creek Power, LLC
File Number: 802989013

The undersigned, as Secretary of State of Texas, hereby certifies that an Application for Registration for the above named Foreign Limited Liability Company (LLC) to transact business in this State has been received in this office and has been found to conform to the applicable provisions of law.

ACCORDINGLY, the undersigned, as Secretary of State, and by virtue of the authority vested in the secretary by law, hereby issues this certificate evidencing the authority of the entity to transact business in this State from and after the effective date shown below for the purpose or purposes set forth in the application under the name of

Coleto Creek Power, LLC

The issuance of this certificate does not authorize the use of a name in this state in violation of the rights of another under the federal Trademark Act of 1946, the Texas trademark law, the Assumed Business or Professional Name Act, or the common law.

Dated: 04/13/2018

Effective: 04/13/2018

Rolando B. Pablos
Secretary of State

Vistra Corp.
6555 Sierra Drive
Irving, TX 75039

O 214-875-8996

Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, Texas 78753

**Re: Delegation of Administrative Authority for Vistra Corp.**

This letter confirms the signatory authority for environmental matters related to the subsidiary entities of Vistra Operations Company LLC, which is a subsidiary of Vistra Corp.

Vistra Operations Company LLC hereby authorizes Renee Collins, Senior Director – Environmental Services, to act in the following capacities as it relates to administrative issues related to the below listed subsidiaries: Authorized Responsible Official and Alternate Designated Representative; as well, Ms. Collins has signatory authority for all air, water and waste permitting activities, and for water rights and water quality regulatory submissions. Those subsidiaries for which Ms. Collins has signatory authority are: Luminant Mining Company LLC, Luminant Generation Company LLC, La Frontera Holdings, LLC, Sandow Power Company LLC, Oak Grove Management Company LLC, Coleto Creek Power, LLC, Brightside Solar, LLC, Emerald Grove, LLC, and Core Solar SPV I, LLC.

Vistra Operations Company LLC hereby authorizes Renee Collins, Senior Director – Environmental Services, to act in the following capacities as it relates to administrative issues related to the below listed Vistra Corp. subsidiaries: Duly Authorized Representative and Alternate Designated Representative; as well, Ms. Collins has signatory authority for all air, water and waste permitting activities, and for water rights and water quality regulatory submissions. Those subsidiaries for which Ms. Collins has signatory authority are: Hays Energy, LLC and Midlothian Energy, LLC.

This delegation of authority is effective as of January 12, 2022, supersedes all previous delegations for this responsibility, and is valid until revoked or revised by Vistra Operations Company LLC.

*I, Barry Boswell, being Executive Vice President—Generation Operations and Services of Vistra Operations Company LLC, the parent company to each of the above listed entities, and designee in charge of business functions, policy or decision-making functions for solar, battery, and fossil operations, hereby delegate authority, as detailed herein, to Renee Collins, Senior Director – Environmental Services.*

Barry Boswell 1/12/22

Signature Date

cc: David Mitchell – Senior Counsel

# TCEQ Core Data Form

| TCEQ Use Only |
|---|
| |

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

## SECTION I: General Information

**1. Reason for Submission** *(If other is checked please describe in space provided.)*

☒ New Permit, Registration or Authorization (*Core Data Form should be submitted with the program application.*)

☐ Renewal (*Core Data Form should be submitted with the renewal form*) ☐ Other

| 2. Customer Reference Number *(if issued)* | Follow this link to search for CN or RN numbers in Central Registry** | 3. Regulated Entity Reference Number *(if issued)* |
|---|---|---|
| CN 605521988 | | RN 100226919 |

## SECTION II: Customer Information

**4. General Customer Information** | **5. Effective Date for Customer Information Updates** (mm/dd/yyyy) 01/24/2022

☐ New Customer ☒ Update to Customer Information ☐ Change in Regulated Entity Ownership

☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

***The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).***

**6. Customer Legal Name** *(If an individual, print last name first: eg: Doe, John)* — *If new Customer, enter previous Customer below:*

Coleto Creek Power, LLC

| 7. TX SOS/CPA Filing Number | 8. TX State Tax ID (11 digits) | 9. Federal Tax ID (9 digits) | 10. DUNS Number *(if applicable)* |
|---|---|---|---|
| 0802989013 | 32066860142 | 030599683 | 146129908 |

**11. Type of Customer:** ☒ Corporation ☐ Individual Partnership: ☐ General ☐ Limited

Government: ☐ City ☐ County ☐ Federal ☐ State ☐ Other ☐ Sole Proprietorship ☐ Other:

**12. Number of Employees**
☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

**13. Independently Owned and Operated?**
☐ Yes ☒ No

**14. Customer Role** (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other:

**15. Mailing Address:**

6555 Sierra Drive

| City | Irving | State | TX | ZIP | 75039 | ZIP + 4 | 2479 |
|---|---|---|---|---|---|---|---|

| 16. Country Mailing Information *(if outside USA)* | 17. E-Mail Address *(if applicable)* |
|---|---|
| | |

| 18. Telephone Number | 19. Extension or Code | 20. Fax Number *(if applicable)* |
|---|---|---|
| ( 214 ) 875-8338 | | (   )   - |

## SECTION III: Regulated Entity Information

**21. General Regulated Entity Information** *(If 'New Regulated Entity" is selected below this form should be accompanied by a permit application)*

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☒ Update to Regulated Entity Information

***The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC).***

**22. Regulated Entity Name** *(Enter name of the site where the regulated action is taking place.)*

Coleto Creek Power Station

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 23. Street Address of the Regulated Entity: *(No PO Boxes)* | 45 FM 2987 | | | | | | | |
| | | | | | | | | |
| | City | Fannin | State | TX | ZIP | 77960 | ZIP + 4 | |
| 24. County | Goliad | | | | | | | |

**Enter Physical Location Description if no street address is provided.**

| | |
|---|---|
| 25. Description to Physical Location: | On 45 FM 2987 |

| 26. Nearest City | State | Nearest ZIP Code |
|---|---|---|
| Fannin | TX | 77960 |

| 27. Latitude (N) In Decimal: | 28.7128 | | 28. Longitude (W) In Decimal: | -97.2142 | |
|---|---|---|---|---|---|
| Degrees | Minutes | Seconds | Degrees | Minutes | Seconds |
| 28 | 42 | 49 | 97 | 12 | 50 |

| 29. Primary SIC Code (4 digits) | 30. Secondary SIC Code (4 digits) | 31. Primary NAICS Code (5 or 6 digits) | 32. Secondary NAICS Code (5 or 6 digits) |
|---|---|---|---|
| 4911 | | 221112 | |

| 33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)* |
|---|
| Generation of Electricity |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 34. Mailing Address: | 6555 Sierra Drive | | | | | | | |
| | | | | | | | | |
| | City | Irving | State | TX | ZIP | 75039 | ZIP + 4 | 2479 |
| 35. E-Mail Address: | | | | | | | | |

| 36. Telephone Number | 37. Extension or Code | 38. Fax Number *(if applicable)* |
|---|---|---|
| ( 214 ) 875-8338 | | ( ) - |

**39. TCEQ Programs and ID Numbers** Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

| | | | | |
|---|---|---|---|---|
| ☐ Dam Safety | ☐ Districts | ☐ Edwards Aquifer | ☐ Emissions Inventory Air | ☐ Industrial Hazardous Waste |
| | | | | |
| ☐ Municipal Solid Waste | ☐ New Source Review Air | ☐ OSSF | ☐ Petroleum Storage Tank | ☐ PWS |
| | | | | |
| ☐ Sludge | ☐ Storm Water | ☐ Title V Air | ☐ Tires | ☐ Used Oil |
| | | | | |
| ☐ Voluntary Cleanup | ☐ Waste Water | ☐ Wastewater Agriculture | ☐ Water Rights | ☐ Other: |
| | | | | |

## SECTION IV: Preparer Information

| 40. Name: | Eric Chavers | 41. Title: | Environmental Coordinator |
|---|---|---|---|
| 42. Telephone Number | 43. Ext./Code | 44. Fax Number | 45. E-Mail Address |
| ( 903 ) 389-6062 | | ( ) - | eric.chavers@luminant.com |

## SECTION V: Authorized Signature

**46.** By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

| | | | |
|---|---|---|---|
| Company: | Luminant Generation Company LLC | Job Title: | Sr. Director, Environmental Services |
| Name *(In Print)*: | Renee Collins | Phone: | ( 214 ) 875- 8382 |
| Signature: | Rene Co | Date: | 1/28/2022 |

## ATTACHMENT 1

## CCR UNIT MAPS AND INFORMATION


**REFERENCE(S)**
BASE MAP TAKEN FROM BING MAPS.

STATE OF TEXAS
WILLIAM F VIENNE
GEOLOGY
No. 10492
LICENSED
PROFESSIONAL GEOSCIENTIST
12/29/21

COLETO CREEK POWER LP

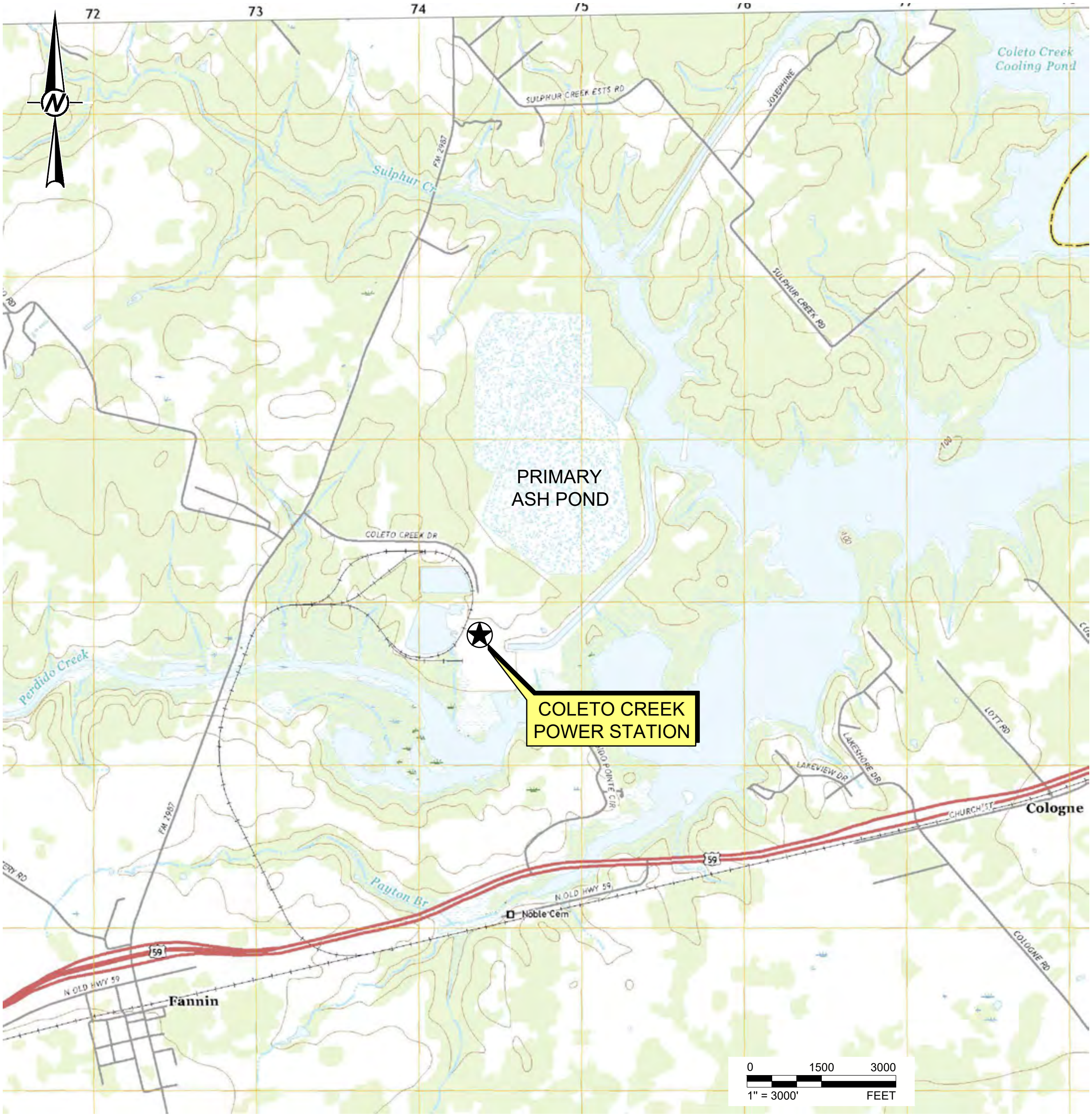
COLETO CREEK POWER STATION
FANNIN, TEXAS

**GENERAL LOCATION MAP**

GOLDER
MEMBER OF WSP

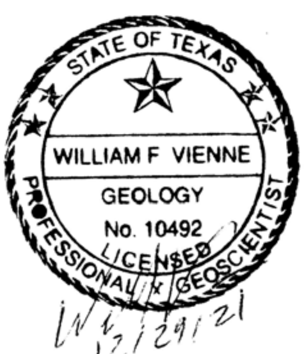
2021-12-14
RS
RS
WFV
WFV

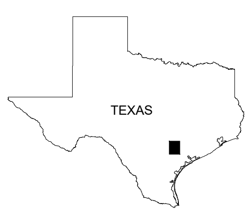
20142034
0
FIGURE
1




**REFERENCE(S)**

BASE MAP TAKEN FROM USGS.GOV, FANNIN, TX 7.5 MIN. USGS QUADRANGLE DATED 2019.




QUADRANGLE LOCATION

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**TOPOGRAPHIC MAP**

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-07 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 20142034 | | 0 | 2 |


**LEGEND**

- PROPERTY BOUNDARY
- CCR MONITORING UNIT
- DOWNGRADIENT CCR MONITORING WELL
- UPGRADIENT CCR MONITORING WELL
- RAILROAD

STATE OF TEXAS
WILLIAM F VIENNE
GEOLOGY
No. 10492
LICENSED
PROFESSIONAL GEOSCIENTIST

**REFERENCE(S)**

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 1/15/21.

0 600 1200
1" = 1200' FEET

CLIENT
COLETO CREEK POWER LP

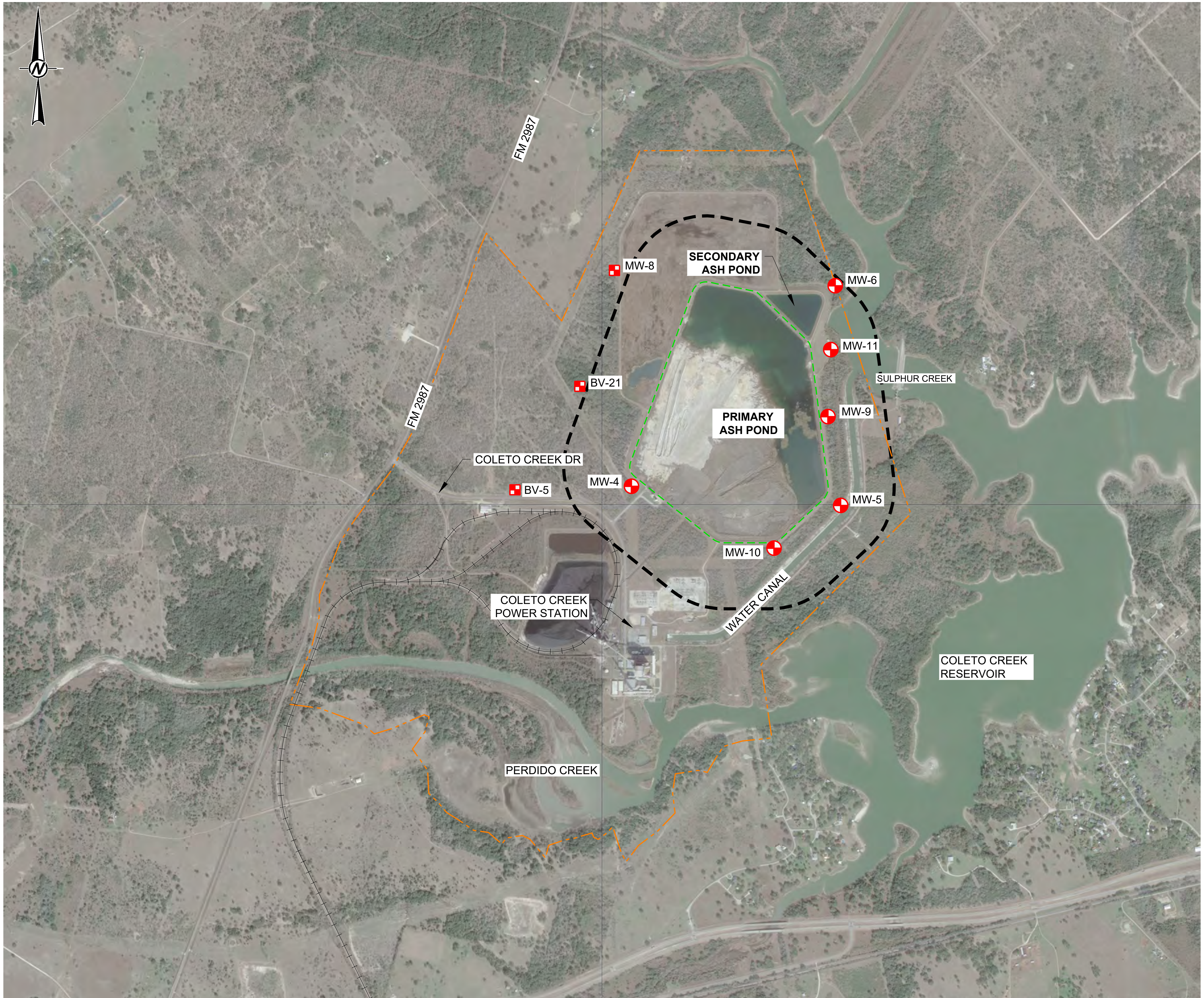
PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**FACILITY LAYOUT MAP**

CONSULTANT
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-14 |
| DESIGNED | RS |
| PREPARED | RS |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 20142034 | 0 | 3 |




**LEGEND**

- PROPERTY BOUNDARY
- CCR MONITORING UNIT
- DOWNGRADIENT CCR MONITORING WELL
- UPGRADIENT CCR MONITORING WELL
- 1,000 ft RADIUS
- RAILROAD

STATE OF TEXAS
WILLIAM F VIENNE
GEOLOGY
No. 10492
LICENSED
PROFESSIONAL GEOSCIENTIST
12/29/21

**REFERENCE(S)**

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 1/15/21.

0 750 1500
1" = 1500' FEET

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**SURROUNDING FEATURES MAP**

CONSULTANT

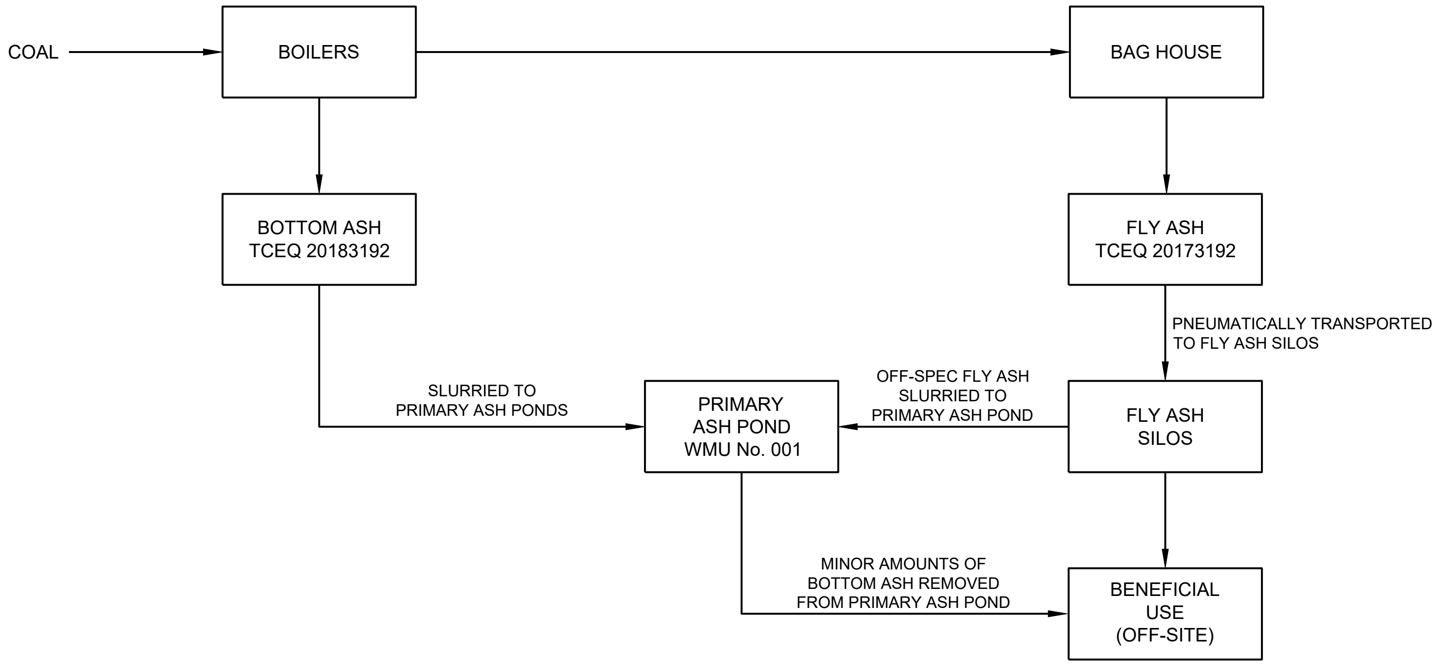
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-14 |
| DESIGNED | RS |
| PREPARED | RS |
| REVIEWED | WFV |
| APPROVED | WFV |

PROJECT NO. 20142034 | REV. 0 | FIGURE 4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Last Edited By: adiamond Date: 2021-12-16 Time:11:53:47 AM | Printed By: adiamond Date: 2021-12-16 Time:1:52:18 PM
Path: \\golder.gds\complexdata\office\Texarkana\Projects - Round Rock_2020\20142034 - Luminant\PRODUCTION\C - COLETO CREEK\ | File Name: 5 - Process Flow Diagram.dwg





CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

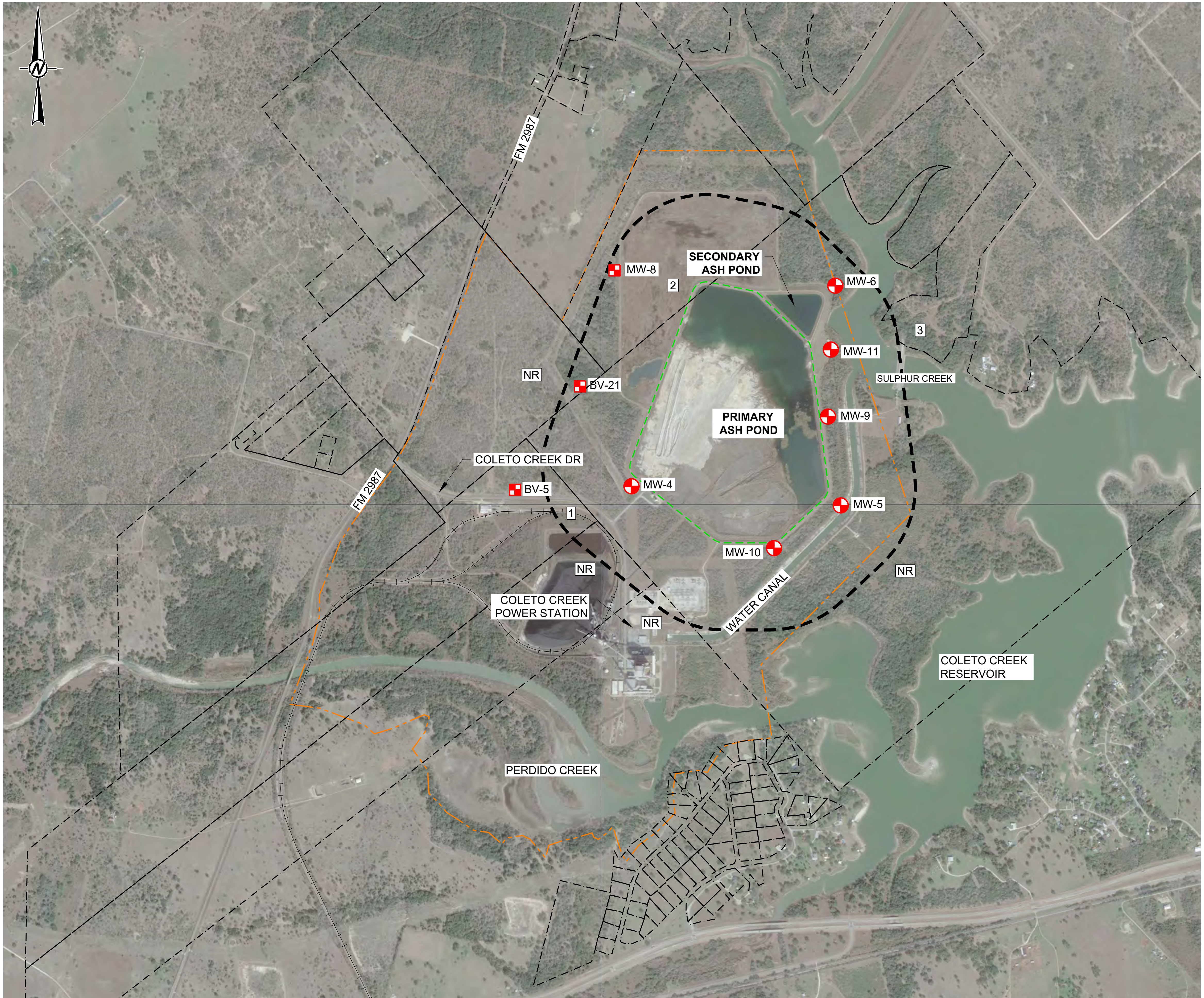
CONSULTANT
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-13 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | PJB |

TITLE
**SIMPLIFIED CCR PROCESS FLOW DIAGRAM**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 20142034 | | 0 | 5 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
0




STATE OF TEXAS
WILLIAM F VIENNE
GEOLOGY
No. 10492
LICENSED
PROFESSIONAL GEOSCIENTIST
12/29/21

**LEGEND**

- PROPERTY BOUNDARY
- CCR MONITORING UNIT
- DOWNGRADIENT CCR MONITORING WELL
- UPGRADIENT CCR MONITORING WELL
- 0.25 MILE RADIUS
- RAILROAD
- 1 PARCEL MAP ID

**NOTE(S)**

1. NR - NO RECORD OF PROPERTY OWNERSHIP IN COUNTY APPRAISAL DISTRICT RECORDS.

**REFERENCE(S)**

1. BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 1/15/21.
2. PROPERTY AND MINERAL OWNER'S NAMES AND MAILING ADDRESSES WERE RESEARCHED FROM GOLIAD COUNTY APPRAISAL DISTRICT REAL PROPERTY ACCOUNT INFORMATION RECORDS AS OF DECEMBER 13, 2021.

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**LAND OWNERSHIP MAP**

CONSULTANT
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-14 |
| DESIGNED | RS |
| PREPARED | RS |
| REVIEWED | WFV |
| APPROVED | WFV |

PROJECT NO. 20142034 REV. 0 FIGURE 6

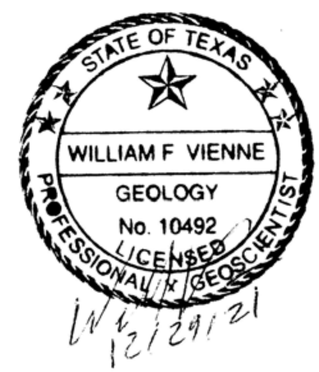
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

**TABLE 1**
**LAND OWNERSHIP LIST**
**COLETO CREEK POWER STATION**

| ID No. | Owner Name | Mailing Address | | | |
|---|---|---|---|---|---|
| 1 | HANLEY RANCH PARTNERSHIP | 576 LAKESHORE DR | VICTORIA | TX | 77905 |
| 2 | COLETO CREEK POWER LLC | 6555 SIERRA DRIVE | IRVING | TX | 75039 |
| 3 | GREG SCHERER | 7875 US HWY 87N | VICTORIA | TX | 77904 |

Notes:

1. Property information from Goliad County Appraisal District (CAD) real property account information records as of December 3, 2021.



# APPENDIX B – LOCATION RESTRICTIONS AND GEOLOGY

## Location Restrictions Demonstration

Bullock, Bennett & Associates, LLC * 165 N. Lampasas Street * Bertram, Texas 78605
Telephone: 512.355.9198 * Fax: 512.355.9197

# MEMORANDUM

October 17, 2018

SUBJECT: Location Restriction Demonstration – Placement Above Uppermost Aquifer
Coleto Creek Power, LP
Coleto Creek Power Station
Coleto Creek Primary Ash Pond
Fannin, Texas

Coleto Creek Power, LP operates the coal-fired Coleto Creek Power Station (Plant) located in Fannin, Texas. The Coleto Creek Primary Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.60 *Placement Above the Uppermost Aquifer* of the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 rule, effective 19 October 2015 for the Unit.

*§257.60(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.*

Bullock, Bennett & Associates, LLC (BBA) reviewed original construction documentation and the results of other historic field investigation programs at the Unit and used that information to create a generalized stratigraphic model of the site. Elevations for the top of the uppermost aquifer as defined in the rule range from approximately El. 82 feet NAVD88 to El. 116 feet NAVD88. Base of unit elevations appear to range from El. 101 feet NAVD88 to El. 135 feet NAVD88. As a result, the separation between the base of the unit and the upper limit of the uppermost aquifer was confirmed to be greater than five feet and therefore meets the requirement of §257.60(a) for the Unit.

*<u>§257.60(b):</u> The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Daniel Bullock, being a Licensed Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the CCR Unit meets the Placement Above the Uppermost Aquifer criteria as included in the CCR Rule Location Restrictions Evaluation memorandum dated 17 October 2018 and, therefore, meets the requirements of 40 CFR §257.60(a).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

10-17-2018

Signed: ______________________
Principal Engineer

| | |
|---|---|
| Print Name: | Daniel Bullock, P.E. |
| Texas License No.: | 82596 |
| Title: | Principal Engineer |
| Firm: | Bullock, Bennett & Associates, LLC |
| Texas Engineering Firm No.: | F-8542 |

Bullock, Bennett & Associates, LLC * 165 N. Lampasas Street * Bertram, Texas 78605
Telephone: 512.355.9198 * Fax: 512.355.9197

# MEMORANDUM

October 17, 2018

SUBJECT: Location Restriction Demonstration – Wetlands
Coleto Creek Power, LP
Coleto Creek Power Station
Coleto Creek Primary Ash Pond
Fannin, Texas

Coleto Creek Power, LP operates the coal-fired Coleto Creek Power Station (Plant) located in Fannin, Texas. The Coleto Creek Primary Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.61 *Wetlands* of the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 rule, effective 19 October 2015 for the Unit.

*§257.61(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.*

Bullock, Bennett & Associates (BBA) reviewed USGS Topographic Maps, National Welands Inventory data, local soil survey data, and FEMA floodplain data to evaluate whether the Unit is located in a wetland area. BBA's findings were field verified during a site visit. The Unit is not located in wetlands as defined by 40 CFR §232.2

*§257.61(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.*



I, Daniel Bullock, being a Licensed Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the CCR Unit is not located in wetlands as included in the CCR Rule Location Restrictions Evaluation memorandum dated 17 October 2018 and, therefore, meets the requirements of 40 CFR §257.61(a).

Signed: [signature]
Principal Engineer

| | |
|---|---|
| Print Name: | Daniel Bullock, P.E. |
| Texas License No.: | 82596 |
| Title: | Principal Engineer |
| Firm: | Bullock, Bennett & Associates, LLC |
| Texas Engineering Firm No.: | F-8542 |

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER
[signature]
10-17-2018

Bullock, Bennett & Associates, LLC * 165 N. Lampasas Street * Bertram, Texas 78605
Telephone: 512.355.9198 * Fax: 512.355.9197

# MEMORANDUM

October 17, 2018

SUBJECT: Location Restriction Demonstration – Fault Areas
Coleto Creek Power, LP
Coleto Creek Power Station
Coleto Creek Primary Ash Pond
Fannin, Texas

Coleto Creek Power, LP operates the coal-fired Coleto Creek Power Station (Plant) located in Fannin, Texas. The Coleto Creek Primary Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.62 *Fault Areas* of the U.S. Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 rule effective 19 October 2015, for the Unit.

*§257.62(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.*

Bullock, Bennett & Associates (BBA) reviewed available public records including the United States Geologic Survey (USGS) Earthquake Hazards Program Quarternary Fault and Fold Database, USGS Interactive Fault Map, The Geologic Atlas of Texas, and reports generated by the Texas Bureau of Economic Geology. BBA also reviewed site boring log and stratigraphy data supplemented by a site visit to perform a visual inspection. Based on the available published geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the Unit.

*<u>§257.62(b):</u> The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Daniel Bullock, being a Licensed Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the CCR Unit is not located within 60 meters (200 feet) of the outermost damage zone of a fault that has had a displacement in Holocene time as included in the CCR Rule Location Restrictions Evaluation memorandum dated 17 October 2018 and, therefore, meets the requirements of 40 CFR §257.62(a).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock

10-17-2018

Signed: Daniel B. Bullock
Principal Engineer

| | |
|---|---|
| Print Name: | Daniel Bullock, P.E. |
| Texas License No.: | 82596 |
| Title: | Principal Engineer |
| Firm: | Bullock, Bennett & Associates, LLC |
| Texas Engineering Firm No.: | F-8542 |

Bullock, Bennett & Associates, LLC * 165 N. Lampasas Street * Bertram, Texas 78605
Telephone: 512.355.9198 * Fax: 512.355.9197

# MEMORANDUM

October 17, 2018

SUBJECT: Location Restriction Demonstration – Seismic Impact Zones
Coleto Creek Power, LP
Coleto Creek Power Station
Coleto Creek Primary Ash Pond
Fannin, Texas

Coleto Creek Power, LP operates the coal-fired Coleto Creek Power Station (Plant) located in Fannin, Texas. The Coleto Creek Primary Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.63 *Seismic Impact Zones* of the U.S. Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 rule, effective 19 October 2015, for the Unit.

*§257.63(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of a CCR unit must not be located in seismic impact zones unless the owner or operator demonstrates by October 17, 2018 that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

A Seismic Impact Zone is defined in 40 CFR §257.63 as "an area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years." The 2014 U.S. Geological Survey National Seismic Hazard Map indicates that the Unit falls within the area with a maximum probable earthquake peak ground acceleration ranging from 0.02 g to 0.04g. Accordingly, the Unit is not located in a seismic impact zone and a demonstration that the structural components have been designed to resist the maximum horizontal acceleration in lithified earth material for the site is not required.

*§257.63(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.*

I, Daniel Bullock, being a Licensed Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the demonstration that the CCR Unit is not located in a seismic impact zone as included in the CCR Rule Location Restrictions Evaluation memorandum dated 17 October 2018 meets the requirements of 40 CFR §257.63(a).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER
10-17-2018

Signed: ____________________
Principal Engineer

| | |
|---|---|
| Print Name: | Daniel Bullock, P.E. |
| Texas License No.: | 82596 |
| Title: | Principal Engineer |
| Firm: | Bullock, Bennett & Associates, LLC |
| Texas Engineering Firm No.: | F-8542 |

Bullock, Bennett & Associates, LLC * 165 N. Lampasas Street * Bertram, Texas 78605
Telephone: 512.355.9198 * Fax: 512.355.9197

# MEMORANDUM

October 17, 2018

SUBJECT: Location Restriction Demonstration – Unstable Area
Coleto Creek Power, LP
Coleto Creek Power Station
Coleto Creek Primary Ash Pond
Fannin, Texas

Coleto Creek Power, LP operates the coal-fired Coleto Creek Power Station (Plant) located in Fannin, Texas. The Coleto Creek Primary Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.64 *Unstable Area* of the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 rule, effective 19 October 2015, for the Unit.

*§257.64(a): An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.*

*§257.64(b): The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:*

*(1) On-site or local soil conditions that may result in significant differential settling;*
*(2) On-site or local geologic or geomorphologic features; and*
*(3) On-site or local human-made features or events (both surface and subsurface).*

Bullock, Bennett & Associates, LLC (BBA) reviewed original construction documentation and the results of other historic field investigation programs at the Unit and used that information to create a generalized stratigraphic model of the site. In addition, BBA reviewed historic annual Unit inspection reports generated by professional engineers and the findings of the Liquifaction Assessment conducted in support of the Initial Structural Integrity Assessment. As a result of this evaluation, BBA concludes that the Unit is not located in an unstable area and therefore meets the requirement of §257.64(a) for the Unit.

*§257.64(c): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.*

> I, Daniel Bullock, being a Licensed Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the CCR Unit is not located in an unstable area as included in the CCR Rule Location Restrictions Evaluation memorandum dated 17 October 2018 and, therefore, meets the requirements of 40 CFR §257.64(a).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER
10-17-2018

Signed: ______________________
Principal Engineer

| | |
|---|---|
| Print Name: | Daniel Bullock, P.E. |
| Texas License No.: | 82596 |
| Title: | Principal Engineer |
| Firm: | Bullock, Bennett & Associates, LLC |
| Texas Engineering Firm No.: | F-8542 |

## APPENDIX C – FUGITIVE DUST CONTROL PLAN

**CCR Fugitive Dust Control Plan**
**2021 Annual CCR Fugitive Dust Control Report**

# COAL COMBUSTION RESIDUAL FUGITIVE DUST CONTROL PLAN (AMENDMENT 1)

## COLETO CREEK POWER STATION
### FANNIN, TEXAS

**JANUARY 24, 2018**

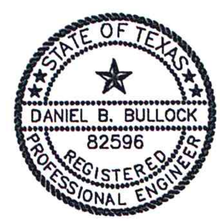
*Prepared for:*

**COLETO CREEK POWER, LP**
Fannin, Texas

*Prepared by:*


**BULLOCK, BENNETT & ASSOCIATES, LLC**
Engineering and Geoscience
Registrations: Engineering F-8542, Geoscience 50127

165 N. Lampasas Street
Bertram, Texas 78605
(512) 355-9198


BBA Project No. 15214-2

Daniel B. Bullock
1/24/2018

## TABLE OF CONTENTS

## LIST OF FIGURES

## Site Summary

Coleto Creek Power, LP operates the Coleto Creek Power Station located at 45 FM 2987 near the city of Fannin in Goliad County, Texas (Figure 1). One boiler is operated at the facility to generate electricity for distribution to the area power grid. The boiler uses coal as the primary fuel and fuel oil as a backup fuel. There are two streams of coal combustion residuals (CCR) generated at this plant. Bottom ash is collected from the boiler, combined with water, and transferred in slurry form for disposal in the facility's surface impoundment named the Coleto Creek Primary Ash Pond (Figures 2 and 3). Fly ash is collected from the boiler exhaust and transported pneumatically to two storage silos. From there, the fly ash is loaded into enclosed dry haul hoppers for off-site beneficial reuse. Off-spec fly ash is combined with water and pumped to the Primary Ash Pond for disposal (Figure 3). CCR in the Primary Ash Pond is recovered for beneficial reuse via excavation, screening, and placement in covered dump trucks for transport off site.

Pursuant to Rule 40 *CFR* §257.80, "the owner or operator of a CCR landfill, CCR surface impoundment...must adopt measures that will effectively minimize CCR from becoming airborne at the facility, including CCR fugitive dust originating from CCR units, road, and other CCR management and material handling activities." 40 *CFR* §257.80(b) requires the owner or operator of the CCR unit to "prepare and operate in accordance with a CCR fugitive dust control plan." This *Fugitive Dust Control Plan* has been prepared to meet the requirements of the rule. This plan should be amended at any time that CCR management operations substantially change. A copy of this Plan and all associated inspection reports/neighborhood complaints shall be maintained in the facility's operating record and publicly accessible internet site.

The potential for excessive CCR fugitive dust emissions at the Coleto Creek Power Station site is relatively low. Bottom ash is conveyed to the surface impoundment for disposal in slurry form. Fly ash from the boiler is conveyed to two storage silos in an enclosed pneumatic conveyance system. Fugitive emissions are possible in equipment flanges/piping leading to the storage silos. Off-spec fly ash that is not shipped off-site for beneficial use and requires on-site disposal is conveyed in slurry form to the surface impoundment. The surface impoundment is surrounded on three sides by dense tree cover that serves as a windbreak. Dry areas of the impoundment are generally either crusted over or covered with vegetation. CCR within the surface impoundment boundary can be recovered via excavation as a plant product for off-site beneficial re-use. Ingress and egress from the surface impoundment is via a paved road. The road surrounding the surface impoundment is a dirt road that is primarily vegetated with the exception of the tire paths. Figure 3 shows potential fugitive dust source locations. There are no sensitive receptors (i.e., residential areas/schools) within the immediate vicinity of the site (Figure 1).

This Plan will be assessed to evaluate its effectiveness (40 *CFR* §257.80(4)) at a minimum frequency of once per year. Any changes will be noted and included in the facility operating record (§257.105(g)) and publicly accessible internet site (§257.107(g)). In addition, notification of any amendment of this plan will be reported to the relevant State director as required in §257.106(g)(1).

**Coleto Creek Power Station**
**Coal Combustion Residuals Management**
**Fugitive Dust Control Plan**
**Section 1 – General Information – Page 1**

## 1-A Facility Name and Location

Facility Name: Coleto Creek Power Station

Facility Address: 45 FM 2987

Major X-Streets: Hwy 59 and FM 2987

City: Fannin County: Goliad

## 1-B Contacts

Names, addresses, and phone numbers of persons and owners or operators responsible for the implementation of the Dust Control Plan and responsible for the dust generating operation and dust control applications.

**Property Owner:** Coleto Creek Power, LP

Address: 45 FM 2987 P.O. Box 8

City / State / Zip: Fannin, TX 77960

Phone: 361-788-5100 Fax: 361-788-5136

**Health and Safety Coordinator:** Richard Coleman

Address: 45 FM 2987 P.O. Box 8

City / State / Zip: Fannin, TX 77960

Phone: 361-788-5145 Fax: 361-788-5136

**Plant Manager:** Robert Stevens

Address: 45 FM 2987 P.O. Box 8

City / State / Zip: Fannin, TX 77960

Phone: 361-788-5112 Fax: 361-788-5136

**This Dust Control Plan was prepared by:**

Name: Kimberly Maloney, P.E. Title: Project Engineer

Company Name: Bullock, Bennett & Associates, LLC

Address: 165 N. Lampasas St

City / State / Zip: Bertram, TX 78605

Phone: 512-355-9198 Fax: 512-355-9197

**Facility Name:** Coleto Creek Power Station

## 1-C Contractors

Names, addresses, and phone numbers of the contractors involved in CCR dust generating activities **or** performing dust control as part of this project.

1. Boral Material Technologies, Inc.
   45 NE Loop 410 San Antonio, TX 78216-5832
   210-349-4069
2. 
3. 
4. 

**Facility Name:** Coleto Creek Power Station

## 2-A Responsibilities

All staff members will be required to notify the operations manager of excessive CCR fugitive emissions when observed. This will include a description of the source of the excessive emission. The operations manager will be responsible for directing dust control measures.

## 2-B Surface Impoundment Sources of CCR Fugitive Dust

This section describes the minimum requirements for limiting visible dust emissions from activities that cause CCR fugitive dust.

### Active Operations Within the Surface Impoundment

- ☒ Water will be applied to dry areas during leveling, grading, trenching, and earthmoving activities as needed to reduce dust emissions. Chemical dust suppressants may also be used.
- ☒ Material fall distances will be reduced to the lowest level reasonably practicable.
- ☒ The existing tree line and other vegetative cover which serve as wind barriers will be maintained.
- ☒ In the event that the application of water does not achieve the desired reduction in visible emissions, such as may occur during a high wind event, all operations will cease to the extent practicable until such time conditions will not result in excessive visible emissions.

### Inactive Operations Within the Surface Impoundment

- ☒ Vehicle access will be restricted to maintain the surface crust and/or vegetative cover.
- ☒ The existing tree line and other vegetative cover which serve as wind barriers will be maintained.

### Temporary Stabilization of CCR Excavation Areas that Remain Unused for Seven or More Days

- ☒ Water or dust suppressants will be applied as needed to reduce visible emissions if excessive dusting is observed. CCR piles also may be covered with a tarp, plastic, or other suitable material and anchored in such a manner that prevents the cover from being removed by wind action.

### Unpaved Access and Haul Roads Surrounding the Surface Impoundment

- ☒ Restrict traffic to only necessary activities.
- ☒ Post "Drive Slow – Reduce Dusting" signs at each entrance.
- ☒ Water or dust suppressants will be applied to vehicle traffic areas if high traffic use is necessary and excessive visible emissions are observed.

### High Wind Events

- ☒ Water application equipment will apply water to control fugitive dust during high wind events if excessive visible emissions are occurring, unless unsafe to do so. Outdoor activities that disturb the CCR will cease whenever excessive visible dust emissions cannot be effectively controlled.

## 2-C Bulk CCR Materials (Management Outside of Primary Ash Pond)

### Outdoor Handling of Bulk CCR Materials (Only occurs during equipment maintenance/malfunction)

- ☒ Water or dust suppressants will be applied when handling bulk materials as needed to reduce emissions.
- ☒ Material fall distances will be reduced to the lowest level reasonably practicable.
- ☒ If the addition of water and/or dust suppressants does not achieve the desired reduction in visible emissions, wind barriers, administrative controls, or other engineering controls will be used to reduce dusting.

### On-Site Transport of Bulk CCR Materials

- ☒ Transport vehicles will be operated at low speeds to reduce potential for dusting.
- ☒ Haul trucks will maintain adequate freeboard to prevent excessive dusting while in transit.
- ☒ Water will be applied to the load to reduce visible dust emissions if the material is not already sufficiently moist.
- ☒ Haul trucks will be covered with a tarp or other suitable cover as needed for dust control.
- ☒ Spills on roadways (unless deminimus) will be cleaned up in a timely manner using shovels, brooms, or other equipment appropriate for the amount of the spill. Collected materials shall be appropriately disposed.

### Pneumatic Fly Ash Conveyance Equipment

- ☒ Pneumatic conveyance equipment will be periodically inspected to ensure that no leaking piping, flanges, or other equipment is present.
- ☒ Leaking equipment will be repaired as soon as practicable.
- ☒ Operations will cease if excessive fugitive emissions are observed until such time that the equipment is repaired.

**Facility Name:** Coleto Creek Power Station

## 3-A Dust Suppressant Products

These materials include, but are not limited to: hygroscopic suppressants (road salts), adhesives, petroleum emulsions, polymer emulsions, and bituminous materials (road oils).

The following information is to be attached, if applicable, to describe dust control products that could potentially be used at this facility.

- ☐ Product Specifications (MSDS, Product Safety Data Sheet, etc.)
- ☐ Manufacturer's Usage Instructions (method, frequency, and intensity of application)
- ☐ Environmental impacts and approvals or certifications related to the appropriate and safe use for ground application.

## 3-B Other CCR Dust Control Methods

Other types of dust control methods that may be employed at the site depending on conditions.

- ☒ Physical barriers:
  - ☐ Plastic ☐ Tarps ☐ Gravel
  - ☐ Other: __________
- ☒ Wind barriers Describe: __________
- ☒ Re-establish vegetation for temporarily stabilizing previously disturbed surfaces.
- ☐ Other: __________

## 3-C Contingencies

Contingencies to be implemented if application equipment becomes inoperable, more equipment is needed to effectively control CCR fugitive dust emissions during active and inactive periods, accessibility limitations occur at the water sources, or staff is not available to operate the application equipment. Contingencies that will be in place and when they will be implemented include:

- Dust-causing operations will be limited to the extent practicable.
- Rental equipment may be obtained from local (Victoria, TX) locations, including United Rentals (361)578-5125, Hertz Equipment Rental (361)579-9425, Sunbelt Rentals (361)576-3434, or others as-needed.
- Various sources of water exist on site, the Health and Safety Coordinator may be contacted regarding alternate sources as-needed.
- Off-site support contractors may be contacted if sufficient staff is not available to operate equipment.

## 4-A Recordkeeping

**Records and any other supporting documents for demonstrating compliance will be maintained in the facility operating record and on the publicly accessible internet site as required in 40 *CFR* §257.105(g) and §257.107(g). Records shall be maintained for at least five (5) years (§257.105(b)).**

The following recordkeeping forms will be used to report the response to fugitive dust events (see attached).

- ☒ Fugitive Dust Control Report (to be completed in the event that active CCR fugitive dust control methods, such as the application of water and/or dust suppressants, is utilized.
- ☒ Citizen Complaint Log (40 *CFR* §257.80(3))

## Coleto Creek Power Station
## Coal Combustion Residuals Management
## Fugitive Dust Control Report – Page 1 of 2

**Site Area:** ______________________________ **Date:** ________________

### Cause of CCR Fugitive Dust

### Water Application

**Water Application Equipment:**

☐ Sprinklers: Describe the activities that used sprinklers:

______________________________________________________________

Minimum treated area: __________ ☐ Square Feet ☐ Acres
Maximum treated area: __________ ☐ Square Feet ☐ Acres
Minimum water flow rate: __________ Gallons/minute Duration: ____________________

☐ Water Truck, ☐ Water Trailer, ☐ Water Wagon, ☐ Other: ____________________

Describe the activities that utilized this equipment:

______________________________________________________________

Number of application equipment used: ______________________________
Application equipment capacity: ______________________________
Application frequency: ______________________________
Application rate: ______________________ Gallons per acre per application
Hours of operation: ______________________

**Water Supply:**

☐ Fire hydrants
☐ Storage tanks
☐ Wells
☐ Canal, River, Pond, Lake, etc. Describe: ______________________________
☐ Other: ______________________________

### CCR Dust Suppressant Application

**Dust Suppression Product Application:**

☐ Dust Suppressant Product: Describe the dust suppressant. Attach MSDS and other information if not already contained within the facility's Fugitive Dust Control Plan:

______________________________________________________________

Minimum treated area: __________ ☐ Square Feet ☐ Acres
Maximum treated area: __________ ☐ Square Feet ☐ Acres
Application rate: __________ Duration: ____________________

**Coleto Creek Power Station**
**Coal Combustion Residuals Management**
**Fugitive Dust Control Report – Page 2 of 2**

| **Other CCR Dust Control Methods** |
|---|
| Check below the other types of dust control methods that were employed at the site. |
| ☐ Physical barriers:<br>☐ Plastic ☐ Tarps ☐ Gravel<br>☐ Other: ______<br>☐ Wind barriers Describe: ______<br>☐ Re-establish vegetation for temporarily stabilizing previously disturbed surfaces.<br>Explain: ______<br>☐ Other: ______ |

**Coleto Creek Power Station**
**Coal Combustion Residuals Management**
**Citizen CCR Fugitive Dust Complaint Record**

**Date:** ______________________ **Time:** ______________________

| **Citizen Contact Information** | |
|---|---|
| **Citizen Name:** | |
| Address: | |
| City / State / Zip: | |
| Phone: | |
| E-mail: | |

| **Employee Logging Complaint:** | |
|---|---|

**Description:** (Include as much information regarding location/conditions/nature of complaint (e.g., odor, respiratory issues, etc.) as possible)

**Weather Conditions:**

| Temp (deg. F): | | Avg. Wind Speed (mph): | | Wind Direction: | |
|---|---|---|---|---|---|

**Employee Comments:**

**Employee Signature:** ______________________

**Coleto Creek Power Station**
**Coal Combustion Residuals Management**
**Fugitive Dust Control Plan**
**Section 5 – Certification**

**Facility Name:** **Coleto Creek Power Station**

**5-A Certification**

I certify that all information contained herein and information submitted in the attachments to this document are true and correct.

**Facility Representative**

Richard Coleman — Print Name
EHS Manager — Title

[signature] — Signature
1/26/18 — Date

Phone Number: 361-788-5145
Fax Number: 361-788-5136
Cell Number: 361-208-5774

**Professional Engineer**

Dan Bullock, P.E. — Print Name
Principal Engineer — Title

Daniel B. Bullock [signature] — Signature
1/24/2018 — Date

Phone Number 512-355-9198 Fax Number 512-355-9197 Cell Number 512-587-8079

**Coleto Creek Power Station**
**Coal Combustion Residuals Management**
**Fugitive Dust Control Plan**

**Figures**

| | |
|---|---|
| **Facility Name:** | **Coleto Creek Power Station** |
| **Figures** | |
| Figure 1. Area Map<br>Figure 2. Simplified CCR Management Process Flow Diagram<br>Figure 3. Potential Fugitive CCR Dust Sources | |


STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

Daniel B. Bullock
10-23-2017

N

SOURCE: AERIAL PHOTO PROVIDED BY IMAGEPATCH.COM EARTHSTAR GEOGRAPHICS, DATE: MAY-OCT 2011.

**Coleto Creek Power, LP**

Figure 1

AREA MAP

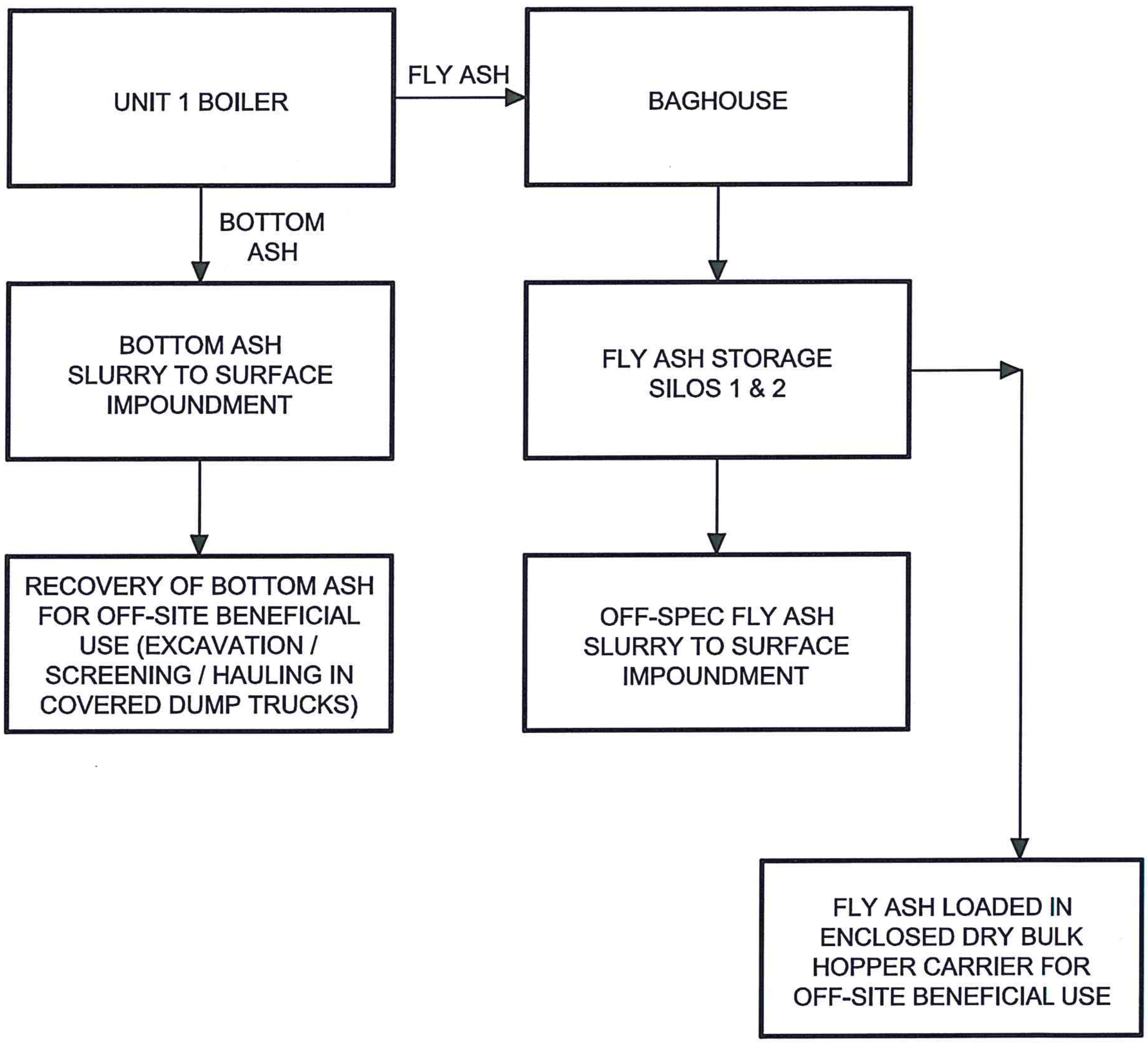
| PROJECT: 15214-2 | BY: K2P-RR | DATE: OCT. 2015 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

APPROXIMATE SCALE: 1" = 2000'

0 1000 2000 4000

Plot Date: 10/23/17 - 9:46am, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\ Drawing Name: C-ST-PL101.dwg




STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock
10-23-2017

**Coleto Creek Power, LP**

Figure 2

## SIMPLIFIED CCR MANAGEMENT PROCESS FLOW DIAGRAM

| PROJECT: 15214-2 | BY: K2P-RR | DATE: OCT. 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/23/17 - 9:49am, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: G-FS-DI101.dwg


N

APPROXIMATE SCALE: 1" = 1500'

0 750 1500 3000

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock
10-23-2017

NOTE:
ALL ROADS ON WHICH CCR WOULD POTENTIALLY BE TRANSPORTED ARE PAVED UNLESS OTHERWISE INDICATED.

SOURCE:
AERIAL PHOTO PROVIDED BY IMAGEPATCH.COM
EARTHSTAR GEOGRAPHICS, DATE: MAY-OCT 2011.

**Coleto Creek Power, LP**

Figure 3

# POTENTIAL CCR FUGITIVE DUST SOURCES

| PROJECT: 15214-2 | BY: K2P-RR | DATE: OCT. 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/23/17 - 9:45am, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL102.dwg

Annual CCR Fugitive Dust Report

Coleto Creek Power Plant
Solid Waste Registration (SWR) # 31911

Reporting Year: 2021

Date of Report: October 12, 2021

| **CCR Unit** | **CCR Material Managed** | **Dust Control Methods Used During the Reporting Year** | **Complaint** | **Date of Complaint** | **Summary of Corrective Measures Taken** |
|---|---|---|---|---|---|
| Primary Ash Pond | Fly Ash & Bottom Ash | • Water spray or fogging system<br>• Compaction<br>• Vegetative cover<br>• Reduced vehicle speed limits | NONE | N/A | N/A |

In accordance with §257.80(c), Luminant has reviewed the CCR fugitive dust control plan and prepared this annual report. Based upon this review, no changes or additional measures were determined to be necessary.

Reviewed by: Renee Collins, Sr Director of Environmental Services
Printed Name, Title

Signature

10/12/2021
Date

## APPENDIX D – SURFACE IMPOUNDMENT DESIGN AND OPERATING CRITERIA

**Alternative Closure Plan Demonstration - Part A**
**Hazard Potential Classification Assessment**
**Inflow Design Flood Control Plan**
**History of Construction Report**
**Structural Stability Assessment**
**Safety Factor Assessment**

Cynthia Vodopivec
Coleto Creek Power, LLC
Luminant
6555 Sierra Dr.
Irving, TX 75039

November 30, 2020

Sent via email

Mr. Andrew R. Wheeler, EPA Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Mail Code 5304-P
Washington, DC 20460

Re: Coleto Creek Power Plant Alternative Closure Demonstration

Dear Administrator Wheeler:

Coleto Creek Power, LLC (CCP) hereby submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) for the Primary Ash Pond located at the Coleto Creek Power Plant near Fannin, Texas. CCP is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the Primary Ash Pond may continue to receive CCR and non-CCR wastestreams after April 11, 2021, and complete closure no later than October 17, 2028.

CCP has elected to withdraw the alternate closure demonstration that was previously submitted to EPA on September 29, 2020 pursuant to 40 C.F.R. § 257.103(f)(1) and replace it with the enclosed demonstration prepared by Burns & McDonnell pursuant to 40 C.F.R. § 257.103(f)(2). This demonstration addresses all of the criteria in 40 C.F.R. § 257.103(f)(2)(i)-(iv) and contains the documentation required by 40 C.F.R. § 257.103(f)(2)(v). As allowed by the agency, in lieu of hard copies of these documents, electronic files were submitted to Kirsten Hillyer, Frank Behan, and Richard Huggins via email. If you have any questions regarding this submittal, please contact Renee Collins at 214-875-8338 or renee.collins@luminant.com. The demonstration is also available on CCP's publicly available website: https://www.luminant.com/ccr/

Sincerely,

Cynthia Vodopivec
VP - Environmental Health & Safety

Enclosure

cc: Kirsten Hillyer
Frank Behan
Richard Huggins

# Coleto Creek CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

**Coleto Creek Power, LLC**

**Coleto Creek Power Plant**
**Project No. 122702**

**Revision 0**
**11/30/2020**

# Coleto Creek CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline

prepared for

**Coleto Creek Power, LLC**
**Coleto Creek Power Plant**
**Fannin, Texas**

**Project No. 122702**

**Revision 0**
**11/30/2020**

prepared by


**Burns & McDonnell Engineering Company, Inc.**
**Kansas City, Missouri**

## INDEX AND CERTIFICATION

**Coleto Creek Power, LLC**
**Coleto Creek CCR Surface Impoundment**
**Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline**
**Project No. 122702**

### Report Index



### Certification

I hereby certify, as a Professional Engineer in the state of Texas, that the information in this document as noted in the above Report Index was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Coleto Creek Power, LLC or others without specific verification or adaptation by the Engineer.

STATE OF TEXAS
RANDELL LEE SEDLACEK
99056
LICENSED
PROFESSIONAL ENGINEER
Randell Lee Sedlacek
11/30/20

Randell Lee Sedlacek

Randell Lee Sedlacek, P.E. (Texas License No. 99506)

Date: 11/30/20

Burns & McDonnell Engineering Company, Inc.
Texas Registered Engineering Firm F-845

# TABLE OF CONTENTS

**Page No.**

## LIST OF TABLES

**Page No.**

# LIST OF ABBREVIATIONS

| Abbreviation | Term/Phrase/Name |
|---|---|
| CCP | Coleto Creek Power, LLC |
| CCR | Coal Combustion Residual |
| CFR | Code of Federal Regulations |
| Coleto Creek | Coleto Creek Power Plant |
| EPA | Environmental Protection Agency |
| GWPS | Groundwater Protection Standards |
| POTW | Publicly Owned Treatment Works |
| PSD | Prevention of Significant Deterioration |
| RCRA | Resource Conservation and Recovery Act |
| TPDES | Texas Pollutant Discharge Elimination System |

# 1.0 EXECUTIVE SUMMARY

Coleto Creek Power, LLC (CCP) submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(2) —"Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain"— for the Primary Ash Pond located at the Coleto Creek Power Plant (Coleto) in Texas. The Primary Ash Pond is a 190-acre CCR surface impoundment used to manage CCR and non-CCR wastestreams at Coleto. As discussed herein, the boiler at the station will cease coal-fired operations no later than July 17, 2027, and the impoundment will complete closure no later than October 17, 2028. Therefore, CCP is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(2) so that the Primary Ash Pond may continue to receive CCR and non-CCR waste streams after April 11, 2021, and complete closure no later than October 17, 2028.

# 2.0 INTRODUCTION

Coleto is a 650-megawatt, single unit coal-fueled electrical generating facility located in Fannin, Texas. The Coleto Creek facility includes a CCR unit (the Primary Ash Pond) that is the subject of this demonstration. Coleto uses the 190-acre Primary Ash Pond to manage sluiced bottom ash, economizer ash, and mill rejects, as well as non-marketable dry fly ash and non-CCR wastewaters. The impoundment was constructed between 1976 and 1977 and has been in service for the life of the plant. The boiler is scheduled to cease coal-fired operations no later than July 17, 2027. Fly ash is currently collected dry and normally hauled offsite for beneficial use; however, periodically, the market will not accept the fly ash due to varying properties or seasonal demand, in which case the ash is sluiced from the storage silo and disposed of in the Primary Ash Pond. The various non-CCR wastewaters received originate from the demineralizer sump (including, reverse osmosis reject and demineralizer regeneration flows) and the boiler sump (including flows from laboratory drains, hopper overflow (ash contact/quench water), boiler blowdown condensate polisher regeneration, water pretreatment filter backwash, oil/water separator discharge, transformer area sump, stormwater from ash piping trench, fabric filter area wash, air heater wash, and boiler wash). A site plan is provided in Appendix A, and the plant water balance diagram is included in Appendix B.

On April 17, 2015, the Environmental Protection Agency (EPA) issued the federal Coal Combustion Residual (CCR) Rule, 40 C.F.R. Part 257, Subpart D, to regulate the disposal of CCR materials generated at coal-fueled units. The rule is being administered under Subtitle D of the Resource Conservation and Recovery Act (RCRA, 42 U.S.C. § 6901 et seq.). On August 28, 2020, the EPA Administrator issued revisions to the CCR Rule that require all unlined surface impoundments to initiate closure by April 11, 2021, unless an alternative deadline is requested and approved. 40 C.F.R. § 257.101(a)(1) (85 Fed. Reg. 53,516 (Aug. 28, 2020)). Specifically, owners and operators of a CCR surface impoundment may continue to receive CCR and non-CCR wastestreams if the facility will cease operation of the coal-fired boiler(s) and complete closure of the impoundments within certain specified timeframes. 40 C.F.R. § 257.103(f)(2). To qualify for an alternative closure deadline under § 257.103(f)(2), a facility must meet the following four criteria:

1. **§ 257.103(f)(2)(i)** – No alternative disposal capacity is available on-site or off-site. An increase in costs or the inconvenience of existing capacity is not sufficient to support qualification.
2. **§ 257.103(f)(2)(ii)** - Potential risks to human health and the environment from the continued operation of the CCR surface impoundment have been adequately mitigated;
3. **§ 257.103(f)(2)(iii)** - The facility is in compliance with the CCR rule, including the requirement to conduct any necessary corrective action; and

4. **§ 257.103(f)(2)(iv) -** The coal-fired boilers must cease operation and closure of the impoundment must be completed within the following timeframes:
    a. For a CCR surface impoundment that is 40 acres or smaller, the coal-fired boiler(s) must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2023.
    b. For a CCR surface impoundment that is larger than 40 acres, the coal-fired boiler(s) must cease operation, and the CCR surface impoundment must complete closure no later than October 17, 2028.

Section 257.103(f)(2)(v) sets out the documentation that must be provided to EPA to demonstrate that the four criteria set out above have been met. Therefore, this demonstration is organized based on the documentation requirements of §§ 257.103(f)(2)(v)(A) – (D).

# 3.0 DOCUMENTATION OF NO ALTERNATIVE DISPOSAL CAPACITY

To demonstrate that the criteria in § 257.103(f)(2)(i) has been met, the following provides documentation that no alternative disposal capacity is currently available on-site or off-site for each CCR and non-CCR wastestream that CCP seeks to continue placing into the Primary Ash Pond after April 11, 2021. Consistent with the regulations, neither an increase in costs nor the inconvenience of existing capacity was used to support qualification under this criteria. Instead, as EPA explained in the preamble to the proposed Part A revisions, "it would be illogical to require [] facilities [ceasing power generation] to construct new capacity to manage CCR and non-CCR wastestreams." 84 Fed. Reg. 65,941, 65,956 (Dec. 2, 2019). EPA again reiterated in the preamble to the final revisions that "[i]n contrast to the provision under § 257.103(f)(1), the owner or operator does not need to develop alternative capacity because of the impending closure of the coal fired boiler. Since the coal-fired boiler will shortly cease power generation, it would be illogical to require these facilities to construct new capacity to manage CCR and non-CCR wastestreams." 85 Fed. Reg. at 53,547. Thus, new construction or the development of new alternative disposal capacity was not considered a viable option for any wastestream discussed below.

## 3.1 Site-Layout and Wastewater Processes

As shown on Figure 1 in Appendix A, Coleto Creek is bounded by Sulfur Creek to the north, the Coleto Creek Reservoir to the east, and Perdido Creek to the south. The western boundary is formed by FM 2987 (farm to market road). The Ash Pond receives both the CCR sluice flows and a portion of the non-CCR wastewater flows onsite. The plant process flows are shown in Appendix B. The remaining impoundments onsite (the Secondary Pond, Evaporation Pond and Coal Pile Runoff Pond) are not authorized to receive CCR material and are not large enough to independently treat the total volume of the plant process water flows.

## 3.2 CCR Wastestreams

CCP evaluated each CCR wastestream placed in the Primary Ash Pond at Coleto. For the reasons discussed below in Table 3-1, each of the following CCR wastestreams must continue to be placed in the Primary Ash Pond due to lack of alternative capacity both on and off-site.

**Table 3-1: Coleto CCR Wastestreams**

| CCR Wastestreams | Estimated Average Flow (MGD) | Alternative Disposal Capacity Currently Available? YES/NO | Details |
|---|---|---|---|
| Bottom Ash, Economizer Ash, and non-CCR mill rejects Sluice | 1.26 | NO | Alternative capacity is not currently available on or off-site and would have to be developed. Alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks to support transport of sluice material offsite for disposal. Refer to the discussion below for a more detailed evaluation on the development of alternative capacity.<br>Some bottom ash/economizer ash/mill reject materials removed from the Primary Ash Pond for off-site beneficial reuse (~21,000 tons in 2019); however, the transport water remains within the pond. |
| Dry Fly Ash | Normally Dry Handled with Intermittent Sluices from Silo for Disposal (0.57 when sluicing)<br>~550 tons/year to Primary Ash Pond based on 2019 rates | NO | The fly ash is collected dry and conveyed to a storage silo near the Primary Ash Pond. Normally, the ash is sent off-site for beneficial reuse. Periodically, the market will not accept the ash due to varying properties or seasonal demand, in which case the ash is sluiced from the silo to the Primary Ash Pond. No conditioning equipment is currently installed to allow for trucking the material offsite for disposal. The existing sluicing system must be removed from service no later than December 31, 2023, to comply with the ELG Rule. CCP must continue its beneficial use marketing efforts to allow for 100% beneficial reuse or install a pug mill to condition any fly ash that must be disposed after that date.<br>CCP does not have a CCR landfill or another CCR surface impoundment located onsite that is available or ready to accept this material. Consequently, there are currently no on-site alternatives for this wastestream, and alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity is not currently available as discussed below. |

CCP evaluated the following on-site and off-site alternative capacity options for these CCR wastestreams:

- Bottom ash, economizer ash, and non-CCR mill rejects sluice (1.26 MGD):
    - On-site alternative capacity is currently not available and would need to be developed. The remaining impoundments onsite (Coal Pile Runoff Pond, Evaporation Pond, and the Secondary Pond) are not authorized to receive the CCR materials.

- Development of on-site alternative capacity would require the design, permitting, and installation of a new dry ash handling system or a treatment system including CCR ponds, clarifiers, and/or storage tank(s), to provide the necessary retention time to meet the TPDES permit limits. The environmental permitting might require a modification to the site's current individual TPDES permit (if rerouting of this wastestream to another outfall), general TPDES stormwater construction permit (includes evaluation of threatened and endangered species and historic preservation assessments), and an updated Stormwater Pollution Prevention Plan (SWPPP) at a minimum. Based on our experience with environmental permitting, this effort could require two to four years.
- Off-site alternative capacity is currently not available and would need to be developed. Developed off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks), and off-site transportation, via tanker trucks. With an average daily flow of 1.26 MGD of sluice water, approximately 60 frac tanks and 168 daily tanker trucks (~7500 gallons per truck to maintain DOT weight restrictions) would be required, if a Publicly Owned Treatment Works (POTW) could be identified to receive it. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a Prevention of Significant Deterioration (PSD) permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up contractual arrangements for a local POTW to accept the wastewater would prove to be difficult since this amount of wastewater would potentially upset their treatment systems causing them to exceed their TPDES discharge limits. The potential for leaks/spills from the tank system or transportation of the wastewater offsite exist as well. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of two years to implement. For all of these reasons, CCP has determined that offsite disposal is not feasible for these flows at Coleto.

- Fly ash (0.57 MGD when sluicing; ~550 tons/year based on 2019 rates):
  - On-site alternative capacity is currently not available and would need to be developed. The remaining impoundments onsite (Coal Pile Runoff Pond, Evaporation Pond, and the Secondary Pond) are not authorized to receive the CCR materials.
  - Development of on-site alternative capacity would require the design, permitting, and installation of a new CCR landfill and new conditioning equipment to support hauling and

disposal at the landfill. Based on our experience with environmental permitting, this effort could require a minimum of three to four years.

- Fly ash transport water cannot be disposed offsite per 40 C.F.R. § 423.16(f). The sluicing system is the only installed method onsite to allow for disposal of dry fly ash, and the Primary Ash Pond is the only CCR surface impoundment onsite to receive this wastestream.
- Off-site alternative capacity for dry fly ash is currently not available and would need to be developed. It should be noted that CCP is currently marketing 99% of the fly ash for beneficial reuse off-site. CCP is focused on expanding beneficial use marketing efforts to eliminate the sluicing of fly ash at Coleto prior to December 31, 2023. As a result, fly ash disposal is projected to be minimal, both in 2020 and over the next several years.
- Developed off-site alternative disposal capacity for fly ash would consist of off-site transportation to a contracted landfill and the installation of conditioning equipment on-site to prepare the material for offsite disposal. The fly ash would likely need to be conditioned (@ 10% moisture) in an on-site pug mill due to fugitive dusting concerns. Low-sulfur Powder River Basin Class C fly ash develops cementitious characteristics when conditioned with water rather quickly. Because of this, off-site transportation must be limited to less than a one-hour haul time, or within 40 miles of the station, to prevent the fly ash from setting up and hardening and causing adverse disposal / unloading issues at the offsite landfill. There is one landfill within approximately 40 miles of the station (see Figure 2 in Appendix A), so CCP is continuing to have discussions with these offsite landfills to determine if they have the capacity and the infrastructure to receive any future fly ash for disposal. This will also include efforts to characterize the waste. CCP will update EPA in forthcoming progress reports if offsite disposal capacity becomes available.

As stated previously, because CCP has elected to pursue the option to permanently cease coal-fired operations of the boiler no later than July 17, 2027, developing alternative disposal capacity is “illogical,” to use EPA’s words, and also counterproductive to the work to cease coal-fired operations of the boiler and close the impoundment. As long as CCP continues to wet handle the bottom ash, economizer ash, and mill reject materials, there are no other onsite CCR impoundments available to receive and treat these flows and it is not feasible to dispose of the wet-handled material offsite. As EPA explained in the preamble of the 2015 rule, it is not possible for sites that sluice CCR material to an impoundment to eliminate the impoundment and dispose of the material offsite. *See* 80 Fed. Reg. 21,301, 21,423 (Apr. 17, 2015) (“[W]hile it is possible to transport dry ash off-site to [an] alternate disposal facility that is simply not feasible for wet-generated CCR. Nor can facilities immediately convert to dry handling systems.”). As a result, the conditions at Coleto satisfy the demonstration requirement in § 257.103(f)(2)(i).

Consequently, in order to continue to operate and generate electricity, Coleto must continue to use the 190-acre Primary Ash Pond to manage the CCR wastestreams discussed above. Accordingly, the non-marketable fly ash must be placed in the only available onsite disposal location (i.e., the Primary Ash Pond) when not hauled offsite for beneficial use due to seasonal market impacts.

## 3.3 Non-CCR Wastestreams

CCP evaluated each non-CCR wastestream placed in the Primary Ash Pond at Coleto. For the reasons discussed below in Table 3-2, each of the following non-CCR wastestreams must continue to be placed in the Primary Ash Pond due to lack of alternative capacity both on and off-site.

**Table 3-2: Coleto Non-CCR Wastestreams**

| Non-CCR Wastestreams | Estimated Average Flow (MGD) | Alternative Disposal Capacity Currently Available? YES/NO | Details |
|---|---|---|---|
| Demineralizer Sump Discharge (including Demineralizer Regeneration Flows and RO Reject) | 0.07 | NO | On-site alternative capacity would need to be designed, permitted, and installed. Off-site alternative capacity would include development of on-site temporary tanks and transporting of this sluice material offsite for disposal. See discussion below for more details. |
| Boiler Sump Discharges (normal operation) | 1.56 | NO | While onsite infrastructure exists to route this flow to the Evaporation Pond, the capacity of the Evaporation Pond would be exceeded by the addition of these flow rates. The average annual precipitation and evaporation rates for the site are 41 and 69 inches, respectively. The coal pile runoff is already routed to the Evaporation Pond, and consequently this pond is only capable of receiving approximately 5% of this boiler sump discharge without having the permit modified to allow for discharge from this pond. Such a modification would require sampling, wastestream characterization, and likely anti-degradation studies to generate a new outfall to Coleto Creek Reservoir.<br>Off-site alternative capacity would include development of on-site temporary tanks and transporting of this sluice material offsite for disposal. See discussion below for more details. |

| Non-CCR Wastestreams | Estimated Average Flow (MGD) | Alternative Disposal Capacity Currently Available? YES/NO | Details |
|---|---|---|---|
| Boiler Sump Discharges (during outage wash events) | ~1.2 million gallons per outage | YES | These wastestreams will be rerouted to the existing Evaporation Pond prior to the April 11, 2021 deadline. |

CCP evaluated on-site and off-site alternative capacity options for the non-CCR wastestreams. Development of on-site alternative capacity would require the design, permitting, and installation of a new treatment system including non-CCR ponds, clarifiers, and/or storage tank(s) to provide the necessary retention time for TSS removal to meet the TPDES permit limits. For the demineralizer sump discharge, this would include installing a minimum of 1,000 feet of additional piping, and potentially replacing the demineralizer sump pumps and upsizing of the power feeds to reroute to the existing Secondary Pond and/or Evaporation Pond. A neutralization tank may also be required depending on the results of the characterization. The environmental permitting might include a modification to the current individual TPDES permit (if rerouting of this wastestream to another outfall), general TPDES stormwater construction permit (includes evaluation of threatened and endangered species and historic preservation assessments), a construction & operating permit, and a SWPPP at a minimum which is expected to require two to four years to implement.

Development of off-site alternative capacity would consist of both temporary on-site wet storage (frac tanks) and off-site transportation via tanker trucks, assuming a local POTW could be identified to receive these streams. The required daily frac tanks and tanker trucks (~7,500 gallons per truck to maintain DOT weight restrictions) for each wastestream is provided in Table 3-3. The daily tanker truck traffic would result in increased potential for safety and noise impacts and further increases in fugitive dust, greenhouse gas emissions and carbon footprint which may require a PSD permit and modification under the Clean Air Act Permit Program if the calculated increases in emissions are over the PSD limits. Setting up arrangements for a local POTW to accept this wastewater could prove to be difficult if this amount of wastewater would upset their treatment systems, causing them to exceed their TPDES discharge limits. CCP is continuing to have discussions with local POTW's to determine if they have the capacity and the infrastructure to handle these daily volumes of wastewater. This will likely also include efforts to characterize the waste, and installation of a chemical treatment/neutralization process prior to hauling the demineralizer sump discharge offsite for disposal. CCP will update EPA in forthcoming progress reports if offsite disposal capacity becomes available. The potential for leaks/spills from the tank system or transportation of the wastewater offsite does also exist. Furthermore, the temporary wet storage needed to accommodate off-site disposal would require reconfiguration, design, installation, and associated environmental permitting which would require a minimum of two years to implement. For all of these reasons, CCP has determined that offsite disposal is not feasible for these flows at Coleto at this time.

**Table 3-3: Non-CCR Wastestream Offsite Disposal**

| Non-CCR Wastestreams | Estimated Flow (MGD) | No. of Frac Tanks required (21,000 gallons each) | No. of Trucks required per day (7,500 gallons each) |
|---|---|---|---|
| Demineralizer Sump Discharge | 0.07 | 4 | 10 |
| Boiler Sump Discharges (normal operation) | 1.56 | 75 | 208 |
| | **Total** | **79** | **218** |

As stated previously, since CCP has elected to pursue the option to permanently cease the use of the coal fired boilers by a certain date, developing alternative disposal capacity is “illogical,” to use EPA’s words, and also counterproductive to the work to cease coal-fired operations of the boilers and close the impoundment. There is currently no available infrastructure at the plant to support reroute of these flows. For the reasons discussed above, each of the non-CCR wastestreams (except the outage wash flows) must continue to be placed in the Primary Ash Pond due to lack of alternative capacity both on and off-site. Consequently, in order to continue to operate and generate electricity, Coleto must continue to use the 190-acre Primary Ash Pond to manage the non-CCR wastestreams discussed above.

# 4.0 RISK MITIGATION PLAN

To demonstrate that the criteria in § 257.103(f)(2)(ii) has been met, CCP has prepared and attached a Risk Mitigation Plan for the Coleto Primary Ash Pond (see Attachment 1). Per § 257.103(f)(2)(v)(B), this Risk Mitigation Plan is only required for the specific CCR Unit(s) that are the subject of this demonstration.

# 5.0 DOCUMENTATION AND CERTIFICATION OF COMPLIANCE

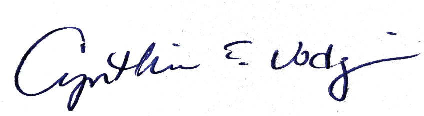
In the Part A rule preamble, EPA reiterates that compliance with the CCR rule is a prerequisite to qualifying for an alternative closure extension, as it "provides some guarantee that the risks at the facility are properly managed and adequately mitigated." 85 Fed. Reg. at 53,543. EPA further stated that it "must be able to affirmatively conclude that facility meets this criterion prior to any continued operation." 85 Fed. Reg. at 53,543. Accordingly, EPA "will review a facility's current compliance with the requirements governing groundwater monitoring systems." 85 Fed. Reg. at 53,543. In addition, EPA will also "require and examine a facility's corrective action documentation, structural stability documents and other pertinent compliance information." 85 Fed. Reg. at 53,543. Therefore, EPA is requiring a certification of compliance and specific compliance documentation be submitted as part of the demonstration. 40 C.F.R. § 257.103(f)(2)(v)(C).

The Coleto Creek facility includes a CCR unit (the Primary Ash Pond) that is the subject of this demonstration. To demonstrate that the criteria in § 257.103(f)(2)(iii) has been met, CCP is submitting the following information as required by § 257.103(f)(2)(v)(C):

## 5.1 Owner's Certification of Compliance - § 257.103(f)(2)(v)(C)(1)

I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for Coleto Creek, the facility is in compliance with all of the requirements contained in 40 C.F.R. Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. Coleto Creek's CCR compliance website is up-to-date and contains all the necessary documentation and notification postings.

**On behalf of CCP:**



Cynthia Vodopivec
VP - Environmental Health & Safety
November 30, 2020

## 5.2 Visual representation of hydrogeologic information - § 257.103(f)(2)(v)(C)(2)

Consistent with the requirements of § 257.103(f)(2)(v)(C)(2)(i) – (iii), CCP has attached the following items to this demonstration:

- Map(s) of groundwater monitoring well locations in relation to the CCR unit (Attachment 2)
- Well construction diagrams and drilling logs for all groundwater monitoring wells (Attachment 3)

- Maps that characterize the direction of groundwater flow accounting for seasonal variations (Attachment 4)

## 5.3 Groundwater monitoring results - § 257.103(f)(2)(v)(C)(3)

Tables summarizing constituent concentrations at each groundwater monitoring well through the first 2020 semi-annual monitoring period are included as Attachment 5.

## 5.4 Description of site hydrogeology including stratigraphic cross-sections - § 257.103(f)(2)(v)(C)(4)

A description of the site hydrogeology and stratigraphic cross-sections of the site are included as Attachment 6.

## 5.5 Corrective measures assessment - § 257.103(f)(2)(v)(C)(5)

Background sampling began at the Primary Ash Pond in March of 2017 and continued through July for eight rounds of background sampling. The first semiannual detection monitoring samples were collected in November 2017. The first assessment monitoring samples were collected in June 2018. The results, through the first 2020 semi-annual monitoring period, indicate the Primary Ash Pond is currently in assessment monitoring, with no exceedances of the Appendix IV parameters recorded. Accordingly, an assessment of corrective measures is not currently required. Coleto will continue to conduct groundwater monitoring in accordance with all state and federal requirements.

## 5.6 Remedy selection progress report - § 257.103(f)(2)(v)(C)(6)

As noted above, an assessment of corrective measures and the resulting selection of remedy are not currently required for the Primary Ash Pond.

## 5.7 Structural stability assessment - § 257.103(f)(2)(v)(C)(7)

Pursuant to § 257.73(d), the initial structural stability assessment report for the Primary Ash Pond was prepared in October 2016 and revised in January 2018 (to remove the Secondary Pond). The revised report is included as Attachment 7.

## 5.8 Safety factor assessment - § 257.103(f)(2)(v)(C)(8)

Pursuant to § 257.73(e), the initial safety factor assessment report for the Primary Ash Pond was prepared in October 2016 and revised in January 2018 (to remove the Secondary Pond). The revised report is included as Attachment 7.

# 6.0 DOCUMENTATION OF CLOSURE COMPLETION TIMEFRAME

To demonstrate that the criteria in § 257.103(f)(2)(iv) has been met, "the owner or operator must submit the closure plan required by § 257.102(b) and a narrative that specifies and justifies the date by which they intend to cease receipt of waste into the unit in order to meet the closure deadlines. The closure plan for the Primary Ash Pond is included as Attachment 8.

In order for a CCR surface impoundment over 40 acres to continue to receive CCR and non-CCR wastestreams after the initial April 11, 2021 deadline, the coal-fired boiler(s) at the facility must cease operation and the CCR surface impoundment must complete closure no later than October 17, 2028. As discussed below, Coleto will begin construction of the Primary Ash Pond closure by April 17, 2025, the boiler will cease coal-fired operations no later than July 17, 2027, and Coleto will cease placing wastestreams into the Primary Ash Pond by September 17, 2027, in order for closure to be completed by this deadline.

Table 6-1 is included below to summarize the major tasks and estimated durations associated with closing the Primary Ash Pond in place. These durations are consistent with the durations experienced with the closure of approximately 500 acres of other CCR impoundments already completed by CCP and its affiliates to date as noted below:

- Baldwin Fly Ash Pond System – 230 acres closed in-place with an approximate 30-month construction schedule
- Hennepin West Ash Ponds System – 35 acres closed in-place with an approximate 24-month construction schedule (includes closure by removal of an adjacent 6-acre settling pond and installing a sheet pile wall)
- Hennepin East Ash Ponds 2 and 4 – 25 acres closed in-place with an approximate 6-month construction schedule
- Coffeen Ash Pond 2 – 60 acres closed in-place with an approximate 24-month construction schedule
- Duck Creek Ash Ponds 1 and 2 – 130 acres closed in-place with an approximate 24-month construction schedule

Each CCR impoundment closure indicated above utilized a coordinated passive or gravity dewatering method, which consisted of the use of trenches excavated to lower the phreatic surface in portions of the impoundment to obtain a stable ash surface to permit the safe construction of the final cover system. The phreatic water in the trenches flows by gravity to sumps constructed within the impoundment. The major benefit associated with this passive or gravity dewatering method is that the sumps are designed to provide holding time to allow the TSS to settle within the impoundment prior to discharge (an active dewatering method with wells would result in potential discharges of unsettled TSS). After solids settling, the water is discharged through the TPDES outfall in compliance with permitted limits.

Construction progressed sequentially as the dewatering of an area stabilized the ash surface. The CCR was graded to subgrade level, then overlain with the compacted clay layers and/or geomembrane liners. Vegetative soil cover was then placed on top of the infiltration layer. As each section of the impoundment was closed, this sequencing progressed to the completion of the pond closure. A similar process will be utilized to close the Coleto Primary Ash Pond in order to allow the final open section of the impoundment to be large enough for the impoundment to remain in operation until the pond ceases the receipt of waste. This would provide sufficient time for closure to be completed by October 17, 2028.

The first construction effort will involve modifying the pond operations by relocating the influent lines, minimizing the pond water levels, and isolating flow to a smaller portion of the current 190-acre impoundment that can be closed during the last two construction seasons. The smaller active portion of the pond will remain in operation while CCP begins dewatering and closing the impoundment as described above. This reduction in footprint may require the addition of chemical feeds to provide adequate treatment but that has not been the case at our other sequenced closures. This approach simultaneously allows for continued operation of the plant to maintain generating capacity for the ERCOT markets and minimizes the risk to the environment both by minimizing the pond size and the potential for any impacts to groundwater and by opening up a significant portion of the remaining impoundment to allow for dewatering, grading, and closure (in Phase 1).

Table 6-1 provides estimates for the durations required to close a portion of the pond footprint after the date noted to begin construction of closure (Phase 1), as well as the current estimates for the closure of the active area (Phase 2, remaining 40-50 acres). In order to dewater the impoundment, CCP will likely release pond water through the existing Outfall 003.

**Table 6-1: Coleto Primary Ash Pond Closure Schedule**

| Action | Estimated Timeline (Months) |
|---|---|
| Spec, bid, and Award Engineering Services for CCR Impoundment Closure | 3 |
| Finalize CCR unit closure plan | 12 |

| Action | Estimated Timeline (Months) |
|---|---|
| Obtain environmental permits:<br>• State Waste Pollution Control Construction/Operating Permit<br>• TPDES Industrial Wastewater Permit Modification (*modification could be required if there are changes to the quantity or quality of discharges or to allow reconfiguration of the various wastestreams to either other TPDES-permitted outfalls or newly constructed TPDES-permitted outfalls*)<br>• General TPDES Permit for Storm Water Discharges from Construction Site Activities and Storm Water Pollution Prevention Plan (SWPPP) | 24 |
| Spec, bid, and Award Construction Services for CCR Impoundment Closure | 3 |
| Begin Construction of Closure | April 17, 2025 |
| Minimize Active Area of Impoundment / Dewater Phase 1 Area | 6 |
| Regrade CCR Material in Phase 1 Area | 18 |
| Install Cover System – Phase 1 Area* | 13 |
| Establish Vegetation – Phase 1 Area** | 2 |
| Cease Coal-Fired Operations of Remaining Boiler Onsite (No Later Than) | July 17, 2027 |
| Begin Dewatering Impoundment – Phase 2 Area | 2 |
| Cease Placement of Waste (No Later Than, allowing for plant cleanup and dredging of impoundments following coal pile and plant closure) | September 17, 2027 |
| Continue Dewatering Impoundment – Phase 2 Area | 1 |
| Regrade CCR Material – Phase 2 Area | 6 |
| Install Cover System – Phase 2 Area | 5 |
| Establish Vegetation, Perform Site Restoration Activities, Complete Closure, and Initiate Post-Closure Care** | 2 |
| Total Estimated Time to Complete Closure | 84 months |

| Action | Estimated Timeline (Months) |
|---|---|
| Date by Which Closure Must be Complete | October 17, 2028 |

* Activity expected to overlap with grading operations, finishing 2 months after grading is completed.

** Activity expected to overlap with cover system installation, finishing 1 month after cover installation is completed.

# 7.0 CONCLUSION

Based upon the information included in and attached to this demonstration, CCP has demonstrated that the requirements of 40 C.F.R. § 257.103(f)(2) are satisfied for the 190-acre Primary Ash Pond at Coleto. This CCR surface impoundment is needed to continue to manage the CCR and non-CCR wastestreams identified in Section 3.2 and 3.3 above, is larger than 40 acres, the coal-fired boiler at the station will cease coal-fired operation no later than July 17, 2027, and the Primary Ash Pond will be closed by the October 17, 2028 deadline. Therefore, this CCR unit qualifies for the site-specific alternative deadline for the initiation of closure authorized by 40 C.F.R. § 257.103(f)(2).

Therefore, it is requested that EPA approve CCP's demonstration and authorize the Primary Ash Pond at Coleto to continue to receive CCR and non-CCR wastestreams notwithstanding the deadline in § 257.101(a)(1) and to grant the alternative deadline of October 17, 2028, by which to complete closure of the impoundment.

# APPENDIX A – SITE PLAN AND NEARBY LANDFILLS


| BURNS McDONNELL<br>Firm Reg. No. F-845<br>date 03/18/02<br>designed A. MYERS | LUMINANT<br>COLETO CREEK POWER STATION<br>SITE PLAN | project 122702<br>contract -<br>dwg FIGURE 1 - |
|---|---|---|

11/24/2020

\\bmcd\dfs\Clients\ENR\VistraEnergy\122702_ALTuseDisposal\Design\Civil\Dwgs\Sketches\Coleto_Figure1.dgn

# MSW Facility Viewer

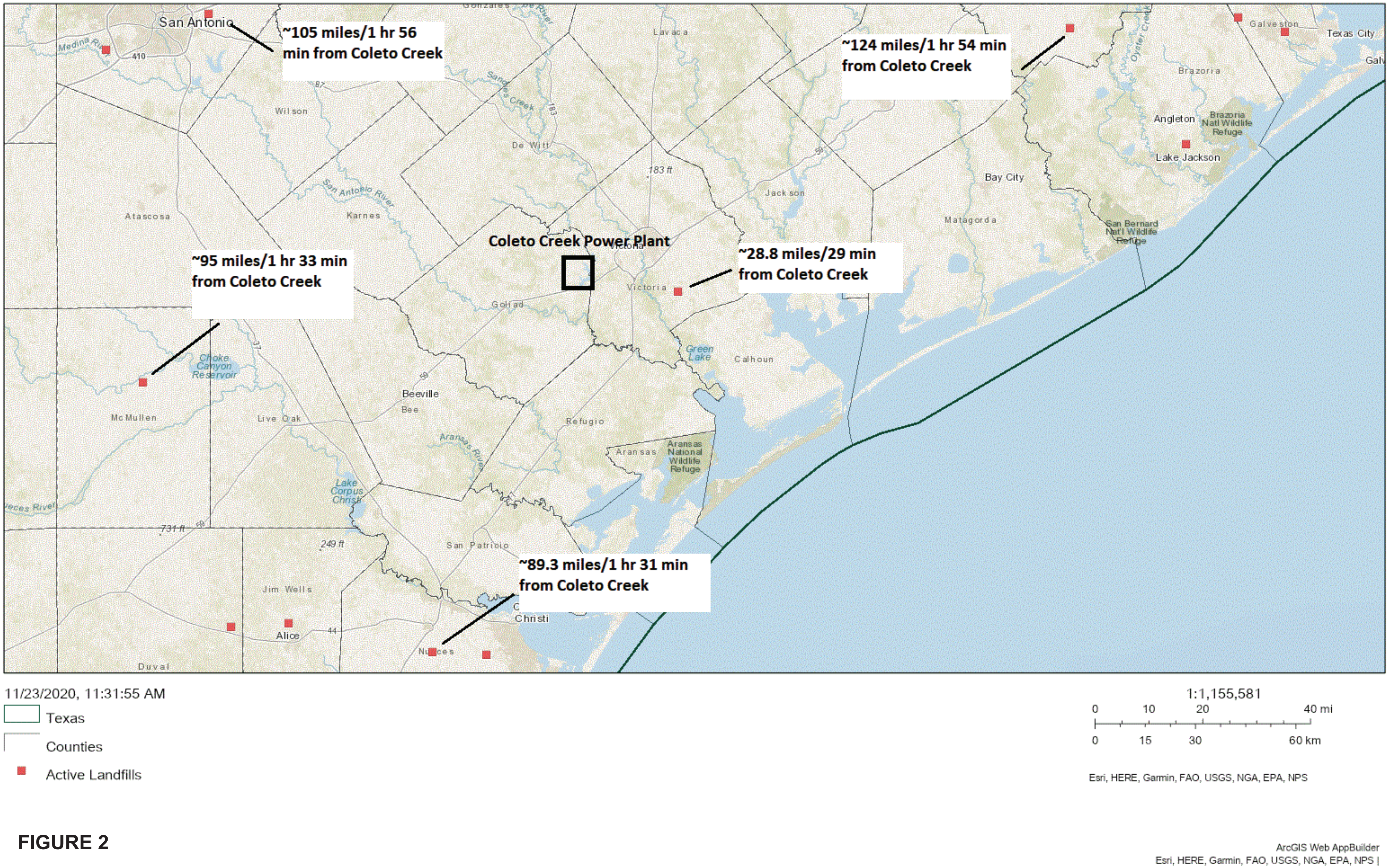
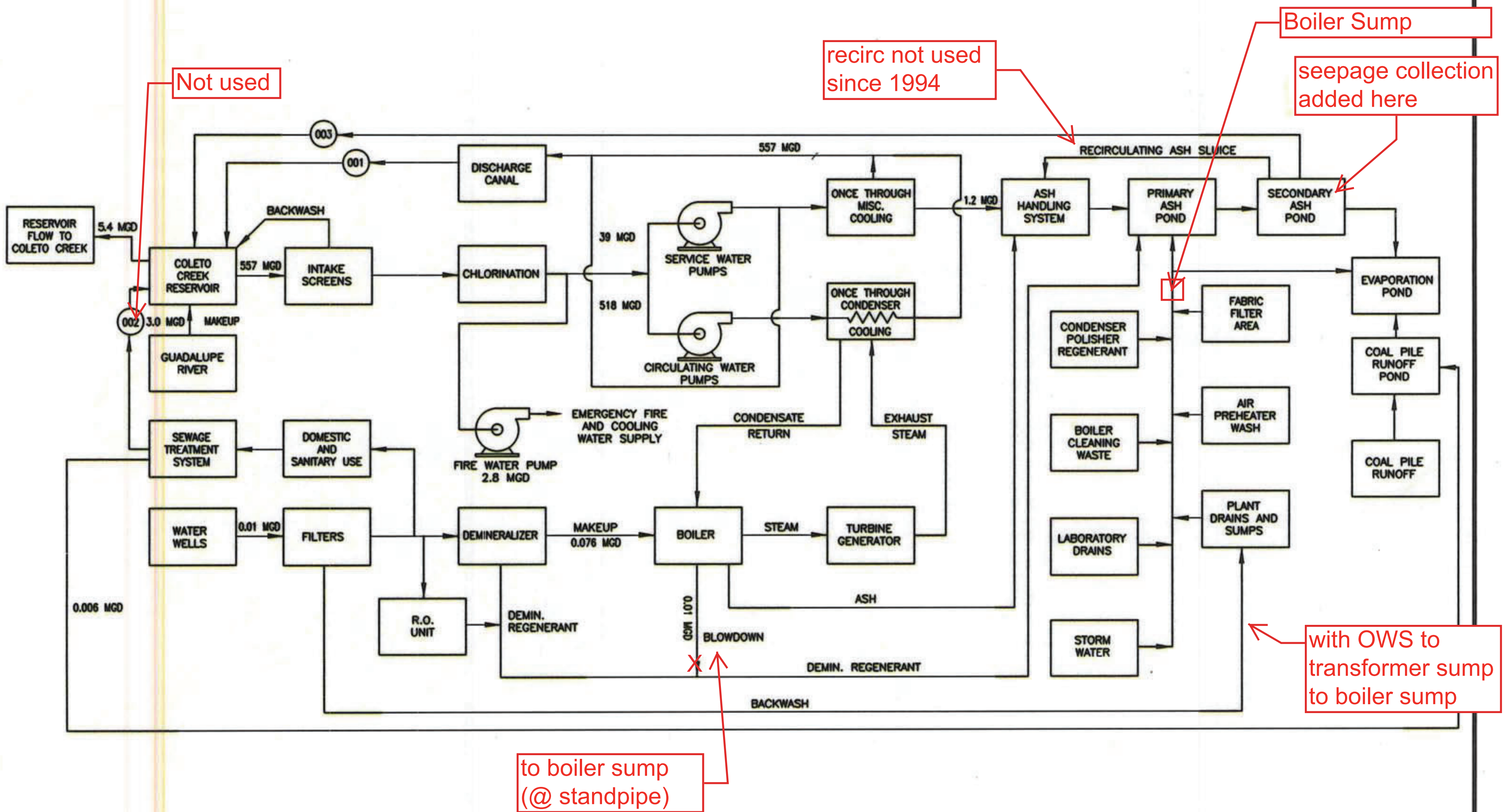



**FIGURE 2**

# APPENDIX B – WATER BALANCE DIAGRAM

FILE INFO: J:\12261-IPA\12261-002 Coleto Creek Power Exp-Env Permitting\Water Permitting\2008 TPDES Application\02-TPDES Attachments\01-Final Attachments\Attach 10 Flow Schematic\Phase I Flow Diagram.dwg




ENSR | AECOM

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PHASE I FLOW DIAGRAM
COLETO CREEK POWER STATION

| DRAWN BY: | DATE: | PROJECT NUMBER: | SHEET NUMBER: |
|---|---|---|---|
| GAJ | 4-8-08 | 12261-003-300 | 1 |

ATTACHMENT NO. 5

# ATTACHMENT 1 – RISK MITIGATION PLAN

# RISK MITIGATION PLAN - 40 C.F.R. § 257.103(f)(2)(v)(B)

## INTRODUCTION

To demonstrate that the criteria in 40 C.F.R. § 257.103(f)(2)(ii) has been met, Coleto Creek Power, LLC ("CCP") has prepared this Risk Mitigation Plan for the Primary Ash Pond located at the Coleto Creek Power Plant ("Coleto Creek") located near Fannin, Texas.

- EPA is requiring a risk mitigation plan to "address the potential risk of continued operation of the CCR surface impoundment while the facility moves towards closure of their coal-fired boiler(s), to be consistent with the court's holding in *USWAG* that RCRA requires EPA to set minimum criteria for sanitary landfills that prevent harm to either human health or the environment." 85 Fed. Reg. 53,516, 53,548 (Aug. 28, 2020).

As required by § 257.103(f)(2)(v)(B), the Risk Mitigation Plan must describe the "measures that will be taken to expedite any required corrective action," and contain the three following elements:

- First, "a discussion of any physical or chemical measures a facility can take to limit any future releases to groundwater during operation." § 257.103(f)(2)(v)(B)(1). In promulgating this requirement, EPA explained that this "might include stabilization of waste prior to disposition in the impoundment or adjusting the pH of the impoundment waters to minimize solubility of contaminants [and that] [t]his discussion should take into account the potential impacts of these measures on Appendix IV constituents." 85 Fed. Reg. at 53,548.
- Second, "a discussion of the surface impoundment's groundwater monitoring data and any found exceedances; the delineation of the plume (if necessary based on the groundwater monitoring data); identification of any nearby receptors that might be exposed to current or future groundwater contamination; and how such exposures could be promptly mitigated." § 257.103(f)(2)(v)(B)(2).
- Third, "a plan to expedite and maintain the containment of any contaminant plume that is either present or identified during continued operation of the unit." § 257.103(f)(2)(v)(B)(3). In promulgating this final requirement, EPA explained that "the purpose of this plan is to demonstrate that a plume can be fully contained and to define how this could be accomplished in the most accelerated timeframe feasible to prevent further spread and eliminate any potential for exposures." 85 Fed. Reg. at 53,549. In addition, EPA stated that "this plan will be based on relevant site data, which may include groundwater chemistry, the variability of local hydrogeology, groundwater elevation and flow rates, and the presence of any surface water features that would influence rate and direction of contamination movement. For example, based on the rate and direction of groundwater flow and potential for diffusion of the plume, this plan could identify the design and spacing of extraction wells necessary to prevent further downgradient migration of contaminated groundwater." 85 Fed. Reg. at 53,549.

Consistent with these requirements and guidance, CCP plans to continue to mitigate the risks to human health and the environment from the Coleto Creek Primary Ash Pond as detailed in this Risk Mitigation Plan.

# 1 Operational Measures to Limit Future Releases to Groundwater – 40 C.F.R. § 257.101(f)(2)(v)(B)(1)

The Coleto Creek Primary Ash Pond is a 190-acre CCR surface impoundment. Consistent with the requirements of the CCR rule, compliance documents on Coleto Creek's CCR public website reflect the characterization of the Primary Ash Pond as a single unit for purposes of groundwater monitoring and closure activities.

The Primary Ash Pond receives sluiced bottom ash, economizer ash, and mill rejects, as well as non-marketable dry fly ash and various non-CCR wastewaters.

At the Coleto Creek Primary Ash Pond, none of the Appendix IV parameter have reported statistically significant levels (SSLs) above their respective Ground Water Protection Standards (GWPSs), as sampled and analyzed per the CCR surface impoundment's groundwater monitoring program. Therefore, Coleto Creek's current physical treatment operation adequately limits potential risks to human health and the environment during operation. Coleto Creek will continue this treatment process for the CCR surface impoundment until such time as closure is required per 40 C.F.R. Part 257. The facility's current physical treatment process is discussed below, followed by a discussion of other treatment processes that could be implemented, as required per § 257.103(f)(2)(v)(B)(1).

## 1.1 Current Operation of Physical Treatment

Fly ash is currently collected dry and normally hauled offsite for beneficial use; however, periodically, the market will not accept the fly ash due to varying properties or seasonal demand, in which case the ash is sluiced from the storage silo and disposed of in the Primary Ash Pond.

As part of normal operations, bottom ash, economizer ash, and mill rejects are transported through the sluice lines into the CCR surface impoundment where they are either removed for beneficial use or remain. The CCR surface impoundment serves as a wastewater treatment settling system which allows the solids to settle.

The various non-CCR wastewaters received originate from the demineralizer sump (including, reverse osmosis reject and demineralizer regeneration flows) and the boiler sump (including flows from laboratory drains, hopper overflow (ash contact/quench water), boiler blowdown condensate polisher regeneration, water pretreatment filter backwash, oil/water separator discharge, transformer area sump, stormwater from ash piping trench, fabric filter area wash, air heater wash, and boiler wash).

Therefore, since fly ash transport water is not routinely conveyed to the CCR surface impoundment, the current operation of Coleto Creek's CCR surface impoundment limits future releases to groundwater during operation, and consequently no potential safety impacts or exposure to human health or environmental receptors are expected to result. This is supported by CCR groundwater monitoring results, which show no SSLs above GWPS(s).

If Appendix IV releases are discovered per the facility's groundwater monitoring program, CCP will test, evaluate, and implement a chemical treatment method (*i.e.*, pH adjustment, coagulation, precipitation, or other method as determined) for the Coleto Creek Primary Ash Pond to limit potential risks to human health and the environment during operation as a supplement to other corrective measures discussed in Section 3.

# 2 GROUNDWATER IMPACTS, RECEPTORS, AND POTENTIAL EXPOSURE MITIGATION – 40 C.F.R. § 257.101(F)(2)(V)(B)(2)

The Coleto Creek Primary Ash Pond, with a footprint of approximately 190 acres (Figure 1), currently remains in assessment monitoring. There have been no SSLs of Appendix IV parameter concentrations since assessment monitoring was established on May 9, 2018 in accordance with 40 C.F.R. § 257.95. The most recent summary of groundwater monitoring activities is provided in the "2019 Annual Groundwater Monitoring and Corrective Action Report, Coleto Creek Primary Ash Pond – Fannin, Texas" (Golder, 2020) [see Attachment 1]. A summary of the assessment monitoring program is provided in Table 1. Samples were collected for the second 2020 semi-annual monitoring period, but results are still under review.

Since there have been no SSLs exceedances of GWPS(s) to date, plume delineation has not been required. However, if one or more Appendix IV constituents are detected at SSLs above the GWPS(s), the nature and extent of the release would be characterized to delineate the contaminant plume. The existing conceptual site model and description of site hydrogeology provides site characterization data that will be used as the basis for executing supplemental plume delineation activities. A demonstration may also be made that a source other than the CCR unit caused the contamination, or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (§257.95(g)(3)(ii)).

<u>Receptors</u>

For constituents of potential concern (COPCs) found in groundwater to pose a risk to human health or the environment, a complete exposure pathway must be present to a receptor with elevated concentrations of COPCs via that pathway.

Should a release of one or more Appendix IV parameters from the Coleto Creek Primary Ash Pond to groundwater occur in the future, the two primary risks to human health and the environment are via groundwater exposure and surface water exposure. Groundwater exposure would be via ingestion or dermal contact, both of which are likely an incomplete exposure pathway for the reasons discussed below. Impacted groundwater potentially migrating to nearby surface water bodies – specifically the Coleto Creek Reservoir and Sulphur Creek – is another potential exposure pathway; however, this is also likely incomplete for the reasons discussed below.

Ambient groundwater flow in the Uppermost Aquifer beneath the Primary Ash Pond is east and southeast towards Sulphur Creek and the Coleto Creek Reservoir. Groundwater elevations indicate minimal seasonal variation of water levels; however, water levels fluctuate in response to drought conditions and may be approximately 5 feet lower. During the background monitoring events, the average horizontal hydraulic gradient was calculated as 0.0027 feet per foot (ft/ft) and 0.0029 ft/ft across the northern and southern boundaries of the Primary Ash Pond. The average groundwater flow velocity was between 0.13 and 0.14 feet per day (ft/day) east and southeast towards Sulphur Creek and the Coleto Creek Reservoir (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

Based on water well survey results completed in 2019 (Golder, 2019) there are three active potable water supply wells owned by Coleto Creek Power Station that provide potable water to the plant. All three wells are located greater than 0.25 miles from the Primary Ash Pond and are completed in a deeper water-bearing zone than the Uppermost Aquifer. A fourth well, owned by Coleto Creek Power Station and located approximately 0.25 miles from the Primary Ash Pond, is inactive. Available well construction information for the production wells completed near the Primary Ash Pond indicate that these wells are completed at total depths ranging from 150 feet to 700 feet bgs, which is significantly deeper than the Uppermost Aquifer that is generally about 20 to 70 feet bgs (Golder, 2019). Three domestic wells are located more than 0.25 miles from the Primary Ash Pond, two of which are located upgradient of the Primary Ash Pond and the third is located on the opposite side of the Coleto Creek Reservoir. Thus, these wells could not plausibly be affected by impacted groundwater and, therefore, pose no risk concern to human health.

Should impacted groundwater migrate to nearby surface water bodies, there is no risk concern to human health because there are no surface-water intakes for community water supply (CWS) withdrawing from the Coleto Creek Reservoir or Sulfur Creek identified within a one-mile radius of the Coleto Creek property line. In addition, there are no known non-CWS surface water intakes withdrawing from the Coleto Creek Reservoir or Sulphur Creek within 2,500 feet of the site boundary.

Since there have been no SSLs above the GWPS, there is no risk to ecological receptors located near the Primary Ash Pond. If a release to groundwater were to occur, ecological receptors could potentially be exposed to COPCs through ingestion or direct contact with impacted groundwater; however, should any surface water or sediment come into contact with impacted groundwater, the risk of exposure is likely low due to expected attenuation and dilution. Depending on the magnitude of the release and other factors, it may or may not be possible to estimate potential increases in COPC concentrations in surface water using mixing calculations.

Although current conditions do not pose a risk concern to human health or the environment, measures presented in the Contaminant Plume Containment Plan (Section 3.1 of this RMP) would address any future potential exposures and risks by containing potential groundwater impacts and mitigating impacts to potential receptors.

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which, if necessary, could include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts.

<u>Exposure Mitigation</u>

Mitigation of future potential exposures to groundwater contamination from continued operation of the Coleto Creek Primary Ash Pond is discussed in detail in the following section.

# 3 CONTAMINANT PLUME CONTAINMENT: OPTIONS EVALUATION AND PLAN- 40 C.F.R. § 257.101(F)(2)(V)(B)(3)

Appropriate corrective measure(s) to address future potential impacted groundwater associated with the Coleto Creek Primary Ash Pond are based on impacts to the Uppermost Aquifer. The Uppermost Aquifer consists mostly of sand and silty sand with intermittent discontinuous layers of clay. Mineral zones containing caliche and calcareous nodules are also prominent throughout this unit. The top of the aquifer is approximately 11 to 25 ft bgs and is 40 to 54 ft thick. The lower limit of the Uppermost Aquifer is defined by a basal clay stratum consisting primarily of clay and silty clay with periodic sandy clay zones. The basal unit is greater than 25 feet thick (refer to the description of hydrogeology attached to the alternative closure demonstration letter).

If one or more Appendix IV parameters are detected and confirmed in groundwater at a SSL above GWPS(s), and the SSL is not attributed to an alternate source, via an alternate source demonstration (ASD), the first steps to mitigating risk will involve the immediate implementation of source control, which, if necessary, could include installation and operation of a groundwater extraction well or recovery trench system. This immediate source control would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors. Furthermore, to characterize the nature and extent of the release, plume delineation wells will be installed as necessary to define the magnitude and limits of the groundwater impacts. If applicable, notifications will be made to all persons who own the land or reside on the land that directly overlies any part of the groundwater plume. Additional soil and groundwater data will be collected as necessary to support a Corrective Measures Assessment (CMA), which will be initiated within 90 days of detecting the SSL. Further discussion of short-term and long-term corrective measures is further discussed in Section 3.1.

Since there has been no release of Appendix IV parameters to groundwater above GWPS(s), which would trigger a CMA under 40 C.F.R. § 257.96 based on specific parameter concentrations and contaminant plume dimensions, several options are evaluated to address potential future plume containments. The evaluation criteria for assessing remedial options are the following: performance; reliability; ease of implementation; potential impacts of the remedies (safety, cross-media, and control of exposure to residual contamination); time required to begin and complete the remedy; and, institutional requirements that may substantially affect implementation of the remedy(s), such as permitting, environmental or public health requirements.

Although future potential source control measures (*e.g.*, closure in place, closure by removal to on-site or off-site landfill, in-situ solidification/stabilization) to mitigate groundwater impacts are typically considered as part of a CMA process upon closure of the Coleto Creek Primary Ash Pond, the shorter-term options considered for mitigating groundwater impacts relative to a potential future release of one or more Appendix IV parameters at Coleto Creek are as follows:

- Groundwater Extraction
- Groundwater Cutoff Wall
- Permeable Reactive Barrier
- In-Situ Chemical Treatment
- Monitored Natural Attenuation

These same groundwater remedial corrective measures will be evaluated for all Appendix IV constituents that present a future risk to human health or the environment.

Groundwater Extraction

This corrective measure includes installation of one or more groundwater pumping wells or trenches to control and extract impacted groundwater. Groundwater extraction captures and contains impacted groundwater and can limit plume expansion and/or off-site migration. Construction of a groundwater extraction system typically includes, but is not limited to, the following primary project components:

- Designing and constructing a groundwater extraction system consisting of one or more extraction wells or trenches located operating at a rate to allow capture of CCR impacted groundwater.
- Management of extracted groundwater, which may include modification to the existing NPDES permit, including treatment prior to discharge, if necessary.
- Ongoing inspection and maintenance of the groundwater extraction system.

Installation of a groundwater extraction system, whether wells or trenches, can be expedited with the assumption that there is a good conceptual site model (CSM) of the hydrogeological system around the CCR unit, groundwater flow and transport model, and aquifer testing. Upon notification of an SSL exceedance of a GWPS for one or more Appendix IV parameters, an aquifer test will be conducted, and groundwater model developed for designing a groundwater extraction system for optimization of contaminant plume capture.

A schematic of a typical groundwater extraction well is shown on Figure 2. Based on site specific hydrogeology and future potential plume width and depth, a groundwater extraction system would likely consist of one to three extraction wells with pitless adapter's manifolded together with high-density polyethylene (HDPE) conveyance pipe to a common tank or lined collection vault prior to treatment at the on-site wastewater treatment plant and discharge via the TPDES permitted outfall.

Groundwater Cutoff Wall

Vertical cutoff walls are used to control and/or isolate impacted groundwater. Low permeability cutoff walls can be used to prevent horizontal off-site migration of potentially impacted groundwater. Cutoff walls act as barriers to migration of impacted groundwater and can isolate soils that have been impacted by CCR to prevent contact with unimpacted groundwater. Cutoff walls are often used in conjunction with an interior pumping system to establish a reverse gradient within the cutoff wall. The reverse gradient imparted by the pumping system maintains an inward flow through the wall, keeping it from acting as a groundwater dam and controlling potential end-around or breakout flow of contaminated groundwater.

A commonly used cutoff wall construction technology is the slurry trench method, which consists of excavating a trench and backfilling it with a soil-bentonite mixture, often created with the soils excavated from the trench. The trench is temporarily supported with bentonite slurry that is pumped into the trench as it is excavated. Excavation for cutoff walls is conducted with conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.*, long-stick excavators), or chisels and clamshells, depending upon the depth of the trench and the material to be excavated.

Permeable Reactive Barrier

Chemical treatment via a Permeable Reactive Barrier (PRB) is defined as an emplacement of reactive materials in the subsurface designed to intercept a contaminant plume, provide a flow path through the reactive media, and transform or otherwise render the contaminant(s) into environmentally acceptable forms to attain remediation concentration goals downgradient of the barrier (EPRI, 2006).

As groundwater passes through the PRB under natural gradients, dissolved constituents in the groundwater react with the media and are transformed or immobilized. A variety of media have been used or proposed for use in PRBs. Zero-valent iron has been shown to effectively immobilize CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium, and sulfate. Zero-valent iron has not been proven effective for boron, antimony, or lithium (EPRI, 2006).

System configurations include continuous PRBs, in which the reactive media extends across the entire path of the contaminant plume; and funnel-and-gate systems, where barrier walls are installed to control groundwater flow through a permeable gate containing the reactive media. Continuous PRBs intersect the entire contaminant plume and do not materially impact the groundwater flow system. Design may or may not include keying the PRB into a low-permeability unit at depth. Funnel-and-gate systems utilize a system of barriers to groundwater flow (funnels) to direct the contaminant plume through the reactive gate. The barriers, typically some form of cutoff wall, are keyed into a low-permeability unit at depth to prevent short circuiting of the plume. Funnel-and-gate design must consider the residence time to allow chemical reactions to occur. Directing the contaminant plume through the reactive gate can significantly increase the flow velocity, thus reducing residence time.

Design of PRB systems requires rigorous site investigation to characterize the site hydrogeology and to delineate the contaminant plume. A thorough understanding of the geochemical and redox characteristics of the plume is critical to assess the feasibility of the process and select appropriate reactive media. Laboratory studies, including batch studies and column studies using samples of site groundwater, are needed to determine the effectiveness of the selected reactive media at the site (EPRI, 2006).

This is a potentially viable option for groundwater corrective measures, to be evaluated further, but is not a short-term solution that can be implemented expeditiously.

In-Situ Chemical Treatment

In-situ chemical treatment for inorganics are being tested and applied with increasing frequency. In-situ chemical treatment includes the targeted injection of reactive media into the subsurface to mitigate groundwater impacts. Inorganic contaminants are typically remediated through immobilization by reduction or oxidation followed by precipitation or adsorption (EPRI, 2006). Chemical reactants that have been applied or are in development for application in treating inorganic contaminants include ferrous sulfate, nanoscale zero-valent iron, organo-phosphorus nutrient mixture (PrecipiPHOS™) and sodium dithionite (EPRI, 2006). Zero-valent iron has been shown to effectively immobilize cobalt and molybdenum. Implementation of in-situ chemical treatment requires detailed technical analysis of field hydrogeological and geochemical conditions along with laboratory studies.

This is a potentially viable option for groundwater corrective measures, to be evaluated further, but is not a short-term solution that can be implemented expeditiously.

Monitored Natural Attenuation (MNA)

Upon notification of a release of one or more Appendix IV constituent(s) to groundwater, MNA will be evaluated with site-specific characterization data and geochemical analysis as a long term remedial option, combined with source control measures, through application of the USEPA’s tiered approach to MNA (USEPA 1999, 2007 and 2015):

1. Demonstrate that the area of groundwater impacts is not expanding.
2. Determine the mechanisms and rates of attenuation.
3. Determine that the capacity of the aquifer is sufficient to attenuate the mass of constituents in groundwater and that the immobilized constituents are stable and will not remobilize.
4. Design a performance monitoring program based on the mechanisms of attenuation and establish contingency remedies (tailored to site-specific conditions) should MNA not perform adequately.

MNA is not regarded as a short-term remedial option for contaminant plume containment, but as a potential long-term option following implementation of shorter-term control measures.

## 3.1 Containment Plan

Based on the options evaluated for containment of a future potential groundwater contaminant plume originating from the Coleto Creek Primary Ash Pond for one or more Appendix IV constituents exceeding their GWPS(s), the most viable short-term option of those evaluated is a groundwater extraction well or recovery trench system, which would allow for capture of impacted groundwater and prevention of further plume migration towards the principal potential receptors, which have been identified as Sulphur Creek and the Coleto Creek Reservoir.

In circumstances where there is not an immediate concern of endangerment to human health or the environment, other longer-term corrective measures may be more viable and will be further evaluated at the Coleto Creek Primary Ash Pond.

Depending on the location, depth, and plume geometry of any future potential Appendix IV exceedances of GWPSs, the specific constituent(s) with exceedances, and distance from potential receptors, the other groundwater corrective measures discussed as part of the corrective options evaluation – groundwater extraction, groundwater cutoff wall, permeable reactive barrier, in-situ chemical treatment, and MNA – are all secondary remedial alternatives available for consideration following the current primary options of groundwater extraction for short-term application.

# 4 REFERENCES

Electric Power Research Institute (EPRI), 2006. Groundwater Remediation of Inorganic Constituents at Coal Combustion Product Management Sites, Overview of Technologies, Focusing on Permeable Reactive Barriers. Electric Power Research Institute, Palo Alto, California. Final Report 1012584, October 2006.

Golder, 2019. Drinking water Survey Report, Coleto Creek Power Station, Goliad County, Texas. May 24, 2019.

Golder, 2020. 2019 Annual Groundwater Monitoring and Corrective Action Report, Coleto Creek Primary Ash Pond – Fannin, Texas. January 31, 2020.

USEPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Directive No. 9200.U-17P. Washington, D.C.: EPA, Office of Solid Waste and Emergency Response.

USEPA, 2007. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume 1 – Technical Basis for Assessment. EPA/600/R-07/139. National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. October 2007.

USEPA, 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. August 2015.

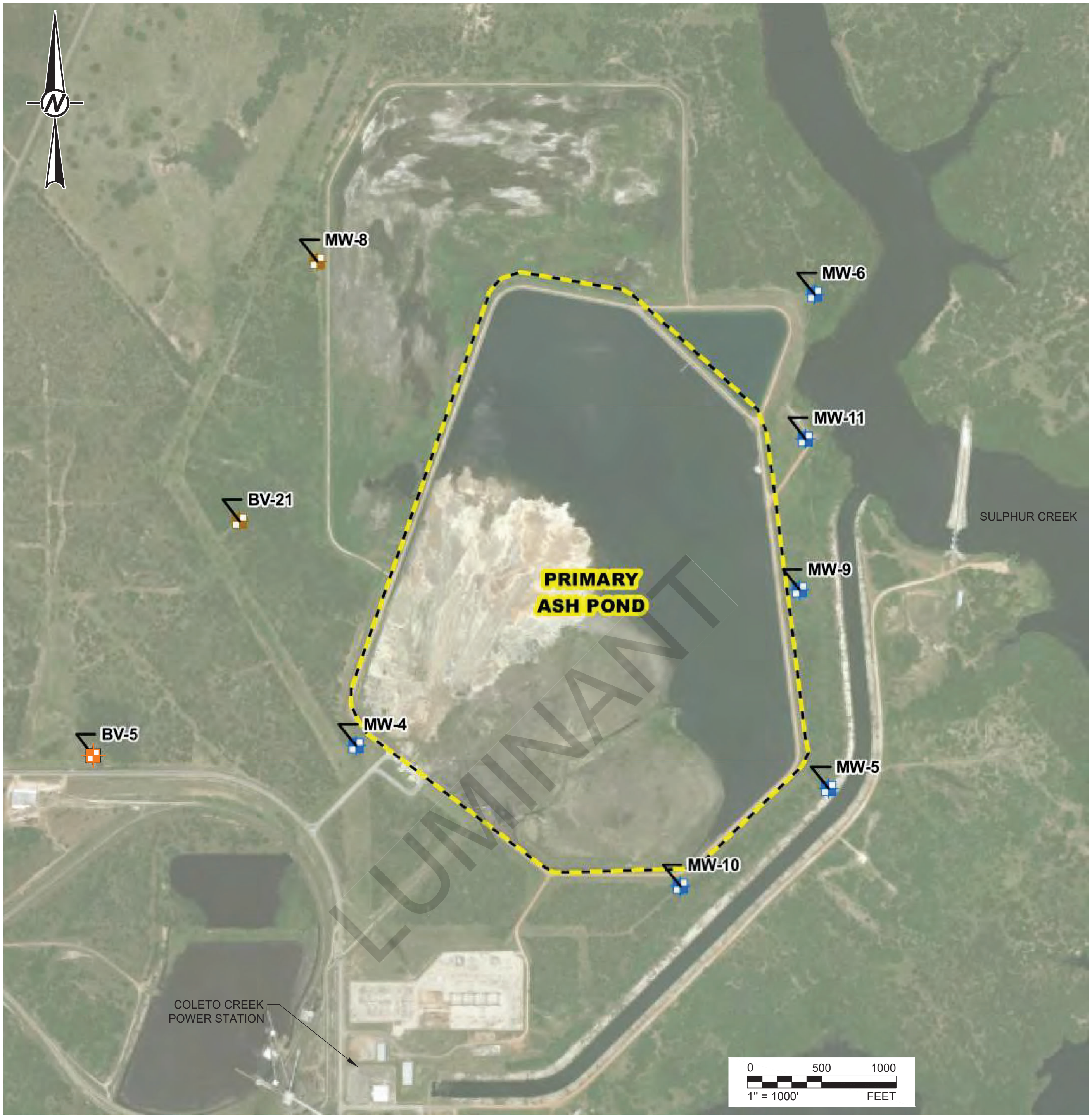
## TABLES

**Table 1 - Assessment Monitoring Program Summary, Coleto Creek Primary Ash Pond**

| Sampling Dates | Analytical Data Receipt Date | Parameters Collected | SSL(s) Appendix IV | SSL(s) Determination | ASD Completion Date | CMA Completion / Status |
|---|---|---|---|---|---|---|
| June 18-25, 2018 | August 7, 2018 | Appendix III<br>Appendix IV | None | NA | NA | NA |
| September 18, 2018 | October 12, 2018 | Appendix III<br>Appendix IV<br>Detected1 | None | NA | NA | NA |
| June 3-5, 2019 | July 12, 2019 | Appendix III<br>Appendix IV | None | NA | NA | NA |
| October 2-3, 2019 | November 5, 2019 | Appendix III<br>Appendix IV<br>Detected1 | None | NA | NA | NA |
| June 9, 2020 | July 15, 2020 | Appendix III<br>Appendix IV | None | NA | NA | NA |
| October 7, 2020 | November 9, 2020 | Appendix III<br>Appendix IV<br>Detected1 | TBD | TBD | TBD | TBD |

**Notes:**
CMA = Corrective Measures Assessment
NA = Not Applicable
TBD = To Be Determined
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. § 257.95(d)(1).

## FIGURES




**LEGEND**

- DOWNGRADIENT MONITORING WELL LOCATION
- UPGRADIENT MONITORING WELL LOCATION
- CCR MONITORING UNIT

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**DETAILED SITE PLAN - COLETO CREEK PRIMARY ASH POND**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2019-01-14 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 18106453 | 0 | 1 |

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Path: \\texarkana\data\Projects - Round Rock\18106453 - Coleto Creek\2019-1 Jan\ | File Name: FIG 1 - Detailed Site Plan.dwg

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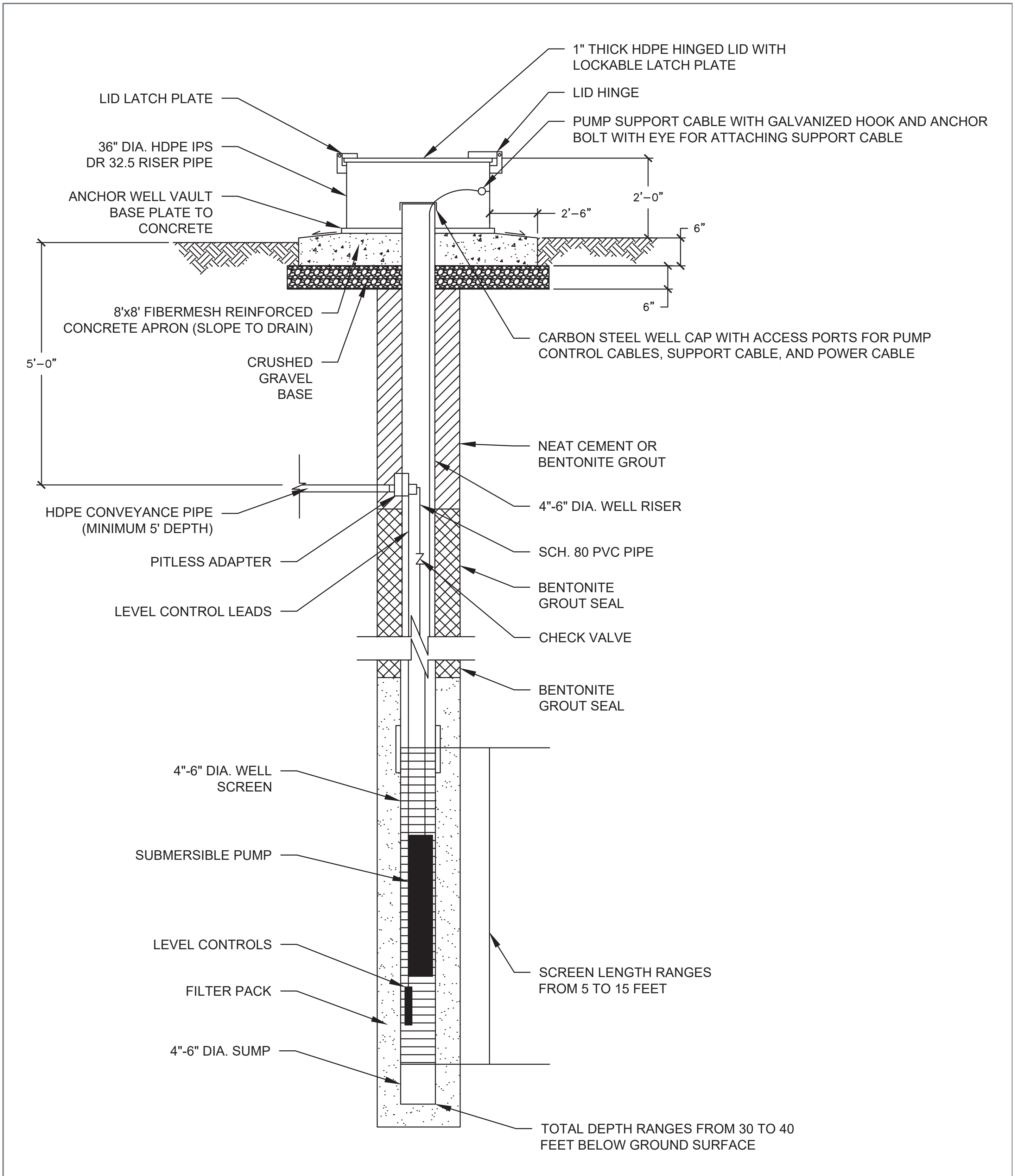


**NOTES**

1. NOT TO SCALE

# TYPICAL HYDRAULIC GRADIENT CONTROL WELL DETAIL

**Coleto Creek Power, L.L.C**

COLETO CREEK PRIMARY ASH POND

FANNIN, TEXAS

## FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

# ATTACHMENT 1
# 2019 Annual Groundwater Monitoring and Corrective Action Report

# 2019 Annual Groundwater Monitoring and Corrective Action Report

*Coleto Creek Primary Ash Pond - Fannin, Texas*

Prepared for:

**Coleto Creek Power, LLC**

Submitted by:

**Golder Associates Inc.**

2201 Double Creek Dr, Suite 4004, Round Rock, Texas, USA 78664

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January 31, 2020

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## LIST OF TABLES

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CCR | Coal Combustion Residuals |
| CFR | Code of Federal Regulations |
| GWPS | Groundwater Protection Standard |
| MCL | Maximum Concentration Level |
| mg/L | Milligrams per Liter |
| NA | Not Applicable |
| OBG | O’Brien & Gere Engineers, Inc. |
| SSI | Statistically Significant Increase |
| SSL | Statistically Significant Levels |
| USEPA | United States Environmental Protection Agency |

# 1.0 INTRODUCTION

Golder Associates, Inc. (Golder) has prepared this report on behalf of Coleto Creek Power, LLC to satisfy annual groundwater monitoring and corrective action reporting requirements of the Coal Combustion Residuals (CCR) Rule for the Primary Ash Pond at the Coleto Creek Power Station in Fannin, Texas. The CCR units and CCR monitoring well network are shown on Figure 1.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the United States Environmental Protection Agency (USEPA) to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. For existing CCR landfills and surface impoundments, the CCR Rule requires that the owner or operator prepare an annual groundwater monitoring and corrective action report to document the status of the groundwater monitoring and corrective action program for the CCR unit for the previous calendar year. Per 40 CFR 257.90(e) of the CCR Rule, the report should contain the following information, to the extent available:

(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

(4) A narrative discussion of any transition between monitoring programs (*e.g.,* the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

## 2.0 MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

O'Brien & Gere Engineers, Inc. (OBG) collected the initial Detection Monitoring Program groundwater samples from the Primary Ash Pond CCR monitoring well network in November 2017. OBG completed an evaluation of those data in 2018 to identify statistically significant increases (SSIs) of Appendix III parameters over background concentrations. The Detection Monitoring Program sampling dates and parameters are summarized in the following table:

**Detection Monitoring Program Summary**

| Sampling Dates | Parameters | SSIs | Assessment Monitoring Program Established |
|---|---|---|---|
| November 7-8, 2017 | Appendix III | Yes | May 9, 2018 |

Alternate source evaluations were inconclusive for one or more of the SSIs. Consequently, an Assessment Monitoring Program was initiated and established for the Primary Ash Pond CCR units in 2018 in accordance with 40 CFR § 257.94(e)(2).

Assessment Monitoring groundwater samples were collected from the CCR groundwater monitoring network in 2018, as required by the CCR Rule. OBG collected the initial 2018 Assessment Monitoring Program groundwater samples in June 2018. Subsequent Assessment Monitoring Program sampling events have been conducted by Golder on a semi-annual basis, as required by the CCR Rule. All CCR groundwater monitoring wells were sampled for Appendix III and Appendix IV constituents during the first semi-annual sampling events of each year. During the second semi-annual sampling events, the CCR wells were sampled for all Appendix III parameters and for the Appendix IV parameters that were detected during the first semi-annual sampling events in accordance with 40 CFR § 257.95(d)(1). The Assessment Monitoring Program sampling dates and parameters are summarized in the following table:

**Assessment Monitoring Program Summary**

| Sampling Dates | Analytical Data Receipt Date | Parameters Collected | SSL(s) | SSL(s) Determination Date | Corrective Measures Assessment Initiated |
|---|---|---|---|---|---|
| June 19-25, 2018 | August 7, 2018 | Appendix III<br>Appendix IV | No | NA | NA |
| Sept. 18, 2018 | October 12, 2018 | Appendix III<br>Appendix IV[1] | No | NA | NA |
| June 3-5, 2019 | July 12, 2019 | Appendix III<br>Appendix IV | No | NA | NA |
| October 2-3, 2019 | November 5, 2019 | Appendix III<br>Appendix IV | No | NA | NA |

Notes:

NA: Not Applicable

1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 CFR § 257.95(d)(1).



The statistical background values and Groundwater Protection Standards (GWPSs) are summarized in Tables 1 and 2, respectively. Appendix III and Appendix IV analytical data are summarized in Tables 3 and 4, respectively. Statistical analysis of the 2019 data was performed in accordance with the Statistical Analysis Plan for CCR Groundwater Monitoring (PBW 2017) and the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-Unified Guidance (USEPA 2009). The statistical analysis included an evaluation of confidence intervals for each of the Appendix IV parameter data sets to evaluate whether constituent concentrations were present at concentrations above GWPSs. Based on the sample data collected in 2019, Appendix IV parameters were not observed at SSLs above GWPSs

# 3.0 KEY ACTIONS COMPLETED IN 2019

Assessment Monitoring Program groundwater monitoring events were completed in June and October 2019. The number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and the analytical results for the groundwater samples are summarized in Table 3 (Appendix III parameters) and Table 4 (Appendix IV parameters). A map showing the CCR units and monitoring wells is provided as Figure 1.

No CCR wells were installed or decommissioned in 2019.

# 4.0 PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the CCR groundwater monitoring program in 2019.

## 5.0 KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continue the Assessment Monitoring Program in accordance with 40 CFR § 257.95.
- Complete statistical evaluation of Appendix IV analytical data from the downgradient wells and compare results to GWPSs to determine whether an SSL has occurred.
- If an SSL is identified, notification will be prepared as required under 40 CFR § 257.95(g). The notification will be placed in the operating record per 40 CFR § 257.105(h)(8) and will be subsequently placed on the public website per 40 CFR § 257.107(d). Potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated. If an alternate source is identified to be the cause of the SSL, a written demonstration will be completed within 90 days of SSL determination and included in the Annual Groundwater Monitoring and Corrective Action Report.
- If an alternate source is not identified to be the cause of the SSL, the applicable requirements of 40 CFR §§ 257.94 through 257.98 (e.g., assessment of corrective measures) will be met, including associated recordkeeping/notifications required by 40 CFR §§ 257.105 through 257.108.

# 6.0 REFERENCES

O'Brien and Gere Engineers, Inc. (OBG), 2017. Statistical Analysis Plan, Coleto Creek Power Station.

# Signature Page

**Golder Associates Inc.**

Pat Behling
*Principal Engineer*


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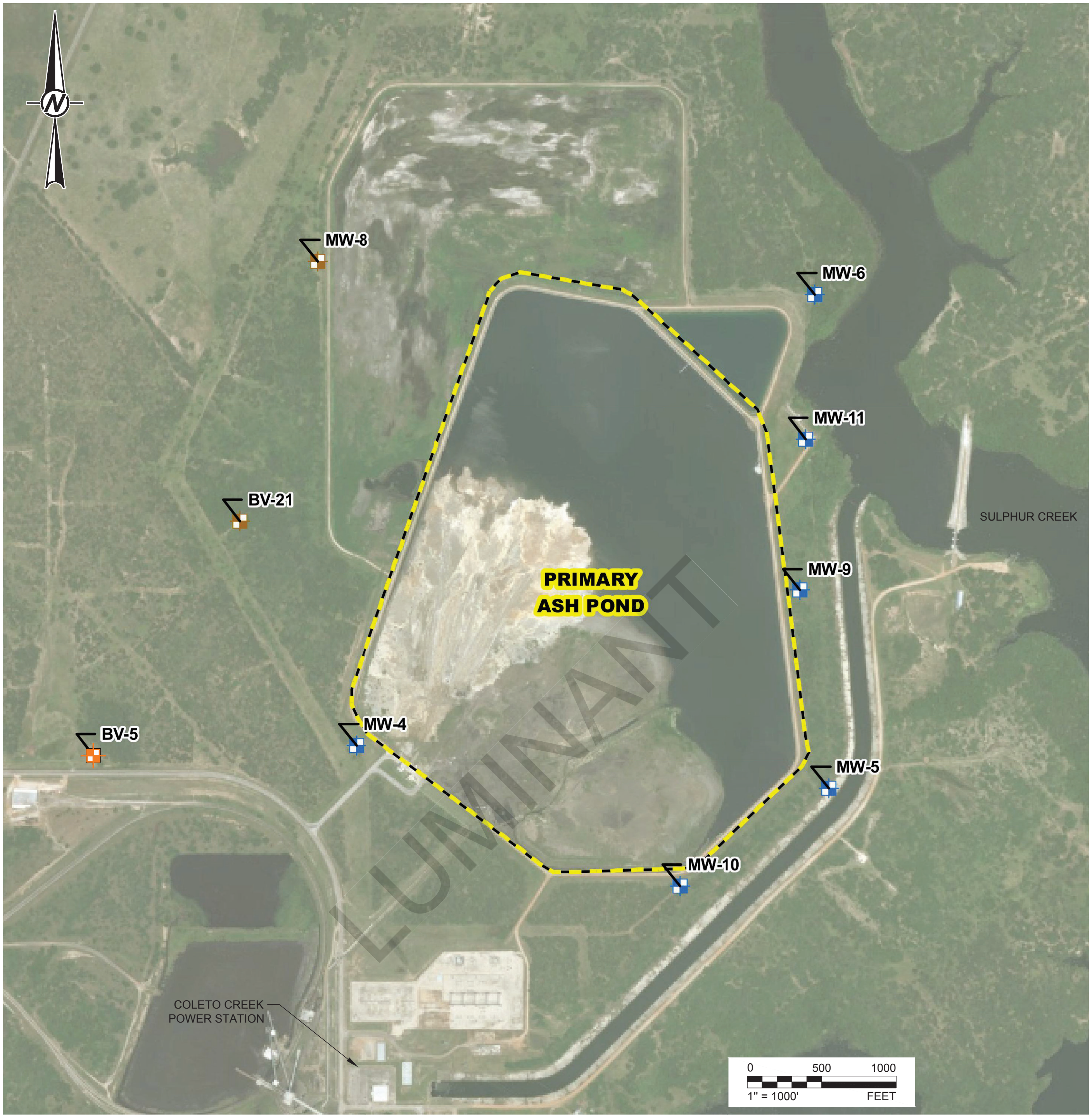
**FIGURES**




**LEGEND**

DOWNGRADIENT MONITORING WELL LOCATION

UPGRADIENT MONITORING WELL LOCATION

CCR MONITORING UNIT

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**DETAILED SITE PLAN - COLETO CREEK PRIMARY ASH POND**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2019-01-14 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 18106453 | 0 | 1 |

TABLES

**Table 1**
**Statistical Background Values**
**Coleto Creek Primary Ash Pond**

| Parameter | Statistical Background Value |
|---|---|
| Boron (mg/L) | 1.26 |
| Calcium (mg/L) | 143 |
| Chloride (mg/L) | 118 |
| Fluoride (mg/L) | 0.61 |
| field pH (s.u.) | 6.51<br>7.33 |
| Sulfate (mg/L) | 148 |
| Total Dissolved Solids (mg/L) | 966 |

**Table 2**
**Groundwater Protection Standards**
**Coleto Creek Primary Ash Pond**

| Parameter | Groundwater Protection Standard |
|---|---|
| Antimony (mg/L) | 0.006 |
| Arsenic (mg/L) | 0.128 |
| Barium (mg/L) | 2 |
| Beryllium (mg/L) | 0.004 |
| Cadmium (mg/L) | 0.005 |
| Chromium (mg/L) | 0.10 |
| Cobalt (mg/L) | 0.0499 |
| Fluoride (mg/L) | 4 |
| Lead (mg/L) | 0.015 |
| Lithium (mg/L) | 0.04 |
| Mercury (mg/L) | 0.002 |
| Molybdenum (mg/L) | 0.10 |
| Selenium (mg/L) | 0.05 |
| Thallium (mg/L) | 0.002 |
| Radium 226+228 (pCi/L) | 5 |

**TABLE 3**
**APPENDIX III ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| **Upgradient Wells** | | | | | | | | |
| BV-5 | 03/29/17 | 1.15 | 90.5 | 118 | 0.54 | 7.01 | 147 | 860 |
| | 05/11/17 | 1.03 | 81.6 | 106 | 0.57 | 6.89 | 148 | 862 |
| | 05/16/17 | 1.17 | 99 | 107 | 0.55 | 6.9 | 145 | 832 |
| | 06/07/17 | 1.11 | 88.8 | 109 | 0.56 | 6.64 | 147 | 810 |
| | 06/20/17 | 1.02 | 90.7 | 106 | 0.58 | 6.54 | 145 | 716 |
| | 06/27/17 | 1.14 | 100 | 114 | 0.55 | 6.76 | 144 | 743 |
| | 07/12/17 | 1.07 | 96.8 | 112 | 0.56 | 6.88 | 140 | 430 |
| | 07/18/17 | 1.17 | 143 | 117 | 0.56 | 6.68 | 142 | 817 |
| | 11/07/17 | 1.10 | 94.2 | 109 | 0.62 | 6.96 | 136 | 850 |
| | 06/19/18 | 1.18 | 56.4 | 112 | 0.97 | -- | 147 | 775 |
| | 09/18/18 | 1.27 | 86.2 | 145 | 0.667 | 6.53 | 146 | 904 |
| | 06/05/19 | 1.26 | 82.9 | 123 | 0.769 | 6.89 | 146 | 828 |
| | 10/03/19 | 1.31 | 72.2 | 141 | 0.753 | 7.11 | 145 | 806 |
| BV-21 | 03/28/17 | 0.651 | 6.89 | 36 | 0.61 | 7.09 | 69 | 490 |
| | 05/09/17 | 0.687 | 65.2 | 38 | 0.61 | 7.04 | 55 | 410 |
| | 05/17/17 | 0.709 | 74.3 | 39 | 0.58 | 7.05 | 53 | 454 |
| | 06/06/17 | 0.657 | 69 | 40 | 0.59 | 7.11 | 49 | 452 |
| | 06/20/17 | 0.642 | 77 | 40 | 0.61 | 6.7 | 45 | 356 |
| | 06/27/17 | 0.727 | 84.9 | 40 | 0.6 | 6.97 | 46 | 420 |
| | 07/10/17 | 0.674 | 90.6 | 39 | 0.58 | 7.22 | 45 | 427 |
| | 07/18/17 | 0.618 | 84.4 | 39 | 0.6 | 6.91 | 44 | 380 |
| | 11/07/17 | 0.515 | 73.6 | 42 | 0.64 | 7.12 | 46 | 423 |
| | 06/25/18 | 0.543 | 69.3 | 38.4 | 0.62 | -- | 38.4 | 380 |
| | 09/18/18 | 0.624 | 72.1 | 33.3 | 0.479 | 6.64 | 36.4 | 416 |
| | 06/05/19 | 0.576 | 61.3 | 30.3 | 0.602 | 7.1 | 34.2 | 379 |
| | 10/03/19 | 0.534 | 63.4 | 23.9 | 0.588 | 6.82 | 33.2 | 342 |
| MW-8 | 03/28/17 | 1.2 | 7.76 | 79 | 0.49 | 7.06 | 76 | 626 |
| | 05/09/17 | 1.21 | 77.5 | 77 | 0.44 | 7.15 | 79 | 564 |
| | 05/15/17 | 1.16 | 81.2 | 76 | 0.44 | 7.01 | 79 | 558 |
| | 06/06/17 | 1.26 | 78.1 | 72 | 0.45 | 6.92 | 83.5 | 570 |
| | 06/20/17 | 1.24 | 86.5 | 67 | 0.43 | 6.7 | 89 | 476 |
| | 06/27/17 | 1.23 | 89.6 | 66 | 0.44 | 6.85 | 97 | 533 |
| | 07/10/17 | 1.24 | 92.6 | 63 | 0.44 | 7.13 | 97 | 533 |
| | 07/18/17 | 1.25 | 92.9 | 61 | 0.46 | 6.91 | 100 | 533 |
| | 11/07/17 | 1.21 | 78.8 | 61 | 0.49 | 7.08 | 100 | 540 |
| | 06/25/18 | 1.25 | 80.3 | 65.9 | 0.52 | -- | 95.2 | 565 |
| | 09/18/18 | 1.29 | 76.5 | 53.7 | 0.402 | 6.70 | 94.8 | 543 |
| | 06/05/19 | 1.11 | 65.2 | 51.4 | 0.497 | 7.10 | 79 | 515 |
| | 10/03/19 | 1.2 | 76.7 | 58.3 | 0.419 | 6.76 | 90.1 | 541 |

**TABLE 3**
**APPENDIX III ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| **Downgradient Wells** | | | | | | | | |
| MW-4 | 03/28/17 | 0.287 | 9.14 | 102 | 0.61 | 9.81 | 157 | 794 |
| | 05/09/17 | 0.395 | 88.7 | 101 | 0.61 | 7.27 | 156 | 668 |
| | 05/17/17 | 0.251 | 92.1 | 101 | 0.6 | 6.93 | 157 | 702 |
| | 06/06/17 | 0.243 | 90.7 | 101 | 0.63 | 7.13 | 157 | 728 |
| | 06/20/17 | 0.254 | 99.3 | 101 | 0.62 | 6.71 | 157 | 626 |
| | 06/27/17 | 0.254 | 102 | 101 | 0.63 | 6.87 | 157 | 690 |
| | 07/10/17 | 0.271 | 111 | 101 | 0.62 | 7.16 | 158 | 670 |
| | 07/18/17 | 0.292 | 108 | 101 | 0.63 | 6.82 | 157 | 717 |
| | 11/07/17 | 0.255 | 94.5 | 99 | 0.62 | 7.12 | 155 | 700 |
| | 06/21/18 | 0.267 | 92.5 | 104 | 0.6 | -- | 159 | 665 |
| | 09/18/18 | 0.28 | 91.8 | 102 | 0.582 | 6.63 | 155 | 720 |
| | 06/05/19 | 0.379 | 85.3 | 108 | 0.67 | 6.92 | 161 | 718 |
| | 10/03/19 | 0.367 | 93.1 | 102 | 0.559 | 6.7 | 155 | 693 |
| MW-5 | 03/30/17 | 0.11 | 110 | 140 | 0.51 | 6.85 | 184 | 830 |
| | 05/10/17 | 0.115 | 114 | 139 | 0.54 | 6.86 | 183 | 900 |
| | 05/16/17 | 0.215 | 121 | 139 | 0.5 | 6.81 | 183 | 848 |
| | 06/08/17 | 0.122 | 118 | 139 | 0.55 | 6.8 | 182 | 862 |
| | 06/21/17 | 0.122 | 124 | 138 | 0.53 | 6.6 | 182 | 813 |
| | 06/26/17 | 0.121 | 129 | 139 | 0.54 | 6.79 | 184 | 900 |
| | 07/11/17 | 0.111 | 120 | 138 | 0.52 | 6.91 | 184 | 797 |
| | 07/19/17 | 0.001 | 0.005 | 137 | 0.53 | 6.84 | 181 | 857 |
| | 11/08/17 | 0.149 | 116 | 138 | 0.52 | 6.92 | 183 | 883 |
| | 06/25/18 | 0.119 | 114 | 140 | 0.56 | -- | 183 | 820 |
| | 09/18/18 | 0.146 | 114 | 136 | 0.493 | 6.70 | 183 | 824 |
| | 06/03/19 | 0.146 | 113 | 143 | 0.596 | 7.06 | 187 | 864 |
| | 10/02/19 | 0.179 | 111 | 147 | 0.543 | 7.06 | 202 | 842 |
| MW-6 | 03/29/17 | 1.67 | 73.9 | 69 | 0.38 | 7.34 | 99 | 510 |
| | 05/11/17 | 1.94 | 70.6 | 70 | 0.37 | 7.1 | 110 | 490 |
| | 05/16/17 | 1.84 | 76.3 | 70 | 0.36 | 7.23 | 107 | 506 |
| | 06/07/17 | 1.8 | 73.8 | 70 | 0.37 | 6.97 | 103 | 492 |
| | 06/22/17 | 1.97 | 79.9 | 69 | 0.37 | 7.11 | 100 | 510 |
| | 06/28/17 | 1.74 | 81.8 | 69 | 0.37 | 7.16 | 99 | 570 |
| | 07/12/17 | 1.76 | 81.6 | 69 | 0.35 | 7.24 | 98 | 557 |
| | 07/20/17 | 0.005 | 0.0002 | 69 | 0.39 | 6.9 | 97 | 530 |
| | 11/07/17 | 1.72 | 76.4 | 69 | 0.39 | 7.41 | 101 | 483 |
| | 06/22/18 | 0.0171 | 76.6 | 70.7 | 0.41 | -- | 107 | 490 |
| | 09/18/18 | 2.09 | 70.8 | 72.5 | 0.353 J | 6.97 | 114 | 505 |
| | 06/03/19 | 1.9 | 73.9 | 73 | 0.043 | 7.31 | 103 | 514 |
| | 10/02/19 | 1.83 | 73.6 | 76.4 | 0.357 J | 7.29 | 115 | 507 |

**TABLE 3**
**APPENDIX III ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| MW-9 | 03/30/17 | 3.38 | 54.5 | 71 | 1.13 | 7.35 | 62 | 406 |
| | 05/10/17 | 3.16 | 52.7 | 66 | 1.29 | 7.48 | 59 | 410 |
| | 05/17/17 | 3.18 | 53.3 | 67 | 1.26 | 7.34 | 58 | 440 |
| | 06/07/17 | 3.12 | 52 | 67 | 1.26 | 7.03 | 57 | 380 |
| | 06/21/17 | 3.44 | 60.7 | 66 | 1.39 | 7.09 | 60 | 393 |
| | 06/26/17 | 3.31 | 60.6 | 67 | 1.4 | 7.23 | 61 | 407 |
| | 07/11/17 | 3.35 | 52.1 | 64 | 1.3 | 7.51 | 60 | 927 |
| | 07/19/17 | 3.4 | 50.2 | 63 | 1.4 | 7.29 | 62 | 407 |
| | 11/08/17 | 2.84 | 49.4 | 62 | 1.56 | 7.54 | 50 | 397 |
| | 06/21/18 | 2.94 | 46.9 | 71.5 | 1.5 | -- | 35.7 | 370 |
| | 09/18/18 | 2.79 | 51.7 | 71.4 | 1.1 | 6.99 | 49.1 | 394 |
| | 06/05/19 | 4.26 | 48 | 74.7 | 1.38 | 7.4 | 66.3 | 421 |
| | 10/03/19 | 3.97 | 71.3 | 70.9 | 1.41 | 7.37 | 63.6 | 462 |
| MW-10 | 03/30/17 | 3.74 | 92.1 | 151 | 0.54 | 6.99 | 130 | 804 |
| | 05/10/17 | 7.32 | 56.1 | 82 | 0.83 | 7.23 | 96 | 582 |
| | 05/16/17 | 7.45 | 62.7 | 81 | 0.81 | 7.28 | 95 | 612 |
| | 06/08/17 | 7.54 | 58.1 | 77 | 0.84 | 7.23 | 92 | 604 |
| | 06/21/17 | 9.22 | 60.7 | 77 | 0.84 | 6.97 | 92 | 550 |
| | 06/26/17 | 8.21 | 63.4 | 78 | 0.84 | 7.14 | 92 | 530 |
| | 07/11/17 | 7.99 | 49.5 | 76 | 0.84 | 7.4 | 88 | 617 |
| | 07/19/17 | 8.74 | 56.6 | 74 | 0.86 | 7.25 | 86 | 533 |
| | 11/08/17 | 8.72 | 77.7 | 74 | 0.88 | 7.35 | 81 | 590 |
| | 06/22/18 | 8.47 | 84.4 | 76.7 | 0.88 | -- | | 550 |
| | 09/18/18 | 8.45 | 51.9 | 81.4 | 0.759 | 6.98 | 95.1 | 577 |
| | 06/03/19 | 8.28 | 43.1 | 87.2 | 0.953 | 7.52 | 97.7 | 587 |
| | 10/02/19 | 8.28 | 44.2 | 85.5 | 0.891 | 7.46 | 104 | 575 |
| MW-11 | 05/10/17 | 1.35 | 64.1 | 55 | 0.82 | 7.27 | 61 | 394 |
| | 05/16/17 | 1.39 | 62.3 | 52 | 0.85 | 7.29 | 58 | 362 |
| | 05/18/17 | 1.27 | 61.6 | 47.8 | 0.94 | | 52.4 | 390 |
| | 06/07/17 | 1.23 | 59.8 | 48 | 0.93 | 7.25 | 50 | 372 |
| | 06/21/17 | 1.19 | 73.1 | 43.7 | 1.04 | 7.15 | 44 | 373 |
| | 06/26/17 | 1.15 | 82 | 44 | 1 | 7.3 | 43 | 407 |
| | 07/11/17 | 1.23 | 44.7 | 44 | 1 | 7.55 | 42 | 603 |
| | 07/19/17 | 1.17 | 48.6 | 43 | 1.01 | 7.21 | 42 | 360 |
| | 11/08/17 | 1.13 | 52.2 | 43 | 1.02 | 7.61 | 56 | 367 |
| | 06/21/18 | 1.07 | 69.6 | 44.3 | 0.96 | -- | 61.4 | 355 |
| | 09/18/18 | 1.12 | 39.3 | 44.6 | 0.754 | 7.00 | 44.4 | 354 |
| | 06/03/19 | 1.27 | 43.4 | 42.2 | 0.837 | 7.55 | 44.8 | 372 |
| | 10/02/19 | 1.22 | 43.4 | 41.4 | 0.768 | 7.43 | 10.8 | 355 |

Notes:
1. All concentrations in mg/L. pH in standard units.
2. J - concentration is below sample quantitation limit; result is an estimate.

**TABLE 4**
**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Upgradient Wells** | | | | | | | | | | | | | | | | | | |
| BV-5 | 03/29/17 | <0.0025 | 0.00856 | 0.04510 | <0.001 | <0.001 | <0.005 | 0.0497 | 0.540 | <0.001 | 0.0206 | <0.0002 | 0.00925 | <0.005 | <0.0015 | -- | -- | 1.503 |
| | 05/11/17 | <0.0025 | 0.00786 | 0.03680 | <0.001 | <0.001 | <0.005 | 0.0462 | 0.570 | <0.001 | 0.018 | <0.0002 | 0.0101 | <0.005 | <0.0015 | -- | -- | 1.555 |
| | 05/16/17 | <0.0025 | 0.00885 | 0.04520 | <0.001 | <0.001 | <0.005 | 0.0495 | 0.550 | 0.00151 | 0.0171 | <0.0002 | 0.0102 | <0.005 | <0.0015 | -- | -- | 0.7550 |
| | 06/07/17 | <0.0025 | 0.00829 | 0.03760 | <0.001 | <0.001 | <0.005 | 0.0483 | 0.560 | <0.001 | 0.0207 | <0.0002 | 0.01 | <0.005 | <0.0015 | -- | -- | 1.457 |
| | 06/20/17 | <0.0025 | 0.00841 | 0.04010 | <0.001 | <0.001 | <0.005 | 0.0499 | 0.580 | <0.001 | 0.0208 | <0.0002 | 0.0114 | <0.005 | <0.0015 | -- | -- | 0.4920 |
| | 06/27/17 | <0.0025 | 0.0083 | 0.04120 | <0.001 | <0.001 | <0.005 | 0.046 | 0.550 | <0.001 | 0.0198 | <0.0002 | 0.00942 | <0.005 | <0.0015 | -- | -- | 2.247 |
| | 07/12/17 | <0.0025 | 0.00849 | 0.04160 | <0.001 | <0.001 | <0.005 | 0.0484 | 0.560 | <0.001 | 0.0188 | <0.0002 | 0.0096 | <0.005 | <0.0015 | -- | -- | 2.139 |
| | 07/18/17 | <0.0025 | 0.00951 | 0.05780 | <0.001 | <0.001 | 0.00739 | 0.0453 | 0.560 | 0.00288 | 0.022 | <0.0002 | 0.0083 | <0.005 | <0.0015 | -- | -- | 1.260 |
| | 06/19/18 | <0.0025 | 0.0106 | 0.0336 | <0.001 | <0.001 | 0.0022 J | 0.0513 J | 0.970 | <0.00074 J | 0.016 | <0.0002 | 0.0139 | <0.005 | <0.0015 | 0.327 | <1.680 | 2.01 |
| | 09/18/18 | NA | 0.00949 | 0.0436 | NA | NA | 0.00228 J | 0.0487 | 0.667 | 0.00039 J | 0.0206 | NA | 0.0102 | NA | NA | 0.302 | <0.608 | 0.91 |
| | 06/05/19 | <0.0008 | 0.0092 | 0.042 | <0.0003 | 0.0009 J | <0.002 | 0.0466 | 0.769 | 0.00144 | 0.0201 | <0.00008 | 0.0109 | <0.0020 | <0.0005 | <0.687 | <1.130 | <1.82 |
| | 10/03/19 | <0.0008 | 0.00941 | 0.0441 | <0.0003 | <0.0003 | 0.00285 J | 0.0437 | 0.753 | 0.0039 | 0.0172 | <0.00008 | 0.0122 | <0.0020 | <0.0005 | 0.928 | 1.35 | 2.28 |
| BV-21 | 03/28/17 | <0.0025 | 0.0954 | 0.09630 | <0.001 | <0.001 | <0.005 | 0.0083 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.390 |
| | 05/09/17 | <0.0025 | 0.108 | 0.09720 | <0.001 | <0.001 | <0.005 | 0.00852 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.7460 |
| | 05/17/17 | <0.0025 | 0.117 | 0.09440 | <0.001 | <0.001 | <0.005 | 0.00878 | 0.580 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.9190 |
| | 06/06/17 | <0.0025 | 0.118 | 0.09540 | <0.001 | <0.001 | <0.005 | 0.00806 | 0.590 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6710 |
| | 06/20/17 | <0.0025 | 0.121 | 0.1010 | <0.001 | <0.001 | <0.005 | 0.00744 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.672 |
| | 06/27/17 | <0.0025 | 0.128 | 0.1040 | <0.001 | <0.001 | <0.005 | 0.00841 | 0.600 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5200 |
| | 07/10/17 | <0.0025 | 0.123 | 0.1100 | <0.001 | <0.001 | <0.005 | 0.0086 | 0.580 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.8050 |
| | 07/18/17 | <0.0025 | 0.115 | 0.1010 | <0.001 | <0.001 | <0.005 | 0.00784 | 0.600 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 4.812 |
| | 06/25/18 | <0.0025 | 0.0697 | 0.104 | <0.001 | <0.001 | <0.005 | 0.00682 | 0.620 | <0.00074 J | 0.00513 J | <0.0002 | 0.00428 J | <0.005 | <0.0015 | 0.267 | <1.417 | 1.68 |
| | 09/18/18 | NA | 0.0625 | 0.109 | NA | NA | <0.002 | 0.0064 | 0.479 | 0.000555 J | 0.00624 J | NA | 0.00450 J | NA | NA | <0.31 | <0.528 | <0.838 |
| | 06/05/19 | <0.0008 | 0.0531 | 0.105 | <0.0003 | <0.0003 | <0.002 | 0.00574 | 0.602 | 0.000354 | 0.00558 J | <0.00008 | 0.00685 | <0.0020 | <0.0005 | 0.65 | <0.687 | 1.337 |
| | 10/03/19 | <0.0008 | 0.049 | 0.0963 | <0.0003 | <0.0003 | <0.002 | 0.00542 | 0.588 | 0.000333 J | <0.005 | <0.00008 | 0.00784 | <0.0020 | <0.0005 | 0.346 | 1.54 | 1.89 |
| MW-8 | 03/28/17 | <0.0025 | 0.00839 | 0.0623 | <0.001 | <0.001 | <0.005 | 0.0236 | 0.490 | <0.001 | 0.0111 | <0.0002 | 0.0154 | <0.005 | <0.0015 | -- | -- | 0.4520 |
| | 05/09/17 | <0.0025 | 0.00848 | 0.064 | <0.001 | <0.001 | <0.005 | 0.0272 | 0.440 | <0.001 | 0.0111 | <0.0002 | 0.0157 | <0.005 | <0.0015 | -- | -- | 0.4740 |
| | 05/15/17 | <0.0025 | 0.00926 | 0.064 | <0.001 | <0.001 | <0.005 | 0.0311 | 0.440 | <0.001 | 0.0112 | <0.0002 | 0.016 | <0.005 | <0.0015 | -- | -- | 0.6140 |
| | 06/06/17 | <0.0025 | 0.00912 | 0.0616 | <0.001 | <0.001 | 0.00744 | 0.0308 | 0.450 | <0.001 | 0.0107 | <0.0002 | 0.0157 | <0.005 | <0.0015 | -- | -- | 0.1320 |
| | 06/20/17 | <0.0025 | 0.00885 | 0.0669 | <0.001 | <0.001 | <0.005 | 0.0297 | 0.430 | <0.001 | 0.0121 | <0.0002 | 0.0171 | <0.005 | <0.0015 | -- | -- | 0.5380 |
| | 06/27/17 | <0.0025 | 0.00939 | 0.0633 | <0.001 | <0.001 | <0.005 | 0.0314 | 0.440 | <0.001 | 0.0115 | <0.0002 | 0.0163 | <0.005 | <0.0015 | -- | -- | 0.9390 |
| | 07/10/17 | <0.0025 | 0.00902 | 0.0631 | <0.001 | <0.001 | <0.005 | 0.031 | 0.440 | <0.001 | 0.0112 | <0.0002 | 0.0165 | <0.005 | <0.0015 | -- | -- | 0.8040 |
| | 07/18/17 | <0.0025 | 0.00937 | 0.0635 | <0.001 | <0.001 | <0.005 | 0.0352 | 0.460 | <0.001 | 0.0118 | <0.0002 | 0.0185 | <0.005 | <0.0015 | -- | -- | 2.113 |
| | 06/25/18 | <0.0025 | 0.0101 | 0.0632 | <0.001 | <0.001 | <0.005 | 0.029 | 0.520 | 0.0011 | 0.0107 | <0.0002 | 0.017 | <0.005 | <0.0015 | <0.234 | <1.204 | <1.44 |
| | 09/18/18 | NA | 0.00896 | 0.0582 | NA | NA | <0.00200 | 0.0237 | 0.402 | <0.0003 | 0.0117 | NA | 0.0178 | NA | NA | <0.281 | <0.558 | <0.84 |
| | 06/05/19 | <0.0008 | 0.00946 | 0.0596 | <0.0003 | <0.0003 | <0.002 | 0.0217 | 0.497 | 0.000355 J | 0.011 | <0.00008 | 0.0156 | <0.0020 | <0.0005 | 0.528 | <0.619 | 1.147 |
| | 10/03/19 | <0.0008 | 0.0083 | 0.0607 | <0.0003 | <0.0003 | <0.002 | 0.231 | 0.419 | <0.0003 | 0.0106 | <0.00008 | 0.0144 | <0.0020 | <0.0005 | 0.224 | 0.241 | 0.465 |

**TABLE 4**
**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Downgradient Wells** | | | | | | | | | | | | | | | | | | |
| MW-4 | 03/28/17 | <0.0025 | 0.00738 | 0.0575 | <0.001 | <0.001 | <0.005 | 0.007 | 0.610 | <0.001 | 0.0192 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.4600 |
| | 05/09/17 | <0.0025 | 0.00733 | 0.0576 | <0.001 | <0.001 | <0.005 | 0.007 | 0.610 | <0.001 | 0.0182 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6940 |
| | 05/15/17 | <0.0025 | 0.00794 | 0.0556 | <0.001 | <0.001 | <0.005 | 0.007 | 0.600 | <0.001 | 0.0166 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.451 |
| | 06/06/17 | <0.0025 | 0.0077 | 0.0556 | <0.001 | <0.001 | <0.005 | 0.007 | 0.630 | <0.001 | 0.0179 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1740 |
| | 06/20/17 | <0.0025 | 0.0081 | 0.0596 | <0.001 | <0.001 | 0.00877 | 0.008 | 0.620 | <0.001 | 0.0195 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5430 |
| | 06/27/17 | <0.0025 | 0.00786 | 0.0554 | <0.001 | <0.001 | <0.005 | 0.007 | 0.630 | <0.001 | 0.0185 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6390 |
| | 07/10/17 | <0.0025 | 0.00846 | 0.0582 | <0.001 | <0.001 | <0.005 | 0.009 | 0.620 | <0.001 | 0.0187 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.069 |
| | 07/18/17 | <0.0025 | 0.00815 | 0.0549 | <0.001 | <0.001 | <0.005 | 0.008 | 0.630 | <0.001 | 0.0183 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1910 |
| | 06/21/18 | <0.0025 | 0.00843 | 0.0591 | <0.001 | <0.001 | <0.005 | 0.00711 | 0.600 | <0.00072 J | 0.0175 | <0.0002 | <0.005 | <0.005 | <0.0015 | 0.370 | 1.705 | 2.08 |
| | 09/18/18 | NA | 0.00793 | 0.0577 | NA | NA | <0.002 | 0.00673 | 0.582 | <0.0003 | 0.019 | NA | <0.002 | NA | NA | 1.610 | <0.543 | 2.15 |
| | 06/05/19 | <0.0008 | 0.0079 | 0.0571 | <0.0003 | <0.0003 | <0.002 | 0.00729 | 0.670 | <0.0003 | 0.0195 | <0.00008 | <0.002 | <0.0020 | <0.0005 | 0.436 | <0.547 | 0.98 |
| | 10/03/19 | <0.0008 | 0.00764 | 0.0532 | <0.0003 | <0.0003 | <0.002 | 0.00699 | 0.559 | 0.00101 | 0.017 | <0.00008 | <0.002 | <0.002 | <0.0005 | 1.85 | -0.102 | 1.85 |
| MW-5 | 03/30/17 | <0.0025 | 0.00953 | 0.0748 | <0.001 | <0.001 | <0.005 | <0.005 | 0.510 | <0.001 | 0.0192 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.443 |
| | 05/10/17 | <0.0025 | 0.00955 | 0.0706 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0179 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6150 |
| | 05/16/17 | <0.0025 | 0.00967 | 0.0708 | <0.001 | <0.001 | <0.005 | <0.005 | 0.500 | <0.001 | 0.0181 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6410 |
| | 06/08/17 | <0.0025 | 0.00908 | 0.0701 | <0.001 | <0.001 | <0.005 | <0.005 | 0.550 | <0.001 | 0.0200 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1790 |
| | 06/21/17 | <0.0025 | 0.00917 | 0.0767 | <0.001 | <0.001 | <0.005 | <0.005 | 0.530 | <0.001 | 0.0197 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1060 |
| | 06/26/17 | <0.0025 | 0.00955 | 0.0735 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0204 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.112 |
| | 07/11/17 | <0.0025 | 0.00945 | 0.0712 | <0.001 | <0.001 | <0.005 | <0.005 | 0.520 | <0.001 | 0.0183 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5120 |
| | 07/19/17 | <0.0025 | 0.00941 | 0.0735 | <0.001 | <0.001 | <0.005 | <0.005 | 0.530 | <0.001 | 0.0186 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1910 |
| | 06/25/18 | <0.0025 | 0.00998 | 0.0733 | <0.001 | <0.001 | <0.005 | <0.005 | 0.560 | <0.001 | 0.0182 | <0.0002 | <0.005 | <0.005 | <0.0015 | <0.251 | <1.369 | <1.62 |
| | 09/18/18 | NA | 0.00945 | 0.0697 | NA | NA | <0.002 | <0.003 | 0.493 | <0.0003 | 0.0195 | NA | <0.002 | NA | NA | <0.282 | <0.606 | <0.89 |
| | 06/03/19 | <0.0008 | 0.00948 | 0.0678 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.596 | <0.0003 | 0.0206 | <0.00008 | <0.002 | <0.002 | <0.0005 | <0.619 | <0.917 | <1.54 |
| | 10/02/19 | <0.0008 | 0.00918 | 0.067 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.543 | <0.0003 | 0.0187 | <0.00008 | <0.002 | <0.002 | <0.0005 | 0.47 | 0.117 | 0.587 |
| MW-6 | 03/29/17 | <0.0025 | 0.00827 | 0.0900 | <0.001 | <0.001 | <0.005 | <0.005 | 0.380 | <0.001 | <0.010 | <0.0002 | 0.00749 | <0.005 | <0.0015 | -- | -- | 1.009 |
| | 05/11/17 | <0.0025 | 0.00738 | 0.0758 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | 0.0101 | <0.0002 | 0.0176 | <0.005 | <0.0015 | -- | -- | 0.8250 |
| | 05/16/17 | <0.0025 | 0.00803 | 0.0784 | <0.001 | <0.001 | <0.005 | <0.005 | 0.360 | <0.001 | <0.010 | <0.0002 | 0.0131 | <0.005 | <0.0015 | -- | -- | 0.7740 |
| | 06/07/17 | <0.0025 | 0.00772 | 0.0798 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | <0.010 | <0.0002 | 0.00949 | <0.005 | <0.0015 | -- | -- | 0.6640 |
| | 06/22/17 | <0.0025 | 0.00764 | 0.083 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | 0.0109 | <0.0002 | 0.0084 | <0.005 | <0.0015 | -- | -- | 0.2150 |
| | 06/28/17 | <0.0025 | 0.00779 | 0.0842 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | <0.010 | <0.0002 | 0.00806 | <0.005 | <0.0015 | -- | -- | 1.730 |
| | 07/12/17 | <0.0025 | 0.0077 | 0.0819 | <0.001 | <0.001 | <0.005 | <0.005 | 0.350 | <0.001 | <0.010 | <0.0002 | 0.0076 | <0.005 | <0.0015 | -- | -- | 1.012 |
| | 07/20/17 | <0.0025 | 0.001 | 0.0010 | <0.001 | <0.001 | <0.005 | <0.005 | 0.390 | <0.001 | <0.010 | <0.0002 | 0.001 | <0.005 | <0.0015 | -- | -- | 0.3660 |
| | 06/22/18 | <0.0025 | 0.00861 | 0.0912 | <0.001 | <0.001 | <0.005 | <0.005 | 0.410 | <0.001 | 0.00924 J | <0.0002 | 0.00837 | <0.005 | <0.0015 | <0.309 | <1.243 | <1.55 |
| | 09/18/18 | NA | 0.008 | 0.0828 | NA | NA | <0.002 | <0.003 | 0.353 J | 0.000349 J | 0.0107 | NA | 0.0274 | NA | NA | <0.196 | 1.06 | 1.256 |
| | 06/03/19 | <0.0008 | 0.00799 | 0.0894 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.438 | <0.0003 | 0.00968 J | <0.00008 | 0.00884 | <0.0020 | <0.0005 | <0.407 | <0.623 | <1.03 |
| | 10/02/19 | <0.0008 | 0.00775 | 0.0876 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.357 J | <0.0003 | 0.00875 J | <0.00008 | 0.00875 | <0.0020 | <0.0005 | 0.715 | 1.23 | 1.94 |

## TABLE 4
## APPENDIX IV ANALYTICAL RESULTS
## COLETO CREEK PRIMARY ASH POND

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-9 | 03/30/17 | <0.0025 | 0.00909 | 0.121 | <0.001 | <0.001 | <0.005 | <0.005 | 1.130 | 0.00217 | <0.010 | <0.0002 | 0.0747 | <0.005 | <0.0015 | -- | -- | 1.353 |
| | 05/10/17 | <0.0025 | 0.00996 | 0.105 | <0.001 | <0.001 | <0.005 | <0.005 | 1.290 | 0.00433 | <0.010 | <0.0002 | 0.0900 | <0.005 | <0.0015 | -- | -- | 0.4800 |
| | 05/17/17 | <0.0025 | 0.00958 | 0.101 | <0.001 | <0.001 | <0.005 | <0.005 | 1.260 | 0.00377 | <0.010 | <0.0002 | 0.0899 | <0.005 | <0.0015 | -- | -- | 0.3600 |
| | 06/07/17 | <0.0025 | 0.0093 | 0.100 | <0.001 | <0.001 | <0.005 | <0.005 | 1.260 | <0.001000 | <0.010 | <0.0002 | 0.0926 | <0.005 | <0.0015 | -- | -- | 0.4760 |
| | 06/21/17 | <0.0025 | 0.00937 | 0.119 | <0.001 | <0.001 | <0.005 | <0.005 | 1.390 | 0.00136 | <0.010 | <0.0002 | 0.1020 | <0.005 | <0.0015 | -- | -- | 1.579 |
| | 06/26/17 | <0.0025 | 0.0107 | 0.114 | <0.001 | <0.001 | 0.0102 | <0.005 | 1.400 | 0.00217 | <0.010 | <0.0002 | 0.1060 | <0.005 | <0.0015 | -- | -- | 1.023 |
| | 07/11/17 | <0.0025 | 0.0105 | 0.103 | <0.001 | <0.001 | 0.00566 | <0.005 | 1.300 | 0.00124 | <0.010 | <0.0002 | 0.1050 | <0.005 | <0.0015 | -- | -- | 0.8630 |
| | 07/19/17 | <0.0025 | 0.0103 | 0.101 | <0.001 | <0.001 | <0.005 | <0.005 | 1.400 | <0.001000 | <0.010 | <0.0002 | 0.1130 | <0.005 | <0.0015 | -- | -- | 0.5840 |
| | 06/21/18 | <0.0025 | 0.0104 | 0.100 | <0.001 | <0.001 | <0.005 | <0.005 | 1.500 | <0.00072 J | <0.01 | <0.0002 | 0.0617 | <0.005 | <0.0015 | 0.608 | <1.303 | 1.91 |
| | 09/18/18 | NA | 0.0103 | 0.0985 | NA | NA | <0.002 | <0.003 | 1.100 | <0.000300 | 0.00639 J | NA | 0.0502 | NA | NA | 0.618 | <0.638 | 1.26 |
| | 06/05/19 | <0.0008 | 0.0109 | 0.102 | <0.0003 | <0.0003 | <0.002 | <0.003 | 1.380 | <0.0003 | 0.00545 J | <0.00008 | 0.0683 | <0.002 | <0.0005 | <0.402 | <0.683 | <1.085 |
| | 10/03/19 | <0.0008 | 0.0109 | 0.128 | 0.000689 J | <0.0003 | <0.002 | 0.00337 J | 1.410 | 0.00876 | 0.0064 J | <0.00008 | 0.0507 | 0.0041 J | <0.0005 | 0.577 | 0.747 | 1.32 |
| MW-10 | 03/30/17 | <0.0025 | 0.0110 | 0.0844 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0179 | <0.0002 | 0.0342 | <0.005 | <0.0015 | -- | -- | 1.439 |
| | 05/10/17 | <0.0025 | 0.0146 | 0.0554 | <0.001 | <0.001 | 0.00533 | <0.005 | 0.830 | <0.001 | 0.0122 | <0.0002 | 0.102 | <0.005 | <0.0015 | -- | -- | 0.8880 |
| | 05/16/17 | <0.0025 | 0.0150 | 0.0598 | <0.001 | <0.001 | <0.005 | <0.005 | 0.810 | <0.001 | 0.0123 | <0.0002 | 0.0987 | <0.005 | <0.0015 | -- | -- | 0.1830 |
| | 06/08/17 | <0.0025 | 0.0144 | 0.0544 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0115 | <0.0002 | 0.1060 | <0.005 | <0.0015 | -- | -- | 0.06700 |
| | 06/21/17 | <0.0025 | 0.0149 | 0.054 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0133 | <0.0002 | 0.1130 | <0.005 | <0.0015 | -- | -- | 0.7090 |
| | 06/26/17 | <0.0025 | 0.0160 | 0.0587 | <0.001 | <0.001 | 0.0177 | <0.005 | 0.840 | <0.001 | 0.0137 | <0.0002 | 0.1160 | <0.005 | <0.0015 | -- | -- | 0.7180 |
| | 07/11/17 | <0.0025 | 0.0149 | 0.0508 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0119 | <0.0002 | 0.1140 | <0.005 | <0.0015 | -- | -- | 1.713 |
| | 07/19/17 | <0.0025 | 0.0146 | 0.0633 | <0.001 | <0.001 | 0.00963 | <0.005 | 0.860 | <0.001 | 0.0127 | <0.0002 | 0.1210 | <0.005 | <0.0015 | -- | -- | 2.132 |
| | 06/22/18 | <0.0025 | 0.0154 | 0.0692 | <0.001 | <0.001 | <0.005 | <0.005 | 0.88 | <0.00095 J | 0.0122 | <0.0002 | 0.134 | <0.005 | <0.0015 | <0.212 | <1.192 | <1.40 |
| | 09/18/18 | NA | 0.0140 | 0.0446 | NA | NA | <0.002 | <0.003 | 0.759 | <0.0003 | 0.0141 | NA | 0.125 | NA | NA | 0.151 | <0.848 | 0.999 |
| | 06/03/19 | <0.0008 | 0.0142 | 0.0420 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.953 | <0.0003 | 0.0139 | <0.00008 | 0.109 | <0.002 | <0.0005 | <0.203 | 0.814 | 1.017 |
| | 10/02/19 | <0.0008 | 0.0139 | 0.0406 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.891 | <0.0003 | 0.0127 | <0.00008 | 0.106 | <0.002 | <0.0005 | -0.0288 | 0.901 | 0.901 |
| MW-11 | 05/10/17 | <0.0025 | 0.0156 | 0.0899 | <0.001 | <0.001 | <0.005 | <0.005 | 0.82 | 0.00239 | 0.0125 | <0.0002 | 0.0082 | <0.005 | <0.0015 | -- | -- | 0.4560 |
| | 05/16/17 | <0.0025 | 0.018 | 0.0869 | <0.001 | <0.001 | 0.00731 | <0.005 | 0.85 | 0.0113 | 0.0144 | <0.0002 | 0.00841 | <0.005 | <0.0015 | -- | -- | 1.418 |
| | 05/18/17 | <0.0025 | 0.0188 | 0.0779 | <0.001 | <0.001 | <0.005 | <0.005 | 0.94 | 0.00204 | 0.0122 | <0.0002 | 0.00781 | <0.005 | <0.0015 | -- | -- | 0.6390 |
| | 06/07/17 | <0.0025 | 0.0175 | 0.0835 | <0.001 | <0.001 | <0.005 | <0.005 | 0.93 | 0.00171 | 0.0137 | <0.0002 | 0.00744 | <0.005 | <0.0015 | -- | -- | 0.5020 |
| | 06/21/17 | <0.0025 | 0.0203 | 0.0822 | <0.001 | <0.001 | <0.005 | <0.005 | 1.04 | 0.00322 | 0.0136 | <0.0002 | 0.00659 | <0.005 | <0.0015 | -- | -- | 1.084 |
| | 06/26/17 | <0.0025 | 0.0237 | 0.0954 | <0.001 | <0.001 | 0.0131 | <0.005 | 1.00 | 0.00593 | 0.0176 | <0.0002 | 0.00796 | <0.005 | <0.0015 | -- | -- | 3.067 |
| | 07/11/17 | <0.0025 | 0.0212 | 0.0725 | <0.001 | <0.001 | <0.005 | <0.005 | 1.00 | <0.001 | 0.012 | <0.0002 | 0.00765 | <0.005 | <0.0015 | -- | -- | 0.7530 |
| | 07/19/17 | <0.0025 | 0.0224 | 0.0709 | <0.001 | <0.001 | 0.00762 | <0.005 | 1.01 | 0.0018 | 0.0137 | <0.0002 | 0.00783 | <0.005 | <0.0015 | -- | -- | 1.551 |
| | 06/21/18 | <0.0025 | 0.0367 | 0.0805 | <0.001 | <0.001 | <0.005 | <0.005 | 0.96 | 0.00241 | 0.0135 | <0.0002 | 0.00465 | <0.005 | <0.0015 | <0.234 | <1.312 | <1.55 |
| | 09/18/18 | NA | 0.0382 | 0.0645 | NA | NA | <0.002 | <0.003 | 0.754 | <0.0003 | 0.0139 | NA | 0.00445 J | NA | NA | <0.188 | 0.597 | 0.785 |
| | 06/03/19 | <0.0008 | 0.0379 | 0.0834 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.0837 | <0.0003 | 0.0154 | <0.00008 | 0.00316 J | <0.002 | <0.0005 | <0.481 | 0.991 | 1.472 |
| | 10/02/19 | <0.0008 | 0.0379 | 0.0744 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.768 | 0.000391 J | 0.014 | <0.00008 | 0.00259 J | <0.002 | <0.0005 | 1.57 | 0.478 | 2.040 |

Notes:
1. All concentrations in mg/L. Ra 226/228 Combined in pCi/L.
2. J - concentration is below sample quantitation limit; result is an estimate.
3. Non-detect Ra isotope results were assigned a value equal to the minimum detectable concentration.
4. NA = Not analyzed.

GOLDER

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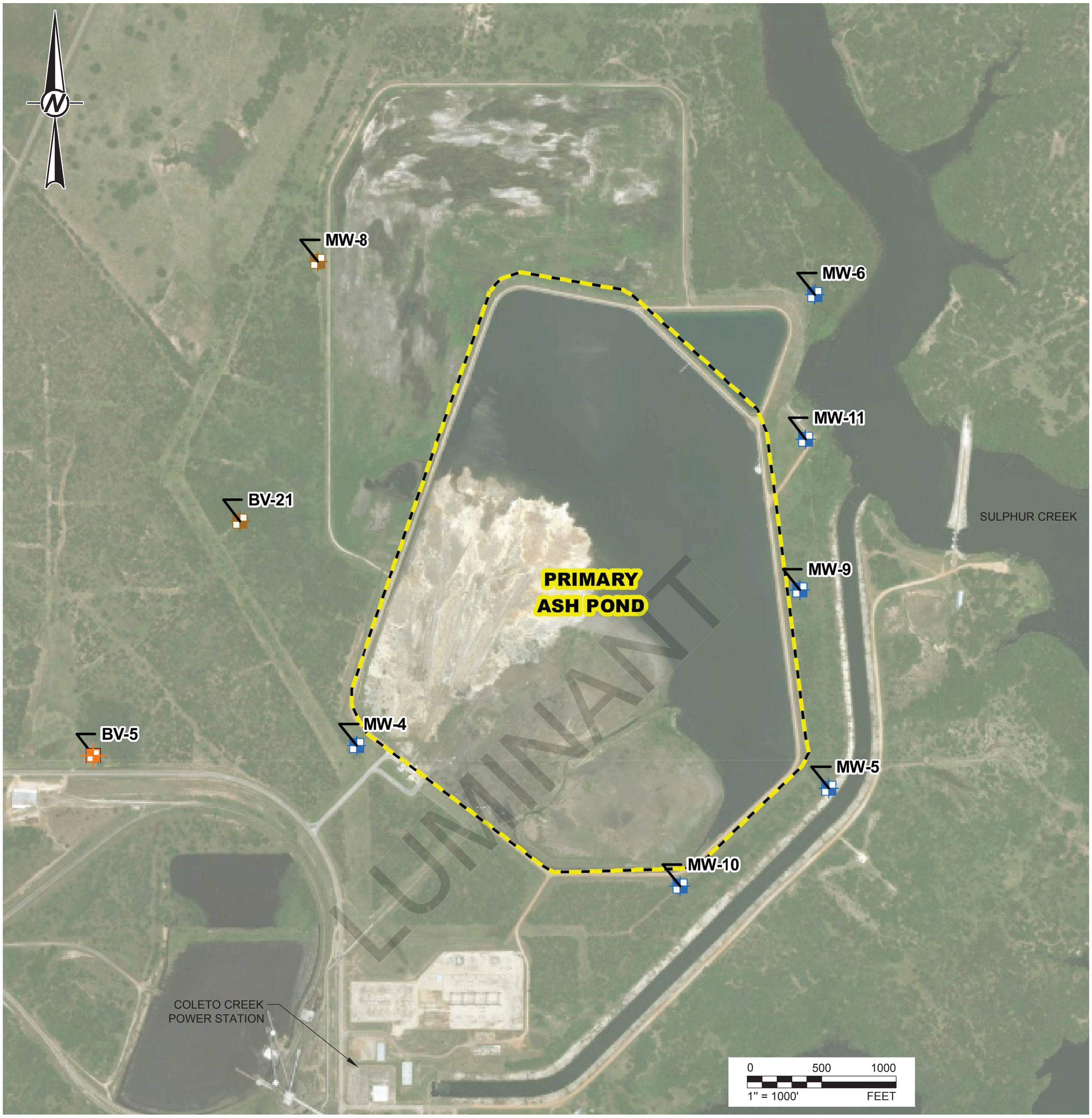
## ATTACHMENT 2 – MAP OF GROUNDWATER MONITORING WELL LOCATIONS




**LEGEND**

DOWNGRADIENT MONITORING WELL LOCATION

UPGRADIENT MONITORING WELL LOCATION

CCR MONITORING UNIT

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**DETAILED SITE PLAN - COLETO CREEK PRIMARY ASH POND**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2019-01-14 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 18106453 | 0 | 1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 1 in

Last Edited By: adiamond Date: 2019-01-14 Time:1:54:25 PM | Printed By: adiamond Date: 2019-01-14 Time:1:54:58 PM
Path: \\texarkana\data\Projects - Round Rock\18106453 - Coleto Creek\2019-1 Jan\ | File Name: FIG 1 - Detailed Site Plan.dwg

# ATTACHMENT 3 – WELL CONSTRUCTION DIAGRAMS AND DRILLING LOGS

# MONITORING WELL BORING LOGS

Appendix B: CCR Groundwater Monitoring Well System Boring Logs

Wells W-4 to W-6 and Well W-8
by Sargent & Lundy Engineers (March and April 1978). These monitoring wells are also designated as MW-4 to MW-6 and MW-8, respectively.

Wells W-9 and W-10
by Bullock, Bennett & Associates, LLC (May 2016). These monitoring wells are also designated as MW-9 and MW-10, respectively.

Well MW-11
by Bullock, Bennett & Associates, LLC (April 2017)

Wells BV-5 and BV-21
by Black & Veatch (August and September 2008)

Renamed
MW-4

## BORING NO. W-4

PROJECT: Calaia Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-4
SURFACE ELEVATION: 134.32 Ft | TOTAL DEPTH: 86.5 Ft
LOCATION: N 33405 E0400
DEPTH TO WATER DURING DRILLING: 42.0 Ft | DATE: 6-3-78
DRILLED BY: Trinity Testing Laboratories, Inc.
LOGGED BY: Sargent & Lundy
TESTED BY: Trinity Testing Laboratories, Inc.

| Depth (Ft.) | Sample Number and Type | Blows/Ft or Blows (Recovery, %) | Pocket Penetrometer (tsf) | Field Moisture Content (%) | Liquid Limit (%) | Plastic Limit (%) | Other Tests | Core Recovery (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | DT1 | (70) | | 16.0 | 40 | 21 | SA | | |
| 5 | DT2 | (80) | | | | | | | |
| | DT3 | (100) | | 13.2 | | | | | |
| 10 | DT4 | (80) | | 11.3 | 43 | 19 | SA | | |
| 15 | DT5 | (01) | | 13.5 | | | SA | | |
| 20 | SS6 | 7-33-40 (100) | | | | | | | |
| 25 | SS7 | 14-20-4 (100) | | | | | | | |
| 30 | SS8 | 38-35-39 (100) | | | | | SA | | |
| 35 | PS9 | 20-20-1 (100) | | | | | | | |
| 40 | SS10 | 41-30-2 | | | | | | | |
| 45 | SS11 | 37-24-47 (100) | | | | | SA | | |
| 50 | SS12 | 105/4 (100) | | | | | | | |
| 55 | SS13 | 32-40-20 (100) | | | | | | | |
| 60 | SS14 | 33-30-34 (100) | | | | | SA | | |
| 65 | SS15 | 60-100/2 (100) | | | | | | | |
| 70 | SS16 | 10-37-100/5 (100) | | | | | SA | | |
| 75 | SS17 | 32-46-66 (100) | | | | | SA | | |
| 80 | SS18 | 19-41-56 (100) | | | 46 | 23 | SA | | |
| 85 | SS19 | 37-33-84 (100) | | | | | | | |
| 90 | | | | | | | | | |

| Symbols | Description | Depth (Ft.) | Elevation (Ft.) |
|---|---|---|---|
| SM | SAND, silty, brown. | 0 | 134.32 |
| SC | SAND, clayey, medium to fine, brown and yellow. | | 132.32 |
| | - seams of cemented sand between 21 Ft and 25 Ft. | 20 | 113.32 |
| SP-SM | SAND, medium to fine, trace silt, yellow. | 25 | 109.32 |
| CL | CLAY, silty, some medium to fine sand, calcareous, yellow. | 30 | 103.32 |
| SP | SAND, medium to fine, yellow. | | 100.32 |
| CL | CLAY, silty and sandy, yellow. | 35 | 99.32 |
| SM | SAND, silty, coarse to fine, trace gravel, yellow. | | 98.32 |
| | - cemented layer. | 40 | 94.32 |
| | - grades to no gravel, white | | 93.32 / 92.32 |
| | - grades to medium to fine. | 45 | 89.32 |
| | - grades to coarse to fine with gravel & caliche. | | 88.02 |
| SM | | 50 | 86.32 |
| CL | CLAY, sandy, yellow and gray. | | 78.02 |
| SC-GC | SAND and Gravel, clayey, gray, with cemented layers. | 60 | 74.32 |
| CL | CLAY, sandy, gray. - grades to yellow | 65 | 69.32 |
| | | | 66.02 |
| SM | SAND, silty, coarse to fine, yellow. | 70 | 63.32 / 62.02 |
| ML | Caliche, (Chalk) | | 60.02 |
| SM | SAND, silty, coarse to fine, yellow. | 75 | |
| CL | CLAY, silty, little medium to fine sand, gray and brown with pockets of Caliche. | | 58.32 |
| | END OF BORING - 86.5 Ft | 85 | 47.82 |

Groundwater encountered at 42.0 Ft.

86.5

ATTACHMENT 11

Renamed MW-5

# BORING NO. W-5

SHEET 1 OF 2

| | |
|---|---|
| PROJECT: | Coleto Creek Power Station |
| CLIENT: | Central Power & Light Co. |
| FEATURE: | Monitoring Well W-5 |
| SURFACE ELEVATION: | 119.57 Ft |
| TOTAL DEPTH: | 71.5Ft |
| LOCATION: | N 30+07.7 E 31+50.6 |
| DEPTH TO WATER DURING DRILLING: | 40.0 Ft |
| DATE: | 3-30-78 |
| DRILLED BY: | Trinity Testing Laboratories, Inc. |
| LOGGED BY: | Sargent & Lundy |
| TESTED BY: | Trinity Testing Laboratories, Inc. |

| DEPTH (ft.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) | SYMBOLS | DESCRIPTION | DEPTH (ft.) | ELEVATION (ft., MSL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | SM | SAND, silty, brown (Topsoil) | 0 | 119.57 |
| | | | | | | | | | | SC | SAND, clayey, medium to fine, brown. | | 119.07 |
| | ST1 | (75) | | 12.8 | | | SA | | | | | | |
| 5 | ST2 | (83) | | | | | | | | CL | CLAY, silty, gray, with Caliche. | 5 | 114.07 |
| | ST3 | (83) | | | | | | | | SC | SAND, clayey, brown, with layers of Caliche. | | 111.57 |
| 10 | ST4 | (83) | | | | | | | | CL | CLAY, silty, yellow and white, with lenses and pockets of Caliche. | 10 | 108.57 |
| 15 | ST5 | (78) | | 3.1 | | | SA | | | SP-SM | SAND, medium to fine, white. | 15 | 104.57 |
| 20 | SS6 | 8-13-20 (100) | | | | | SA | | | | | 20 | |
| 25 | SS7 | 7-47-100/4.5 (100) | | | | | | | | SC | SAND, clayey, calcareous, white. (Caliche) | 25 | 93.57 |
| 30 | SS8 | 6-13-31 (100) | | | | | | | | SM-SC | SAND, silty and clayey, white, with lenses and seems of Caliche - grades to gray. | 30 | 90.57 |
| 35 | SS9 | 14-36-31 (100) | | | | | SA | | | | | 35 | |
| 40 | SS10 | 1-27-31 (100) | | | | | | | | SM | SAND, silty, coarse to fine, white | 40 (water level) | 79.57 / 79.07 |
| 45 | SS11 | 16-67-100/5.5 (100) | | 34 | 15 | | | | | CL | CLAY, silty, gray, with seems of Caliche. | 45 | 73.57 |
| 50 | | | | | | | | | | | | 50 | |

| REVISION | DATE / APPROVED BY | DESCRIPTION |
|---|---|---|
| 0 | 10-24-78 D.G. Bartlett | For Use |
| | | |
| | | |
| | | |
| | | |

COLETO CREEK POWER STATION

LOG OF BORING W-5

CENTRAL POWER & LIGHT CO.

SARGENT & LUNDY ENGINEERS

PROJECT NUMBER 4857

BORING NO. W-5 (cont'd) SHEET 2 OF 2

Renamed MW-5

| DEPTH (ft.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) | SYMBOLS | DESCRIPTION | DEPTH (ft.) / ELEVATION (ft., MSL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | SS12 | 72-100/1 (100) | | | | | SA | | | SM-SC | SAND, silty and clayey, calcareous, white, very dense. (Caliche) | 69.57 |
| | | | | | | | | | | SM | SAND, silty, white. | 66.57 |
| 55 | SS13 | 50-74-130/5.5 (100) | | | | | | | | SM-SC | SAND, silty and clayey, calcareous, white and brown, very dense. (Caliche) | 62.57 |
| 60 | SS14 | 100/3.5 (100) | | | 18 | 14 | SA | | | | | |
| 65 | SS15 | 18-78-100/4.5 (100) | | | | | | | | CL | CLAY, silty, brown. | 53.57 |
| 70 | SS16 | 9-17-21 (100) | | | | | | | | | END OF BORING - 71.5 Ft<br>Groundwater encountered at 40.0 Ft. and rose to 32.5 Ft. | 48.07 |
| 75 | | | | | | | | | | | | |

| REVISION | DATE / APPROVED BY | DESCRIPTION |
|---|---|---|
| 0 | 10-24-78 / R.G. Bolier | For Use |

COLETO CREEK POWER STATION
LOG OF BORING W-5 (cont'd)

CENTRAL POWER & LIGHT CO.

SARGENT & LUNDY ENGINEERS

PROJECT NUMBER 4857

Renamed MW-6

Renamed MW-8

## BORING NO. W-6

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-6

| Symbols | Description |
|---|---|
| SC | SAND, clayey, brown. |
| | - grades to yellow-brown. |
| | - grades to yellow with Caliche. |
| CL | CLAY, sandy, yellow-brown. |
| SM-SC | SAND, silty and clayey, yellow and white with Caliche. |
| SC | SAND, clayey, yellow-gray. |
| SP-SM | SAND, coarse to fine, white to yellow. |
| SM | SAND, silty, trace gravel, white with layer of clayey sand. |
| CL-ML | CLAY, silty and sandy, yellow gray. |
| SC | SAND, clayey, gray, with Caliche. |
| SC | - grades to yellow-gray. |
| SM-SC | SAND, silty and clayey, white. |
| CL | CLAY, silty, gray-pink. |
| | END OF BORING - 56.1 Ft. Groundwater encountered at 35.0 Ft. |

## BORING NO. W-7

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-7

| Symbols | Description |
|---|---|
| SC | SAND, clayey, medium to fine, brown. |
| | - grades to yellow with layers of Caliche. |
| | - grades to brown. |
| | - grades to yellow. |
| SM | SAND, silty, coarse to fine, trace gravel, white. |
| SC | SAND, clayey, yellow, with Caliche. |
| SM | SAND, silty, coarse to fine, yellow. |
| SC | SAND, clayey, gray, with Caliche. |
| SM | SAND, silty, medium to fine, white. |
| SC | SAND, clayey. |
| SM | SAND, silty, coarse to fine, with and without little gravel, white. |
| | - cemented layer. |
| CL | CLAY, silty, gray, very hard. |
| | END OF BORING - 73.11 Ft. Groundwater encountered at 31.0 Ft. |

## BORING NO. W-8

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-8
LOGGED BY: Sargent & Lundy
TESTED BY: Trinity Testing Laboratories, Inc.

| Symbols | Description |
|---|---|
| SC | SAND, clayey, medium to fine, brown. |
| CL | CLAY, silty, and sandy, calcareous, white, (Caliche) |
| SC | SAND, clayey, medium to fine, calcareous light brown to white. |
| SM | SAND, silty, medium to fine, light brown to gray. |
| CL | CLAY, silty, brown. |
| SC | SAND, clayey calcareous, white. (Caliche) |
| SP | SAND, coarse to fine, brown |
| SC | SAND, clayey, coarse to fine, gray. |
| SM | SAND, silty, gray, with clayey sand layers. |
| SC | SAND, clayey, gray, very hard. |
| CL | CLAY, silty, light brown to white with Caliche, very hard. |
| | END OF BORING - 81.3 Ft. Groundwater encountered at 41.0 Ft. |

## NOTES

## REFERENCE DRAWINGS

S-2 SOILS BORINGS LOCATION PLAN

FOR REFERENCE ONLY
SPEC. CC2-513.20
11-21-80

| | | | | | | |
|---|---|---|---|---|---|---|
| REV. | DATE REL'D | PREPARED | REVIEWED | APPROVED | PURPOSE | FILM |
| A | [illegible] | [illegible] | R.S. [illegible] | [illegible] | FOR RECORD | ✓ |

SCALE: NONE
PROJECT NUMBER: 4567

LOG OF BORINGS
W-6 THROUGH W-8
COLETO CREEK POWER STATION UNIT 1
CENTRAL POWER & LIGHT COMPANY
GOLIAD COUNTY, TEXAS

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO. S-10 REV. A
SHEET 3 OF 3

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING W-9

Renamed MW-9



COLETO CREEK POWER STATION
FANNIN, TX

Project No. 15215

| | | | |
|---|---|---|---|
| Date | : 9/15/2015 | Drilling Company | : EnviroCore |
| Easting | : 2543670.9 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13451651.2 | Drill Rig | : CME75 |
| Top of Casing Elevation | 132.3 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

| DEPTH (feet) | Surface Elevation 129.3 | DESCRIPTION | USCS | Recovery (ft/ft) |
|---|---|---|---|---|
| 0.0 | 128 | (0-2.0) - Fill Material: CLAYEY SAND, mottled light gray and reddish brown, moist | SC | 1.5/2 |
| 5.0 | 124 | (2.0-5.5) - Fill Material: Silty CLAY/Clayey SAND, brownish gray to white, soft to firm, Sand is fine to coarse grained, common caliche gravel, moist | SC/CL | 2/2, 2/2 |
| 10.0 | 120 | (5.5-10.0) - Silty CLAY, dark gray to gray with orangish brown mottling, firm to hard, medium plasticity, common caliche gravel, minor roots, moist | CL | 2/2, 2/2 |
| 15.0 | 116, 112 | (10.0-20.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low plascticity, dry | ML/CL | 2/2, 2/2, 2/2, 2/2, 2/2 |
| 20.0 | 108 | (20.5-22.0) - SILTY SAND, very light brownish gray, fine to coarse grained, trace of gravel, moist | SM | 2/2 |
| 25.0, 30.0, 35.0, 40.0 | 104, 100, 96, 92, 88 | (22.0-44.0) - SAND, very light orangish brownish to very light gray, fine to coarse grained, slightly silty, wet | SW | 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2 |
| 45.0 | 84 | (44.0-47.0) - SILTY SAND, light gray, fine to coarse grained, wet | SM | 2/2, 2/2 |
| 50.0 | 80, 76 | (47.0-54.0) - Silty CLAY/Clayey SAND, light gray, soft to firm, Sand is fine to coarse grained, wet | SC/CL | 2/2, 2/2, 2/2 |
| 55.0, 60.0 | 72 | (54.0-60.0) - Silty, Clayey SAND, gray, fine to coarse grained, wet | SC/SM | 2/2, 2/2, 2/2 |

## WELL DIAGRAM/REMARKS

Well Construction:
Riser ~3.0' AGL - 40.0' BGL
Neat Cement: 0' - 2.0' BGL
Bentonite chips seal: 2.0' - 38.0' BGL
Sand Pack: 38.0' - 60.0' BGL
Screen: 40.0' - 60.0' BGL

Water Level: 25.2' BGL

Craig E. Bennett

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC. # 1205
LICENSED
PROFESSIONAL GEOSCIENTIST

5-26-16

Total Boring Depth = 60 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING W-10

Renamed MW-10

(Page 1 of 1)

COLETO CREEK POWER STATION
FANNIN, TX

Project No. 15215

| | | | |
|---|---|---|---|
| Date | : 9/17/2015 | Drilling Company | : EnviroCore |
| Easting | : 2542864.5 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13449694.0 | Drill Rig | : CME75 |
| Top of Casing Elevation | 130.4 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

Surface Elevation: 127.6

| DEPTH (feet) | DESCRIPTION | USCS |
|---|---|---|
| 0.0–2.0 | (0-2.0) - Fill Material: SILTY SAND, fine to coarse grained, brown, clayey, common roots, moist | SM |
| 2.0–8.0 | (2.0-8.0) - Silty,Sandy CLAY,mottled organish brown and light gray, firm, medium plasticity, moist | CL |
| 8.0–11.0 | (8.0-11.0) - Silty CLAY/Clayey SAND, light gray, Sand is medium grained, moist | SC/CL |
| 11.0–19.0 | (11.0-19.0) - SILTY SAND, very light gray, medium to coarse grained, abundant caliche, moist | SM |
| 19.0–30.0 | (19.0-30.0) - SAND, light gray, medium to coase grained, occasional gravel, moist | SP |
| 30.0–32.0 | (30.0-32.0) - Silty CLAY/Clayey SAND, light gray, soft to firm, occasional gravel and caliche, medium plasticity, wet | CL/SC |
| 32.0–34.0 | (32.0-34.0) - CLAYEY SAND, brownish grey, soft, very fine, wet | SC |
| 34.0–36.0 | (34.0-36.0) - SILTY SAND, light gray, fine to medium grained, wet | SM |
| 36.0–52.0 | (36.0-52.0) - Silty, Clayey SAND, light gray, fine to coarse grained, wet | SC/SM |
| 52.0–60.0 | (52.0-60.0) - SILTY SAND, light gray, fine to coarse grained, clayey, wet | SM |

| Depth (feet) | Recovery (ft/ft) |
|---|---|
| 0–2 | 2/2 |
| 2–4 | 1.8/2 |
| 4–6 | 0/2 |
| 6–8 | 1.7/2 |
| 8–10 | 2/2 |
| 10–12 | 1.7/2 |
| 12–14 | 1.8/2 |
| 14–16 | 1.8/2 |
| 16–18 | 1.8/2 |
| 18–20 | 1.8/2 |
| 20–22 | 1.8/2 |
| 22–24 | 1.8/2 |
| 24–26 | 1.8/2 |
| 26–28 | 1.8/2 |
| 28–30 | 1.8/2 |
| 30–32 | 1.8/2 |
| 32–34 | 1.8/2 |
| 34–36 | 1.5/2 |
| 36–38 | 1.8/2 |
| 38–40 | 1.8/2 |
| 40–42 | 1.8/2 |
| 42–44 | 1.8/2 |
| 44–46 | 1.8/2 |
| 46–48 | 2/2 |
| 48–50 | 2/2 |
| 50–52 | 1.8/2 |
| 52–54 | 1.8/2 |
| 54–56 | 1.8/2 |
| 56–58 | 2/2 |
| 58–60 | 1.5/2 |

Depth scale: 0.0, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, 50.0, 55.0, 60.0
Elevation scale: 124, 120, 116, 112, 108, 104, 100, 96, 92, 88, 84, 80, 76, 72, 68

## WELL DIAGRAM/REMARKS

Well Construction:
Riser ~3.0' AGL - 40.0' BGL
Neat Cement: 0' - 2.0' BGL
Bentonite chips seal: 2.0' - 38.0' BGL
Sand Pack: 38.0' - 60.0' BGL
Screen: 40.0' - 60.0' BGL

Water Level: 24.8' BGL

Craig E. Bennett
STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC. # 1205
LICENSED
PROFESSIONAL GEOSCIENTIST
5-26-16

Total Boring Depth = 60 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING MW-11



COLETO CREEK POWER STATION
FANNIN, TX

Project No. 17252

| | | | |
|---|---|---|---|
| Date | : 4/25/2017 | Drilling Company | : EnviroCore |
| Easting | : 2543727.0 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13452676.5 | Drill Rig | : CME75 |
| Top of Casing Elevation | 118.66 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

Surface Elevation: 115.8

| DEPTH (feet) | DESCRIPTION | USCS |
|---|---|---|
| 0.0–1.0 | (0-1.0) - Silty CLAY, dark brown, soft to firm, medium plasticity, minor roots, moist | CL |
| 1.0–6.5 | (1.0-6.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low to medium plascticity, wet | CL/ML |
| 6.5–13.8 | (6.5-13.8) - Silty, Clayey SAND, light gray to white, very fine to medium grained, wet | SM |
| 13.8–28.5 | (13.8-28.5) - SAND, very light orangish brownish to very light gray, fine to coarse grained, abundant gravel, slightly silty, wet | SW |
| 28.5–38.0 | (28.5-38.0) - Silty, Clayey SAND, gray to light brownish gray, very fine to medium grained, wet | SM/SC |
| 38.0–40.0 | (38.0-40.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | CL/SC |
| 40.0–46.0 | (40.0-46.0) - Silty, Clayey SAND, gray, fine to medium grained, wet | SM/SC |
| 46.0–49.0 | (46.0-49.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | SC |

Recovery (ft/ft), top to bottom: 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 0/2, 2/2, 1.5/2, 0.5/1

Elevation scale: 112, 108, 104, 100, 96, 92, 88, 84, 80, 76, 72, 68

## WELL DIAGRAM/REMARKS

Water Level: 11.2' BGL

Well Construction:
Riser ~2.7' AGL - 29.0' BGL
Neat Cement: 0' - 1.0' BGL
Bentonite chips seal: 1.0' - 27.0' BGL
Sand Pack: 27.0' - 49.0' BGL
Screen: 29.0' - 49.0' BGL

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
04-28-2017

Total Boring Depth = 49 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE, SAMPLE NUMBER, SET 6 INCHES, 2ND 6 INCHES, 3RD 6 INCHES, N VALUE, SAMPLE RECOVERY
ROCK CORING: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| SPT | 1 | 3 | 7 | 11 | 18 | 1.0 | 0 | 132 | Clayey SAND; brownish gray; medium dense; moist; fine grained; poorly graded; some roots | Boring advanced w/ 3-1/4" ID hollow stem auger. SPT performed w/ auto hammer. |
| SPT | 2 | 13 | 11 | 10 | 21 | 1.2 | 2–4 | 130 | @ 3.0'-3.2' yellowish brown fine to medium sand partings; roots grade out | Sand partings are vertical and dry. |
| SPT | 3 | 6 | 10 | 13 | 23 | 1.2 | 6 | 128 | grading light gray w/ some black mottling | |
| SPT | 4 | 6 | 10 | 13 | 23 | 1.1 | 8 | 126, 124 | | |
| CA | 5 | 6 | 14 | 19 | 33 | 1.4 | 10–12 | 122 | grading w/some light brown staining | |
| | | | | | | | 12.5 | | CLAY; white; hard; moist; low plasticity; frequent pockets of gray fine grained clayey sand | |
| SPT | 6 | 13 | 16 | 20 | 36 | 1.5 | 14 | 120, 118 | | |
| | | | | | | | 16 | 116 | | |
| CA | 7 | 19 | 30 | 28 | 58 | 1.5 | 18 | 114 | grading w/ frequent pockets of gray & light brown clay | |
| | | | | | | | 20.0 | 112 | SAND; grayish white; moist; fine to medium grained; poorly graded | |
| | | | | | | | 22 | 110 | | |
| SPT | 8 | 6 | 8 | 8 | 16 | 1.5 | 24 | 108 | grading medium dense w/trace angular gravel @ 24.0' gravel grades out | |
| | | | | | | | 26 | 106 | | Encountered water @ 25.5' during drilling |
| SPT | 9 | 50/5" | - | - | >50 | 0.3 | 28–30 | 104 | grading very dense @29.2' calcareous sand nodules; some white silt w/ | Sand in augers. Augers being |

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG

BORING NO. BV-5



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE / SAMPLE NUMBER / SET 6 INCHES / 2ND 6 INCHES / 3RD 6 INCHES / N VALUE / SAMPLE RECOVERY

ROCK CORING: CORE SIZE / RUN NUMBER / RUN LENGTH / RUN RECOVERY / RQD RECOVERY / PERCENT RECOVERY / RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 30 | | chalk nodules | driven along w/ spoon. Below 28.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid. Driller reported trace gravel from 28.5'-38.5'. |
| SPT | 10 | 6 | 8 | 10 | 18 | 0.9 | 34 | | grading medium dense; wet; fine to medium grained; well graded | |
| SPT | 11 | 14 | 33 | 38 | 71 | 1.5 | 39 | | grading very dense<br>@ 38.5'-39.3' yellow silty clay layer<br>@ 39.3' grading grayish white w/ fine grained sand & some silt | |
| | | | | | | | 40.0 | | Clayey <u>SAND</u>; light gray; dense; moist; fine grained; poorly graded | Based on driller's comments. |
| SPT | 12 | 12 | 16 | 21 | 37 | 1.5 | 44 | | | |
| SPT | 13 | 12 | 17 | 20 | 37 | 1.5 | 49 | | grading light brown; silt grades out | |
| SPT | 14 | 17 | 40 | 33 | 73 | 0.9 | 54 | | grading fine to medium grained<br>some angular gravel | |
| | | | | | | | 56–58 | | | Driller reported alternating hard and soft drilling efforts. |
| SPT | 15 | 7 | 50/3" | - | >50 | 0.3 | 59 | | grading w/ white fine sand; some clay cementation | |

Depth scale: 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale: 102, 100, 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 78, 76, 74

BLACK & VEATCH

# *PRELIMINARY* BORING LOG

BORING NO. BV-5



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60.0 | Silty SAND; white; very dense; moist; fine grained; poorly graded; some pockets of light brown clay; highly cemented | Based on driller's comments & cuttings from rotary wash. |
| SPT | 16 | 50/4" | - | - | >50 | 0.2 | 64 | | |
| SPT | 17 | 50/3" | - | - | >50 | 0.3 | 69 | grading w/ trace angular to subangular gravel; clay pockets grade to trace | |
| | | | | | | | 73.5 | CLAY; dark tan; hard; moist; low plasticity; some sand<br>@ 74.5' yellowish gray | No clay cuttings in drilling fluid return. |
| SPT | 18 | 12 | 17 | 22 | 39 | 1.5 | 74 | | |
| SPT | 19 | 13 | 17 | 22 | 39 | 1.5 | 79 | | |
| | | | | | | | 80 | | Bottom of boring @ 80.0'. Water level recorded @ 24.6' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/17/08. Piezometer PZ-5 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

ROCK CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

Depth scale (feet): 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90. Elevation scale (feet): 72, 70, 68, 66, 64, 62, 60, 58, 56, 54, 52, 50, 48, 46, 44.

# BLACK & VEATCH

## *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

**SOIL SAMPLING**

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY |
|---|---|---|---|---|---|---|
| SPT | 1 | 1 | 2 | 5 | 7 | 0.9 |
| SPT | 2 | 5 | 5 | 6 | 11 | 1.5 |
| SPT | 3 | 4 | 6 | 9 | 15 | 1.5 |
| SPT | 4 | 5 | 6 | 8 | 14 | 1.1 |
| CA | 5 | 3 | 3 | 4 | 7 | 1.5 |
| SPT | 6 | 22 | 50/3 | - | >50 | 0.7 |
| SPT | 7 | 24 | 50 | 50/4 | >50 | 0.9 |
| SPT | 8 | 5 | 6 | 14 | 20 | 1.5 |
| SPT | 9 | 20 | 48 | 48 | 96 | 1.5 |

**ROCK CORING**: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

DEPTH (FEET) | SAMPLE TYPE | ELEVATION (FEET) | GRAPHIC LOG

**CLASSIFICATION OF MATERIALS**

| Depth (ft) | Classification of Materials |
|---|---|
| 0 | SAND; dark brown; loose; moist; fine grained; poorly graded |
| 1.2 | Clayey SAND; light brown; medium dense; moist; fine grained; poorly graded |
| | grading light gray; some black mottling & trace roots |
| | grading w/trace chalk nodules; roots grade out |
| | grading w/frequent seams of chalk nodules |
| 9.5 | Clayey SAND; light gray; moist; fine to medium grained; poorly graded; trace gravel |
| | grading w/highly cemented calcareous sand |
| 12.0 | Silty SAND; grayish white; very dense; moist; fine grained; poorly graded |
| | grading orange; wet; fine to medium grained; trace calcareous sand nodules |
| 23.5 | CLAY; light gray; very stiff; moist; high plasticity; some light brown clay pockets |
| 25.0 | SAND; light gray; very dense; wet; fine to coarse grained; well graded; w/trace gravel |

**REMARKS**

Boring advanced w/3-1/4" ID hollow stem auger. SPT performed w/auto hammer.

Water encountered during drilling @ 17.6'.

Driller reports softer drilling. Below 18.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid.

White silt & fine sand in bottom of SPT-8

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

**SOIL SAMPLING** / **ROCK CORING**

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) |
|---|---|---|---|---|---|---|---|
| SPT | 10 | 33 | 50/4" | - | >50 | 0.4 | 34 |
| SPT | 11 | 9 | 24 | 40 | 64 | 1.4 | 39 |
| SPT | 12 | 13 | 39 | 50/4" | >50 | 1.1 | 44 |
| CA | 13 | 30 | 45 | 50/5" | >50 | 1.0 | 46 |
| SPT | 14 | 36 | 50/5" | - | >50 | 1.0 | 48.5 |
| SPT | 15 | 17 | 30 | 32 | 62 | 1.5 | 54 |
| SPT | 16 | 50/4" | - | - | >50 | 0.3 | 59 |

(Rock coring columns: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD)

Depth (feet): 30–60; Elevation (feet): 98–70

**CLASSIFICATION OF MATERIALS**

- (30.0) grading grayish white; fine grained; poorly graded; w/ trace clay & some gravel
- (34.0) grading fine to medium grained; clay & gravel grade out
- (39.0) grading w/occasional light brown clay pockets
- @ 40.5' white clayey silt & some chalk nodules
- —40.5— Silty CLAY; grayish white; hard; moist; low plasticity; w/ some light gray fine sand pockets
- grading w/limestone nodules
- —47.1— SAND; light gray; wet; fine grained; poorly graded; highly cemented
- @ 47.2' grading light brown; fine to medium grained; cementation grades out
- —49.0— Sandy CLAY; grayish white; hard; dry; low plasticity
- —54.0— SAND; light brown; very dense; wet; fine to medium grained; poorly graded; some gravel & coarse sand sized chalk nodules; occasional light brown clay pockets

**REMARKS**

@ 34.0'-35.0' boulder encountered. Hard drilling. Drilled through w/ 4" tricone driller bit. Driller reported limestone in cuttings. Continued w/4" paddle bit.
39.0'- 43.2' driller reported clay like drilling.

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

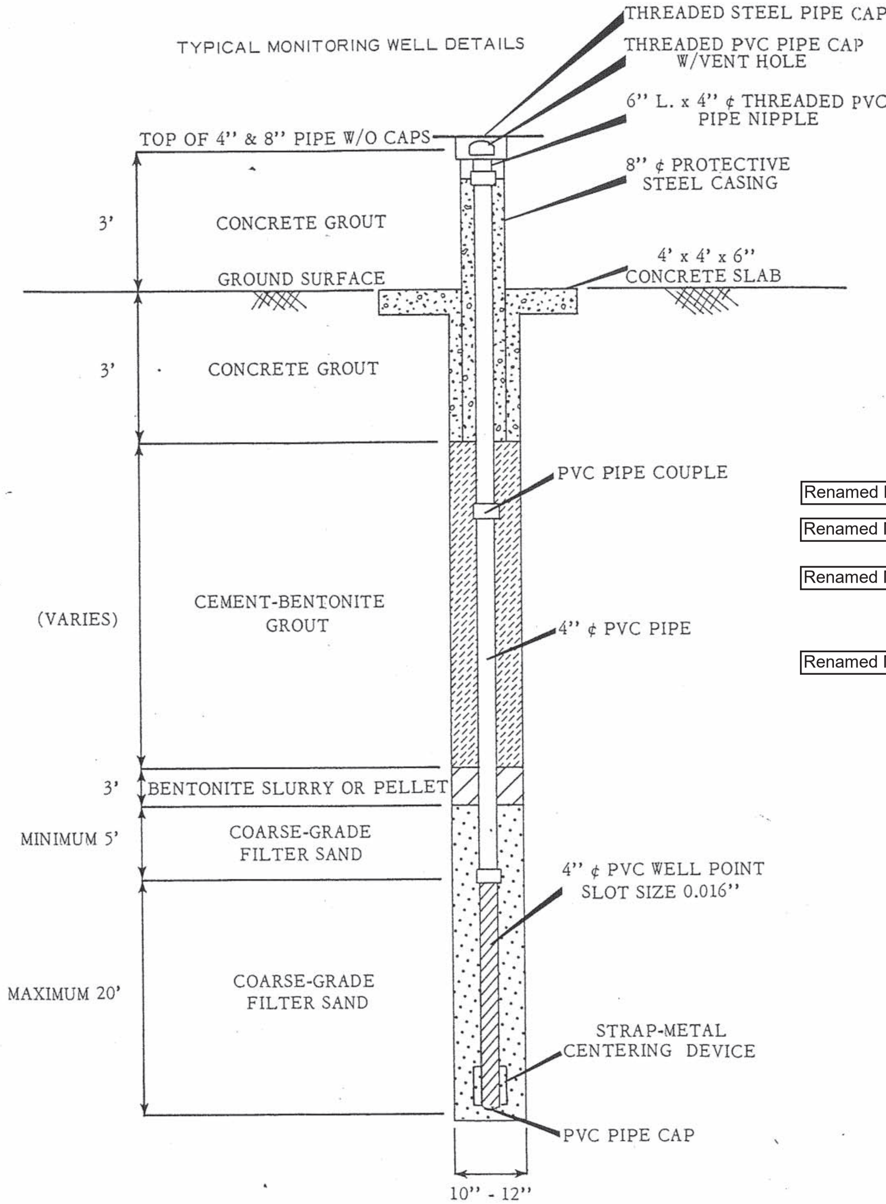
| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60 | 68 | @ 60.0' white chalk layer | |
| | | | | | | | 61.0 | | CLAY; yellowish gray; hard; moist; high plasticity | Clay cuttings from rotary wash |
| SPT | 17 | 11 | 20 | 25 | 45 | 1.5 | 64 | 64 | | |
| SPT | 18 | 18 | 25 | 25 | 50 | 1.5 | | | grading w/frequent partings of grayish white fine sand w/gravel sized chalk nodules | |
| SPT | 19 | 14 | 27 | 27 | 54 | 1.5 | 74 | 54 | @ 73.5'-74.0' light brown<br>fine sand partings grade to occasional | |
| SPT | 20 | 18 | 18 | 29 | 47 | 1.5 | 79.0 | | SAND; grayish white; dense; moist; fine grained; poorly graded; trace clay | |
| | | | | | | | 80 | 48 | | Bottom of boring @ 80.0'. Water level recorded @ 16.3' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/09/08. Piezometer PZ-21 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

# MONITORING WELL CONSTRUCTION FORMS

EXHIBIT 11
SL–3689

TYPICAL MONITORING WELL DETAILS




AS-BUILT DETAILS

| | Well No. | Elevation Top of PVC | Elevation Ground Surface | Elevation Top of Gravelpack | Elevation Top Well Screen | Elevation Bottom of Well |
|---|---|---|---|---|---|---|
| | W-1 | 114.78 | 112.0 | 89.8 | 80.2 | 60.0 |
| | W-2 | 127.38 | 124.2 | 93.3 | 85.0 | 65.2 |
| | W-3 | 132.49 | 129.3 | 97.5 | 89.5 | 70.2 |
| Renamed MW-4 | W-4 | 137.71 | 134.3 | 110.5 | 83.8 | 64.2 |
| Renamed MW-5 | W-5 | 122.31 | 119.0 | 85.8 | 80.1 | 60.3 |
| Renamed MW-6 | W-6 | 119.22 | 116.4 | 82.2 | 75.1 | 55.2 |
| | W-7 | 130.07 | 127.0 | 80.4 | 74.9 | 50.1 |
| Renamed MW-8 | W-8 | 134.72 | 131.8 | 103.0 | 94.8 | 74.9 |

NOTES:
1. ELEVATIONS ARE IN FT ABOVE MSL
2. MONITORING WELLS WERE INSTALLED USING TEMPORARY STEEL CASING TO EXCLUDE CAVING SOILS FROM CONTAMINATING WELL
3. MONITORING WELLS WERE INSTALLED AND DISINFECTED TO THE REQUIREMENTS OF SARGENT & LUNDY TECHNICAL SPECIFICATION FOR SOIL BORING AND MONITORING WELL WORK

SUMMARY OF GROUNDWATER MONITORING WELL DETAILS

SARGENT & LUNDY ENGINEERS

# STATE OF TEXAS WELL REPORT for Tracking #423117

| | | | |
|---|---|---|---|
| Owner: | **IPA Operations, Inc.** | Owner Well #: | **W-9** Renamed MW-9 |
| Address: | **Coleto Creek Power LP<br>PO Box 8<br>Fannin, TX 77960** | Grid #: | **79-23-2** |
| | | Latitude: | **28° 43' 27" N** |
| Well Location: | **Coletto Creek Power Plant<br>Fannin, TX 77960** | Longitude: | **097° 12' 19" W** |
| | | Elevation: | **No Data** |
| Well County: | **Goliad** | | |
| Type of Work: | **New Well** | Proposed Use: | **Monitor** |

Drilling Start Date: **9/16/2015** Drilling End Date: **9/17/2015**

**Borehole:**

| Diameter (in.) | Top Depth (ft.) | Bottom Depth (ft.) |
|---|---|---|
| 6 | 0 | 60 |

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

**Filter Pack Intervals:**

| Top Depth (ft.) | Bottom Depth (ft.) | Filter Material | Size |
|---|---|---|---|
| 38 | 60 | Sand | 16/30 |

**Annular Seal Data:**

| Top Depth (ft.) | Bottom Depth (ft.) | Description (number of sacks & material) |
|---|---|---|
| 0 | 2 | Cement 1 Bags/Sacks |
| 2 | 38 | Bentonite 15 Bags/Sacks |

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

---

Water Level: **25.2 ft.** below land surface on **2015-09-18** Measurement Method: **water level meter**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

| Strata Depth (ft.) | Water Type |
|---|---|
| **No Data** | **No Data** |

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **EnviroCore, Inc.**

**7525 Idle Hour Dr.**
**Corpus Christi, TX 78414**

Driller Name: **Craig Schena**

License Number: **4694**

Comments: **No Data**

**Report Amended on 5/26/2016 by Request #17930**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

| Top (ft.) | Bottom (ft.) | Description |
|---|---|---|
| **0** | **2** | **fill material** |
| **2** | **5.5** | **silty clay/clayey sand;brownish gray to white** |
| **5.5** | **10** | **silty clay; dark gray** |
| **10** | **20.5** | **caliche and silty clay;light gray to white** |
| **20.5** | **22** | **silty sand;brownish gray** |
| **22** | **44** | **sand; light orangish brown** |
| **44** | **47** | **silty sand; light gray** |
| **47** | **54** | **silty clay/clayey sand; light gray** |
| **54** | **60** | **silty, clayey sand; gray** |

Casing:
BLANK PIPE & WELL SCREEN DATA

| DIa (in.) | Type | Material | Sch./Gage | Top (ft.) | Bottom (ft.) |
|---|---|---|---|---|---|
| **2** | **Riser** | **New Plastic (PVC)** | **40** | **-3** | **40** |
| **2** | **Screen** | **New Plastic (PVC)** | **10** | **40** | **60** |

**IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY**

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation**
**P.O. Box 12157**
**Austin, TX 78711**
**(512) 463-7880**

# STATE OF TEXAS WELL REPORT for Tracking #423118

| | | | |
|---|---|---|---|
| Owner: | **IPA Operations, Inc.** | Owner Well #: | **W-10** Renamed MW-10 |
| Address: | **Coleto Creek Power LP**<br>**PO Box 8**<br>**Fannin, TX 77960** | Grid #: | **79-23-2** |
| | | Latitude: | **28° 43' 27" N** |
| Well Location: | **Coletto Creek Power Plant**<br>**Fannin, TX 77960** | Longitude: | **097° 12' 19" W** |
| | | Elevation: | **No Data** |
| Well County: | **Goliad** | | |
| Type of Work: | **New Well** | Proposed Use: | **Monitor** |

Drilling Start Date: **9/15/2015** Drilling End Date: **9/15/2015**

Borehole:

| *Diameter (in.)* | *Top Depth (ft.)* | *Bottom Depth (ft.)* |
|---|---|---|
| **6** | **0** | **60** |

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

| *Top Depth (ft.)* | *Bottom Depth (ft.)* | *Filter Material* | *Size* |
|---|---|---|---|
| **38** | **60** | **Sand** | **16/30** |

Annular Seal Data: **No Data**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

---

Water Level: **24.8 ft.** below land surface on **2015-09-18** Measurement Method: **water level meter**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

| Strata Depth (ft.) | Water Type |
|---|---|
| **No Data** | **No Data** |

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

---

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **EnviroCore, Inc.**

**7525 Idle Hour Dr.**
**Corpus Christi, TX 78414**

Driller Name: **Craig Schena**

License Number: **4694**

Comments: **No Data**

**Report Amended on 5/26/2016 by Request #17931**

---

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

| Top (ft.) | Bottom (ft.) | Description |
|---|---|---|
| 0 | 2 | fill material |
| 2 | 8 | silty sandy clay; orangish brown |
| 8 | 11 | silty clay/clayey sand; light gray |
| 11 | 19 | silty sand; light gray |
| 19 | 30 | sand; light gray |
| 30 | 32 | silty clay/clayey sand; light gray |
| 32 | 34 | clayey sand; brownish gray |
| 34 | 36 | silty sand; light gray |
| 36 | 52 | silty, clayey sand; light gray |
| 52 | 60 | silty sand; light gray |

Casing:
BLANK PIPE & WELL SCREEN DATA

| DIa (in.) | Type | Material | Sch./Gage | Top (ft.) | Bottom (ft.) |
|---|---|---|---|---|---|
| 2 | Riser | New Plastic (PVC) | 40 | -3 | 40 |
| 2 | Screen | New Plastic (PVC) | 10 | 40 | 60 |

**IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY**

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Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation**
**P.O. Box 12157**
**Austin, TX 78711**
**(512) 463-7880**

# STATE OF TEXAS WELL REPORT for Tracking #462686

| | | | |
|---|---|---|---|
| Owner: | **Dynegy Inc.** | Owner Well #: | **MW-11** |
| Address: | **Coleto Creek Power Station<br>PO Box 8<br>Fannin, TX 77960** | Grid #: | **79-23-2** |
| | | Latitude: | **28° 43' 37.02" N** |
| Well Location: | **Coleto Creek Power Station<br>Fannin, TX** | Longitude: | **097° 12' 18.36" W** |
| | | Elevation: | **No Data** |
| Well County: | **Goliad** | | |

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **4/25/2017** Drilling End Date: **4/25/2017**

Borehole:

| *Diameter (in.)* | *Top Depth (ft.)* | *Bottom Depth (ft.)* |
|---|---|---|
| **6** | **0** | **49** |

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

| *Top Depth (ft.)* | *Bottom Depth (ft.)* | *Filter Material* | *Size* |
|---|---|---|---|
| **27** | **49** | **Sand** | **16/30** |

Annular Seal Data:

| *Top Depth (ft.)* | *Bottom Depth (ft.)* | *Description (number of sacks & material)* |
|---|---|---|
| **0** | **1** | **Cement 1 Bags/Sacks** |
| **1** | **27** | **Bentonite 13 Bags/Sacks** |

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

| Strata Depth (ft.) | Water Type |
|---|---|
| **No Data** | **No Data** |

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

**The driller did certify that while drilling, deepening or otherwise altering the above described well, injurious water or constituents was encountered and the landowner or person having the well drilled was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **EnviroCore, Inc.**

**7525 Idle Hour Dr.**
**Corpus Christi, TX 78414**

Driller Name: **Craig Schena** License Number: **4694**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

| Top (ft.) | Bottom (ft.) | Description |
|---|---|---|
| 0 | 1 | 0-1.0 - Silty CLAY |
| 1 | 6.5 | Predominately Caliche and Silty Clay |
| 6.5 | 13.8 | Silty Clayey Sand |
| 13.8 | 28.5 | Sand with abundant gravel |
| 28.5 | 38 | Silty Clayey Sand |
| 38 | 40 | Silty Clay/Clayey Sand |
| 40 | 46 | Silty Clayey Sand |
| 46 | 49 | Silty Clay/Clayey Sand |

Casing:
BLANK PIPE & WELL SCREEN DATA

| DIa (in.) | Type | Material | Sch./Gage | Top (ft.) | Bottom (ft.) |
|---|---|---|---|---|---|
| 2 | Riser | New Plastic (PVC) | 40 | -3 | 29 |
| 2 | Screen | New Plastic (PVC) | 40 10 | 29 | 49 |

**IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY**

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Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation**
**P.O. Box 12157**
**Austin, TX 78711**
**(512) 334-5540**

# Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING MW-11

(Page 1 of 1)

COLETO CREEK POWER STATION
FANNIN, TX

Project No. 17252

| | |
|---|---|
| Date | : 4/25/2017 |
| Easting | : 2543727.0 |
| Northing | : 13452676.5 |
| Top of Casing Elevation | 118.66 ft NAVD 88 |
| Logger | : EEF |
| Drilling Company | : EnviroCore |
| Driller | : Craig Schena (Lic. #4694) |
| Drill Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger - 6" |
| Sampling Method | : Split-Spoon |

| DEPTH (feet) | Surface Elevation 115.8 | DESCRIPTION | USCS |
|---|---|---|---|
| 0.0 | | (0-1.0) - Silty CLAY, dark brown, soft to firm, medium plasticity, minor roots, moist | CL |
| 5.0 | 112 | (1.0-6.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low to medium plascticity, wet | CL/ML |
| 10.0 | 108, 104 | (6.5-13.8) - Silty, Clayey SAND, light gray to white, very fine to medium grained, wet | SM |
| 15.0, 20.0, 25.0 | 100, 96, 92, 88 | (13.8-28.5) - SAND, very light orangish brownish to very light gray, fine to coarse grained, abundant gravel, slightly silty, wet | SW |
| 30.0, 35.0 | 84, 80 | (28.5-38.0) - Silty, Clayey SAND, gray to light brownish gray, very fine to medium grained, wet | SM/SC |
| | 76 | (38.0-40.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | CL/SC |
| 40.0, 45.0 | 72 | (40.0-46.0) - Silty, Clayey SAND, gray, fine to medium grained, wet | SM/SC |
| | 68 | (46.0-49.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | SC |

Recovery (ft/ft), top to bottom: 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 0/2, 2/2, 1.5/2, 0.5/1

**WELL DIAGRAM/REMARKS**

Water Level: 11.2' BGL

Well Construction:
Riser ~2.7' AGL - 29.0' BGL
Neat Cement: 0' - 1.0' BGL
Bentonite chips seal: 1.0' - 27.0' BGL
Sand Pack: 27.0' - 49.0' BGL
Screen: 29.0' - 49.0' BGL

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
04-28-2017

Total Boring Depth = 49 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

BLACK & VEATCH

# PRELIMINARY BORING LOG



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE, SAMPLE NUMBER, SET 6 INCHES, 2ND 6 INCHES, 3RD 6 INCHES, N VALUE, SAMPLE RECOVERY
ROCK CORING: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| SPT | 1 | 3 | 7 | 11 | 18 | 1.0 | 0 | 132 | Clayey SAND; brownish gray; medium dense; moist; fine grained; poorly graded; some roots | Boring advanced w/ 3-1/4" ID hollow stem auger. SPT performed w/ auto hammer. |
| SPT | 2 | 13 | 11 | 10 | 21 | 1.2 | 2 | 130 | @ 3.0'-3.2' yellowish brown fine to medium sand partings; roots grade out | Sand partings are vertical and dry. |
| SPT | 3 | 6 | 10 | 13 | 23 | 1.2 | 4–6 | 128 | grading light gray w/ some black mottling | |
| SPT | 4 | 6 | 10 | 13 | 23 | 1.1 | 8 | 126–124 | | |
| CA | 5 | 6 | 14 | 19 | 33 | 1.4 | 10–12 | 122 | grading w/some light brown staining | |
| | | | | | | | 12.5 | | CLAY; white; hard; moist; low plasticity; frequent pockets of gray fine grained clayey sand | |
| SPT | 6 | 13 | 16 | 20 | 36 | 1.5 | 14 | 120–118 | | |
| | | | | | | | 16 | 116 | | |
| CA | 7 | 19 | 30 | 28 | 58 | 1.5 | 18 | 114 | grading w/ frequent pockets of gray & light brown clay | |
| | | | | | | | 20.0 | 112 | SAND; grayish white; moist; fine to medium grained; poorly graded | |
| | | | | | | | 22 | 110 | | |
| SPT | 8 | 6 | 8 | 8 | 16 | 1.5 | 24 | 108 | grading medium dense w/trace angular gravel<br>@ 24.0' gravel grades out | |
| | | | | | | | 26 | 106 | | Encountered water @ 25.5' during drilling |
| SPT | 9 | 50/5" | - | - | >50 | 0.3 | 28–30 | 104 | grading very dense<br>@29.2' calcareous sand nodules; some white silt w/ | Sand in augers. Augers being |

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 30 | 102 | chalk nodules | driven along w/ spoon. Below 28.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid. Driller reported trace gravel from 28.5'-38.5'. |
| SPT | 10 | 6 | 8 | 10 | 18 | 0.9 | 34 | 98 | grading medium dense; wet; fine to medium grained; well graded | |
| SPT | 11 | 14 | 33 | 38 | 71 | 1.5 | 39 | 94 | grading very dense<br>@ 38.5'-39.3' yellow silty clay layer<br>@ 39.3' grading grayish white w/ fine grained sand & some silt | |
| | | | | | | | 40.0 | | Clayey SAND; light gray; dense; moist; fine grained; poorly graded | Based on driller's comments. |
| SPT | 12 | 12 | 16 | 21 | 37 | 1.5 | 44 | 89 | | |
| SPT | 13 | 12 | 17 | 20 | 37 | 1.5 | 49 | 84 | grading light brown; silt grades out | |
| SPT | 14 | 17 | 40 | 33 | 73 | 0.9 | 54 | 79 | grading fine to medium grained<br>some angular gravel | |
| SPT | 15 | 7 | 50/3" | - | >50 | 0.3 | 59 | 74 | grading w/ white fine sand; some clay cementation | Driller reported alternating hard and soft drilling efforts. |

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG

BORING NO. BV-5



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE / SAMPLE NUMBER / SET 6 INCHES / 2ND 6 INCHES / 3RD 6 INCHES / N VALUE / SAMPLE RECOVERY

ROCK CORING: CORE SIZE / RUN NUMBER / RUN LENGTH / RUN RECOVERY / RQD RECOVERY / PERCENT RECOVERY / RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60.0 | 73.0 | Silty SAND; white; very dense; moist; fine grained; poorly graded; some pockets of light brown clay; highly cemented | Based on driller's comments & cuttings from rotary wash. |
| SPT | 16 | 50/4" | - | - | >50 | 0.2 | 64 | | | |
| SPT | 17 | 50/3" | - | - | >50 | 0.3 | 69 | | grading w/ trace angular to subangular gravel; clay pockets grade to trace | |
| | | | | | | | 73.5 | | CLAY; dark tan; hard; moist; low plasticity; some sand | No clay cuttings in drilling fluid return. |
| SPT | 18 | 12 | 17 | 22 | 39 | 1.5 | 74 | | @ 74.5' yellowish gray | |
| SPT | 19 | 13 | 17 | 22 | 39 | 1.5 | 79 | | | |
| | | | | | | | 80.0 | | | Bottom of boring @ 80.0'. Water level recorded @ 24.6' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/17/08. Piezometer PZ-5 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

Depth scale (feet): 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90

Elevation scale (feet): 72, 70, 68, 66, 64, 62, 60, 58, 56, 54, 52, 50, 48, 46, 44

BLACK & VEATCH

# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

**SOIL SAMPLING** / **ROCK CORING**

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY |
|---|---|---|---|---|---|---|
| SPT | 1 | 1 | 2 | 5 | 7 | 0.9 |
| SPT | 2 | 5 | 5 | 6 | 11 | 1.5 |
| SPT | 3 | 4 | 6 | 9 | 15 | 1.5 |
| SPT | 4 | 5 | 6 | 8 | 14 | 1.1 |
| CA | 5 | 3 | 3 | 4 | 7 | 1.5 |
| SPT | 6 | 22 | 50/3 | - | >50 | 0.7 |
| SPT | 7 | 24 | 50 | 50/4 | >50 | 0.9 |
| SPT | 8 | 5 | 6 | 14 | 20 | 1.5 |
| SPT | 9 | 20 | 48 | 48 | 96 | 1.5 |

(Rock coring columns: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD)

DEPTH (FEET) | SAMPLE TYPE | ELEVATION (FEET) | GRAPHIC LOG

**CLASSIFICATION OF MATERIALS**

- 0 ft: SAND; dark brown; loose; moist; fine grained; poorly graded
- 1.2 ft: Clayey SAND; light brown; medium dense; moist; fine grained; poorly graded
  - grading light gray; some black mottling & trace roots
  - grading w/trace chalk nodules; roots grade out
  - grading w/frequent seams of chalk nodules
- 9.5 ft: Clayey SAND; light gray; moist; fine to medium grained; poorly graded; trace gravel
  - grading w/highly cemented calcareous sand
- 12.0 ft: Silty SAND; grayish white; very dense; moist; fine grained; poorly graded
  - grading orange; wet; fine to medium grained; trace calcareous sand nodules
- 23.5 ft: CLAY; light gray; very stiff; moist; high plasticity; some light brown clay pockets
- 25.0 ft: SAND; light gray; very dense; wet; fine to coarse grained; well graded; w/trace gravel

**REMARKS**

Boring advanced w/3-1/4" ID hollow stem auger. SPT performed w/auto hammer.

Water encountered during drilling @ 17.6'.

Driller reports softer drilling. Below 18.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid.

White silt & fine sand in bottom of SPT-8

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# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

**SOIL SAMPLING**

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) |
|---|---|---|---|---|---|---|---|
| SPT | 10 | 33 | 50/4" | - | >50 | 0.4 | 34 |
| SPT | 11 | 9 | 24 | 40 | 64 | 1.4 | 39 |
| SPT | 12 | 13 | 39 | 50/4" | >50 | 1.1 | 44 |
| CA | 13 | 30 | 45 | 50/5" | >50 | 1.0 | 46 |
| SPT | 14 | 36 | 50/5" | - | >50 | 1.0 | 49 |
| SPT | 15 | 17 | 30 | 32 | 62 | 1.5 | 54 |
| SPT | 16 | 50/4" | - | - | >50 | 0.3 | 59 |

**ROCK CORING**: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

| DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|
| 30 | 98 | grading grayish white; fine grained; poorly graded; w/ trace clay & some gravel | |
| 34 | 94 | grading fine to medium grained; clay & gravel grade out | @ 34.0'-35.0' boulder encountered. Hard drilling. Drilled through w/ 4" tricone driller bit. Driller reported limestone in cuttings. Continued w/4" paddle bit. 39.0'- 43.2' driller reported clay like drilling. |
| 39.5 | | grading w/occasional light brown clay pockets | |
| 40.5 | | @ 40.5' white clayey silt & some chalk nodules | |
| 40.5 | | Silty CLAY; grayish white; hard; moist; low plasticity; w/ some light gray fine sand pockets | |
| 47 | | grading w/limestone nodules | |
| 47.1 | | SAND; light gray; wet; fine grained; poorly graded; highly cemented | |
| 47.2 | | @ 47.2' grading light brown; fine to medium grained; cementation grades out | |
| 49.0 | | Sandy CLAY; grayish white; hard; dry; low plasticity | |
| 54.0 | | SAND; light brown; very dense; wet; fine to medium grained; poorly graded; some gravel & coarse sand sized chalk nodules; occasional light brown clay pockets | |

Depth scale: 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60. Elevation scale: 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 78, 76, 74, 72, 70.

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# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60 | @ 60.0' white chalk layer | |
| | | | | | | | 61.0 | CLAY; yellowish gray; hard; moist; high plasticity | Clay cuttings from rotary wash |
| SPT | 17 | 11 | 20 | 25 | 45 | 1.5 | 64 | | |
| SPT | 18 | 18 | 25 | 25 | 50 | 1.5 | 69 | grading w/frequent partings of grayish white fine sand w/gravel sized chalk nodules | |
| SPT | 19 | 14 | 27 | 27 | 54 | 1.5 | 74 | @ 73.5'-74.0' light brown<br>fine sand partings grade to occasional | |
| | | | | | | | 79.0 | SAND; grayish white; dense; moist; fine grained; poorly graded; trace clay | |
| SPT | 20 | 18 | 18 | 29 | 47 | 1.5 | 79 | | |
| | | | | | | | 80 | | Bottom of boring @ 80.0'. Water level recorded @ 16.3' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/09/08. Piezometer PZ-21 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

ROCK CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

Depth scale (feet): 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90
Elevation scale (feet): 68, 66, 64, 62, 60, 58, 56, 54, 52, 50, 48, 46, 44, 42, 40

# STATE OF TEXAS
# WELL COMPLETION REPORTS

# STATE OF TEXAS WELL REPORT for Tracking #423117

| | | | |
|---|---|---|---|
| Owner: | **IPA Operations, Inc.** | Owner Well #: | **W-9** Renamed MW-9 |
| Address: | **Coleto Creek Power LP**<br>**PO Box 8**<br>**Fannin, TX 77960** | Grid #: | **79-23-2** |
| | | Latitude: | **28° 43' 27" N** |
| Well Location: | **Coletto Creek Power Plant**<br>**Fannin, TX 77960** | Longitude: | **097° 12' 19" W** |
| | | Elevation: | **No Data** |
| Well County: | **Goliad** | | |
| Type of Work: | **New Well** | Proposed Use: | **Monitor** |

Drilling Start Date: **9/16/2015** Drilling End Date: **9/17/2015**

Borehole:

| *Diameter (in.)* | *Top Depth (ft.)* | *Bottom Depth (ft.)* |
|---|---|---|
| **6** | **0** | **60** |

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

| *Top Depth (ft.)* | *Bottom Depth (ft.)* | *Filter Material* | *Size* |
|---|---|---|---|
| **38** | **60** | **Sand** | **16/30** |

Annular Seal Data:

| *Top Depth (ft.)* | *Bottom Depth (ft.)* | *Description (number of sacks & material)* |
|---|---|---|
| **0** | **2** | **Cement 1 Bags/Sacks** |
| **2** | **38** | **Bentonite 15 Bags/Sacks** |

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

---

Water Level: **25.2 ft.** below land surface on **2015-09-18** Measurement Method: **water level meter**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

| Strata Depth (ft.) | Water Type |
|---|---|
| **No Data** | **No Data** |

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **EnviroCore, Inc.**

**7525 Idle Hour Dr.**
**Corpus Christi, TX 78414**

Driller Name: **Craig Schena**

License Number: **4694**

Comments: **No Data**

**Report Amended on 5/26/2016 by Request #17930**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

| Top (ft.) | Bottom (ft.) | Description |
|---|---|---|
| **0** | **2** | **fill material** |
| **2** | **5.5** | **silty clay/clayey sand;brownish gray to white** |
| **5.5** | **10** | **silty clay; dark gray** |
| **10** | **20.5** | **caliche and silty clay;light gray to white** |
| **20.5** | **22** | **silty sand;brownish gray** |
| **22** | **44** | **sand; light orangish brown** |
| **44** | **47** | **silty sand; light gray** |
| **47** | **54** | **silty clay/clayey sand; light gray** |
| **54** | **60** | **silty, clayey sand; gray** |

Casing:
BLANK PIPE & WELL SCREEN DATA

| DIa (in.) | Type | Material | Sch./Gage | Top (ft.) | Bottom (ft.) |
|---|---|---|---|---|---|
| **2** | **Riser** | **New Plastic (PVC)** | **40** | **-3** | **40** |
| **2** | **Screen** | **New Plastic (PVC)** | **10** | **40** | **60** |

**IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY**

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation**
**P.O. Box 12157**
**Austin, TX 78711**
**(512) 463-7880**

# STATE OF TEXAS WELL REPORT for Tracking #423118

| | | | |
|---|---|---|---|
| Owner: | **IPA Operations, Inc.** | Owner Well #: | **W-10** Renamed MW-10 |
| Address: | **Coleto Creek Power LP**<br>**PO Box 8**<br>**Fannin, TX 77960** | Grid #: | **79-23-2** |
| | | Latitude: | **28° 43' 27" N** |
| Well Location: | **Coletto Creek Power Plant**<br>**Fannin, TX 77960** | Longitude: | **097° 12' 19" W** |
| | | Elevation: | **No Data** |
| Well County: | **Goliad** | | |
| Type of Work: | **New Well** | Proposed Use: | **Monitor** |

Drilling Start Date: **9/15/2015** Drilling End Date: **9/15/2015**

**Borehole:**

| Diameter (in.) | Top Depth (ft.) | Bottom Depth (ft.) |
|---|---|---|
| 6 | 0 | 60 |

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

**Filter Pack Intervals:**

| Top Depth (ft.) | Bottom Depth (ft.) | Filter Material | Size |
|---|---|---|---|
| 38 | 60 | Sand | 16/30 |

Annular Seal Data: **No Data**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **24.8 ft.** below land surface on **2015-09-18** Measurement Method: **water level meter**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

| Strata Depth (ft.) | Water Type |
|---|---|
| **No Data** | **No Data** |

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **EnviroCore, Inc.**

**7525 Idle Hour Dr.**
**Corpus Christi, TX 78414**

Driller Name: **Craig Schena** License Number: **4694**

Comments: **No Data**

**Report Amended on 5/26/2016 by Request #17931**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

| Top (ft.) | Bottom (ft.) | Description |
|---|---|---|
| **0** | **2** | **fill material** |
| **2** | **8** | **silty sandy clay; orangish brown** |
| **8** | **11** | **silty clay/clayey sand; light gray** |
| **11** | **19** | **silty sand; light gray** |
| **19** | **30** | **sand; light gray** |
| **30** | **32** | **silty clay/clayey sand; light gray** |
| **32** | **34** | **clayey sand; brownish gray** |
| **34** | **36** | **silty sand; light gray** |
| **36** | **52** | **silty, clayey sand; light gray** |
| **52** | **60** | **silty sand; light gray** |

Casing:
BLANK PIPE & WELL SCREEN DATA

| DIa (in.) | Type | Material | Sch./Gage | Top (ft.) | Bottom (ft.) |
|---|---|---|---|---|---|
| **2** | **Riser** | **New Plastic (PVC)** | **40** | **-3** | **40** |
| **2** | **Screen** | **New Plastic (PVC)** | **10** | **40** | **60** |

**IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY**

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation**
**P.O. Box 12157**
**Austin, TX 78711**
**(512) 463-7880**

# STATE OF TEXAS WELL REPORT for Tracking #462686

| | | | |
|---|---|---|---|
| Owner: | **Dynegy Inc.** | Owner Well #: | **MW-11** |
| Address: | **Coleto Creek Power Station<br>PO Box 8<br>Fannin, TX 77960** | Grid #: | **79-23-2** |
| | | Latitude: | **28° 43' 37.02" N** |
| Well Location: | **Coleto Creek Power Station<br>Fannin, TX** | Longitude: | **097° 12' 18.36" W** |
| | | Elevation: | **No Data** |
| Well County: | **Goliad** | | |

Type of Work: **New Well** Proposed Use: **Monitor**

Drilling Start Date: **4/25/2017** Drilling End Date: **4/25/2017**

Borehole:

| Diameter (in.) | Top Depth (ft.) | Bottom Depth (ft.) |
|---|---|---|
| 6 | 0 | 49 |

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

| Top Depth (ft.) | Bottom Depth (ft.) | Filter Material | Size |
|---|---|---|---|
| 27 | 49 | Sand | 16/30 |

Annular Seal Data:

| Top Depth (ft.) | Bottom Depth (ft.) | Description (number of sacks & material) |
|---|---|---|
| 0 | 1 | Cement 1 Bags/Sacks |
| 1 | 27 | Bentonite 13 Bags/Sacks |

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

| Strata Depth (ft.) | Water Type |
|---|---|
| **No Data** | **No Data** |

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

**The driller did certify that while drilling, deepening or otherwise altering the above described well, injurious water or constituents was encountered and the landowner or person having the well drilled was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **EnviroCore, Inc.**

**7525 Idle Hour Dr.**
**Corpus Christi, TX 78414**

Driller Name: **Craig Schena** License Number: **4694**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

| Top (ft.) | Bottom (ft.) | Description |
|---|---|---|
| 0 | 1 | 0-1.0 - Silty CLAY |
| 1 | 6.5 | Predominately Caliche and Silty Clay |
| 6.5 | 13.8 | Silty Clayey Sand |
| 13.8 | 28.5 | Sand with abundant gravel |
| 28.5 | 38 | Silty Clayey Sand |
| 38 | 40 | Silty Clay/Clayey Sand |
| 40 | 46 | Silty Clayey Sand |
| 46 | 49 | Silty Clay/Clayey Sand |

Casing:
BLANK PIPE & WELL SCREEN DATA

| DIa (in.) | Type | Material | Sch./Gage | Top (ft.) | Bottom (ft.) |
|---|---|---|---|---|---|
| 2 | Riser | New Plastic (PVC) | 40 | -3 | 29 |
| 2 | Screen | New Plastic (PVC) | 40 10 | 29 | 49 |

## IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

**Texas Department of Licensing and Regulation**
**P.O. Box 12157**
**Austin, TX 78711**
**(512) 334-5540**

# MONITORING WELL DEVELOPMENT DOCUMENTATION

# WELL DEVELOPMENT RECORD

PAGE 1 of 1

Project Number: 15215 Project Name: Coleto Creek Power, LP Date: 9.22.2015

Well Location (well ID, etc.): W-9 Renamed MW-9

Developed by: C. Winkler / E. Ficker

Measuring Point (MP) of Well: TOC/PVC

Screened Interval (ft. BGL): 40-60

Filter Pack Interval (ft. BGL): 30-60

Starting Water Level (ft. BMP): 28.30

Casing Stickup (ft.): 3.15

Starting Water Level (ft. BGL): 25.15

Total Depth (ft. BGL): 60.20

Casing Diameter (In ID): 2.0

Casing Volume (gal.): 15.8

## QUALITY ASSURANCE

METHODS (describe): Submersible pump and/or surge block cleaned between wells

Cleaning Equipment: Deionized water triple rinse

Purging: Water quality stabilization Surge Equipment: Submersible pump

Disposal of Discharged Water: Temporarily stored on-site in 55-gallon drums until authorized disposal

## INSTRUMENTS (Indicate make, model, I.d.)

Water Level: Water line 300 Thermometer: Horiba U50

pH Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Conductivity Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Other:

## DEVELOPMENT MEASUREMENTS

| Time | Flow | | Water Quality | | | Appearance | | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1026 | Cum. Vol. (gal. / L) | Purge Rate (gal. / L pm) | Temp. (°C) | pH | Spec. Cond. (μΣ/cm) | Color | Turbidity & Sediment | |
| 1030 | 0 | 1.25 | 23.49 | 7.30 | 0.663 | TAN, [illegible] | 1000 | D.O. 0.92 |
| 1034 | 5 | " | 23.40 | 7.26 | 0.657 | " | 1000 | D.O. 0.65 |
| 1038 | 10 | " | 23.40 | 7.26 | 0.652 | " | 1000 | D.O. 0.54 |
| 1045 | 15 | ~0.75 | 23.46 | 7.25 | 0.650 | [illegible] | 1000 | WL = 29.80 |
| 1051 | 20 | ~0.85 | 23.40 | 7.25 | 0.659 | " | 1000 | D.O. 0.48 |
| 1059 | 25 | ~0.65 | 23.56 | 7.25 | 0.653 | " | 1000 | WL = 29.80 |
| 1108 | 30 | ~0.55 | 23.78 | 7.25 | 0.648 | " | 1000 | D.O. 0.42 |
| 1130 | 40 | ~0.45 | 24.10 | 7.28 | 0.652 | " | 1000 | D.O. 0.40 |
| 1142 | 50 | ~0.85 | 23.39 | 7.24 | 0.656 | " | 1000 | D.O. 0.35 |
| 1156 | 60 | ~0.70 | 23.54 | 7.24 | 0.659 | " | 1000 | D.O. 0.31 |
| 1206 | 70 | ~1.00 | 23.49 | 7.21 | 0.662 | NEUTRAL | 727 | D.O. 0.30 |
| 1212 | 75 | ~0.85 | 23.41 | 7.21 | 0.663 | " | 946 | D.O. 0.29 |
| 1218 | 80 | ~1.25 | 23.41 | 7.21 | 0.663 | " | 843 | D.O. 0.28 |

Total Discharge (gallons): 80

Observations/Comments:

PURGED WELL 5 WELL VOLUMES

VARIABLE FLOW RATE DUE TO BATTERY POWER DRAIN ON GEN., SWITCHED TO VEHICLE.

Bullock, Bennett, & Associates, LLC
165 N. Lampasas St.
Bertram, TX 78605
(512) 355-9198 Fax (512) 355-9197

3

# WELL DEVELOPMENT RECORD

PAGE 1 of 1

Project Number: 15215 Project Name: Coleto Creek Power, LP Date: 9.22.15

Well Location (well ID, etc.): W-10 [Renamed MW-10]

Developed by: C. Winkler / E. Ficker

Measuring Point (MP) of Well: TOC/PVC

Screened Interval (ft. BGL): ~40'-60'

Filter Pack Interval (ft. BGL): ~30-60

Starting Water Level (ft. BMP): 27.73

Casing Stickup (ft.): ~3.00

Starting Water Level (ft. BGL): 24.73

Total Depth (ft. BGL): ~62.00

Casing Diameter (In ID): 2.0

Casing Volume (gal.): ~5.30

## QUALITY ASSURANCE

METHODS (describe): Submersible pump and/or surge block cleaned between wells

Cleaning Equipment: Deionized water triple rinse

Purging: Water quality stabilization Surge Equipment: Submersible pump

Disposal of Discharged Water: Temporarily stored on-site in 55-gallon drums until authorized disposal

## INSTRUMENTS (Indicate make, model, I.d.)

Water Level: Water line 300 Thermometer: Horiba U50

pH Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Conductivity Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Other:

## DEVELOPMENT MEASUREMENTS

| Time | Flow | | Water Quality | | | | Appearance | | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | Cum. Vol. (gal. / L) | Purge Rate (gal. / L pm) | Temp. (°C) | pH | | Spec. Cond. (μΣ/cm) | Color | Turbidity & Sediment | |
| 0828 | — | — | — | — | | — | TAN ~~brown~~ | — | |
| 0832 | 5 | ~1.75 | 24.48 | 6.83 | | 1.27 | cloudy | 1000 | D.O. 6.39 |
| 0836 | 10 | " | 24.54 | 6.79 | | 1.26 | " | 1000 | D.O. 5.14 |
| 0840 | 15 | " | 24.55 | 6.77 | | 1.27 | " | 1000 | DO 3.93 |
| 0844 | 20 | " | 24.56 | 6.76 | | 1.31 | ~~[illegible]~~ clr | 1000 | WL = 41.57 |
| 0849 | 25 | " | 24.57 | 6.76 | | 1.32 | " | 511 | WL 41.51 |
| 0853 | 30 | " | 24.53 | 6.77 | | 1.30 | " | 419 | " 42.73 |
| 0857 | 35 | " | 24.57 | 6.75 | | 1.33 | " | 348 | D.O. 0.62 |
| 0901 | 40 | " | 24.55 | 6.76 | | 1.32 | " | 278 | D.O. 0.60 |
| 0905 | 45 | " | 24.55 | 6.76 | | 1.32 | " | 257 | D.O. 0.62 |
| 0909 | 50 | " | 24.55 | 6.76 | | 1.32 | " | 202 | D.O. 0.60 |
| 0913 | 55 | " | 24.55 | 6.76 | | 1.32 | " | 216 | WL = 42.80 |
| 0918 | 60 | " | 24.52 | 6.73 | | 1.34 | " | 223 | D.O = 0.58 |
| 0922 | 65 | " | 24.51 | 6.75 | | 1.34 | " | 181 | D.O. = 0.62 |

Total Discharge (gallons): 65

Observations/Comments: PURGING 10 WELL VOLUMES, PARAMETERS RECORDED AFTER EACH WELL VOLUME.
* LOWERED PUMP ~ 4 FEET

Bullock, Bennett, & Associates, LLC
165 N. Lampasas St.
Bertram, TX 78605
(512) 355-9198 Fax (512) 355-9197

# WELL DEVELOPMENT RECORD



Project Number: 17252 Project Name: Coleto Creek Power Date: 4.26.17

| | |
|---|---|
| Well Location (well ID, etc.): MW 11 | Starting Water Level (ft. BMP): 13.93 |
| Developed by: EEF | Casing Stickup (ft.): 2.7 |
| Measuring Point (MP) of Well: TOC | Starting Water Level (ft. BGL): 11.23 |
| Screened Interval (ft. BGL): 29-49 | Total Depth (ft. ~~BGL~~ MP): 51.83 |
| Filter Pack Interval (ft. BGL): 27-49 | Casing Diameter (In ID): 2" |
| | Casing Volume (gal.): 6.1 |

## QUALITY ASSURANCE

METHODS (describe):

Cleaning Equipment: Alconox Solution rinse then triple rinse of pump & tubing with DI water

Purging: Water quality Stabilization Surge Equipment: Submersible Pump

Disposal of Discharged Water: Temporarily Stored in 55-gallon drum

## INSTRUMENTS (Indicate make, model, I.d.)

Water Level: Solinst 300 Thermometer: Horiba U50

pH Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Conductivity Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Other:

## DEVELOPMENT MEASUREMENTS

| Time | Flow | | Water Quality | | | Appearance | | Remarks | WL |
|---|---|---|---|---|---|---|---|---|---|
| | Cum. Vol. (gal. / L) | Purge Rate (gal. / L pm) | Temp. (°C) | pH | Spec. Cond. (μΣ/cm) | Color | Turbidity & Sediment | | |
| 1220 | 5 | 1 | 24.11 | 7.56 | 0.727 | white | >1000 | 46 | |
| 1225 | 10 | 1.7 | 23.76 | 7.68 | 0.717 | White | " | -16 | 17.35 |
| 1228 | 15 | 1.7 | ~ | — | — | White | " | -20 | |
| 1231 | 20 | 1.7 | 23.31 | 7.65 | 0.716 | White | " | -33 | 17.85 |
| 1234 | 25 | 1.7 | 23.16 | 7.45 | 0.719 | Cloudy | 975 | -26 | |
| 1237 | 30 | 1.7 | 23.16 | 7.48 | 0.721 | Clear | 642 | -5 | |
| 1241 | 35 | 0.5 | 24.33 | 7.76 | 0.743 | Clear | 704 | 44 | lower pump |
| 1317 | 40 | 1 | 24.04 | 7.68 | 0.742 | Clear | 358 | 4 | |
| 1322 | 45 | 1 | 23.72 | 7.60 | 0.735 | Clear | 319 | 6 | 18.25 |
| 1327 | 50 | 1 | 23.51 | 7.47 | 0.735 | Clear | 206 | -7 | |
| 1332 | 55 | 1 | 23.56 | 7.35 | 0.733 | Clear | 187 | -18 | |
| 1337 | 60 | 1 | 23.46 | 7.39 | 0.732 | Clear | 176 | -1 | 18.70 |
| 1342 | 65 | 1 | 23.42 | 7.28 | 0.733 | Clear | 132 | -11 | |

Total Discharge (gallons): 65

Observations/Comments:

Purged ten well volumes

Bullock, Bennett, & Associates, LLC
165 N. Lampasas St.
Bertram, TX 78605
(512) 355-9198 Fax (512) 355-9197

# WELL DEVELOPMENT RECORD



Project Number: 17258 Project Name: Coleto Creek Power Date: 3.21.17

| | |
|---|---|
| Well Location (well ID, etc.): BV-21 | Starting Water Level (ft. BMP): 18.88 |
| Developed by: EEF | Casing Stickup (ft.): ~3 |
| Measuring Point (MP) of Well: Toc | Starting Water Level (ft. BGL): 15.88 |
| Screened Interval (ft. BGL): 30 - 40 | Total Depth (ft. B~~GL~~ MP): 40.71 |
| Filter Pack Interval (ft. BGL): 30 - 40 | Casing Diameter (In ID): 2 |
| | Casing Volume (gal.): 3.5 |

## QUALITY ASSURANCE

METHODS (describe):

Cleaning Equipment: Alconox solution rinse then triple rinse of pump & tubing with DI water

Purging: Water quality Stabilization Surge Equipment: Submersible pump

Disposal of Discharged Water: Temporarily Stored in 55-gallon drum

## INSTRUMENTS (Indicate make, model, I.d.)

Water Level: Solinst 300 Thermometer: Horiba U50

pH Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Conductivity Meter: Horiba U50 Field Calibration: Horiba U50 Autocal

Other:

## DEVELOPMENT MEASUREMENTS

| Time | Flow: Cum. Vol. (gal. / L) | Flow: Purge Rate (gal. / L pm) | Water Quality: Temp. (°C) | Water Quality: pH | Water Quality: Spec. Cond. (μΣ/cm) | Appearance: Color | Appearance: Turbidity & Sediment | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1400 | 5 | 1 | 24.42 | 7.12 | 0.707 | White, Cloudy | >1000 | |
| 1405 | 10 | 1 | 23.58 | 6.88 | 0.719 | " " | >1000 | WL = 19.50 |
| 1410 | 15 | 1 | 23.79 | 6.78 | 0.726 | " " | >1000 | WL = 19.50 |
| 1425 | 20 | 0.5 | 24.21 | 6.90 | 0.735 | " " | >1000 | WL = 19.10 |
| 1430 | 25 | 1 | 24.72 | 6.99 | 0.666 | " " | >1000 | |
| 1440 | 30 | 0.5 | 24.12 | 6.99 | 0.721 | " " | >1000 | |
| 1450 | 35 | 0.5 | 23.99 | 7.04 | 0.723 | " " | 429 | |
| 1500 | 40 | 0.5 | 24.19 | 7.12 | 0.725 | " " | 792 | |

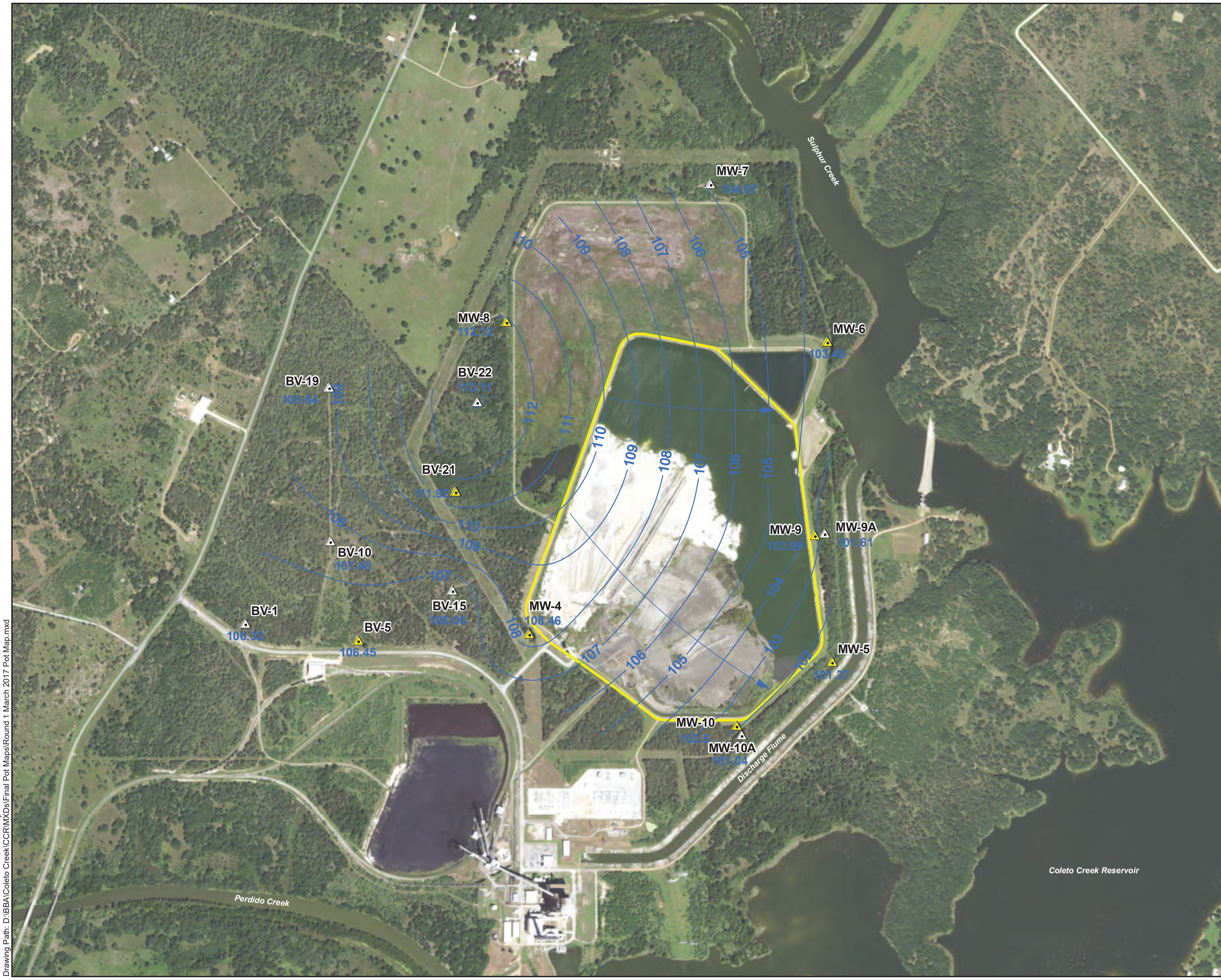
Total Discharge (gallons): 40

Observations/Comments:

Purged ten well volumes

Bullock, Bennett, & Associates, LLC
165 N. Lampasas St.
Bertram, TX 78605
(512) 355-9198 Fax (512) 355-9197

# ATTACHMENT 4 – MAPS OF THE DIRECTION OF GROUNDWATER FLOW




**Explanation**

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 March 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 — 1:12,000 — 2,000 Feet

**COLETO CREEK POWER STATION**

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 1: March 28-30, 2017**

| | | |
|---|---|---|
| PROJECT: 17258 | BY: EEF | REVISIONS |
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:01:19 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\MXDs\Final Pot Maps\Round 1 March 2017 Pot Map.mxd


## Explanation

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 May 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

**COLETO CREEK POWER STATION**

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 2: May 9-11, 2017**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

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Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:04:56 PM, Plotted by: E.Ficker
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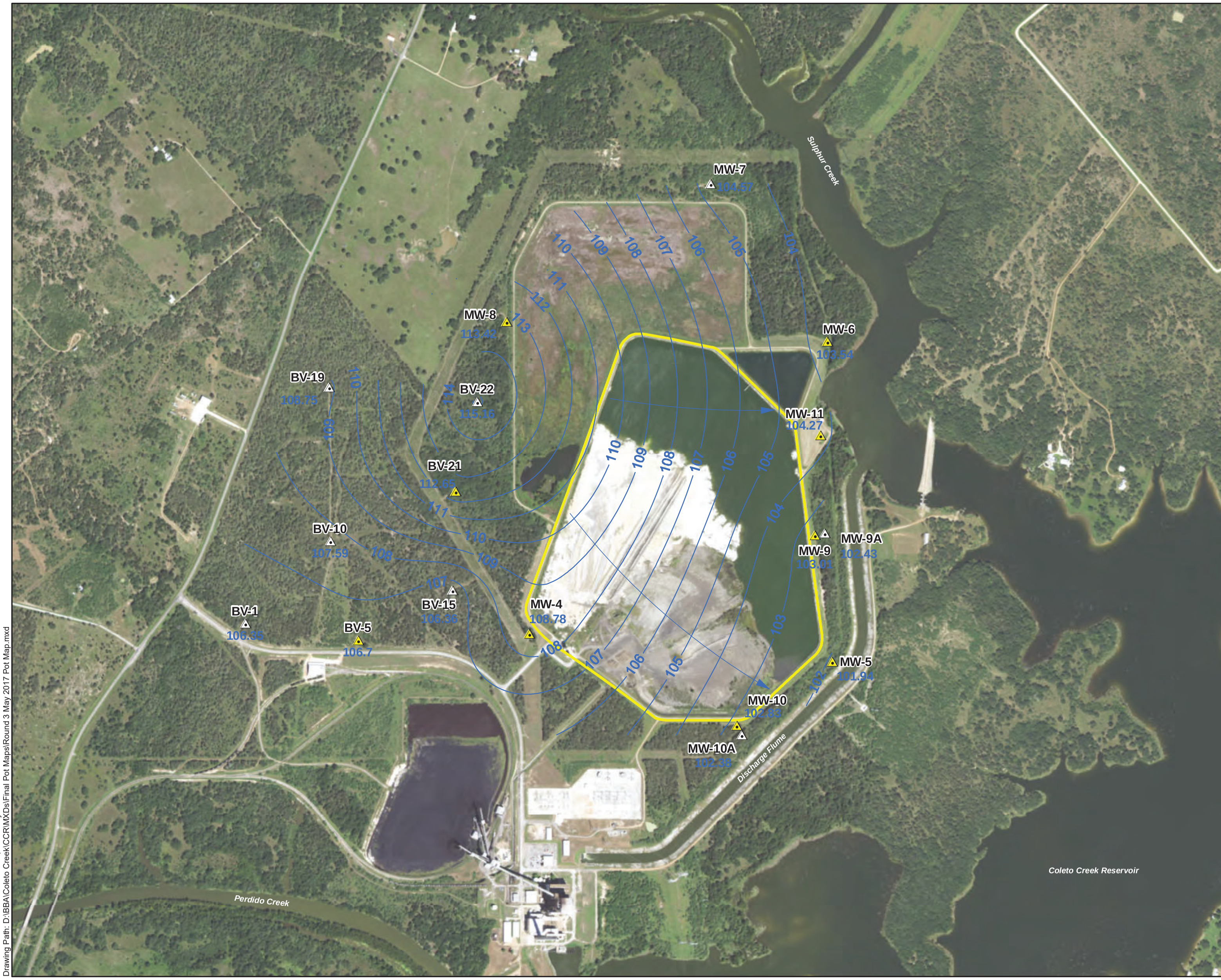


## Explanation

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 May 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
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Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 — 1:12,000 — 2,000 Feet

**COLETO CREEK POWER STATION**

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 3: May 15-17, 2017**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

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Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:08:45 PM, Plotted by: E.Ficker
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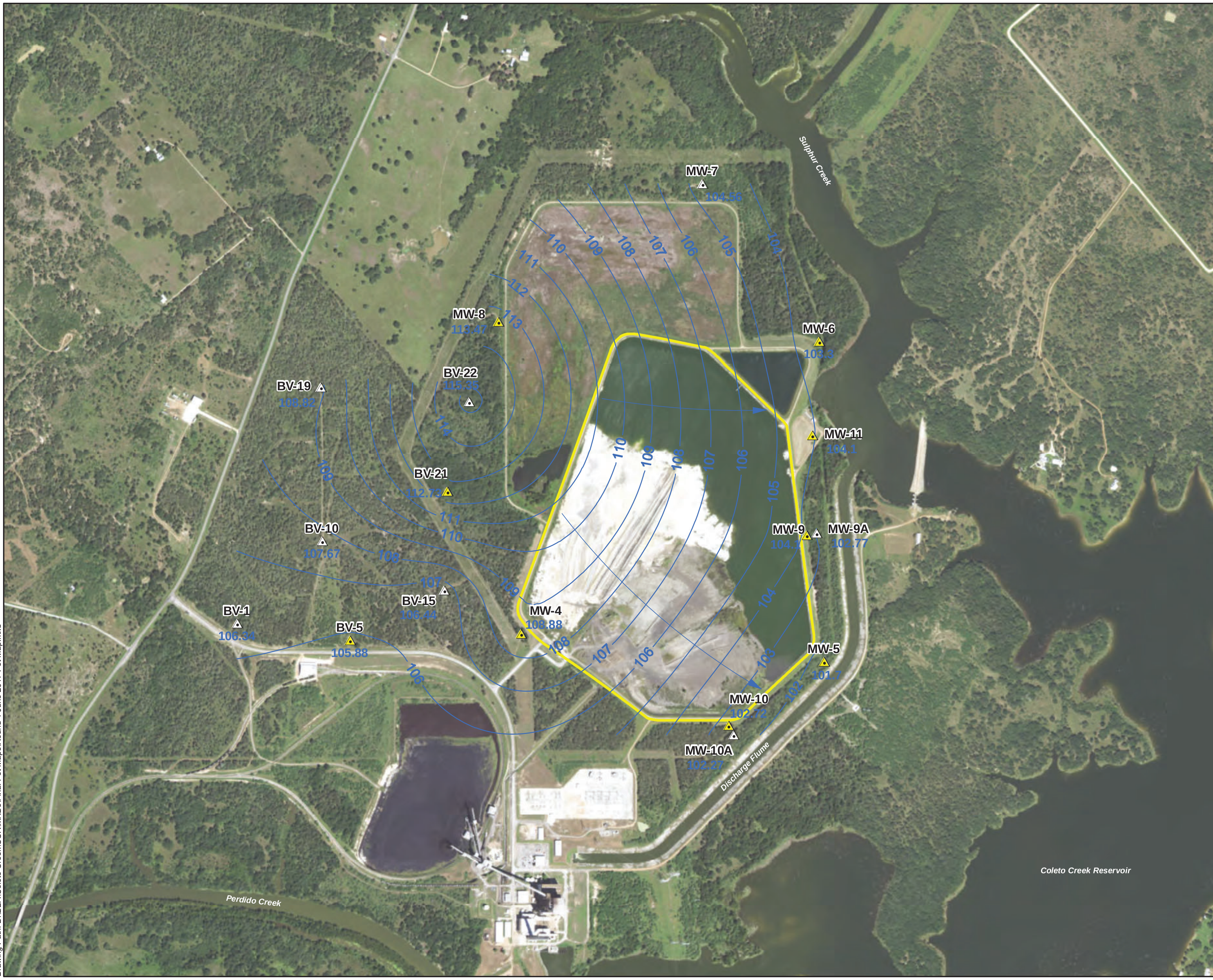


**Explanation**

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 June 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

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CRAIG E. BENNETT
GEOLOGY
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10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

## COLETO CREEK POWER STATION

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 4: June 6-8, 2017**

| | | |
|---|---|---|
| PROJECT: 17258 | BY: EEF | REVISIONS |
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:10:39 PM, Plotted by: E.Ficker
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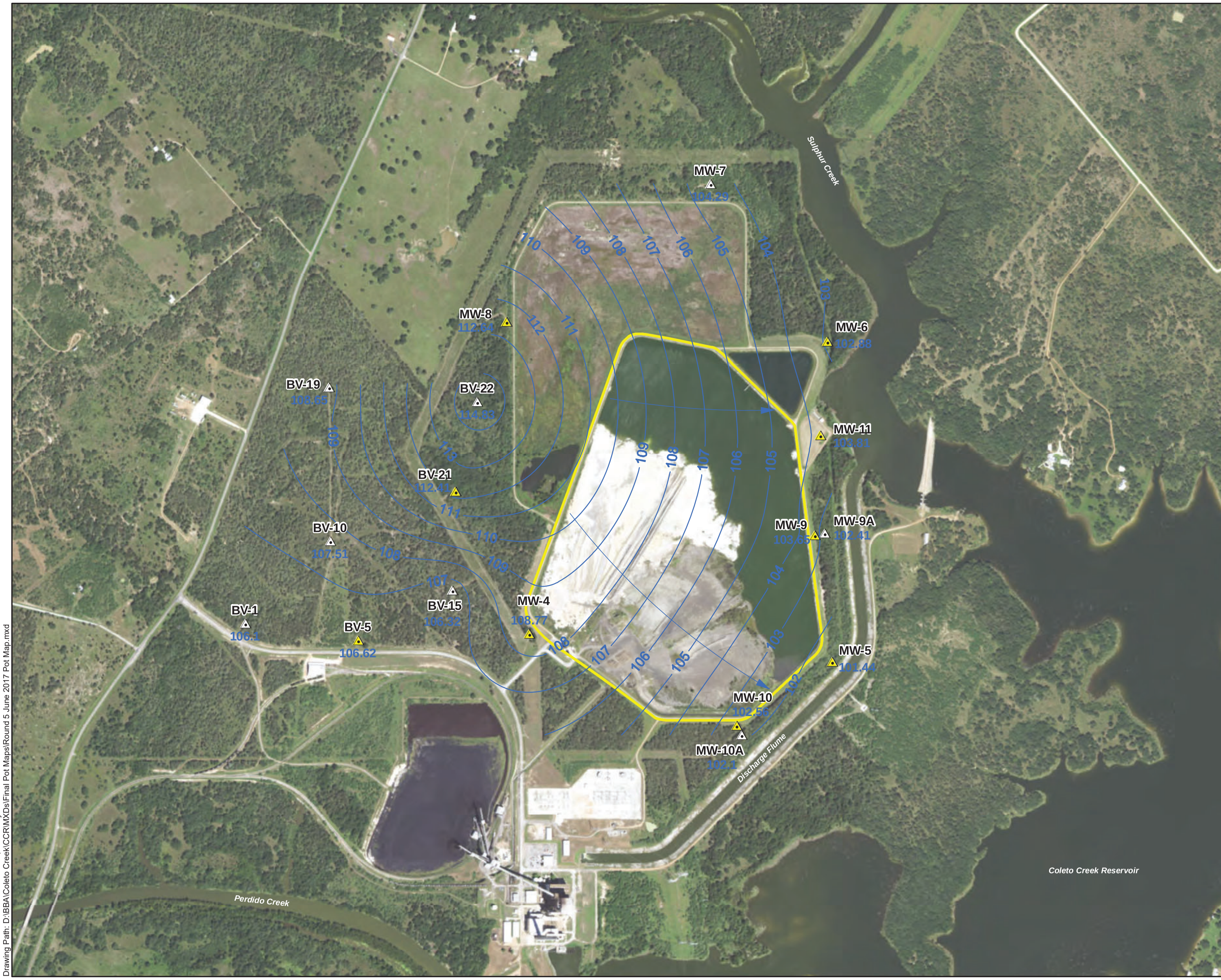



**Explanation**

CCR Rule Monitoring Well

Non-CCR Rule Monitoring Well

105 June 2017 Potentiometric Surface Elevation Contour (ft. MSL)

CCR Monitored Unit

Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

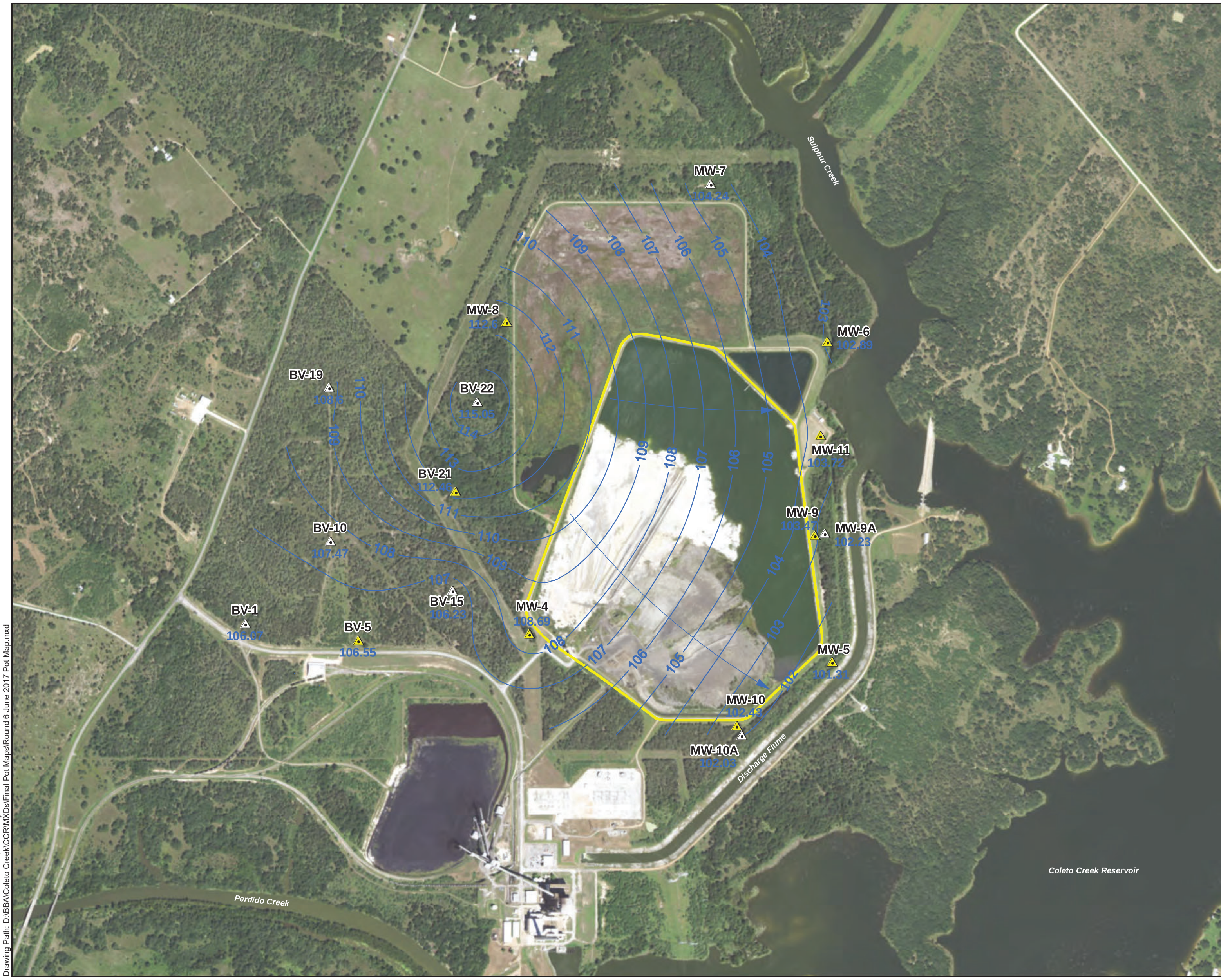
## COLETO CREEK POWER STATION

### Primary Ash Pond (Unit Id: 141) Uppermost Aquifer Unit Potentiometric Surface Map Round 5: June 20-22, 2017

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:12:49 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\MXDs\Final Pot Maps\Round 5 June 2017 Pot Map.mxd




**Explanation**

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 June 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
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PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 — 1:12,000 — 2,000 Feet

## COLETO CREEK POWER STATION

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 6: June 26-28, 2017**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:16:57 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\MXDs\Final Pot Maps\Round 6 June 2017 Pot Map.mxd


**Explanation**

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- July 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 — 1:12,000 — 2,000 Feet

**COLETO CREEK POWER STATION**

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 7: July 10-12, 2017**

| | | |
|---|---|---|
| PROJECT: 17258 | BY: EEF | REVISIONS |
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:18:32 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\MXDs\Final Pot Maps\Round 7 July 2017 Pot Map.mxd


## Explanation

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 July 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-4-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

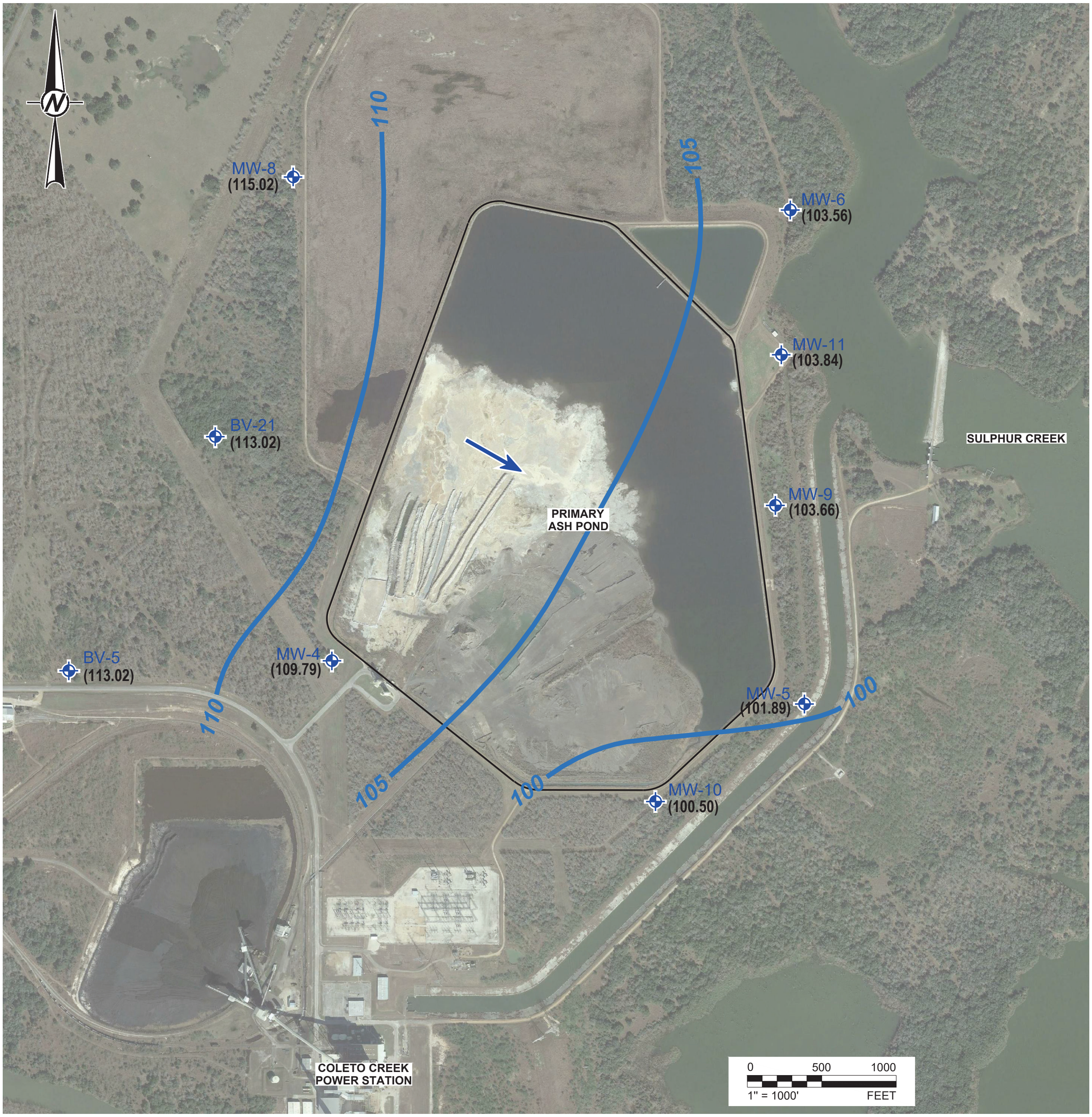
**COLETO CREEK POWER STATION**

**Primary Ash Pond (Unit Id: 141)**
**Uppermost Aquifer Unit**
**Potentiometric Surface Map**
**Round 8: July 18-20, 2017**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/4/2017 - 2:20:39 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\MXDs\Final Pot Maps\Round 8 July 2017 Pot Map.mxd




**LEGEND**

| | |
|---|---|
| ⊕ | CCR MONITORING WELL |
| *(113.02)* | GROUNDWATER POTENTIOMETRIC SURFACE (FT MSL) |
| ━━━ | GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR (C.I. = 10 FT) |
| ➔ | INFERRED DIRECTION OF GROUNDWATER FLOW |

**REFERENCE(S)**

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 1/22/16.

CLIENT
LUMINANT

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**PRIMARY ASH POND**
**POTENTIOMETRIC SURFACE MAP - OCTOBER 2, 2019**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2020-03 |
| DESIGNED | AJD |
| PREPARED | TNB |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 19122449 | ---- | 1 |

Last Edited By: tbookout Date: 2020-04-02 Time:3:57:03 PM | Printed By: TBookout Date: 2020-04-02 Time:3:59:42 PM
Path: \\texarkana\Data\projects - round rock_2019\19122449 - luminant\Coleto Creek\ | File Name: FIG 1 - Pot Surface Map-Primary Ash Pond (October 2019).dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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# ATTACHMENT 5 – TABLES SUMMARIZING CONSTITUENT CONCENTRATIONS AT EACH MONITORING WELL

## APPENDIX III ANALYTICAL RESULTS
## COLETO CREEK PRIMARY ASH POND

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| **Prediction Limit:** | | 1.26 | 143 | 118 | 0.61 | 6.51<br>7.33 | 148 | 966 |
| **Upgradient Wells** | | | | | | | | |
| BV-5 | 03/29/17 | 1.15 | 90.5 | 118 | 0.54 | 7.01 | 147 | 860 |
| | 05/11/17 | 1.03 | 81.6 | 106 | 0.57 | 6.89 | 148 | 862 |
| | 05/16/17 | 1.17 | 99 | 107 | 0.55 | 6.9 | 145 | 832 |
| | 06/07/17 | 1.11 | 88.8 | 109 | 0.56 | 6.64 | 147 | 810 |
| | 06/20/17 | 1.02 | 90.7 | 106 | 0.58 | 6.54 | 145 | 716 |
| | 06/27/17 | 1.14 | 100 | 114 | 0.55 | 6.76 | 144 | 743 |
| | 07/12/17 | 1.07 | 96.8 | 112 | 0.56 | 6.88 | 140 | 430 |
| | 07/18/17 | 1.17 | 143 | 117 | 0.56 | 6.68 | 142 | 817 |
| | 11/07/17 | 1.10 | 94.2 | 109 | 0.62 | 6.96 | 136 | 850 |
| | 06/19/18 | 1.18 | 56.4 | 112 | 0.97 | -- | 147 | 775 |
| | 09/18/18 | 1.27 | 86.2 | 145 | 0.667 | 6.53 | 146 | 904 |
| | 06/05/19 | 1.26 | 82.9 | 123 | 0.769 | 6.89 | 146 | 828 |
| | 10/03/19 | 1.31 | 72.2 | 141 | 0.753 | 7.11 | 145 | 806 |
| | 06/09/20 | 1.35 | 90.4 | 171 | 0.498 | 6.97 | 159 | 951 |
| BV-21 | 03/28/17 | 0.651 | 6.89 | 36 | 0.61 | 7.09 | 69 | 490 |
| | 05/09/17 | 0.687 | 65.2 | 38 | 0.61 | 7.04 | 55 | 410 |
| | 05/17/17 | 0.709 | 74.3 | 39 | 0.58 | 7.05 | 53 | 454 |
| | 06/06/17 | 0.657 | 69 | 40 | 0.59 | 7.11 | 49 | 452 |
| | 06/20/17 | 0.642 | 77 | 40 | 0.61 | 6.7 | 45 | 356 |
| | 06/27/17 | 0.727 | 84.9 | 40 | 0.6 | 6.97 | 46 | 420 |
| | 07/10/17 | 0.674 | 90.6 | 39 | 0.58 | 7.22 | 45 | 427 |
| | 07/18/17 | 0.618 | 84.4 | 39 | 0.6 | 6.91 | 44 | 380 |
| | 11/07/17 | 0.515 | 73.6 | 42 | 0.64 | 7.12 | 46 | 423 |
| | 06/25/18 | 0.543 | 69.3 | 38.4 | 0.62 | -- | 38.4 | 380 |
| | 09/18/18 | 0.624 | 72.1 | 33.3 | 0.479 | 6.64 | 36.4 | 416 |
| | 06/05/19 | 0.576 | 61.3 | 30.3 | 0.602 | 7.1 | 34.2 | 379 |
| | 10/03/19 | 0.534 | 63.4 | 23.9 | 0.588 | 6.82 | 33.2 | 342 |
| | 06/09/20 | 0.447 | 72.5 | 34.2 | 0.522 | 6.96 | 18.5 | 362 |
| MW-8 | 03/28/17 | 1.2 | 7.76 | 79 | 0.49 | 7.06 | 76 | 626 |
| | 05/09/17 | 1.21 | 77.5 | 77 | 0.44 | 7.15 | 79 | 564 |
| | 05/15/17 | 1.16 | 81.2 | 76 | 0.44 | 7.01 | 79 | 558 |
| | 06/06/17 | 1.26 | 78.1 | 72 | 0.45 | 6.92 | 83.5 | 570 |
| | 06/20/17 | 1.24 | 86.5 | 67 | 0.43 | 6.7 | 89 | 476 |
| | 06/27/17 | 1.23 | 89.6 | 66 | 0.44 | 6.85 | 97 | 533 |
| | 07/10/17 | 1.24 | 92.6 | 63 | 0.44 | 7.13 | 97 | 533 |
| | 07/18/17 | 1.25 | 92.9 | 61 | 0.46 | 6.91 | 100 | 533 |
| | 11/07/17 | 1.21 | 78.8 | 61 | 0.49 | 7.08 | 100 | 540 |
| | 06/25/18 | 1.25 | 80.3 | 65.9 | 0.52 | -- | 95.2 | 565 |
| | 09/18/18 | 1.29 | 76.5 | 53.7 | 0.402 | 6.70 | 94.8 | 543 |
| | 06/05/19 | 1.11 | 65.2 | 51.4 | 0.497 | 7.10 | 79 | 515 |
| | 10/03/19 | 1.2 | 76.7 | 58.3 | 0.419 | 6.76 | 90.1 | 541 |
| | 06/09/20 | 1.33 | 73.1 | 46.4 | 0.392 J | 7.04 | 72.3 | 511 |

**APPENDIX III ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| **Prediction Limit:** | | 1.26 | 143 | 118 | 0.61 | 6.51<br>7.33 | 148 | 966 |
| **Downgradient Wells** | | | | | | | | |
| MW-4 | 03/28/17 | 0.287 | 9.14 | 102 | 0.61 | 9.81 | 157 | 794 |
| | 05/09/17 | 0.395 | 88.7 | 101 | 0.61 | 7.27 | 156 | 668 |
| | 05/17/17 | 0.251 | 92.1 | 101 | 0.6 | 6.93 | 157 | 702 |
| | 06/06/17 | 0.243 | 90.7 | 101 | 0.63 | 7.13 | 157 | 728 |
| | 06/20/17 | 0.254 | 99.3 | 101 | 0.62 | 6.71 | 157 | 626 |
| | 06/27/17 | 0.254 | 102 | 101 | 0.63 | 6.87 | 157 | 690 |
| | 07/10/17 | 0.271 | 111 | 101 | 0.62 | 7.16 | 158 | 670 |
| | 07/18/17 | 0.292 | 108 | 101 | 0.63 | 6.82 | 157 | 717 |
| | 11/07/17 | 0.255 | 94.5 | 99 | 0.62 | 7.12 | 155 | 700 |
| | 06/21/18 | 0.267 | 92.5 | 104 | 0.6 | -- | 159 | 665 |
| | 09/18/18 | 0.28 | 91.8 | 102 | 0.582 | 6.63 | 155 | 720 |
| | 06/05/19 | 0.379 | 85.3 | 108 | 0.67 | 6.92 | 161 | 718 |
| | 10/03/19 | 0.367 | 93.1 | 102 | 0.559 | 6.7 | 155 | 693 |
| | 06/09/20 | 0.241 | 94.9 | 24.6 | 0.205 J | 6.88 | 26.8 | 400 |
| MW-5 | 03/30/17 | 0.11 | 110 | 140 | 0.51 | 6.85 | 184 | 830 |
| | 05/10/17 | 0.115 | 114 | 139 | 0.54 | 6.86 | 183 | 900 |
| | 05/16/17 | 0.215 | 121 | 139 | 0.5 | 6.81 | 183 | 848 |
| | 06/08/17 | 0.122 | 118 | 139 | 0.55 | 6.8 | 182 | 862 |
| | 06/21/17 | 0.122 | 124 | 138 | 0.53 | 6.6 | 182 | 813 |
| | 06/26/17 | 0.121 | 129 | 139 | 0.54 | 6.79 | 184 | 900 |
| | 07/11/17 | 0.111 | 120 | 138 | 0.52 | 6.91 | 184 | 797 |
| | 07/19/17 | 0.001 | 0.005 | 137 | 0.53 | 6.84 | 181 | 857 |
| | 11/08/17 | 0.149 | 116 | 138 | 0.52 | 6.92 | 183 | 883 |
| | 06/25/18 | 0.119 | 114 | 140 | 0.56 | -- | 183 | 820 |
| | 09/18/18 | 0.146 | 114 | 136 | 0.493 | 6.70 | 183 | 824 |
| | 06/03/19 | 0.146 | 113 | 143 | 0.596 | 7.06 | 187 | 864 |
| | 10/02/19 | 0.179 | 111 | 147 | 0.543 | 7.06 | 202 | 842 |
| | 09/06/20 | 0.152 | 117 | 138 | 0.370 J | 6.84 | 182 | 858 |
| MW-6 | 03/29/17 | 1.67 | 73.9 | 69 | 0.38 | 7.34 | 99 | 510 |
| | 05/11/17 | 1.94 | 70.6 | 70 | 0.37 | 7.1 | 110 | 490 |
| | 05/16/17 | 1.84 | 76.3 | 70 | 0.36 | 7.23 | 107 | 506 |
| | 06/07/17 | 1.8 | 73.8 | 70 | 0.37 | 6.97 | 103 | 492 |
| | 06/22/17 | 1.97 | 79.9 | 69 | 0.37 | 7.11 | 100 | 510 |
| | 06/28/17 | 1.74 | 81.8 | 69 | 0.37 | 7.16 | 99 | 570 |
| | 07/12/17 | 1.76 | 81.6 | 69 | 0.35 | 7.24 | 98 | 557 |
| | 07/20/17 | 0.005 | 0.0002 | 69 | 0.39 | 6.9 | 97 | 530 |
| | 11/07/17 | 1.72 | 76.4 | 69 | 0.39 | 7.41 | 101 | 483 |
| | 06/22/18 | 0.0171 | 76.6 | 70.7 | 0.41 | -- | 107 | 490 |
| | 09/18/18 | 2.09 | 70.8 | 72.5 | 0.353 J | 6.97 | 114 | 505 |
| | 06/03/19 | 1.9 | 73.9 | 73 | 0.043 | 7.31 | 103 | 514 |
| | 10/02/19 | 1.83 | 73.6 | 76.4 | 0.357 J | 7.29 | 115 | 507 |
| | 06/09/20 | 2.51 | 69.7 | 80.9 | 0.4 | 6.95 | 122 | 507 |

## APPENDIX III ANALYTICAL RESULTS
## COLETO CREEK PRIMARY ASH POND

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| Prediction Limit: | | 1.26 | 143 | 118 | 0.61 | 6.51<br>7.33 | 148 | 966 |
| MW-9 | 03/30/17 | 3.38 | 54.5 | 71 | 1.13 | 7.35 | 62 | 406 |
| | 05/10/17 | 3.16 | 52.7 | 66 | 1.29 | 7.48 | 59 | 410 |
| | 05/17/17 | 3.18 | 53.3 | 67 | 1.26 | 7.34 | 58 | 440 |
| | 06/07/17 | 3.12 | 52 | 67 | 1.26 | 7.03 | 57 | 380 |
| | 06/21/17 | 3.44 | 60.7 | 66 | 1.39 | 7.09 | 60 | 393 |
| | 06/26/17 | 3.31 | 60.6 | 67 | 1.4 | 7.23 | 61 | 407 |
| | 07/11/17 | 3.35 | 52.1 | 64 | 1.3 | 7.51 | 60 | 927 |
| | 07/19/17 | 3.4 | 50.2 | 63 | 1.4 | 7.29 | 62 | 407 |
| | 11/08/17 | 2.84 | 49.4 | 62 | 1.56 | 7.54 | 50 | 397 |
| | 06/21/18 | 2.94 | 46.9 | 71.5 | 1.5 | -- | 35.7 | 370 |
| | 09/18/18 | 2.79 | 51.7 | 71.4 | 1.1 | 6.99 | 49.1 | 394 |
| | 06/05/19 | 4.26 | 48 | 74.7 | 1.38 | 7.4 | 66.3 | 421 |
| | 10/03/19 | 3.97 | 71.3 | 70.9 | 1.41 | 7.37 | 63.6 | 462 |
| | 09/06/20 | 4.10 | 47.4 | 63.7 | 1.58 | 7.21 | 54.9 | 397 |
| MW-10 | 03/30/17 | 3.74 | 92.1 | 151 | 0.54 | 6.99 | 130 | 804 |
| | 05/10/17 | 7.32 | 56.1 | 82 | 0.83 | 7.23 | 96 | 582 |
| | 05/16/17 | 7.45 | 62.7 | 81 | 0.81 | 7.28 | 95 | 612 |
| | 06/08/17 | 7.54 | 58.1 | 77 | 0.84 | 7.23 | 92 | 604 |
| | 06/21/17 | 9.22 | 60.7 | 77 | 0.84 | 6.97 | 92 | 550 |
| | 06/26/17 | 8.21 | 63.4 | 78 | 0.84 | 7.14 | 92 | 530 |
| | 07/11/17 | 7.99 | 49.5 | 76 | 0.84 | 7.4 | 88 | 617 |
| | 07/19/17 | 8.74 | 56.6 | 74 | 0.86 | 7.25 | 86 | 533 |
| | 11/08/17 | 8.72 | 77.7 | 74 | 0.88 | 7.35 | 81 | 590 |
| | 06/22/18 | 8.47 | 84.4 | 76.7 | 0.88 | -- | | 550 |
| | 09/18/18 | 8.45 | 51.9 | 81.4 | 0.759 | 6.98 | 95.1 | 577 |
| | 06/03/19 | 8.28 | 43.1 | 87.2 | 0.953 | 7.52 | 97.7 | 587 |
| | 10/02/19 | 8.28 | 44.2 | 85.5 | 0.891 | 7.46 | 104 | 575 |
| | 06/09/20 | 7.58 | 46.9 | 76.9 | 0.818 | 7.13 | 96.5 | 575 |
| MW-11 | 05/10/17 | 1.35 | 64.1 | 55 | 0.82 | 7.27 | 61 | 394 |
| | 05/16/17 | 1.39 | 62.3 | 52 | 0.85 | 7.29 | 58 | 362 |
| | 05/18/17 | 1.27 | 61.6 | 47.8 | 0.94 | | 52.4 | 390 |
| | 06/07/17 | 1.23 | 59.8 | 48 | 0.93 | 7.25 | 50 | 372 |
| | 06/21/17 | 1.19 | 73.1 | 43.7 | 1.04 | 7.15 | 44 | 373 |
| | 06/26/17 | 1.15 | 82 | 44 | 1 | 7.3 | 43 | 407 |
| | 07/11/17 | 1.23 | 44.7 | 44 | 1 | 7.55 | 42 | 603 |
| | 07/19/17 | 1.17 | 48.6 | 43 | 1.01 | 7.21 | 42 | 360 |
| | 11/08/17 | 1.13 | 52.2 | 43 | 1.02 | 7.61 | 56 | 367 |
| | 06/21/18 | 1.07 | 69.6 | 44.3 | 0.96 | -- | 61.4 | 355 |
| | 09/18/18 | 1.12 | 39.3 | 44.6 | 0.754 | 7.00 | 44.4 | 354 |
| | 06/03/19 | 1.27 | 43.4 | 42.2 | 0.837 | 7.55 | 44.8 | 372 |
| | 10/02/19 | 1.22 | 43.4 | 41.4 | 0.768 | 7.43 | 10.8 | 355 |
| | 06/09/20 | 1.20 | 56.6 | 44.4 | 0.571 | 6.88 | 67.7 | 414 |

Notes:
1. All concentrations in mg/L. pH in standard units.
2. J - concentration is below sample quantitation limit; result is an estimate.

**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWPS: | | 0.006 | 0.128 | 2 | 0.004 | 0.005 | 0.10 | 0.0499 | 4 | 0.015 | 0.04 | 0.002 | 0.10 | 0.05 | 0.002 | -- | -- | 5 |
| Upgradient Wells | | | | | | | | | | | | | | | | | | |
| BV-5 | 03/29/17 | <0.0025 | 0.00856 | 0.04510 | <0.001 | <0.001 | <0.005 | 0.0497 | 0.540 | <0.001 | 0.0206 | <0.0002 | 0.00925 | <0.005 | <0.0015 | -- | -- | 1.503 |
| | 05/11/17 | <0.0025 | 0.00786 | 0.03680 | <0.001 | <0.001 | <0.005 | 0.0462 | 0.570 | <0.001 | 0.018 | <0.0002 | 0.0101 | <0.005 | <0.0015 | -- | -- | 1.555 |
| | 05/16/17 | <0.0025 | 0.00885 | 0.04520 | <0.001 | <0.001 | <0.005 | 0.0495 | 0.550 | 0.00151 | 0.0171 | <0.0002 | 0.0102 | <0.005 | <0.0015 | -- | -- | 0.7550 |
| | 06/07/17 | <0.0025 | 0.00829 | 0.03760 | <0.001 | <0.001 | <0.005 | 0.0483 | 0.560 | <0.001 | 0.0207 | <0.0002 | 0.01 | <0.005 | <0.0015 | -- | -- | 1.457 |
| | 06/20/17 | <0.0025 | 0.00841 | 0.04010 | <0.001 | <0.001 | <0.005 | 0.0499 | 0.580 | <0.001 | 0.0208 | <0.0002 | 0.0114 | <0.005 | <0.0015 | -- | -- | 0.4920 |
| | 06/27/17 | <0.0025 | 0.0083 | 0.04120 | <0.001 | <0.001 | <0.005 | 0.046 | 0.550 | <0.001 | 0.0198 | <0.0002 | 0.00942 | <0.005 | <0.0015 | -- | -- | 2.247 |
| | 07/12/17 | <0.0025 | 0.00849 | 0.04160 | <0.001 | <0.001 | <0.005 | 0.0484 | 0.560 | <0.001 | 0.0188 | <0.0002 | 0.0096 | <0.005 | <0.0015 | -- | -- | 2.139 |
| | 07/18/17 | <0.0025 | 0.00951 | 0.05780 | <0.001 | <0.001 | 0.00739 | 0.0453 | 0.560 | 0.00288 | 0.022 | <0.0002 | 0.0083 | <0.005 | <0.0015 | -- | -- | 1.260 |
| | 06/19/18 | <0.0025 | 0.0106 | 0.0336 | <0.001 | <0.001 | 0.0022 J | 0.0513 J | 0.970 | <0.00074 J | 0.016 | <0.0002 | 0.0139 | <0.005 | <0.0015 | 0.327 | <1.680 | 2.01 |
| | 09/18/18 | NA | 0.00949 | 0.0436 | NA | NA | 0.00228 J | 0.0487 | 0.667 | 0.00039 J | 0.0206 | NA | 0.0102 | NA | NA | 0.302 | <0.608 | 0.91 |
| | 06/05/19 | <0.0008 | 0.0092 | 0.042 | <0.0003 | 0.0009 J | <0.002 | 0.0466 | 0.769 | 0.00144 | 0.0201 | <0.00008 | 0.0109 | <0.0020 | <0.0005 | <0.687 | <1.130 | <1.82 |
| | 10/03/19 | <0.0008 | 0.00941 | 0.0441 | <0.0003 | <0.0003 | 0.00285 J | 0.0437 | 0.753 | 0.0039 | 0.0172 | <0.00008 | 0.0122 | <0.0020 | <0.0005 | 0.928 | 1.35 | 2.28 |
| | 06/09/20 | <0.0008 | 0.00879 | 0.0462 | <0.0003 | <0.0003 | 0.00818 | 0.0486 | 0.498 | 0.00162 | 0.0201 | <0.0000800 | 0.0120 | <0.00200 | <0.000500 | 0.363 | 0 | 0.363 |
| BV-21 | 03/28/17 | <0.0025 | 0.0954 | 0.09630 | <0.001 | <0.001 | <0.005 | 0.0083 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.390 |
| | 05/09/17 | <0.0025 | 0.108 | 0.09720 | <0.001 | <0.001 | <0.005 | 0.00852 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.7460 |
| | 05/17/17 | <0.0025 | 0.117 | 0.09440 | <0.001 | <0.001 | <0.005 | 0.00878 | 0.580 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.9190 |
| | 06/06/17 | <0.0025 | 0.118 | 0.09540 | <0.001 | <0.001 | <0.005 | 0.00806 | 0.590 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6710 |
| | 06/20/17 | <0.0025 | 0.121 | 0.1010 | <0.001 | <0.001 | <0.005 | 0.00744 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.672 |
| | 06/27/17 | <0.0025 | 0.128 | 0.1040 | <0.001 | <0.001 | <0.005 | 0.00841 | 0.600 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5200 |
| | 07/10/17 | <0.0025 | 0.123 | 0.1100 | <0.001 | <0.001 | <0.005 | 0.0086 | 0.580 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.8050 |
| | 07/18/17 | <0.0025 | 0.115 | 0.1010 | <0.001 | <0.001 | <0.005 | 0.00784 | 0.600 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 4.812 |
| | 06/25/18 | <0.0025 | 0.0697 | 0.104 | <0.001 | <0.001 | <0.005 | 0.00682 | 0.620 | <0.00074 J | 0.00513 J | <0.0002 | 0.00428 J | <0.005 | <0.0015 | 0.267 | <1.417 | 1.68 |
| | 09/18/18 | NA | 0.0625 | 0.109 | NA | NA | <0.002 | 0.0064 | 0.479 | 0.000555 J | 0.00624 J | NA | 0.00450 J | NA | NA | <0.31 | <0.528 | <0.838 |
| | 06/05/19 | <0.0008 | 0.0531 | 0.105 | <0.0003 | <0.0003 | <0.002 | 0.00574 | 0.602 | 0.000354 | 0.00558 J | <0.00008 | 0.00685 | <0.0020 | <0.0005 | 0.65 | <0.687 | 1.337 |
| | 10/03/19 | <0.0008 | 0.049 | 0.0963 | <0.0003 | <0.0003 | <0.002 | 0.00542 | 0.588 | 0.000333 J | <0.005 | <0.00008 | 0.00784 | <0.0020 | <0.0005 | 0.346 | 1.54 | 1.89 |
| | 06/09/20 | <0.0008 | 0.0793 | 0.132 | <0.0003 | <0.0003 | 0.007 | 0.00437 J | 0.522 | 0.00033 J | <0.005 | <0.00008 | 0.00698 | <0.0020 | <0.0005 | 0.211 | 1.15 | 1.36 |
| MW-8 | 03/28/17 | <0.0025 | 0.00839 | 0.0623 | <0.001 | <0.001 | <0.005 | 0.0236 | 0.490 | <0.001 | 0.0111 | <0.0002 | 0.0154 | <0.005 | <0.0015 | -- | -- | 0.4520 |
| | 05/09/17 | <0.0025 | 0.00848 | 0.064 | <0.001 | <0.001 | <0.005 | 0.0272 | 0.440 | <0.001 | 0.0111 | <0.0002 | 0.0157 | <0.005 | <0.0015 | -- | -- | 0.4740 |
| | 05/15/17 | <0.0025 | 0.00926 | 0.064 | <0.001 | <0.001 | <0.005 | 0.0311 | 0.440 | <0.001 | 0.0112 | <0.0002 | 0.016 | <0.005 | <0.0015 | -- | -- | 0.6140 |
| | 06/06/17 | <0.0025 | 0.00912 | 0.0616 | <0.001 | <0.001 | 0.00744 | 0.0308 | 0.450 | <0.001 | 0.0107 | <0.0002 | 0.0157 | <0.005 | <0.0015 | -- | -- | 0.1320 |
| | 06/20/17 | <0.0025 | 0.00885 | 0.0669 | <0.001 | <0.001 | <0.005 | 0.0297 | 0.430 | <0.001 | 0.0121 | <0.0002 | 0.0171 | <0.005 | <0.0015 | -- | -- | 0.5380 |
| | 06/27/17 | <0.0025 | 0.00939 | 0.0633 | <0.001 | <0.001 | <0.005 | 0.0314 | 0.440 | <0.001 | 0.0115 | <0.0002 | 0.0163 | <0.005 | <0.0015 | -- | -- | 0.9390 |
| | 07/10/17 | <0.0025 | 0.00902 | 0.0631 | <0.001 | <0.001 | <0.005 | 0.031 | 0.440 | <0.001 | 0.0112 | <0.0002 | 0.0165 | <0.005 | <0.0015 | -- | -- | 0.8040 |
| | 07/18/17 | <0.0025 | 0.00937 | 0.0635 | <0.001 | <0.001 | <0.005 | 0.0352 | 0.460 | <0.001 | 0.0118 | <0.0002 | 0.0185 | <0.005 | <0.0015 | -- | -- | 2.113 |
| | 06/25/18 | <0.0025 | 0.0101 | 0.0632 | <0.001 | <0.001 | <0.005 | 0.029 | 0.520 | 0.0011 | 0.0107 | <0.0002 | 0.017 | <0.005 | <0.0015 | <0.234 | <1.204 | <1.44 |
| | 09/18/18 | NA | 0.00896 | 0.0582 | NA | NA | <0.00200 | 0.0237 | 0.402 | <0.0003 | 0.0117 | NA | 0.0178 | NA | NA | <0.281 | <0.558 | <0.84 |
| | 06/05/19 | <0.0008 | 0.00946 | 0.0596 | <0.0003 | <0.0003 | <0.002 | 0.0217 | 0.497 | 0.000355 J | 0.011 | <0.00008 | 0.0156 | <0.0020 | <0.0005 | 0.528 | <0.619 | 1.147 |
| | 10/03/19 | <0.0008 | 0.0083 | 0.0607 | <0.0003 | <0.0003 | <0.002 | 0.231 | 0.419 | <0.0003 | 0.0106 | <0.00008 | 0.0144 | <0.0020 | <0.0005 | 0.224 | 0.241 | 0.465 |
| | 06/09/20 | <0.0008 | 0.00856 | 0.0599 | <0.0003 | <0.0003 | <0.002 | 0.0174 | 0.392 J | 0.000479 J | 0.0104 | <0.00008 | 0.0158 | <0.002 | <0.0005 | 0.304 | 2.64 | 2.94 |

**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

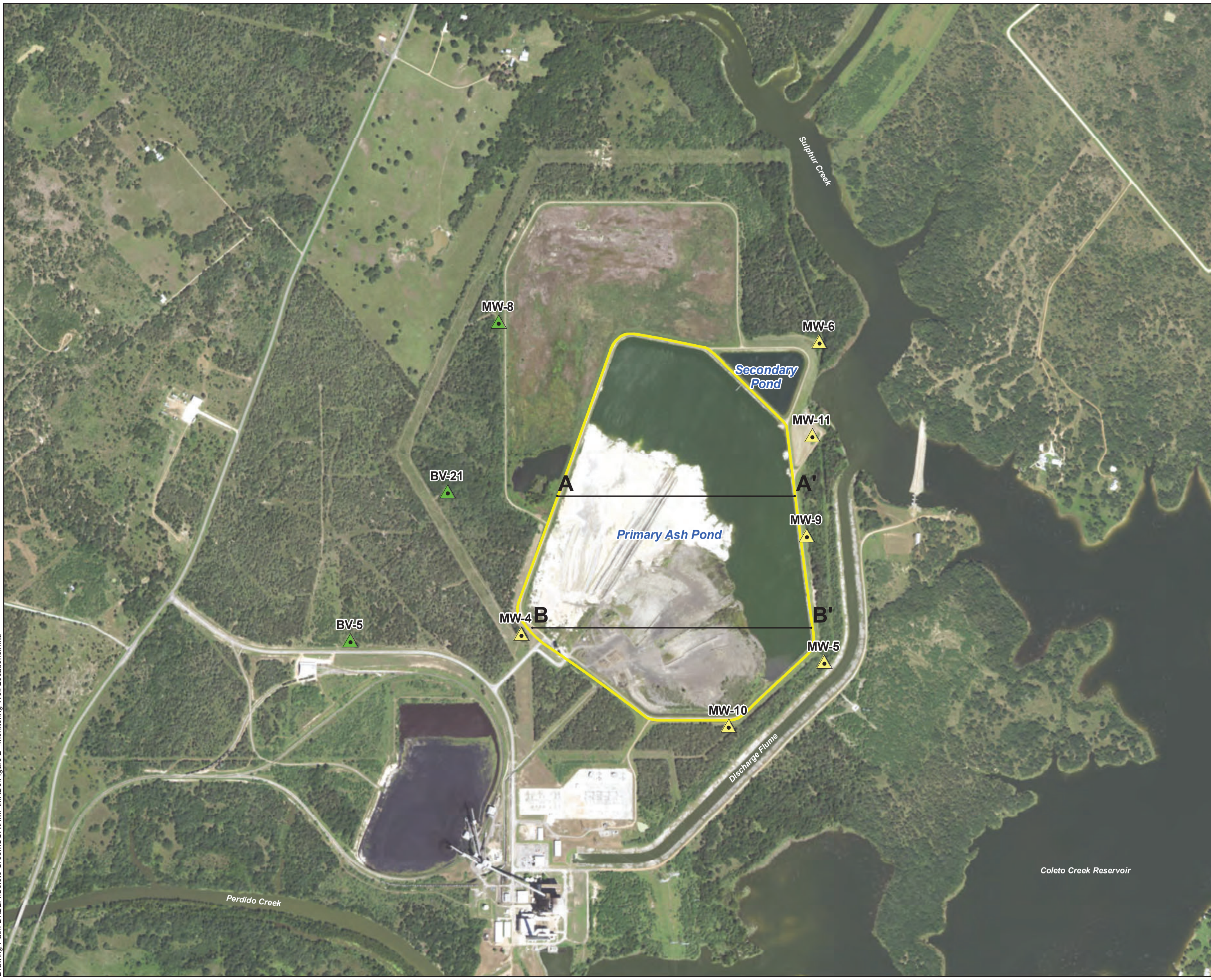
| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWPS: | | 0.006 | 0.128 | 2 | 0.004 | 0.005 | 0.10 | 0.0499 | 4 | 0.015 | 0.04 | 0.002 | 0.10 | 0.05 | 0.002 | -- | -- | 5 |
| Downgradient Wells | | | | | | | | | | | | | | | | | | |
| MW-4 | 03/28/17 | <0.0025 | 0.00738 | 0.0575 | <0.001 | <0.001 | <0.005 | 0.007 | 0.610 | <0.001 | 0.0192 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.4600 |
| | 05/09/17 | <0.0025 | 0.00733 | 0.0576 | <0.001 | <0.001 | <0.005 | 0.007 | 0.610 | <0.001 | 0.0182 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6940 |
| | 05/15/17 | <0.0025 | 0.00794 | 0.0556 | <0.001 | <0.001 | <0.005 | 0.007 | 0.600 | <0.001 | 0.0166 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.451 |
| | 06/06/17 | <0.0025 | 0.0077 | 0.0556 | <0.001 | <0.001 | <0.005 | 0.007 | 0.630 | <0.001 | 0.0179 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1740 |
| | 06/20/17 | <0.0025 | 0.0081 | 0.0596 | <0.001 | <0.001 | 0.00877 | 0.008 | 0.620 | <0.001 | 0.0195 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5430 |
| | 06/27/17 | <0.0025 | 0.00786 | 0.0554 | <0.001 | <0.001 | <0.005 | 0.007 | 0.630 | <0.001 | 0.0185 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6390 |
| | 07/10/17 | <0.0025 | 0.00846 | 0.0582 | <0.001 | <0.001 | <0.005 | 0.009 | 0.620 | <0.001 | 0.0187 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.069 |
| | 07/18/17 | <0.0025 | 0.00815 | 0.0549 | <0.001 | <0.001 | <0.005 | 0.008 | 0.630 | <0.001 | 0.0183 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1910 |
| | 06/21/18 | <0.0025 | 0.00843 | 0.0591 | <0.001 | <0.001 | <0.005 | 0.00711 | 0.600 | <0.00072 J | 0.0175 | <0.0002 | <0.005 | <0.005 | <0.0015 | 0.370 | 1.705 | 2.08 |
| | 09/18/18 | NA | 0.00793 | 0.0577 | NA | NA | <0.002 | 0.00673 | 0.582 | <0.0003 | 0.019 | NA | <0.002 | NA | NA | 1.610 | <0.543 | 2.15 |
| | 06/05/19 | <0.0008 | 0.0079 | 0.0571 | <0.0003 | <0.0003 | <0.002 | 0.00729 | 0.670 | <0.0003 | 0.0195 | <0.00008 | <0.002 | <0.0020 | <0.0005 | 0.436 | <0.547 | 0.98 |
| | 10/03/19 | <0.0008 | 0.00764 | 0.0532 | <0.0003 | <0.0003 | <0.002 | 0.00699 | 0.559 | 0.00101 | 0.017 | <0.00008 | <0.002 | <0.002 | <0.0005 | 1.85 | -0.102 | 1.85 |
| | 06/09/20 | <0.0008 | <0.002 | 0.0376 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.205 J | <0.0003 | 0.00751 J | <0.00008 | 0.0021 J | <0.002 | <0.0005 | 0.0553 | 0.264 | 0.319 |
| MW-5 | 03/30/17 | <0.0025 | 0.00953 | 0.0748 | <0.001 | <0.001 | <0.005 | <0.005 | 0.510 | <0.001 | 0.0192 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.443 |
| | 05/10/17 | <0.0025 | 0.00955 | 0.0706 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0179 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6150 |
| | 05/16/17 | <0.0025 | 0.00967 | 0.0708 | <0.001 | <0.001 | <0.005 | <0.005 | 0.500 | <0.001 | 0.0181 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6410 |
| | 06/08/17 | <0.0025 | 0.00908 | 0.0701 | <0.001 | <0.001 | <0.005 | <0.005 | 0.550 | <0.001 | 0.0200 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1790 |
| | 06/21/17 | <0.0025 | 0.00917 | 0.0767 | <0.001 | <0.001 | <0.005 | <0.005 | 0.530 | <0.001 | 0.0197 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1060 |
| | 06/26/17 | <0.0025 | 0.00955 | 0.0735 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0204 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.112 |
| | 07/11/17 | <0.0025 | 0.00945 | 0.0712 | <0.001 | <0.001 | <0.005 | <0.005 | 0.520 | <0.001 | 0.0183 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5120 |
| | 07/19/17 | <0.0025 | 0.00941 | 0.0735 | <0.001 | <0.001 | <0.005 | <0.005 | 0.530 | <0.001 | 0.0186 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1910 |
| | 06/25/18 | <0.0025 | 0.00998 | 0.0733 | <0.001 | <0.001 | <0.005 | <0.005 | 0.560 | <0.001 | 0.0182 | <0.0002 | <0.005 | <0.005 | <0.0015 | <0.251 | <1.369 | <1.62 |
| | 09/18/18 | NA | 0.00945 | 0.0697 | NA | NA | <0.002 | <0.003 | 0.493 | <0.0003 | 0.0195 | NA | <0.002 | NA | NA | <0.282 | <0.606 | <0.89 |
| | 06/03/19 | <0.0008 | 0.00948 | 0.0678 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.596 | <0.0003 | 0.0206 | <0.00008 | <0.002 | <0.002 | <0.0005 | <0.619 | <0.917 | <1.54 |
| | 10/02/19 | <0.0008 | 0.00918 | 0.067 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.543 | <0.0003 | 0.0187 | <0.00008 | <0.002 | <0.002 | <0.0005 | 0.47 | 0.117 | 0.587 |
| | 06/09/20 | <0.0008 | 0.00891 | 0.0689 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.370 J | <0.0003 | 0.0192 | <0.00008 | <0.002 | <0.002 | <0.0005 | 0.171 | 0.211 | 0.382 |
| MW-6 | 03/29/17 | <0.0025 | 0.00827 | 0.0900 | <0.001 | <0.001 | <0.005 | <0.005 | 0.380 | <0.001 | <0.010 | <0.0002 | 0.00749 | <0.005 | <0.0015 | -- | -- | 1.009 |
| | 05/11/17 | <0.0025 | 0.00738 | 0.0758 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | 0.0101 | <0.0002 | 0.0176 | <0.005 | <0.0015 | -- | -- | 0.8250 |
| | 05/16/17 | <0.0025 | 0.00803 | 0.0784 | <0.001 | <0.001 | <0.005 | <0.005 | 0.360 | <0.001 | <0.010 | <0.0002 | 0.0131 | <0.005 | <0.0015 | -- | -- | 0.7740 |
| | 06/07/17 | <0.0025 | 0.00772 | 0.0798 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | <0.010 | <0.0002 | 0.00949 | <0.005 | <0.0015 | -- | -- | 0.6640 |
| | 06/22/17 | <0.0025 | 0.00764 | 0.083 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | 0.0109 | <0.0002 | 0.0084 | <0.005 | <0.0015 | -- | -- | 0.2150 |
| | 06/28/17 | <0.0025 | 0.00779 | 0.0842 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | <0.010 | <0.0002 | 0.00806 | <0.005 | <0.0015 | -- | -- | 1.730 |
| | 07/12/17 | <0.0025 | 0.0077 | 0.0819 | <0.001 | <0.001 | <0.005 | <0.005 | 0.350 | <0.001 | <0.010 | <0.0002 | 0.0076 | <0.005 | <0.0015 | -- | -- | 1.012 |
| | 07/20/17 | <0.0025 | 0.001 | 0.0010 | <0.001 | <0.001 | <0.005 | <0.005 | 0.390 | <0.001 | <0.010 | <0.0002 | 0.001 | <0.005 | <0.0015 | -- | -- | 0.3660 |
| | 06/22/18 | <0.0025 | 0.00861 | 0.0912 | <0.001 | <0.001 | <0.005 | <0.005 | 0.410 | <0.001 | 0.00924 J | <0.0002 | 0.00837 | <0.005 | <0.0015 | <0.309 | <1.243 | <1.55 |
| | 09/18/18 | NA | 0.008 | 0.0828 | NA | NA | <0.002 | <0.003 | 0.353 J | 0.000349 J | 0.0107 | NA | 0.0274 | NA | NA | <0.196 | 1.06 | 1.256 |
| | 06/03/19 | <0.0008 | 0.00799 | 0.0894 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.438 | <0.0003 | 0.00968 J | <0.00008 | 0.00884 | <0.0020 | <0.0005 | <0.407 | <0.623 | <1.03 |
| | 10/02/19 | <0.0008 | 0.00775 | 0.0876 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.357 J | <0.0003 | 0.00875 J | <0.00008 | 0.00875 | <0.0020 | <0.0005 | 0.715 | 1.23 | 1.94 |
| | 06/09/20 | <0.0008 | 0.00799 | 0.078 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.4 | <0.0003 | 0.0113 | <0.00008 | 0.0357 | <0.002 | <0.0005 | 0.00643 | 0.127 | 0.134 |

**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GWPS: | | 0.006 | 0.128 | 2 | 0.004 | 0.005 | 0.10 | 0.0499 | 4 | 0.015 | 0.04 | 0.002 | 0.10 | 0.05 | 0.002 | -- | -- | 5 |
| MW-9 | 03/30/17 | <0.0025 | 0.00909 | 0.121 | <0.001 | <0.001 | <0.005 | <0.005 | 1.130 | 0.00217 | <0.010 | <0.0002 | 0.0747 | <0.005 | <0.0015 | -- | -- | 1.353 |
| | 05/10/17 | <0.0025 | 0.00996 | 0.105 | <0.001 | <0.001 | <0.005 | <0.005 | 1.290 | 0.00433 | <0.010 | <0.0002 | 0.0900 | <0.005 | <0.0015 | -- | -- | 0.4800 |
| | 05/17/17 | <0.0025 | 0.00958 | 0.101 | <0.001 | <0.001 | <0.005 | <0.005 | 1.260 | 0.00377 | <0.010 | <0.0002 | 0.0899 | <0.005 | <0.0015 | -- | -- | 0.3600 |
| | 06/07/17 | <0.0025 | 0.0093 | 0.100 | <0.001 | <0.001 | <0.005 | <0.005 | 1.260 | <0.001000 | <0.010 | <0.0002 | 0.0926 | <0.005 | <0.0015 | -- | -- | 0.4760 |
| | 06/21/17 | <0.0025 | 0.00937 | 0.119 | <0.001 | <0.001 | <0.005 | <0.005 | 1.390 | 0.00136 | <0.010 | <0.0002 | 0.1020 | <0.005 | <0.0015 | -- | -- | 1.579 |
| | 06/26/17 | <0.0025 | 0.0107 | 0.114 | <0.001 | <0.001 | 0.0102 | <0.005 | 1.400 | 0.00217 | <0.010 | <0.0002 | 0.1060 | <0.005 | <0.0015 | -- | -- | 1.023 |
| | 07/11/17 | <0.0025 | 0.0105 | 0.103 | <0.001 | <0.001 | 0.00566 | <0.005 | 1.300 | 0.00124 | <0.010 | <0.0002 | 0.1050 | <0.005 | <0.0015 | -- | -- | 0.8630 |
| | 07/19/17 | <0.0025 | 0.0103 | 0.101 | <0.001 | <0.001 | <0.005 | <0.005 | 1.400 | <0.001000 | <0.010 | <0.0002 | 0.1130 | <0.005 | <0.0015 | -- | -- | 0.5840 |
| | 06/21/18 | <0.0025 | 0.0104 | 0.100 | <0.001 | <0.001 | <0.005 | <0.005 | 1.500 | <0.00072 J | <0.01 | <0.0002 | 0.0617 | <0.005 | <0.0015 | 0.608 | <1.303 | 1.91 |
| | 09/18/18 | NA | 0.0103 | 0.0985 | NA | NA | <0.002 | <0.003 | 1.100 | <0.000300 | 0.00639 J | NA | 0.0502 | NA | NA | 0.618 | <0.638 | 1.26 |
| | 06/05/19 | <0.0008 | 0.0109 | 0.102 | <0.0003 | <0.0003 | <0.002 | <0.003 | 1.380 | <0.0003 | 0.00545 J | <0.00008 | 0.0683 | <0.002 | <0.0005 | <0.402 | <0.683 | <1.085 |
| | 10/03/19 | <0.0008 | 0.0109 | 0.128 | 0.000689 J | <0.0003 | <0.002 | 0.00337 J | 1.410 | 0.00876 | 0.0064 J | <0.00008 | 0.0507 | 0.0041 J | <0.0005 | 0.577 | 0.747 | 1.32 |
| | 06/09/20 | <0.0008 | 0.0126 | 0.0865 | <0.0003 | <0.0003 | <0.002 | <0.003 | 1.58 | 0.000577 J | <0.005 | <0.00008 | 0.0774 | <0.002 | <0.0005 | 0.132 | -0.0432 | 0.132 |
| MW-10 | 03/30/17 | <0.0025 | 0.0110 | 0.0844 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0179 | <0.0002 | 0.0342 | <0.005 | <0.0015 | -- | -- | 1.439 |
| | 05/10/17 | <0.0025 | 0.0146 | 0.0554 | <0.001 | <0.001 | 0.00533 | <0.005 | 0.830 | <0.001 | 0.0122 | <0.0002 | 0.102 | <0.005 | <0.0015 | -- | -- | 0.8880 |
| | 05/16/17 | <0.0025 | 0.0150 | 0.0598 | <0.001 | <0.001 | <0.005 | <0.005 | 0.810 | <0.001 | 0.0123 | <0.0002 | 0.0987 | <0.005 | <0.0015 | -- | -- | 0.1830 |
| | 06/08/17 | <0.0025 | 0.0144 | 0.0544 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0115 | <0.0002 | 0.106 | <0.005 | <0.0015 | -- | -- | 0.06700 |
| | 06/21/17 | <0.0025 | 0.0149 | 0.054 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0133 | <0.0002 | 0.113 | <0.005 | <0.0015 | -- | -- | 0.7090 |
| | 06/26/17 | <0.0025 | 0.0160 | 0.0587 | <0.001 | <0.001 | 0.0177 | <0.005 | 0.840 | <0.001 | 0.0137 | <0.0002 | 0.116 | <0.005 | <0.0015 | -- | -- | 0.7180 |
| | 07/11/17 | <0.0025 | 0.0149 | 0.0508 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0119 | <0.0002 | 0.114 | <0.005 | <0.0015 | -- | -- | 1.713 |
| | 07/19/17 | <0.0025 | 0.0146 | 0.0633 | <0.001 | <0.001 | 0.00963 | <0.005 | 0.860 | <0.001 | 0.0127 | <0.0002 | 0.121 | <0.005 | <0.0015 | -- | -- | 2.132 |
| | 06/22/18 | <0.0025 | 0.0154 | 0.0692 | <0.001 | <0.001 | <0.005 | <0.005 | 0.88 | <0.00095 J | 0.0122 | <0.0002 | 0.134 | <0.005 | <0.0015 | <0.212 | <1.192 | <1.40 |
| | 09/18/18 | NA | 0.0140 | 0.0446 | NA | NA | <0.002 | <0.003 | 0.759 | <0.0003 | 0.0141 | NA | 0.125 | NA | NA | 0.151 | <0.848 | 0.999 |
| | 06/03/19 | <0.0008 | 0.0142 | 0.0420 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.953 | <0.0003 | 0.0139 | <0.00008 | 0.109 | <0.002 | <0.0005 | <0.203 | 0.814 | 1.017 |
| | 10/02/19 | <0.0008 | 0.0139 | 0.0406 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.891 | <0.0003 | 0.0127 | <0.00008 | 0.106 | <0.002 | <0.0005 | -0.0288 | 0.901 | 0.901 |
| | 06/09/20 | <0.0008 | 0.014 | 0.0444 | <0.0003 | <0.0003 | <0.002 | 0.00334 J | 0.818 | <0.0003 | 0.013 | <0.00008 | 0.088 | <0.002 | <0.0005 | 0.0959 | 1.22 | 1.31 |
| MW-11 | 05/10/17 | <0.0025 | 0.0156 | 0.0899 | <0.001 | <0.001 | <0.005 | <0.005 | 0.82 | 0.00239 | 0.0125 | <0.0002 | 0.0082 | <0.005 | <0.0015 | -- | -- | 0.4560 |
| | 05/16/17 | <0.0025 | 0.018 | 0.0869 | <0.001 | <0.001 | 0.00731 | <0.005 | 0.85 | 0.0113 | 0.0144 | <0.0002 | 0.00841 | <0.005 | <0.0015 | -- | -- | 1.418 |
| | 05/18/17 | <0.0025 | 0.0188 | 0.0779 | <0.001 | <0.001 | <0.005 | <0.005 | 0.94 | 0.00204 | 0.0122 | <0.0002 | 0.00781 | <0.005 | <0.0015 | -- | -- | 0.6390 |
| | 06/07/17 | <0.0025 | 0.0175 | 0.0835 | <0.001 | <0.001 | <0.005 | <0.005 | 0.93 | 0.00171 | 0.0137 | <0.0002 | 0.00744 | <0.005 | <0.0015 | -- | -- | 0.5020 |
| | 06/21/17 | <0.0025 | 0.0203 | 0.0822 | <0.001 | <0.001 | <0.005 | <0.005 | 1.04 | 0.00322 | 0.0136 | <0.0002 | 0.00659 | <0.005 | <0.0015 | -- | -- | 1.084 |
| | 06/26/17 | <0.0025 | 0.0237 | 0.0954 | <0.001 | <0.001 | 0.0131 | <0.005 | 1.00 | 0.00593 | 0.0176 | <0.0002 | 0.00796 | <0.005 | <0.0015 | -- | -- | 3.067 |
| | 07/11/17 | <0.0025 | 0.0212 | 0.0725 | <0.001 | <0.001 | <0.005 | <0.005 | 1.00 | <0.001 | 0.012 | <0.0002 | 0.00765 | <0.005 | <0.0015 | -- | -- | 0.7530 |
| | 07/19/17 | <0.0025 | 0.0224 | 0.0709 | <0.001 | <0.001 | 0.00762 | <0.005 | 1.01 | 0.0018 | 0.0137 | <0.0002 | 0.00783 | <0.005 | <0.0015 | -- | -- | 1.551 |
| | 06/21/18 | <0.0025 | 0.0367 | 0.0805 | <0.001 | <0.001 | <0.005 | <0.005 | 0.96 | 0.00241 | 0.0135 | <0.0002 | 0.00465 | <0.005 | <0.0015 | <0.234 | <1.312 | <1.55 |
| | 09/18/18 | NA | 0.0382 | 0.0645 | NA | NA | <0.002 | <0.003 | 0.754 | <0.0003 | 0.0139 | NA | 0.00445 J | NA | NA | <0.188 | 0.597 | 0.785 |
| | 06/03/19 | <0.0008 | 0.0379 | 0.0834 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.0837 | <0.0003 | 0.0154 | <0.00008 | 0.00316 J | <0.002 | <0.0005 | <0.481 | 0.991 | 1.472 |
| | 10/02/19 | <0.0008 | 0.0379 | 0.0744 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.768 | 0.000391 J | 0.014 | <0.00008 | 0.00259 J | <0.002 | <0.0005 | 1.57 | 0.478 | 2.040 |
| | 06/09/20 | <0.0008 | 0.0293 | 0.0948 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.571 | 0.000675 J | 0.0156 | <0.00008 | 0.00215 J | <0.002 | <0.0005 | 0.163 | 1.31 | 1.480 |

Notes:
1. All concentrations in mg/L. Ra 226/228 Combined in pCi/L.
2. J - concentration is below sample quantitation limit; result is an estimate.
3. Non-detect Ra isotope results were assigned a value equal to the minimum detectable concentration.
4. NA = Not analyzed.

# ATTACHMENT 6 – SITE HYDROGEOLOGY AND STRATIGRAPHIC CROSS-SECTIONS OF THE SITE




**Explanation**

Downgradient CCR Monitoring Well

Upgradient/Backround CCR Monitoring Well

CCR Monitored Unit

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-17-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

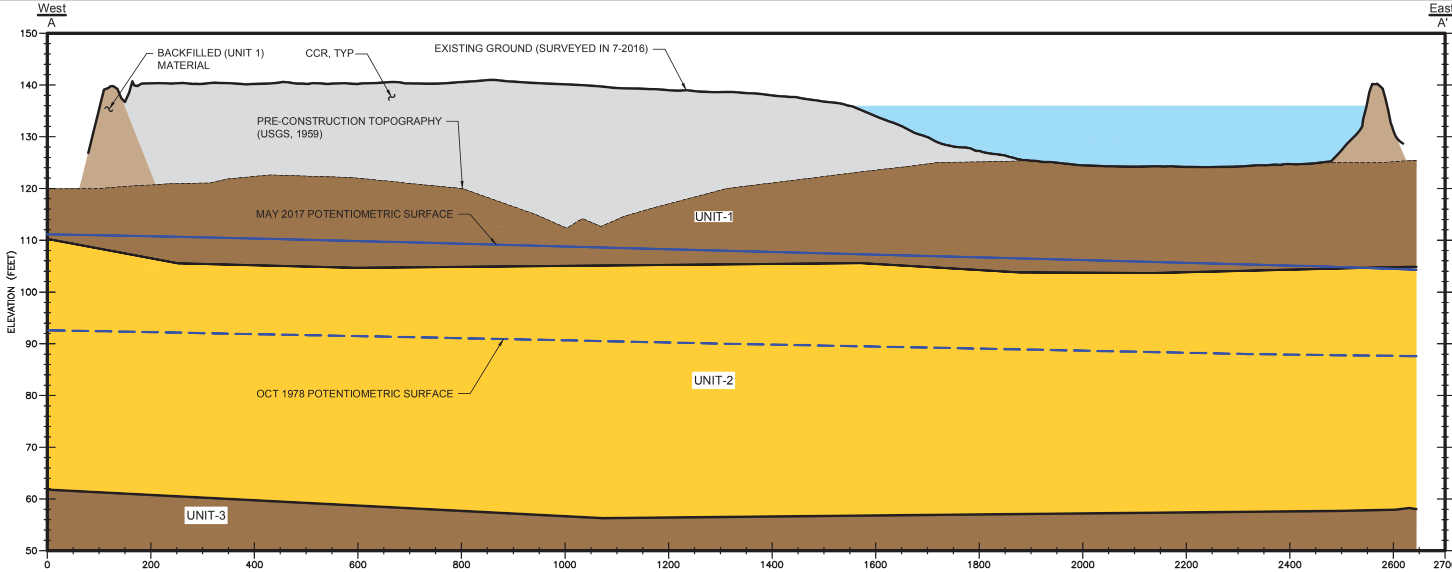
**Coleto Creek Power, LP**

**Monitoring Well Locations**

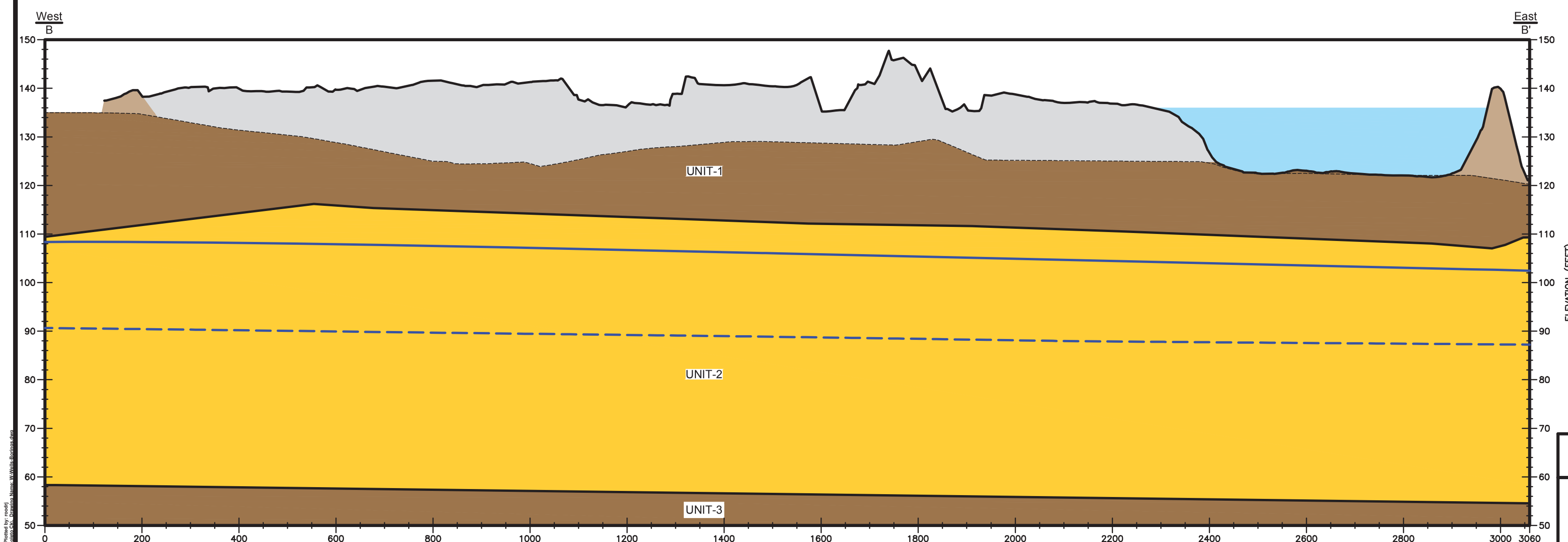
| | | |
|---|---|---|
| PROJECT: 17258 | BY: EEF | REVISIONS |
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/13/2017 - 6:10:57 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 2 - Monitoring Well Locations.mxd




PROFILE A-A' (LOOKING NORTH)
SCALE:1"=120'(H), 1"=12'(V)




PROFILE B-B' (LOOKING NORTH)
SCALE:1"=120'(H), 1"=12'(V)

NOTES:

July 2016 bathymetry and topographic surface data collected by Naismith Marine Services of Corpus Christi, Texas.

Unit 1 thickness based on EXHIBIT 3: BORING LOCATION PLAN AND THICKNESS CONTOURS OF INSITU COHESIVE SOILS from Sargent & Lundy (1978).

Original pond bottom depths and site stratigraphy are estimated and interpolated based on data in Sargent & Lundy (1978), 1959 USGS pre-construction topographic data, AECOM (2009), and various post-construction borings located outside of pond footprint.

October 1978 potentiometric surface estimated from data in Sargent & Lundy (1978).

May 2017 potentiometric surface based on groundwater data collected by Coleto Creek Power.

UNIT DESCRIPTIONS:

Unit 1 - Sandy CLAY and Silty CLAY. Surficial unit.

Unit 2 - Sand and Silty SAND with caliche and CLAY/Sandy CLAY lenses. First groundwater-bearing unit.

Unit 3 - CLAY and Silty CLAY. Basal unit.

Unit descriptions based on AECOM (2009).

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-17-2017

**Coleto Creek Power, LP**

GENERALIZED GEOLOGIC
CROSS SECTIONS A-A' AND B-B'

| PROJECT: 17258 | DATE: OCT 2017 | BY: RCAD-RR | CHECKED: CBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
ENGINEERING AND GEOSCIENCE
Texas Registrations: Engineering F-8542, Geoscience 50127

# CONCEPTUAL SITE MODEL AND DESCRIPTION OF SITE HYDROGEOLOGY (PRIMARY ASH POND)

The Coleto Creek conceptual site model (CSM) and Description of Site Hydrogeology for the Primary Ash Pond (PAP), located near Fannin, Texas are described in the following sections.

## REGIONAL SETTING

The Site is located on the Lissie Formation which is part of the Houston Group (BBA, 2017). The Lissie Formation is a deltaic plain that consists primarily of undifferentiated alluvium, fine-grained channel facies, and fine-grained overbank facies (Moore and Wermund, 1993). The Lissie Formation is middle Pleistocene in age and is described as primarily sands, silts, and clays containing iron and manganese nodules, calcareous concretions, and organic-rich lenses (Moore and Wermund, 1993). Below the Lissie Formation are the Goliad Formation, the Oakville Sandstone/Fleming Formation, and the Catahoula Formations which consist primarily of sand, clays, sands, and tuffs respectively (Nicot et. al, 2010).

Within the central coastal plain of Texas, the Lissie Formation's outcrop is a belt ranging from approximately 10 to 20 miles wide (Solis, 1981). Located within the western region of the Gulf Coast Basin, Lissie sediments extend into the subsurface, dipping southeast at 5 to 20 ft per mile (Doering, 1935). Maximum outcrop thickness is estimated to be about 600 ft in East Texas and 400 ft in South Texas (Plummer, 1932).

## SITE GEOLOGY

The Site is located on the Lissie Formation described above (BBA, 2017). Surficial soils in the vicinity of the Site include the following (described in order from shallow to deep) based on Site soil borings (BBA, 2017):

- Upper Confining Unit (Unit 1) – a laterally continuous low permeability unit approximately 11 to 25 feet thick that contains primarily sandy clay and clayey sand with intermittent layers of silty clay.
- Intermediate Sand Unit (Unit 2, Uppermost Aquifer) - a laterally continuous sand and silty sand unit approximately 40 to 54 feet thick that contains discontinuous cohesive layers and variable mineralized zones.
- Lower Confining Unit (Unit 3) - a laterally continuous basal clay unit greater than 25 feet hick consisting primarily of clay and silty clay.

The geologic units discussed above are shown on cross-sections attached to this demonstration.

## SITE HYDROGEOLOGY

The Site is located in the Coleto Creek Watershed, adjacent to Sulphur Creek, part of the Coleto Creek Reservoir. The Coleto Creek Reservoir was constructed in the 1970s for use as a cooling pond. The Uppermost Aquifer is monitored by nine monitoring wells surrounding the PAP as part of the CCR groundwater monitoring system. All wells included in the CCR monitoring system are screened in the intermediate sand unit (i.e., uppermost aquifer) at the Site (BBA, 2017).

The CCR groundwater monitoring system consists of nine monitoring wells installed in the Uppermost Aquifer and adjacent to the PAP (BV-5, BV-21, MW-4, MW-5, MW-6, MW-8, MW-9, MW10, and MW-11) (see Monitoring Well Location Map, and Well Construction Diagrams and Drilling Logs attached to this demonstration). The unit utilizes three background monitoring wells (BV-5, BV-21, and MW-8) as part of the CCR groundwater monitoring system.

## Hydraulic Conductivity

Hydraulic conductivity results from field testing (i.e., slug tests) at monitoring wells BV-5, BV-21, BV-22, MW-9, MW-10, and MW-11 in the intermediate sand unit (Uppermost Aquifer) ranged from approximately $5.14 \times 10^{-4}$ to $1.37 \times 10^{-2}$ centimeters per second (cm/s), with a geometric mean of approximately $3.35 \times 10^{-5}$ cm/s (BBA, 2017). Generally, hydraulic conductivities upgradient of the PAP were higher than hydraulic conductivities downgradient of the PAP, which was attributed to the varying clay and silt contents of the sandy soils (BBA, 2017).

## Groundwater Elevations, Flow Direction and Velocity

Groundwater elevations adjacent to the Site for the eight CCR background monitoring events from March to July 2017 ranged from approximately 101.1 feet North American Vertical Datum of 1988 (NAVD88) to 113.5 feet NAVD88, corresponding to groundwater depths from approximately 14.3 to 29.9 feet below ground surface (BBA, 2017). Groundwater typically flows east to southeast across the PAP towards Sulphur Creek, part of the Coleto Creek Reservoir. During the background monitoring events, the average horizontal hydraulic gradient was calculated as 0.0027 feet per foot (ft/ft) and 0.0029 ft/ft across the northern and southern boundaries of the PAP. The average groundwater flow velocity was between 0.13 and 9.46 feet per day (ft/day) (BBA, 2017). These groundwater elevations, flow direction, and flow velocities are consistent with the groundwater potentiometric map for October 2, 2019 provided as an attachment to this demonstration.

## REFERENCES

Doering, JA. 1935. Post-Fleming surface formations of coastal southeast Texas and southern Louisiana: American Association of Petroleum Geologists Bulletin, v.19, no.5, p. 651-688.

Moore, David W. and Wermund, E.G., Jr. 1993. Quaternary Geologic Map of Austin 4° x 6° Quadrangle, United States. Quaternary Geologic Atlas of the United States. Map I-1420 (NH-14). Scale 1:1,000,000.

Nicot, Jean-Philippe, Bridget R Scanlon, Changbing Yang, and John B Gates. 2010. Geological and Geographical Attributes of the South Texas Uranium Province, Texas Commission on Environmental Quality and Bureau of Economic Geology. April 2010.

Plummer, FB. 1932. Cenozoic Systems in Texas, Part 3, in The Geology of Texas: University of Texas, Austin, Bulletin 3232, p.729-795.

Solis, Raul Fernando. 1981. Upper Tertiary and Quaternary Depositional Systems, Central Coastal Plain, Texas, University of Texas at Austin Bureau of Economic Geology Report of Investigations No. 108.

# ATTACHMENT 7 – STRUCTURAL STABILITY AND SAFETY FACTOR ASSESSMENTS

# COAL COMBUSTION RESIDUALS
# SURFACE IMPOUNDMENT
# HISTORY OF CONSTRUCTION AND
# INITIAL HAZARD POTENTIAL ASSESSMENT, STRUCTURAL INTEGRITY ASSESSMENT, AND SAFETY FACTOR ASSESSMENT
# (REV. 1)

## COLETO CREEK POWER STATION
**FANNIN, TEXAS**

**JANUARY 24, 2018**
**(ORIGINAL VERSION: OCTOBER 13, 2016)**

*Prepared for:*

**COLETO CREEK POWER, LP**
Coleto Creek Power Station
Fannin, Texas

*Prepared by:*


**BULLOCK, BENNETT & ASSOCIATES, LLC**
Engineering and Geoscience
Registrations: Engineering F-8542, Geoscience 50127

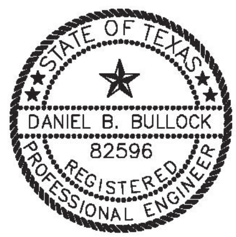
165 N. Lampasas Street
Bertram, Texas 78605
(512) 355-9198


BBA Project No. 17266

**Certification Statement 40 *CFR* § 257.73(c) - Structural Integrity Criteria for Existing CCR Surface Impoundments, History of Construction**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the History of Construction, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(c).




1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

**Certification Statement 40 *CFR* § 257.73(a) - Structural Integrity Criteria for Existing CCR Surface Impoundments, Potential Hazard Classification Assessment**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Potential Hazard Classification Assessment, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(a).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

**Certification Statement 40 *CFR* § 257.73(d) - Structural Integrity Criteria for Existing CCR Surface Impoundments, Initial Structural Stability Assessment**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Initial Structural Stability Assessment, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(d).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

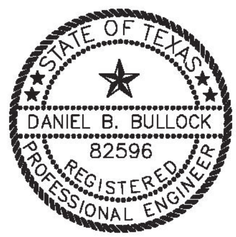
1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

**Certification Statement 40 *CFR* § 257.73(e) - Structural Integrity Criteria for Existing CCR Surface Impoundments, Initial Safety Factor Assessment**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Initial Safety Factor Assessment, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(e).




1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

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# 1.0 INTRODUCTION

Coleto Creek Power Station is located at 45 FM 2987 just outside the city of Fannin in Goliad County, Texas. The power station consists of one coal-fired boiler. Bottom ash and fly ash, or coal combustion residuals (CCR), generated in the boiler are either shipped off-site for beneficial re-use or managed in an on-site CCR surface impoundment (Coleto Creek Primary Ash Pond). Figures 1-1A and 1-1B provide site location maps showing the Primary Ash Pond configuration.

In April 2015, the Environmental Protection Agency (EPA) enacted rules codified in 40 *CFR* Part 257 to address potential risks associated with operating CCR surface impoundments at coal-fired power plants. This report has been prepared to specifically address the requirements identified in §257.73 *Structural Integrity Criteria for Existing CCR Surface Impoundments*[1]. Section 2.0 of the report provides the History of Construction (§257.73(c)(1)(i – xii)). Section 3.0 contains the Initial Potential Hazard Classification Assessment (§257.73(a)(2)), Section 4.0 provides the Initial Structural Stability Assessment (§257.73(d)(1)), and Section 5.0 includes the Initial Safety Factor Assessment (§257.73(e)(1).

[1]This revised History of Construction and Initial Hazard Potential Assessment, Structural Integrity Assessment, and Safety Factor Assessment replaces the initial version of this report dated October 13, 2016.

## 2.0 HISTORY OF CONSTRUCTION

The following History of Construction has been prepared in accordance with the requirements defined in §257.73 (c)(1)(i – xii).

### 2.1 Owner and Operator of CCR Unit

The Coleto Creek Power Station is owned and operated by Coleto Creek Power, LP. The address is as follows:

Coleto Creek Power Station
45 FM 2987
PO Box 8
Fannin, Texas 77960
Primary Ash Pond SWR No. 31911, Unit No. 001

### 2.2 CCR Unit Location

The Coleto Creek Power Station and associated CCR surface impoundment (Primary Ash Pond) is located just outside the city of Fannin in Goliad County, Texas on approximately 8,000 total acres. The Primary Ash Pond is approximately 190 acres in surface area with a reported storage capacity of 2,700 acre-feet (S&L, December 1978). The Primary Ash Pond is located adjacent to the facility's Evaporation Pond and Secondary Pond. Figure 2-1 (U.S.G.S. Area Map) shows the CCR surface impoundment on the most recent US Geological Survey (USGS) 7½ minute quadrangle topographic map.

### 2.3 Primary Ash Pond Statement of Purpose

The Coleto Creek Primary Ash Pond was constructed between 1976 and 1977 during the Power Station site development. The pond was designed and constructed to accommodate wastes from two coal-fired boilers (S&L, December 1978). However, only one boiler has been constructed and operated at the facility.

Bottom ash is collected from the boiler, combined with water, and transferred in slurry form for disposal in the facility's surface impoundment. Fly ash is collected from the boiler exhaust using a baghouse. The fly ash is transported pneumatically to two storage silos. From there, the fly ash is loaded into enclosed dry haul hoppers for off-site beneficial reuse. Fly ash not meeting required beneficial reuse specifications is combined with water and pumped to the facility's Primary Ash Pond for disposal. CCR solids settle out of the conveyance water in the Primary Ash Pond and the treated water overflows stoplogs within an outlet (weir box) structure then flows through a 30" diameter pipe to the smaller Secondary Pond as needed to control water levels. Water from the Secondary Pond can be recirculated to the ash sluice system or discharged in accordance with the facility's TPDES permit. The Secondary Pond has never received more than deminimis quantities of CCR; therefore, it is not subject to the CCR Rule.

Other plant wastes may also reportedly be sluiced into the Coleto Creek Primary Ash Pond including aqueous lab waste, boiler chemical cleaning rinseate, air preheater cleaning rinseate, air preheater cleaning residue, basin solids, de-ionizer regenerate wastewater, heat exchanger cleaning rinseate, waste de-ionizer resin beads, waste molybdate contaminated cooling water, waste filter media, boiler blowdown, demineralizer effluent, storm water, low volume waste, and effluent water/wastewater from plant processes (S&L, 1981).

### 2.4 Watershed Description

Coleto Creek Power Station is located in the lower half of the Coleto Creek Watershed (Figure 2-2) which is maintained by the Guadalupe-Blanco River Authority (GBRA). Coleto Creek is approximately 27 miles long, beginning in DeWitt County and travels through Goliad and Victoria Counties before its confluence with the Guadalupe River (GBRA, 2013). Approximately 558 square miles drain into the Coleto Creek Watershed. Typical land uses in the watershed include farming, ranching, oil and gas production and more recently, in-situ uranium mining. The only urbanized area in the watershed is the small city of Yorktown located upstream of the Power Station in DeWitt County.

Coleto Creek Reservoir Dam was constructed in the late 1970s to create the approximate 3,100 surface acre Coleto Creek Reservoir which serves as a cooling pond for the Coleto Creek Power Station. The Power Station discharges approximately 360,000 gallons per minute of water to the reservoir (GBRA, 2013). Perdido Creek, Turkey Creek, and Sulphur Creek also feed into the reservoir. Although the reservoir is managed by the GBRA, it is reportedly wholly owned by Coleto Creek Power, LP up to an elevation of 104 feet MSL.

## 2.5 Primary Ash Pond Foundation and Abutment Material Description

The Coleto Creek Primary Ash Pond was designed and constructed under the guidance of Sargent & Lundy Engineers (S&L). As part of the design process, S&L advanced 63 soil borings and installed eight monitoring wells in the immediate vicinity of the pond. Based on the information collected, the pond is constructed within a surface deposit of cohesive soils consisting of mostly clayey sand and silty clay with varying amounts of caliche. The soils are classified as CH, CL, and SC soils using the Unified Soil Classification System. These soils range in thickness from 4 to 20 feet, and average 9 feet beneath the Primary Ash Pond and Secondary Pond (average thickness data for the Primary Ash Pond only is not provided in the report) (S&L, December 1978). Figure 2-3 provides the Thickness Contour Map for In-Situ Cohesive Soils in the vicinity of the Primary Ash Pond. The impoundment dikes are continuous and do not include a conventional spillway, thus there are no abutments with other structures.

## 2.6 Primary Ash Pond Construction Summary

As noted in Section 2.3, the Coleto Creek Primary Ash Pond was constructed between 1976 and 1977 during overall site development. Construction was performed by H. B. Zachary Construction with full-time on-site inspection by S&L. Field testing of site soils and construction materials was performed by Trinity Testing Laboratory, Inc. In general, the Primary Ash Pond dikes have a total interior circumference of approximately 10,975 feet and a height ranging from approximately 4 feet up to 39 feet. The maximum reported storage volume is 2,700 acre-feet in the Primary Ash Pond (S&L, December 1978).

As further described below, a topographic and bathymetric survey was conducted for the Primary Ash Pond in July 2016. Results of that survey were combined with assumptions regarding the original base elevation of the pond (limited as-built base elevation data is available) to generate area-capacity estimates for use in subsequent assessments presented in this report. The area-capacity estimates generated using 2016 data indicate that the top of dike capacity is approximately 3,700 acre-ft, or nearly 1,000 acre-ft more than originally reported by S&L. The originally reported 2,700 acre-ft corresponds to an approximate elevation of 135 feet in the 2016 assessment, which is also the operating level identified in the S&L report. For the purposes of this report, the larger capacity is used where appropriate.

In-situ cohesive soils were used as the Primary Ash Pond lining and the geotechnical characteristics of those soils are documented in the S&L construction summary report dated December, 1978. Laboratory geotechnical testing was performed on representative samples collected post-construction from the borings advanced in the in-situ liner soils. The median laboratory permeability was reported as $3.8x10^{-8}$ cm/sec. The average plasticity index, liquid limit, and fines content were listed as 23%, 42%, and 40%, respectively. S&L concluded that the soil liner as constructed overall either met or exceeded requirements for a 3-foot thick compacted clay liner of $1x10^{-7}$ cm/sec permeability in accordance with Texas Department of Water Resources technical guidelines for the design and construction of waste water ponds that were in place at the time of construction (S&L, December 1978).

Primary Ash Pond dikes were constructed using controlled and compacted cohesive fill excavated from borrow areas around the Plant site (S&L, December 1978). As noted previously, site soils generally consist of clayey sand and silty clay, with various amounts of caliche. The dikes were constructed with side slopes ranging from 2.5 and/or 3.0 horizontal to 1.0 vertical. This side slope was specified in accordance with the Bureau of Reclamation Design of Small Dams, 1974, for small homogenous dams constructed with cohesive fill on a stable foundation. Side slopes were reportedly seeded.

Dike fill was specified to be placed and compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698. Four hundred and twenty field density tests conducted specifically on Primary Ash Pond dike materials during construction reported densities ranging from a minimum of 92 percent up to 110 percent, with an average of 98 percent.

The exterior dikes for the Primary Ash Pond were constructed approximately 4 to 39 feet above the existing grade. The crest of the dike is reportedly 15 feet wide and includes a gravel perimeter access road. Typical cross-sections depicting the Primary Ash Pond construction configuration are provided on Figure 2-5.

The Primary Ash Pond and Secondary Pond are separated by a dike that has side slopes of approximately 3.0 horizontal to 1.0 vertical and a height of approximately 40 feet above natural grade. This dike also has a crest that is approximately 15 feet wide and contains a gravel road (see Figure 2-5). An outlet structure intersects the divider dike to allow the overflow of water from the Primary Ash Pond to the Secondary Pond. The structure inlet is located in the Primary Ash Pond and consists of a 7-feet wide by 9.5-feet long concrete structure configured with stoplogs supported by a 12-feet wide by 14.5 feet long foundation. The inlet structure is accessed by a walkway extending from the shared Primary Ash Pond and Secondary Pond dike into the Primary Ash Pond. The concrete inlet structure is intersected by a 30-inch diameter corrugated metal pipe (CMP) with 7-feet by 7-feet steel seepage collars at 28 feet on center. The CMP has an inlet elevation of El. 106 and an outlet elevation of El. 105 (CDM, March 2011).

Bottom ash and boiler slag are sluiced along the south embankment into the Primary Ash Pond via one 12-inch-diameter high density polyethylene (HDPE) pipe and one 12-inch-diameter carbon steel pipe (CSP). The ash slurry is sluiced onto a screen processor to separate fine and coarse material. Demineralizer effluent is sluiced into the Primary Ash Pond along the southeast embankment through an 8-inch-diameter HDPE pipe.

A boiler area sump in the plant collects other liquid waste and sluices it through a 20-inch diameter Class 200 polyvinyl chloride (PVC) pipe along the Primary Ash Pond west embankment adjacent to the groin with the evaporation pond. A valve in the pipeline also allows the boiler area sump water to be discharged directly into the evaporation pond. Flow to the Primary Ash Pond from the boiler area sump is regulated depending on water levels and weather conditions. The pipeline can also be used as a clean water decanting pipe.

In 2012, Coleto Creek Power, LP contracted AECOM Technical Services, Inc. (AECOM) to prepare a hydraulic and geotechnical stability analysis of the Primary Ash Pond (AECOM, March 2012). Under that study, AECOM conducted field and laboratory testing to evaluate the current geotechnical stability of the Primary Ash Pond dike system. According to the report, AECOM found that “the ash pond has adequate factor of safety under the steady-state, normal operating, maximum operating, rapid drawdown, and seismic conditions modeled.”

## 2.7 Primary Ash Pond Drawings

Figures 2-4 and 2-5A, -B, and -C provide dimensional drawings of the Primary Ash Pond as required in §257.73(c)(1)(vii).

## 2.8 Primary Ash Pond Instrumentation

The Coleto Creek Primary Ash Pond water levels are observed on a daily basis during site inspections using the pond staff gauge located on the inlet structure. The staff gauge has a maximum reading of +140 feet which approximately corresponds to the top of the dike embankment. Based on an on-site topographic survey conducted by Naismith Marine Services of Corpus Christi, Texas (Naismith) in July 2016, the elevation 140 reading on the staff gauge corresponds to approximate elevation 140.4 feet NAVD88. Furthermore, the plant datum (referred to as MSL) was surveyed and determined by Naismith to be equal to NAVD88. Water levels are normally maintained at an elevation of El. 136 feet (NAVD88) or lower. There is no other instrumentation used to monitor the Primary Ash Pond.

## 2.9 Primary Ash Pond Area-Capacity Curves

Figure 2-6 provides the area-capacity curves for the Primary Ash Pond.

## 2.10 Primary Ash Pond Spillway and Diversion Design Features

The Primary Ash Pond was not constructed with a conventional spillway. Water from the Primary Ash Pond is primarily lost through evaporation. Excess water that needs to be removed to maintain proper freeboard distances can either be discharged through the Secondary Pond and subsequently through Outfall 003 in accordance with the plant's TPDES permit or recirculated back to the plant for re-use.

Pond water levels are maintained to accommodate safe plant operations and are primarily dependent on plant water and ash loading rates as no storm water runoff from the surrounding area (other than run-off from the dike crest) enters the pond. Water levels are monitored daily and the amount discharged to the outfall or recirculated to the plant can be adjusted to accommodate for expected rain events or drought conditions. The Primary Ash Pond is currently operated with more than four feet of freeboard to allow removal of bottom ash and fly ash for off-site beneficial reuse.

## 2.11 Primary Ash Pond Surveillance, Maintenance, and Repair Provisions

Formal and informal inspections of the pond are conducted by qualified facility personnel for the purpose of ensuring proper and safe operation in accordance with the provisions defined in §257.83(a). Weekly inspections include observation of the static pond water level, vegetation control, and structural integrity evaluations of dike embankments and any noted issues are addressed as necessary. In addition to the weekly observational inspections performed by site personnel, formal inspections of the pond conditions are conducted by an independent consulting firm annually in accordance with §257.83(b).

## 2.12 Primary Ash Pond Structural Stability History

There is no record or knowledge of structural instability of the Primary Ash Pond. The pond dikes have been maintained to minimize the potential for structural failure.

## 3.0 INITIAL POTENTIAL HAZARD CLASS ASSESSMENT

According to 40 *CFR* §257.73(a)(2), the owner and operator of a CCR surface impoundment must assign a hazard potential classification to each operating unit. For the purposes of the rule, hazard potential classification means "the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances." The impoundment must be classified as high hazard, significant hazard, or low hazard. Each hazard potential classification is defined as follows (§257.53):

1) *High hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

2) *Low hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

3) *Significant hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

In 2010 the United States Environmental Protection Agency (USEPA) contracted CDM to perform a site assessment of the Primary Ash Pond at the Coleto Creek Power Station. As part of the assessment, CDM assigned the pond with a Low Hazard classification (CDM, 2011).

Subsequent to the CDM report findings, Coleto Creek Power, LP contracted AECOM to perform geotechnical studies to further evaluate the structural stability of the CCR surface impoundments. AECOM implemented a subsurface investigation and performed a geotechnical stability evaluation, a liquefaction assessment, and hydraulic analysis. AECOM also performed an independent hazard assessment of the Primary Ash Pond and Secondary Pond. The results of that assessment supported the initial CDM classification of Low Hazard.

### 3.1 Dam Breach Analysis

The Coleto Creek Primary Ash Pond is the only CCR-regulated surface impoundment at the Coleto Creek Power Station and is therefore subject to the Hazard Classification Assessment under the CCR rules. Because the Primary Ash Pond is hydraulically connected to, and is separated by a dike system from, the Secondary Pond, it is necessary to include the Secondary Pond when evaluating potential failure scenarios as noted below. Although the Secondary Pond is not a CCR-regulated unit, it is subject to operational and safety standards established by the Texas Commission on Environmental Quality (TCEQ) in its Dam Safety rules (30 TAC Part 1 Chapter 299).

Bullock, Bennett & Associates (BBA) performed a simplified dam breach analysis of the Primary Ash Pond and Secondary Pond to support the loss of life, and environmental and economic impact analyses. The Primary Ash Pond and Secondary Pond combined, as indicated by the most recent survey conducted in July 2016, have a maximum storage capacity of approximately 4,000 acre-ft and a maximum levee height for the Secondary Pond of approximately 39 feet above adjacent lake level of 101 feet MSL. Construction was completed in 1978 and the effective fluid storage capacity in the Primary Ash Pond has diminished with the placement of CCR over time. According to topography and bathymetric survey data collected in July 2016, the fluid capacity in the Primary Ash Pond has been reduced to approximately 1,720 acre-ft at the maximum dike crest height.

The Primary Ash Pond and Secondary Pond are located next to the Coleto Creek Reservoir which was constructed to serve as a cooling pond for the Power Station. The reservoir is divided into a "hot" side and a "cool" side. The ponds are located immediately adjacent to the hot side of the lake. The hot side of the lake is created from Sulphur Creek behind Dike No. 1 (Dike No. 1 Lake) which is connected to Turkey Creek behind Dike No. 2 (Dike No. 2 Lake) by a secondary flume. Water from these lakes then flows into Main Lake which is the cool side. Decant water from the Secondary Pond can be combined with other plant water then routed through TCEQ-approved Outfall 003 to the hot side of the lake. Cool water is pumped into the Power Station from the Main Lake.

GBRA provided area-capacity tables for the Coleto Creek Reservoir and Dike Lake Nos. 1 and 2. These tables are presented as Attachments 3-1, 3-2, and 3-3 in Appendix E. Dike No. 1

Lake consists of approximately 164 acres at the normal operating elevation of 101 feet MSL. Dike No. 2 Lake is approximately 429 acres at the normal operating elevation of 101 feet MSL. The two Dike Lakes are separated from Coleto Creek Reservoir by splitter dikes with an approximate elevation of 102 feet MSL (GBRA, 2016). Coleto Creek Reservoir covers an area of approximately 2,652 acres at a normal operating elevation of 98 feet MSL (GBRA, 2016). Coleto Creek Power, LP reportedly controls the lake up to an elevation of 104 feet MSL. An area map showing the relative locations of the Primary Ash Pond, Secondary Pond, Dike Lakes, and Coleto Creek Reservoir is presented in the attachments as Figure 1-1.

For the purposes of this evaluation, a conservatively worst-case dam breach scenario was developed assuming that the breach was due to overtopping of the surface impoundment levees and that the breach occurs in the shared Primary Ash Pond and Secondary Pond dike and subsequently in the Secondary Pond dike adjacent to Coleto Creek Reservoir, releasing the entire water contents of both ponds. This scenario allows for the greatest quantity of pond decant water to be released.

An evaluation of potential water and residual solids flow paths was performed to support the loss of life, environmental, and economic evaluations. Surface elevation cross-sections assembled from Google Earth™ profiles of the areas adjacent to the pond dikes were reviewed to estimate the potential flow path of the released water and solids. As shown in Figure 1-1A, the wet side of the ponds are bound by the Evaporation Pond followed by Dike No. 1 lake on the north-northwest, Dike No. 1 lake on the northeast corner, and the primary plant discharge flume on the east. The surface elevation of the terrain that bounds the east side of the discharge flume appears to extend to approximately elevation 132 feet. The flume channel, therefore, appears to be located within a larger basin bounded to the west by the Primary Ash Pond and Secondary Pond dikes (approximate elevation 140 feet) and to the east by land mass (approximate elevation 132 feet). The distance between the dike on the west side of the basin and land mass high points on the east side appears to be approximately 300 feet. The flume channel and basin would route flow from an east-side breach of the dike to the hot side of the lake. Released water and solids, therefore, would initially flow to the hot side of the lake regardless of the location of the breach. From there, water levels would increase one foot (the amount of available freeboard behind Dike No. 1 and Dike No. 2 lakes) then flow into the Main lake. Eventually all water would be released into the Main lake.

Using the tables provided by GBRA, a one-foot increase in the Main Lake elevation requires an additional approximately 2,720 acre-feet of water. The estimated maximum volume of discharge from the Primary Ash Pond and Secondary Pond is approximately 1,720 acre-feet of water, resulting in a water surface elevation change on the reservoir of approximately eight inches. An eight-inch change in water surface elevation is considered to be nominal and would not result in the loss of major infrastructure elements or disrupt lifeline facilities.

### 3.2 Loss of Life Evaluation

The Primary Ash Pond and Secondary Pond are located apart from the active industrial areas of the Power Station. Two fly-ash silos are located adjacent to the western border of the Primary Ash Pond and loading of trucks for off-site transport and beneficial reuse of the fly ash regularly occurs at this location. These silos and truck loading operations are adjacent to the southwest half of the Primary Ash Pond which is filled with dry and compact CCRs, and any catastrophic failure of the impoundment in this area is highly unlikely. If a failure were to occur, it would probably be located on the "wet" side of the pond, including the northern or eastern dikes for both the Primary Ash Pond and Secondary Pond (see Figure 1-1). There are no regular or active plant operations that occur downstream of those areas where personnel would be expected to be present in the event of a catastrophic failure of the dike. There are no residences or other off-site manned operations immediately downstream of the ponds. As noted in Section 3.1 the Dike 1, Dike 2, and Main Lakes would absorb the released water and raise reservoir levels a nominal amount (less than a foot). Loss of life in the event of a catastrophic failure of the surface impoundment dike system, therefore, is considered to be improbable.

### 3.3 Economic and/or Environmental Loss Evaluation

Additional consideration was given to the impacts of the water quality from a large volume discharge from Primary Ash Pond and Secondary Pond into the Coleto Creek Reservoir. Using the volume ratio of pond water (approximately 1,720 acre-feet) that could potentially be discharged into the Coleto Creek Reservoir to the existing volume of water in the reservoir (approx. 31,280 acre-feet at elevation 98 feet msl), the impacts to the water quality are minimal (31,280 acre-feet/1,720 acre-feet = ~18 dilution factor of analytes in the Primary Ash Pond water). Discharge of Secondary Pond water is currently allowed to the Coleto Creek Reservoir under Permit No. WQ002159000 (TCEQ, 2010).

Currently, the coal combustion by-products are sluiced into the Primary Ash Pond. The assumed ratio of solids-to-water is approximated at 20%-to-80%. The solids settle out of solution and the water decants to the surface. As the solids settle out of solution, they consolidate. Additionally, based on field observations the ash “sets up” similar to cement, becoming very hard and massive. The expected flow of any unconsolidated solids from the Primary Ash Pond is believed to be minimal.

Additionally, approximately 90% of the approximate 90,000 cubic yards of ash produced annually is currently being sold and recycled rather than disposed in the Primary Ash Pond (Coleto Creek Power, 2015). However, for the sake of conservatism, it is assumed that a volume of ash equivalent to six months of production (assuming no recycling) is disposed in the Primary Ash Pond and may not be consolidated, and may flow should a breach occur. Under these assumptions, there is potential for approximately 45,000 cubic yards (approximately 28 acre-feet) of ash flow. The ash volume would be in solution with the decant water, displacing an equal volume of the decant water. This ash would be expected to be contained within the hot side of the lake. Impacts would therefore be primarily limited to the owner’s property.

### 3.4 Hazard Potential Classification

Based on a review of previous studies, analytical data, ash production/recycling volumes, available impoundment capacities, available lake capacities, observed current conditions at the site, assumptions, and other factors, the Coleto Creek Primary Ash Pond is classified as a Low Hazard Potential impoundment.

## 4.0 INITIAL STRUCTURAL STABILITY ASSESSMENT

According to §257.73(d), the owner or operator of the CCR surface impoundment "must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein."

*Stable foundations and abutments.* As noted in Section 2.5, the Primary Ash Pond was constructed on a foundation of in-place cohesive soils whose geotechnical characteristics either met or exceeded Texas Department of Water Resources technical guidelines for the design and construction of waste water ponds that were in force at the time of construction (S&L, December 1978). The dikes are continuous, with no constructed abutments. A review of the geotechnical data collected at the time of construction confirms that the foundation for the pond should continue to be stable over its operational life.

*Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.* The Primary Ash Pond dikes were constructed with 2.5 to 3 horizontal to 1 vertical side slope. Outer slopes were seeded for slope protection but interior dike surfaces were not. Vegetation does naturally occur on these surfaces thus assisting in the control of erosion. The interior dike sections in areas impounding water are armored with rock riprap. The dikes are regularly inspected in accordance with §257.83(a) and (b) and repaired as necessary to maintain their integrity. An engineering site inspection was performed in December 2016 in accordance with the requirements defined in §257.83(b) which included an evaluation of the surface impoundment dikes. No additional slope protection was deemed to be necessary at that time. (BBA, 2018).

*Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.* The dike system was engineered by S&L and constructed in approximately 1978. As discussed in Section 2.6 – Ash Pond Construction Summary, dike fill material was placed in controlled, mechanically compacted lifts, averaging approximately 98% maximum dry density as determined by ASTM D698. Full time field inspection was performed during construction, with approximately 420 field density tests performed on the dikes.

*Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection.* The slopes of the dikes and surrounding areas are vegetated as required. The slopes are reportedly mowed as necessary to comply with height of grass requirements.

*A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of the section of the rule*. As is common with surface impoundments of this type, the Primary Ash Pond was not constructed with a spillway. The results of the hydraulic analysis completed in support of the Inflow Design Flood Control System evaluation (BBA, January 2018) showed that the Primary Ash Pond, as configured without a spillway and when operated at a maximum storage operating elevation of 136.1 feet NAVD88, has sufficient capacity to manage the design flood. The design flood is designated by rule for a Low Hazard Potential surface impoundment (see Section 3.0) to equal the 100-year rainfall event. It is therefore not necessary for the surface impoundment to have a spillway.

*Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.* The weir system and pipe penetrations were visually inspected by a professional engineer in December of 2016 (BBA, 2018). There were no observations of conditions that would negatively impact operation of the structures. The inspection was limited to visual observations during a site visit, and did not include, for instance, use of a remote video camera in the outlet structure pipe for inspection of internal conditions.

*For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.* The dike that separates the Primary Ash Pond from the Secondary Pond was evaluated for stability in the event of rapid drawdown of the Secondary Pond, as further discussed in Section 5.0 Initial Safety Factor Assessments. As noted in the Initial Safety Factor Assessment, the modeled slope stability results indicate this divider dike exceeds the required safety factors under the max surcharge pool/rapid drawdown scenario.

No structural stability deficiencies were identified in this initial Structural Stability Assessment that would require corrective measures.

## 5.0 INITIAL SAFETY FACTOR ASSESSMENTS

§257.63(e) requires that owners of existing and newly constructed CCR surface impoundments conduct initial and periodic safety factor assessments. The purpose of the safety factor assessment is to document that the as-constructed CCR surface impoundment configuration either meets or exceeds regulatory safety factor criteria under long-term, maximum storage pool loading conditions, and maximum surcharge pool loading conditions. In addition, the liquefaction and seismic factor of safety must be estimated.

The rule requires that the safety factor evaluation be performed across the critical cross section of the impoundment dikes. For the purposes of this initial assessment, previous data collected as part of historical site assessments as noted in Section 4.0 were evaluated to determine whether it represented the critical cross section of the pond dikes that would be most susceptible to failure. The critical cross sections for the Primary Ash Pond, as shown in Figure 2-5A, are in the areas of the pond that still contain water, are generally representative of the tallest sections of dikes and contain representative side slopes, and are where the highest potential impacts would be expected were a dike breach to occur.

Geotechnical sampling and analysis of as-constructed dike materials has been conducted during three different events. The first was performed by S&L during and after construction of the pond in 1978. Subsequent studies were performed in 1981 by Underground Resource Management, Inc. (URM) (URM, July 29, 1981) and in 2012 by AECOM Technical Services, Inc. (AECOM, March 2012).

BBA reviewed the previous site geotechnical investigation data gathered by S&L, URM and AECOM used in previously conducted stability analyses of the dikes and the data appears sufficient to provide a reliable estimation of current conditions, therefore no further geotechnical testing was required for the current analysis. Coleto Creek Power provided all previous investigation data to BBA for use in evaluation and preparation of an updated structural stability analysis. The most recent stability analysis, conducted by AECOM in 2012, summarizes previous evaluations by others. A brief summary of previous geotechnical investigations is provided below.

S&L completed approximately 80 soil borings to document the subsurface soils in and around the Primary Ash Pond. All of the borings were reportedly completed prior to construction of the ponds, in support of the pond design. Following commissioning of Unit 1 and filling of the ponds to normal operating levels, seepage was observed west and adjacent to the Recirculating Pump House. URM was contracted to investigate the seeps and their potential impact to dike stability. URM completed a geotechnical investigation of the pond dikes near the seep location, and assessment of both the dike embankment stability and groundwater quality indicated no detrimental effects due to the seep at that time and that, based on site geotechnical investigations, laboratory data analysis, and slope stability modeling of the dike, short and long-term stability of the embankments in the study area were considered satisfactory (URM, July 29, 1981).

AECOM, upon reviewing previous geotechnical investigations from S&L and URM, completed a supplemental geotechnical investigation program to evaluate stability of the dike system in 2012. While their review of previous data found the data to be acceptable for use in evaluation of dike stability of the ponds, they also identified critical areas of interest within the dike system for further evaluation, and implemented a geotechnical investigation of these critical areas (cross sections A and B as shown in Figure 2-5A of the attachments). BBA agrees that these locations are the critical areas to evaluate for stability, given cross section A is near a location of historically observed seepage at the outside toe of the Primary Ash Pond dike and cross section B is located along the splitter dike that separates the Primary Ash Pond and Secondary Pond. It should be noted that due to recent reduction in water surface operational levels at the Primary Ash Pond, the historically observed seepage in the area of cross section A has recently been observed to be dry.

AECOM field data gathering included construction of 8 geotechnical borings extending from depths ranging from 29.5 to 121.5 feet below ground surface (bgs). Five borings were completed from the top of the dikes and three borings were located along the exterior toe of dike. Laboratory testing included water content, dry unit weight, calibrated penetrometer, grain-size distribution, triaxial shear testing and direct shear testing. AECOM contracted with Subsurface Exploration Services, LLC of Green Bay, Wisconsin to complete the field work, and AECOM field staff observed the exploration work, assisted with collection of soil samples, and completed field boring logs. Laboratory testing was conducted by AECOM geotechnical laboratory technicians. AECOM geotechnical laboratories are reportedly certified by multiple state and federal agencies to complete geotechnical testing in accordance with American Society for Testing and Materials (ASTM), United States Army Corp of Engineers (USACE), and State Department of Transportation approved methods and standards (AECOM, 2012).

BBA reviewed the data available from the S&L, URM, and the supplemental data gathered by AECOM including geotechnical data, cross sections, and methodology used by AECOM for modeling slope stability. The data and methods are suitable for evaluation of slope stability of the critical cross section locations. The geotechnical investigation data from the AECOM study, including soil bore logs and geotechnical laboratory data is included in Appendices A and B, respectively, of this report.

BBA contracted Naismith to complete an existing conditions topographic survey of these critical cross section areas, as well as topography of the entire perimeter dike system and bathymetry of the pond interiors. Using the 2016 existing conditions survey data, and geotechnical data obtained from the previous studies (including similar lithology as indicated in the AECOM study for the critical cross sections), BBA graphically reconstructed the cross section locations A and B for completion of further analysis. Upon review of all data and methodologies used by AECOM in analysis of the critical cross section locations of the dike systems, BBA completed a similar analysis. BBA compared the 2016 as-built topographic survey cross sections at cross section locations A and B to the design sections. Based on this review it appeared the as-built sections generally were slightly overbuilt when compared to the design sections, and contained slightly gentler slopes. Based on comparison of design versus as-built sections at each location it was determined that the design sections were likely worse case than the as-built sections in regards to analysis for slope stability, therefore only the design sections were evaluated.

Based on review of the AECOM bore logs and geotechnical laboratory test data, BBA generally agrees with the lithology and soil engineering strength properties used in the AECOM stability analysis. However, BBA's evaluation of field data and laboratory indices testing did result in minor changes in assumed soil properties – the reduction of the effective shear strength of caliche from 36 degrees to 34 degrees for cross section B and the increase in unit weight from 120 pounds per cubic foot (pcf) to 130 pcf. BBA evaluated stability with both sets of data and observed that these changes do not alter the overall safety factor for these sections, however, the revised data set appear more appropriate based on review of field and indices test data and are therefore reported. Review of the data indicates that generally the AECOM engineering strength properties used in their analysis were conservative and representative of the field and laboratory data gathered.

Similar to the AECOM stability evaluation, BBA evaluated the dikes using two sets of time-dependent strength parameters, effective stress and total stress. Effective stress analysis was used to model drained, long-term, steady-state loading conditions where excess pore pressures have had time to dissipate. This would be the normal steady state operating conditions (maximum storage pool) of the pond. Total stress analysis was used to model undrained, short-term loading conditions such as maximum surcharge pool, rapid drawdown, and seismic events, where excess pore water pressure could develop in fine grained silts clays and not have had time to dissipate. The rapid drawdown case is representative of the conditions that would occur immediately after a significant flood event, or if the Secondary Pond was rapidly drained.

The seismic conditions analyze the effect an earthquake would have on the stability of the dike. BBA selected a maximum probable earthquake for the Coleto Creek Power Station based on the 2014 United States Geological Survey National Seismic Hazard Maps found at (http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014pga2pct.pdf). The maximum probable earthquake has a peak ground acceleration of 0.03 g with a 2 percent Probability of Exceedance in 50 years.

Table 5-1 summarizes the effective and total stress soil strength parameters used for each soil layer in the analysis:

**TABLE 5-1**
Soil Strength Parameters used in Geotechnical Stability Analysis
(color shading as shown in cross sections)

**Cross Section A-A'**

| Soil Description | Unit Weight (pcf) | Effective Stress Strength Parameters | | Total Stress Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Ø' | c (psf) | Ø |
| Clayey Sand Fill Material (SC) | 130 | 150 | 29 | 3,000 | 0 |
| Natural Silty Clay or Clayey Sand (CL, SC, CL-Caliche) | 130 | 150 | 27 | 4,000 | 0 |
| Natural Sands (SM, SP, SC) | 130 | 0 | 36 | 0 | 36 |

**Cross Section B-B'**

| Soil Description | Unit Weight (pcf) | Effective Stress Strength Parameters | | Total Stress Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Ø' | c (psf) | Ø |
| Clayey Sand Fill Material (SC) | 130 | 150 | 29 | 3,000 | 0 |
| Caliche (SC) | 135 | 250 | 34 | 250 | 0 |
| Medium Dense to Dense Sands (SP) | 132 | 0 | 36 | 0 | 36 |
| Dense to Extremely Dense Sands (SP, SC, SM, SP-SM) | 133 | 0 | 38 | 0 | 38 |
| Very Stiff to Hard Silty Clay (CL, CL-ML, CH) | 128 | 0 | 29 | 3,250 | 0 |

Based on field observations, the ash located within the Primary Ash Pond tends to set up, much like cement, into a hard, blocky mass of material. However, as was assumed in the AECOM evaluation, for conservative modeling purposes the interior material was considered to be water, with no structural strength that would add a stabilizing force.

Four model conditions were evaluated at each cross section location, as deemed applicable, including: maximum storage pool (the highest normal operating level) and maximum surcharge pool (level reached during inundation from design storm) conditions, rapid drawdown, and the seismic condition. The normal operating water level, based on the Hydrologic and Hydraulic Capacity Requirements evaluation completed by BBA (BBA, January 2018) is 136.1 (NAVD88).

The water level projected in event of a design storm (the 100 year, 24-hour storm) is 138.0 (NAVD88). The lowest top of dike elevation observed in the 2016 survey was 139.7 (NAVD88).

Cross section A, located in the observed historical seep location near the southeast corner of the Primary Ash Pond, was assumed to have a water table elevation at the ground surface along the exterior toe of slope, as observed in the field and as documented in the AECOM stability analysis as well as the BBA inspection conducted in December 2016. Cross section B, located along the separator dike between the Primary Ash Pond and Secondary Pond, was modeled with the maximum storage and maximum surcharge pool elevations. Cross section B was also evaluated for the rapid draw down (RDD) condition. It is conservatively assumed the phreatic surface at cross section A exits the exterior dike surface at approximately 1/3 the height of the dike (although the only field observations of wet soil occurred at the toe of slope, where the seep locations are located). The phreatic surface for cross section B is at the same elevation as the assumed pond water levels.

Dikes should be designed with appropriate safety factors. Required safety factors per §257.73(e)(1)(i) through (e)(1)(iv) for critical embankment sections are as follows:

**Table 5-2**
Required Factors of Safety

| Condition | Required Factor of Safety |
|---|---|
| Long-Term, Maximum Storage Pool Loading Static Factor of Safety | 1.50 |
| Maximum Surcharge Pool Loading Static Factor of Safety | 1.40 |
| Seismic Factor of Safety | 1.00 |
| Liquefaction Factor of Safety | 1.20 |

BBA used the 2D limit equilibrium computer program SLIDE 7.0 by Rocscience to complete the slope stability analysis for the critical cross sections. A combination of the Simplified Bishop and the Morgenstern-Price method of slices, for both circular and block-type failures, was used to analyze the stability of the slopes. Eighteen stability cases were evaluated for the critical cross sections as summarized in Table 5-3, and the lowest factor of safety generated for each case is reported:

**Table 5-3**
Slope Stability Analysis Summary

| Cross Section | Conditions | Effective Stress Analysis Safety Factor | | Total Stress Analysis Safety Factor | |
|---|---|---|---|---|---|
| | | Block | Circular | Block | Circular |
| A-A’ | Max Storage Pool/Static | 1.8 (1) | 1.9 (2) | 4.9 (3) | 5.5 (4) |
| A-A’ | Max Surcharge Pool/Static | 1.7 (5) | 1.8 (6) | 4.9 (7) | 5.5 (8) |
| A-A’ | Max Storage Pool /Seismic | NA | NA | 4.3 (9) | 4.8 (10) |
| B-B’ | Max Storage Pool /Static | 2.8 (11) | 2.8 (12) | 3.7 (13) | 5.1 (14) |
| B-B’ | Max Surcharge Pool, Rapid Drawdown | NA | NA | 2.0 (15) | 2.1 (16) |
| B-B’ | Max Storage Pool/Seismic | NA | NA | 3.0 (17) | 4.1 (18) |

Note: (#) = Case Number (referenced on model output data in Appendix C).

Cross sections, bore logs, laboratory data, and SLIDE 7.0 stability model output data are included in Figure 2-5A and Appendices A, B, & C, respectively of this report.

As shown in Table 5-3, eighteen stability cases were modeled and all cases meet or exceed required factors of safety.

### 5.1 Liquefaction Assessment

BBA utilized the liquefaction assessment process outlined in the U.S. EPA guidance document titled RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, April 1995, published by the Office of Research and Development and other relevant source documents to perform this liquefaction factor of safety evaluation. As identified in those documents, the liquefaction assessment process begins by screening the subject site for its liquefaction potential using the following criteria.

- Geologic age and origin. If a soil layer is a fluvial, lacustrine or aeolian deposit of Holocene age, a greater potential for liquefaction exists than for till, residual deposits, or older deposits.

- Fines content and plasticity index. Liquefaction potential in a soil layer increases with decreasing fines content and plasticity of the soil. Cohesionless soils having less than 15 percent (by weight) of particles smaller than 0.005 mm, a liquid limit less than 35

percent, and an in situ water content greater than 0.9 times the liquid limit may be susceptible to liquefaction.

- Saturation. Although low water content soils have been reported to liquefy, at least 80 to 85 percent saturation is generally deemed to be a necessary condition for soil liquefaction.

- Depth below ground surface. If a soil layer is within 50 feet of the ground surface, it is more likely to liquefy than deeper layers.

- Soil Penetration Resistance. Soil layers with a normalized SPT blowcount [$(N_1)_{60}$] less than 22 have been known to liquefy. Other sources suggest an SPT value of [$(N_1)_{60}$] less than 30 as the threshold to use for suspecting liquefaction potential.

If three or more of the above criteria indicate that liquefaction is not likely, the potential for liquefaction is considered to be negligible. Otherwise, further evaluation of the liquefaction potential at a facility is required. The soils at the Coleto Creek Power facility generally meet at least three of the specified screening criteria and their liquefaction potential is unlikely. However, there are exceptions such as certain layers that are described in the soil borings logs as SP, or sandy soils, which would by definition have a low fines content. In addition, some liquid limits are below 35 percent. Therefore, further evaluation of the soil data has been completed, and factors of safety against liquefaction calculated for each critical layer, as further described below.

A review of existing data regarding site conditions, soil stratigraphy, soil properties, and potential critical layers as well as the methods used to develop that data indicate that the findings presented in the AECOM report (AECOM, 2012) are sufficient for use in this assessment. As noted in previous sections of this report, AECOM drilled eight borings through critical areas of the site to depths ranging from approximately 30 to 120 feet bgs. Standard penetrometer (SPT) blows per foot, plastic limit, water content, and liquid limit data were collected at two to five foot intervals. In addition, samples were collected and sent to an off-site laboratory for analyses of general geotechnical properties. Copies of the boring logs and laboratory data used in this assessment are provided in Appendices A and B.

When available, site specific information such as SPT blow count and percent fines content (soils passing the #200 sieve) was used in the evaluation of liquefaction potential. For strata with no site specific data, conservative estimates were used based on industry accepted references and engineering judgement. For example, earthquake potential maps and tables presented in the

USEPA guidance document were used to estimate the worst-case earthquake magnitude and associated maximum ground acceleration. USGS references for low to mid-ranges of fines content for the reported soil types were used when no laboratory data existed.

A complete discussion of the methodology used and the calculation spreadsheets for each strata identified in the eight boring logs are presented in Appendix D. The findings of the liquefaction assessment indicate that the factor of safety is well above the 1.2 required. This finding is expected given the generally high fines content of most soil strata, the low water content, and low ground acceleration that would be observed in the unlikely event that an earthquake was to occur in this area.

### 5.2 Initial Safety Factor Assessment Summary

In accordance with §257.73, Structural Integrity Criteria for Existing CCR Surface Impoundments, the critical cross sections of the Primary Ash Pond at the Coleto Creek facility have been evaluated for slope stability under appropriate loading conditions, including steady-state seepage, maximum surcharge pool, rapid drawdown, and seismic. In addition, a liquefaction assessment has been completed. Based on review of historic studies, geotechnical data that has been previously gathered, and on stability analysis evaluation, the Primary Ash Pond has an adequate factor of safety for all evaluated loading conditions.

## 6.0 REFERENCES

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FIGURES


N

APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 5-2011.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

12-28-2017

**Coleto Creek Power, LP**

Figure 1-1A

SITE LOCATION MAP

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
| --- | --- | --- | --- |

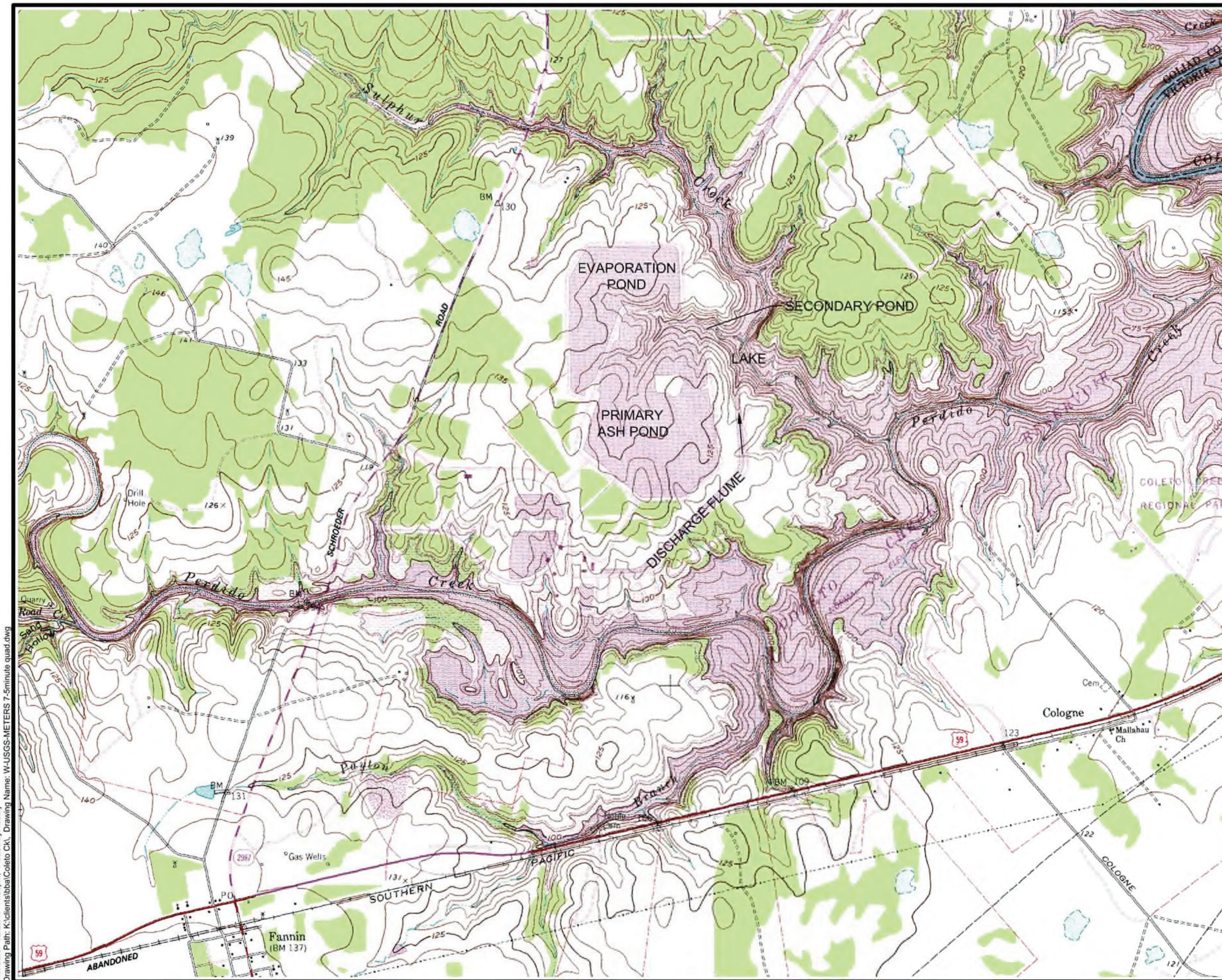
Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:38pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL115.dwg


SOURCE: AERIAL PHOTO PROVIDED BY T.N.R.I.S., NAD83 UTM ZONE 14N, DATE: OCT 2014-AUG 2015.

| | | | |
|---|---|---|---|
| **Coleto Creek Power, LP** | | | |
| Figure 1-1B | | | |
| SITE LOCATION MAP | | | |
| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
| Bullock, Bennett & Associates, LLC<br>Engineering and Geoscience<br>Texas Registrations: Engineering F-8542, Geoscience 50127 | | | |

Plot Date: 12/28/17 - 2:40pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL114.dwg




APPROXIMATE SCALE: 1" = 2000'

0 1000 2000 4000

NOTE: CONTOUR DATA SHOWN ON U.S.G.S. MAP IN AREAS OF ASH PONDS ARE REPRESENTATIVE OF CONDITIONS PRIOR TO ASH POND CONSTRUCTION.

SOURCE: U.S.G.S. FANNIN TEXAS, DATE: 2016, SCALE 1:24000, 10' CONTOURS. NAD1983, NAVD1988.

**Coleto Creek Power, LP**

Figure 2-1

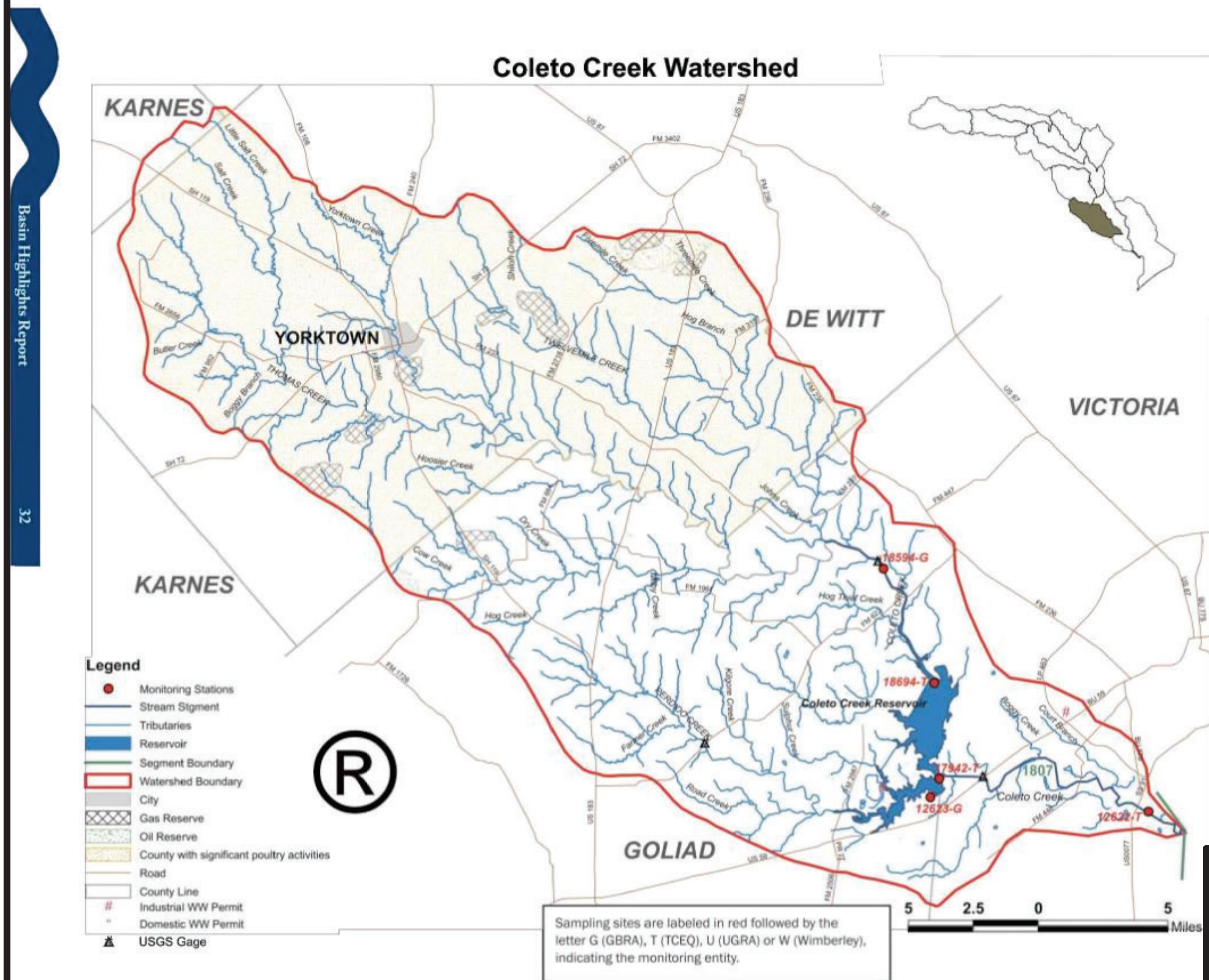
U.S.G.S. AREA MAP

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 4:09pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: W-USGS-METERS 7-5minute quad.dwg

Plot Date: 12/28/17 - 4:11pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL106.dwg



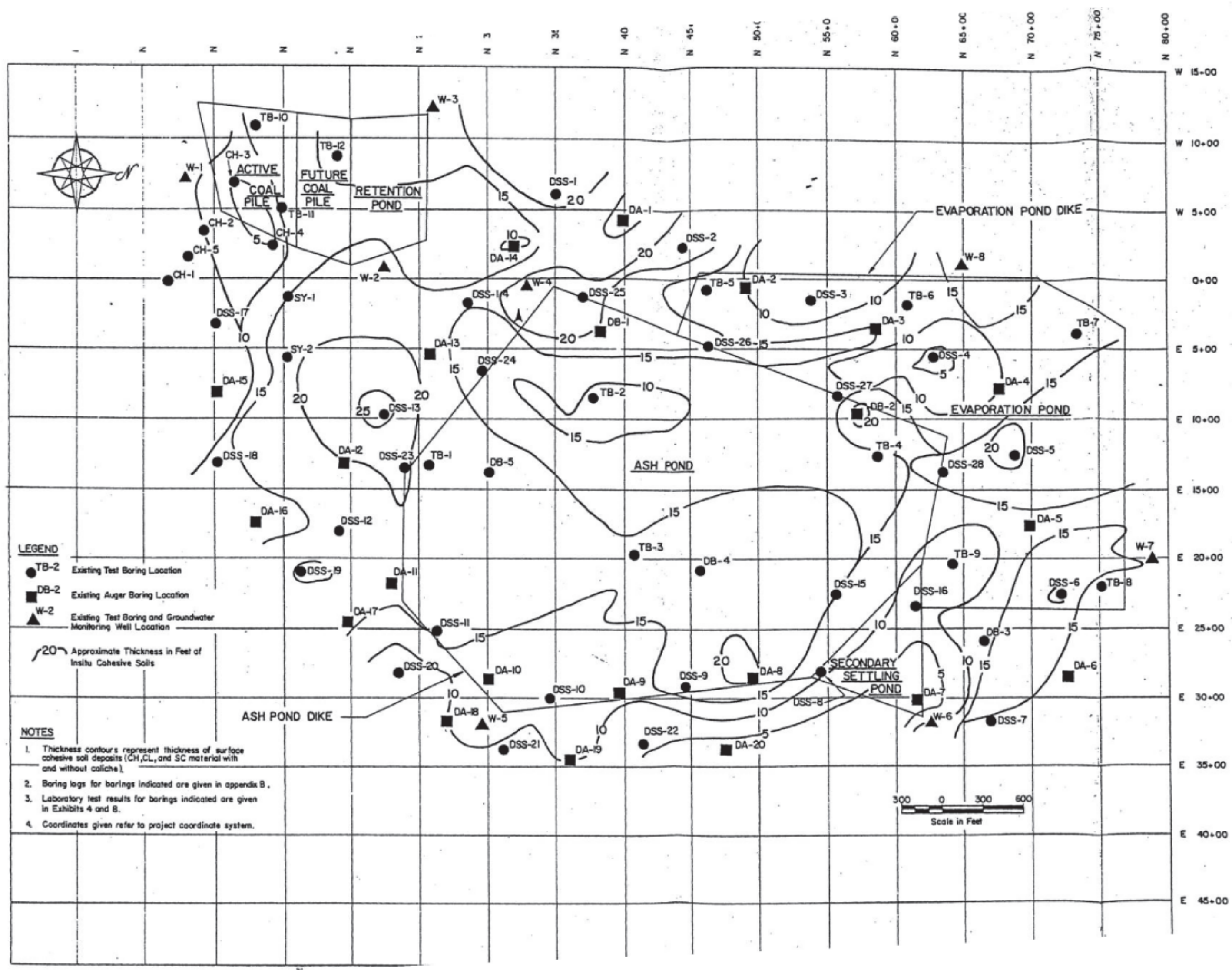

**Coleto Creek Power, LP**

Figure 2-2

COLETO CREEK WATERSHED

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127




SOURCE: MAP PROVIDED BY SARGENT AND LUNDY ENGINEERS, CHICAGO, IL.

**Coleto Creek Power, LP**

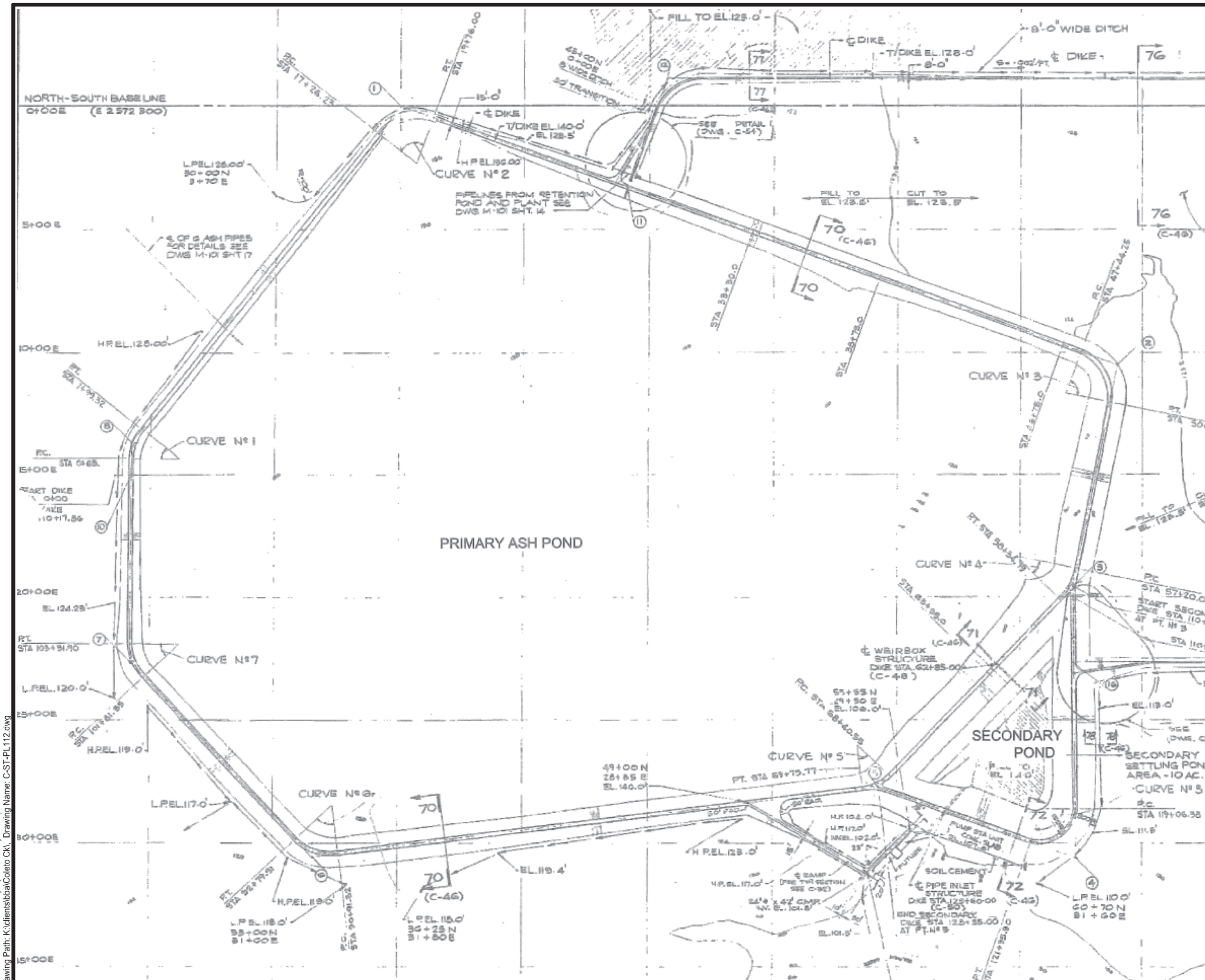
Figure 2-3

THICKNESS MAP OF IN-SITU COHESIVE SOILS

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 4:12pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL108.dwg




NOTE:

THE MAX STORAGE POOL FOR THE PRIMARY ASH POND IS 135.9 (NAVD88).

SOURCE:

BACKGROUND DRAWING PROVIDED BY SARGENT & LUNDY, APRIL 1978.

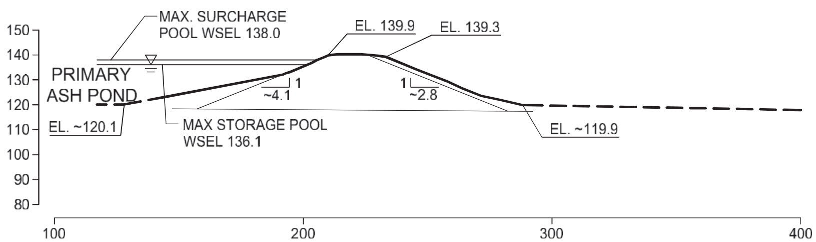
| | | | |
|---|---|---|---|
| **Coleto Creek Power, LP** | | | |
| Figure 2-4 | | | |
| SURFACE IMPOUNDMENT CONFIGURATION | | | |
| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
| Bullock, Bennett & Associates, LLC<br>Engineering and Geoscience<br>Texas Registrations: Engineering F-8542, Geoscience 50127 | | | |

Plot Date: 12/28/17 - 4:14pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL112.dwg

APPROXIMATE SCALE: 1" = 800'

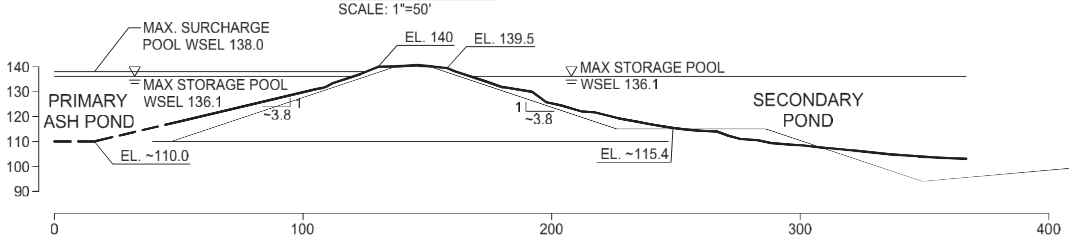
0 400 800 1600


PARTIAL PLAN




SECTION A-A'

SCALE: 1"=50'



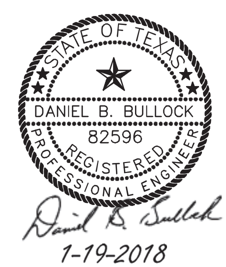

SECTION B-B'

SCALE: 1"=50'

SOURCES:

ON-GROUND TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY NAISMITH MARINE SERVICES ON JULY 2016. HORIZONTAL DATUM: NAD83, TEXAS CENTRAL SOUTH ZONE, US FEET. VERTICAL DATUM: NAVD88.

AERIAL PHOTO PROVIDED BY IMAGEPATCH.COM EARTHSTAR GEOGRAPHICS, DATE: MAY-OCT 2011.




**Coleto Creek Power, LP**

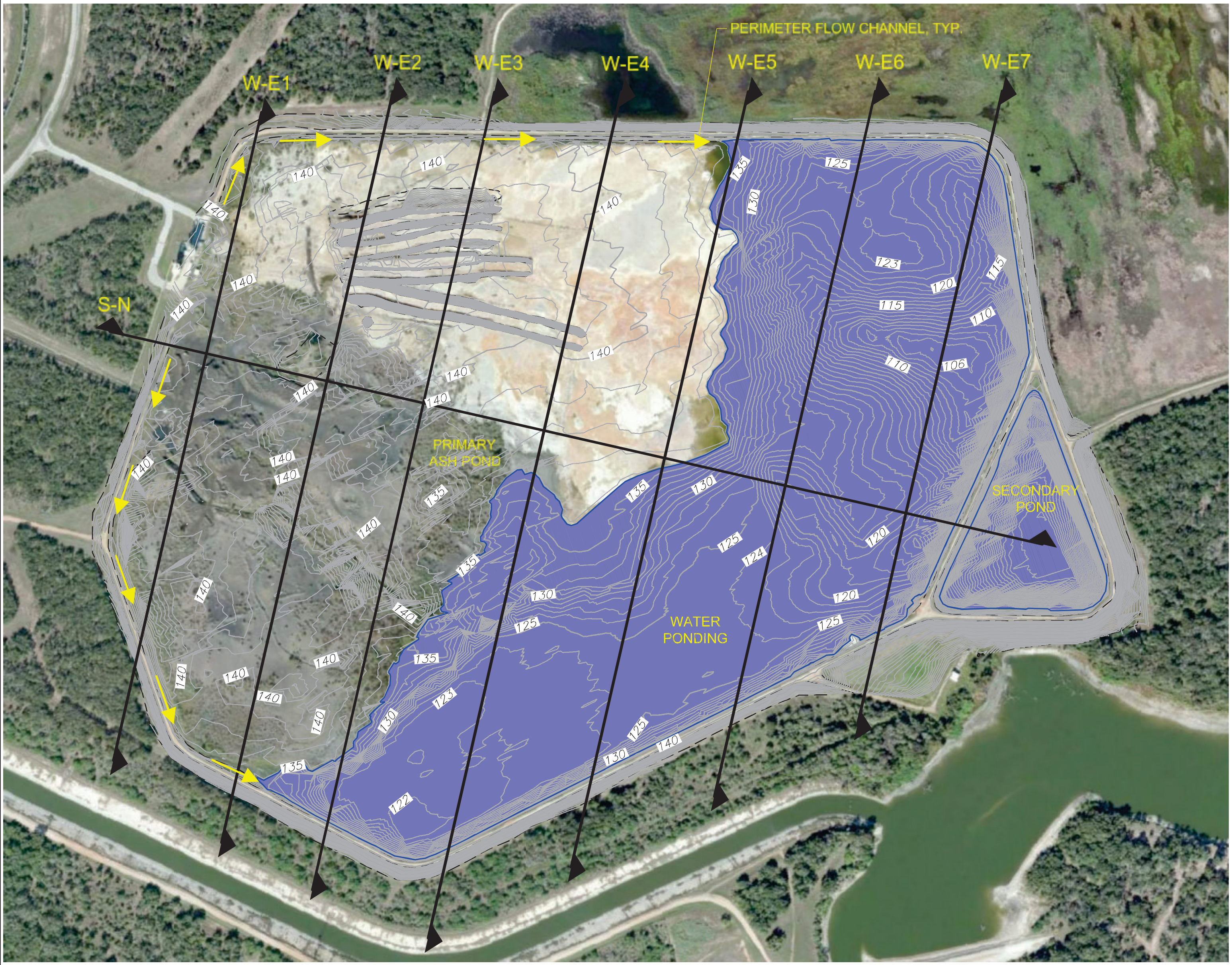
Figure 2-5A

ASH POND PLAN AND CROSS SECTIONS

| PROJECT: 17266 | BY: RR | DATE: JAN 2018 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 01/19/18 - 10:42am, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL130.dwg




APPROXIMATE SCALE: 1" = 400'

0 200 400 800

**NOTES:**

PRIMARY POND DECANT WATER VOLUME CAPACITY. APPROXIMATELY 1,520 AC-FT TO TOP OF DIKE.

SECONDARY POND DECANT WATER VOLUME CAPACITY. APPROXIMATELY 200 AC-FT TO TOP OF DIKE.

SOURCES:

ON-GROUND TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY NAISMITH MARINE SERVICES ON JULY 2016. HORIZONTAL DATUM: NAD83, TEXAS CENTRAL SOUTH ZONE, US FEET. VERTICAL DATUM: NAVD88.

AERIAL PHOTO PROVIDED BY IMAGEPATCH.COM EARTHSTAR GEOGRAPHICS, DATE: MAY-OCT 2011.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

12-28-2017

**Coleto Creek Power, LP**

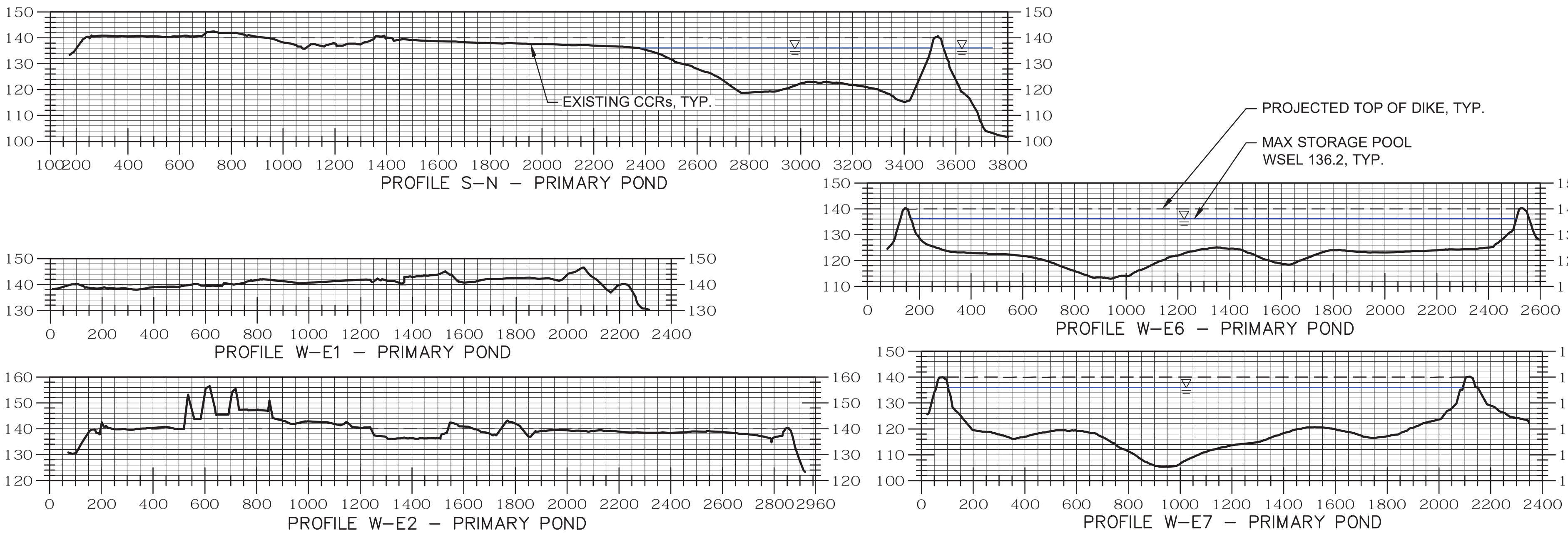
Figure 2-5B

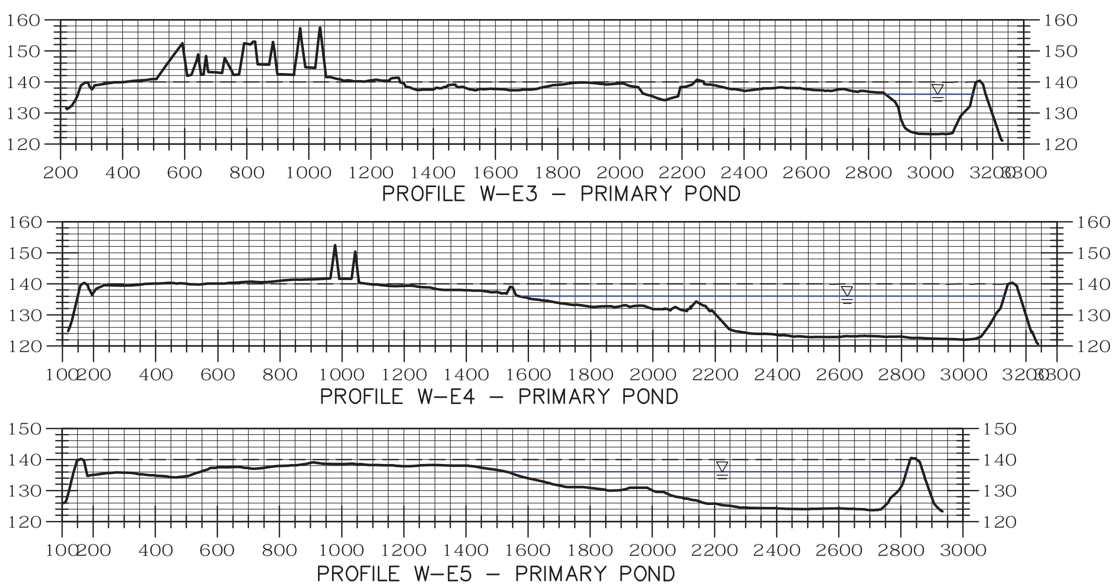
BATHYMETRIC SURVEY
PLAN VIEW

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

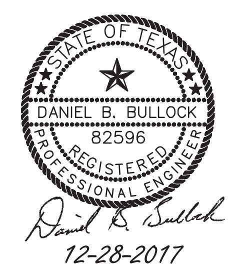
Plot Date: 12/28/17 - 2:56pm, Plotted by: roodr|
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL119.dwg




SOURCES:

ON-GROUND TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY NAISMITH MARINE SERVICES ON JULY 2016. HORIZONTAL DATUM: NAD83, TEXAS CENTRAL SOUTH ZONE, US FEET. VERTICAL DATUM: NAVD88.




**Coleto Creek Power, LP**

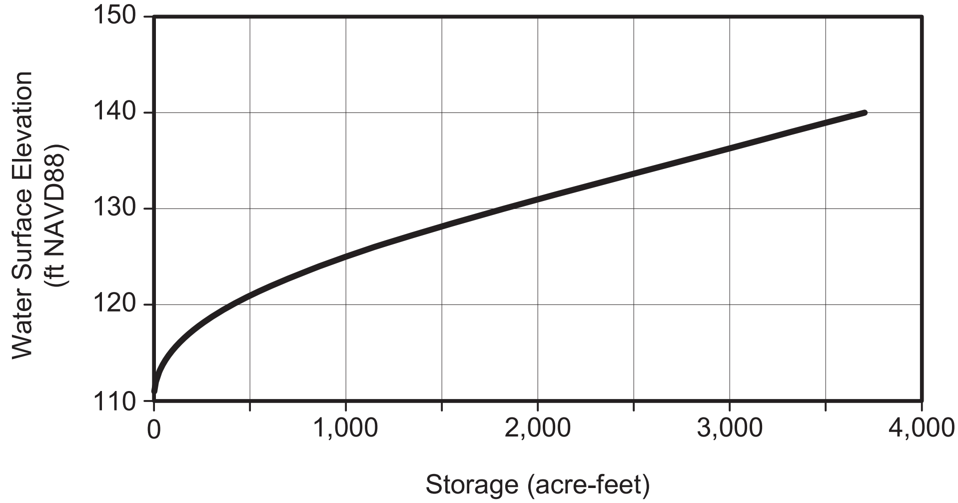
Figure 2-5C

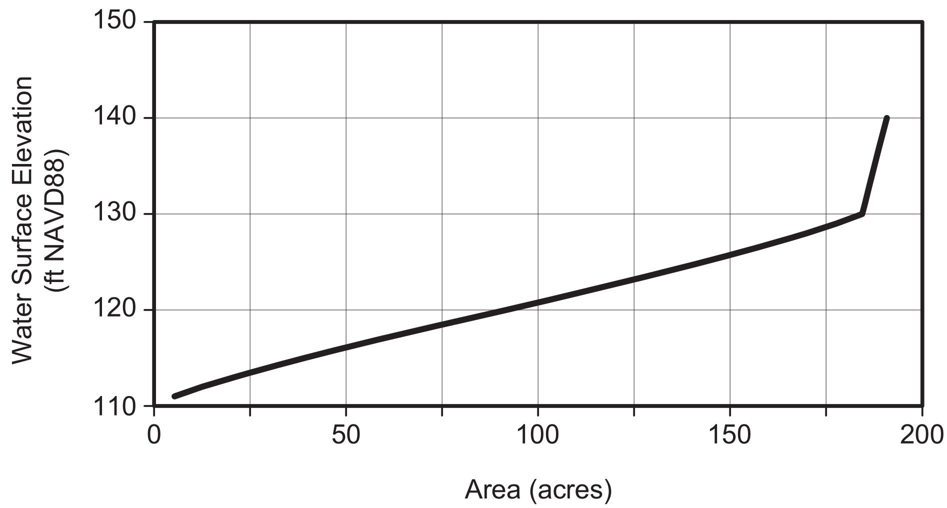
BATHYMETRIC SURVEY SECTIONS

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:58pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: X-EG-15JULY2016 working file.dwg





12-28-2017

**Coleto Creek Power, LP**

Figure 2-6

CAPACITY FOR PRIMARY POND

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:34pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-LG-DT106.DWG

# APPENDIX A:  GEOTECHNICAL BORELOGS

| AECOM | CLIENT: IPR-GDF SUEZ North America | LOG OF BORING NUMBER: B-1-1 |
|---|---|---|
| | PROJECT NAME: Coleto Creek Energy Facility Ash Pond | ARCHITECT/ENGINEER |

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.6 (Continued)

Column headings: DEPTH (FT) · ELEVATION (FT) · SAMPLE NO. · SAMPLE TYPE · SAMPLE DISTANCE · RECOVERY · DESCRIPTION OF MATERIAL · UNIT DRY WT. LBS. / Ft.$^3$ · UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ (1, 2, 3, 4, 5) · PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10, 20, 30, 40, 50) · STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

| Depth to bottom of stratum (ft) | Description of Material |
|---|---|
| 50.4 | (stratum continued from sheet 1) |
| 65.1 | Grayish brown fine to coarse sand (SP), trace fine to coarse gravel - wet - very dense |
| 78.0 | White and gray clayey fine to coarse sand (SC-caliche) - wet - extremely dense |
| 83.0 | Light brown fine to coarse sand (SP) with occasional thin layers of white and gray silty fine to coarse sand (SM-Caliche) - moist to wet - extremely dense<br>Drillers noted hard drilling and gravel while drilling form 80.0 to 85.0 feet |
| 88.0 | Gray and white silty fine to medium sand (SM) with caliche - wet - extremely dense |
| 97.0 | Light gray silty clay (CL), some sand, trace caliche - moist to wet - hard |
| | Light gray clayey fine to coarse sand (SC) - moist - extremely dense |

| Sample No. | Sample Type | Unit Dry Wt. (lbs/ft³) | Standard Penetration Blows/Ft. |
|---|---|---|---|
| 26 | SS | | 50 |
| 27 | SS | 113.5 | 50 |
| 28 | SS | | 66 |
| 29 | SS | | **50/0.3' |
| 30 | SS | 117.3 | 92 |
| 31 | SS | | **50/0.3' |
| 32 | SS | | **50/0.4' |
| 33 | SS | | **50/0.1' |
| 34 | SS | 126.5 | **50/0.4' |
| 35 | SS | 107.6 | **50/0.5' |

Depth scale (ft): 52.0, 54.0, 56.0, 58.0, 60.0, 62.0, 64.0, 66.0, 68.0, 70.0, 72.0, 74.0, 76.0, 78.0, 80.0, 82.0, 84.0, 86.0, 88.0, 90.0, 92.0, 94.0, 96.0, 98.0, 100.0

. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 2 OF 3

STS060701 60225561.GPJ STS.GDT 1/4/12

| AECOM | CLIENT: **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-1-1** |
|---|---|---|
| | PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

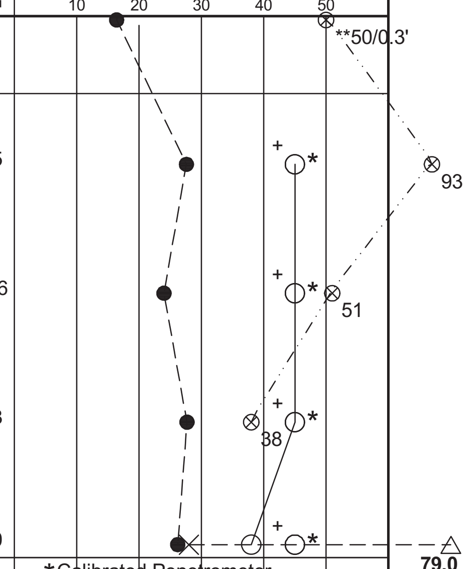
UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ (1, 2, 3, 4, 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10, 20, 30, 40, 50)

STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

SURFACE ELEVATION: +139.6 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|---|---|
| | | 36 | SS | | | Light gray clayey fine to coarse sand (SC) - moist - extremely dense | |
| 102.0 | | | | | | | |
| | | | | | | 103.0 | |
| 104.0 | | | | | | Brown silty clay (CH) with irrgular gray silty clay lenses - moist - hard | |
| 106.0 | | 37 | SS | | | | 92.5 |
| 108.0 | | | | | | | |
| 110.0 | | 38 | SS | | | | 102.6 |
| 112.0 | | | | | | | |
| 114.0 | | | | | | | |
| 116.0 | | 39 | SS | | | | 94.8 |
| 118.0 | | | | | | | |
| 120.0 | | 40 | ST | | | 121.0 | 98.0 |
| 121.0 | | | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 50.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 50.0 feet to 100.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL: **Dry before casing installation** | BORING STARTED: **11/5/11** | AECOM OFFICE: **1035 Kepler Drive, Green Bay, Wisconsin 54311** | |
| WL: **10.0 to 12.0 feet WS** | BORING COMPLETED: **11/6/11** | ENTERED BY: **CAH** | SHEET NO. **3** OF **3** |
| WL | RIG/FOREMAN: **D-25/BZ** | APP'D BY: **TMT** | AECOM JOB NO. **60225561** |

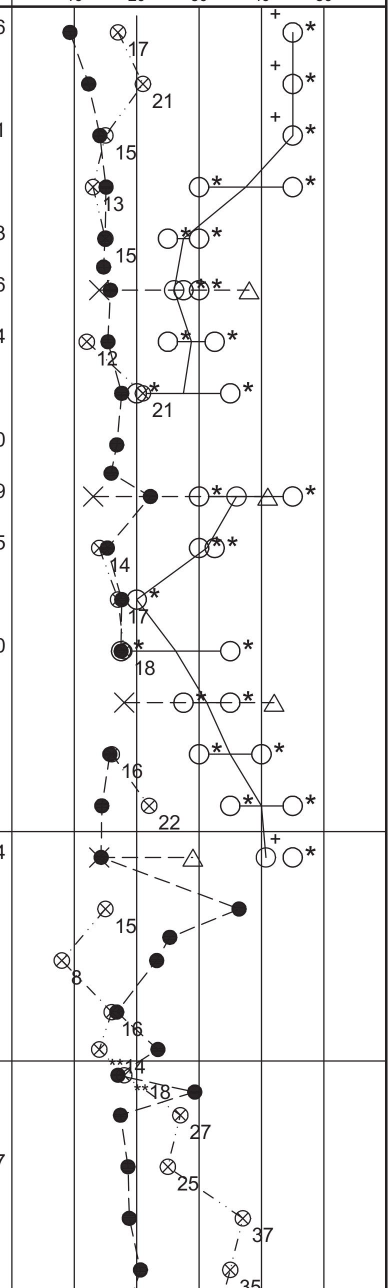
| AECOM | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-1** |
|---|---|---|
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ (1, 2, 3, 4, 5)
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10, 20, 30, 40, 50)
STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

SURFACE ELEVATION: +139.2

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| 2.0 | 1 | SS | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, trace caliche nodules and layers, occasional thin, saturated silty sand lenses - moist to wet - very stiff to hard | 121.6 |
| 4.0 | 2 | SS | | |
| 6.0 | 3 | SS | | 116.1 |
| 8.0 | 4 | SS | | |
| 10.0 | 5 | SS | | 121.3 |
| 12.0 | 6 | ST | | 118.6 |
| 14.0 | 7 | SS | | 117.4 |
| 16.0 | 8 | SS | | |
| 18.0 | 9 | 3" ST | | 114.0 |
| 20.0 | 10 | ST | | 110.9 |
| 22.0 | 11 | SS | | 114.5 |
| 24.0 | 12 | SS | | |
| 26.0 | 13 | SS | | 113.0 |
| 28.0 | 14 | 3" ST | | |
| 30.0 | 15 | SS | | |
| 32.0 | 16 | SS | 32.0 | |
| 34.0 | 17 | ST | White and light gray clayey sand (SC-caliche) - wet - loose to medium dense | 118.4 |
| 36.0 | 18 | SS | | |
| 38.0 | 19 | SS | Note: Saturated loose zone from 36.0 feet to 36.9 feet | |
| 40.0 | 20 | SS | | |
| | 21 | SS | 40.9 | |
| 42.0 | 21A | SS | Grayish brown fine to coarse sand (SP) - wet - medium dense to dense | |
| 44.0 | 22 | SS | Note: Clayey sand (SC-Caliche) layers encountered from 42.9 feet to 43.3 feet and 44.0 feet to 45.0 feet | |
| 46.0 | 23 | SS | | 136.7 |
| 48.0 | 24 | SS | | |
| 50.0 | 25 | SS | 50.0 | |




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 3

STS060701 60225561.GPJ STS.GDT 1/4/12

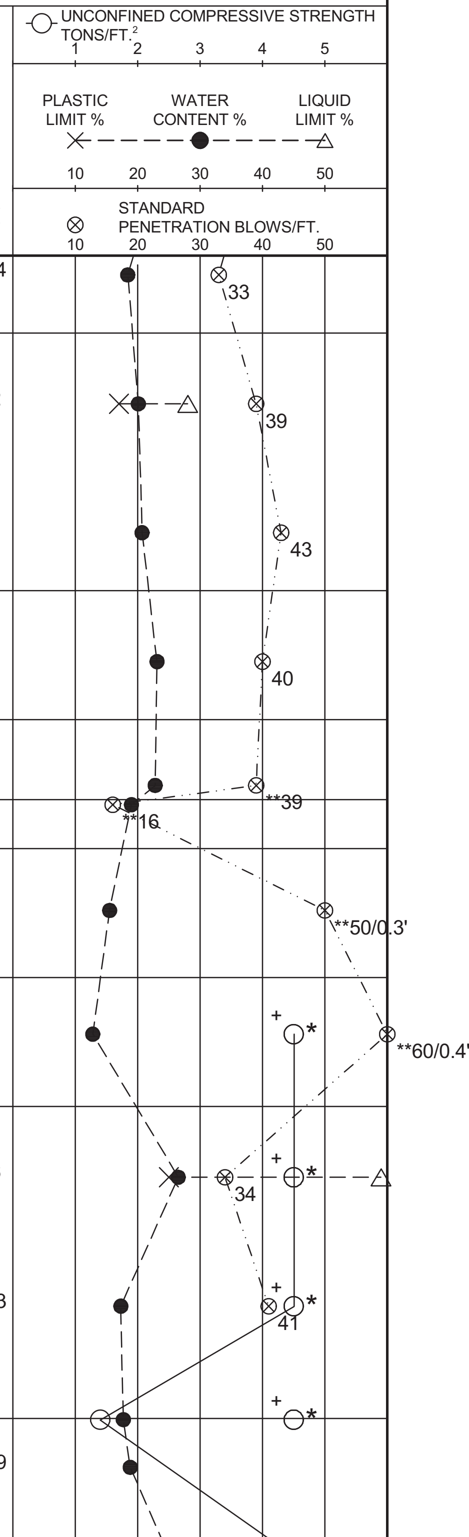
| AECOM | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-1** |
|---|---|---|
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| | | 26 | SS | Grayish brown silty fine sand (SM) - wet - dense | 110.4 |
| 52.0 | | | | | |
| 53.0 | | | | | |
| 54.0 | | | | Light gray clayey fine sand (SC) - wet - dense | |
| 56.0 | | 27 | SS | | 99.2 |
| 58.0 | | | | | |
| 60.0 | | | | | |
| | | 28 | SS | | |
| 62.0 | | | | | |
| 63.0 | | | | Light gray fine sand (SP-SM), trace silt - wet - dense | |
| 64.0 | | | | | |
| 66.0 | | 29 | SS | | |
| 68.0 | | | | Light gray fine to coarse sand (SP) - wet - dense | |
| 70.0 | | | | | |
| | | 30 | SS | | |
| 71.1 | | 30A | SS | Light gray and white clayey sand (SC-caliche) - wet - medium dense | |
| 72.0 | | | | | |
| 73.0 | | | | Light gray silty fine to medium sand (SM), trace to little clay, trace fine gravel - moist to wet - extremely dense | |
| 74.0 | | | | | |
| 76.0 | | 31 | SS | | |
| 78.0 | | | | Tan clayey silt (CL-ML-Weathered Sandstone) - moist to wet - hard | |
| 80.0 | | | | | |
| | | 32 | SS | | |
| 82.0 | | | | | |
| 83.0 | | | | Light gray and brown mottled silty clay (CH), trace sand - moist - hard | |
| 84.0 | | | | | |
| 86.0 | | 33 | SS | | 91.6 |
| 88.0 | | | | | |
| 90.0 | | | | | |
| | | 34 | SS | | 117.3 |
| 92.0 | | | | | |
| 94.0 | | | | | |
| 95.1 | | 35 | ST | Light gray clayey fine sand (SC) - moist - extremely dense | |
| 96.0 | | | | | |
| 98.0 | | | | | 110.9 |
| 100.0 | | | | | |

. . . continued




* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

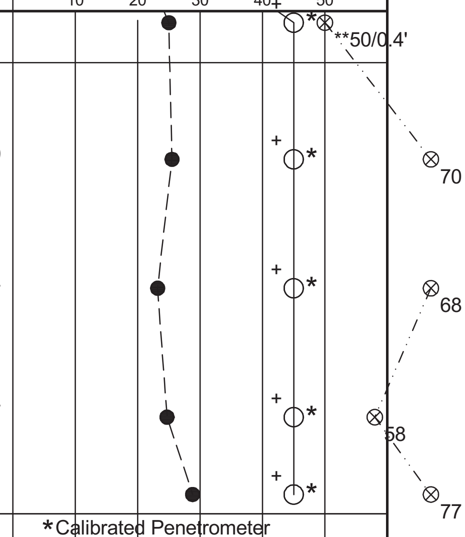
AECOM JOB NO. 60225561 | SHEET NO. 2 OF 3

| AECOM | CLIENT: **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-1** |
|---|---|---|
| | PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|---|---|
| | | 36 | SS | | | Light gray clayey fine sand (SC) - moist - extremely dense | |
| 102.0 | | | | | | 102.0 Brown silty clay (CH) with gray silty clay and silt lenses, trace thin sand lenses - moist - hard | |
| 104.0 | | | | | | | |
| 106.0 | | 37 | SS | | | | 99.9 |
| 108.0 | | | | | | | |
| 110.0 | | | | | | | |
| | | 38 | SS | | | | 96.4 |
| 112.0 | | | | | | | |
| 114.0 | | | | | | | |
| 116.0 | | 39 | SS | | | | 96.7 |
| 118.0 | | | | | | | |
| | | 40 | SS | | | 119.5 | |
| 119.5 | | | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 50.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 50.0 feet to 118.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/3/11 | AECOM OFFICE | 1035 Kepler Drive, Green Bay, Wisconsin 54311 |
| WL 8.0 to 10.0 feet WS | BORING COMPLETED 11/4/11 | ENTERED BY CAH | SHEET NO. 3 OF 3 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT | AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

**AECOM**

CLIENT: **IPR-GDF SUEZ North America**

LOG OF BORING NUMBER **B-2-2**

PROJECT NAME: **Coleto Creek Energy Facility Ash Pond**

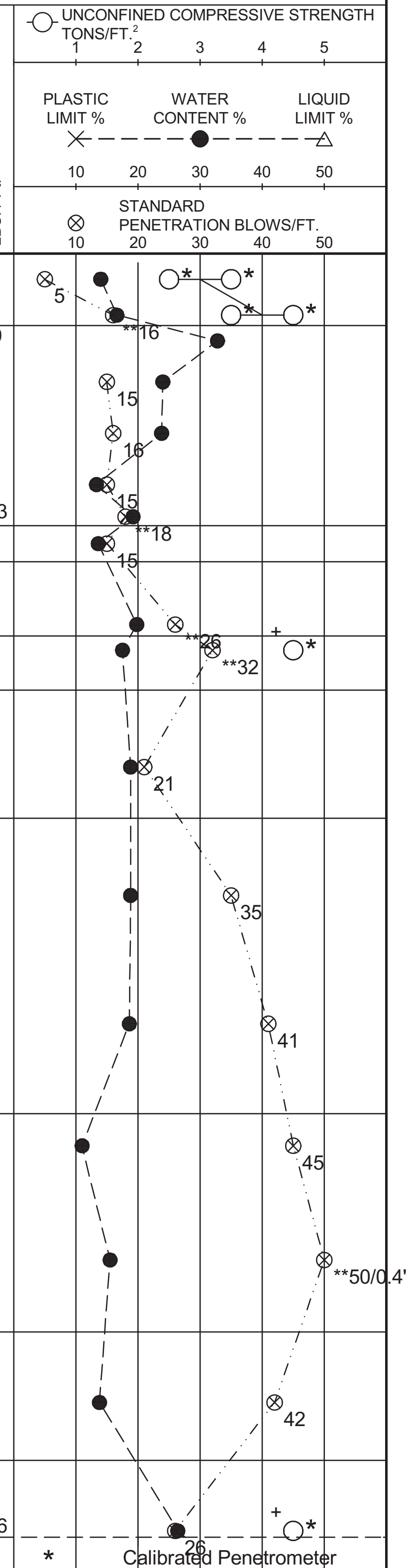
ARCHITECT/ENGINEER:

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +105.1

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / $Ft.^3$ |
|---|---|---|---|---|
| 2.0 | 1 | SS | Black and dark brown organic sandy clay (OL), little fine gravel, trace wood - moist - very stiff to hard | |
| | 2 | SS | 2.8 | |
| 4.0 | 2A | SS | Light gray and white clayey fine to coarse sand (SC-Caliche), trace fine to coarse gravel - moist to wet - dense to medium dense | 90.9 |
| 6.0 | 3 | SS | | |
| 8.0 | 4 | SS | Note: Light brown fine to coarse sand (SP) layers encountered from 6.5 feet to 7.0 feet and 8.3 feet to 8.9 feet | |
| 10.0 | 5 | SS | | |
| | 6 | SS | 10.6 | 113.3 |
| 12.0 | 6A | SS | Light gray fine to coarse sand (SP) - wet - medium dense; 12.0 | |
| 14.0 | | | Light gray and brown mottled silt (ML), trace clay, trace sand - moist - medium dense | |
| | 7 | SS | 14.9 | |
| 16.0 | 7A | SS | Light gray silty clay (CL), trace sand - moist - hard; 17.0 | |
| 18.0 | | | Light gray silt (ML), trace to little sand, trace clay - moist - medium dense | |
| 20.0 | 8 | SS | | |
| 22.0 | | | 22.0 | |
| 24.0 | | | Light brown fine sand (SP) - wet - dense | |
| 26.0 | 9 | SS | | |
| 28.0 | | | | |
| 30.0 | 10 | SS | | |
| 32.0 | | | | |
| 34.0 | | | 33.5 | |
| 36.0 | 11 | SS | Light gray and light brown mottled clayey fine to coarse sand (SC), trace fine to coarse gravel - moist - dense to extremely dense<br>Drillers noted hard drilling from 34.0 to 39.0 feet and gravel while drilling | |
| 38.0 | | | | |
| 40.0 | 12 | SS | | |
| 42.0 | | | 42.0 | |
| 44.0 | | | Light brown fine to coarse sand (SP) - wet - dense | |
| 46.0 | 13 | SS | | |
| | | | 47.0 | |
| 48.0 | | | Light gray and brown mottled silty clay (CL), trace sand - moist - hard | |
| 50.0 | | | | 100.6 |

. . . continued




* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

STS060701 60225561.GPJ STS.GDT 1/4/12

| | | |
|---|---|---|
| **AECOM** | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-2** |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

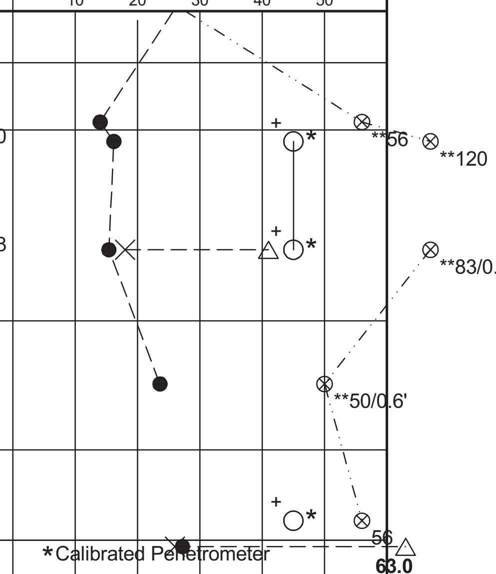
SITE LOCATION
**Goliad County, Fannin, Texas**

-○- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ 1 2 3 4 5

PLASTIC LIMIT % ✕ — WATER CONTENT % ● — LIQUID LIMIT % △ 10 20 30 40 50

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL<br>SURFACE ELEVATION: +105.1 (Continued) | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|---|---|
| | | 14 | SS | | | | |
| 52.0 | | | | | | Light gray and brown mottled silty clay (CL), trace sand - moist - hard (52.0) | |
| 54.0 | | | | | | Light brown fine to coarse sand (SP) - wet - very dense (54.6) | |
| | | 15 | SS | | | | |
| 56.0 | | 15A | SS | | | Light brown and light gray mottled silty sandy clay (CL), trace thin poorly-graded sand seams (SP) - moist - hard | 115.0 |
| 58.0 | | | | | | | |
| 60.0 | | 16 | SS | | | | 117.8 |
| 62.0 | | | | | | (62.0) | |
| 64.0 | | | | | | Light brown and brown mottled silty fine sand (SM) - wet - extremely dense | |
| | | 17 | SS | | | | |
| 66.0 | | | | | | (67.0) | |
| 68.0 | | | | | | Light gray silty clay (CH), trace sand, trace fine to coarse gravel - moist - hard | |
| 70.0 | | 18 | SS | | | (70.5) | |
| 70.5 | | | SS | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 8.0 feet<br>Boring advanced from 6.0 feet to 16.0 feet with 3-inch rock bit and drilling fluid<br>HW casing driven from 8.0 feet to 10.0 feet<br>Boring advanced from 16.0 feet to 69.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL 3.5 feet WS | BORING STARTED 11/1/11 | AECOM OFFICE | 1035 Kepler Drive Green Bay, Wisconsin 54311 |
| WL 3.5 feet before casing installation | BORING COMPLETED 11/1/11 | ENTERED BY CAH | SHEET NO. 2 OF 2 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT | AECOM JOB NO. 60225561 |

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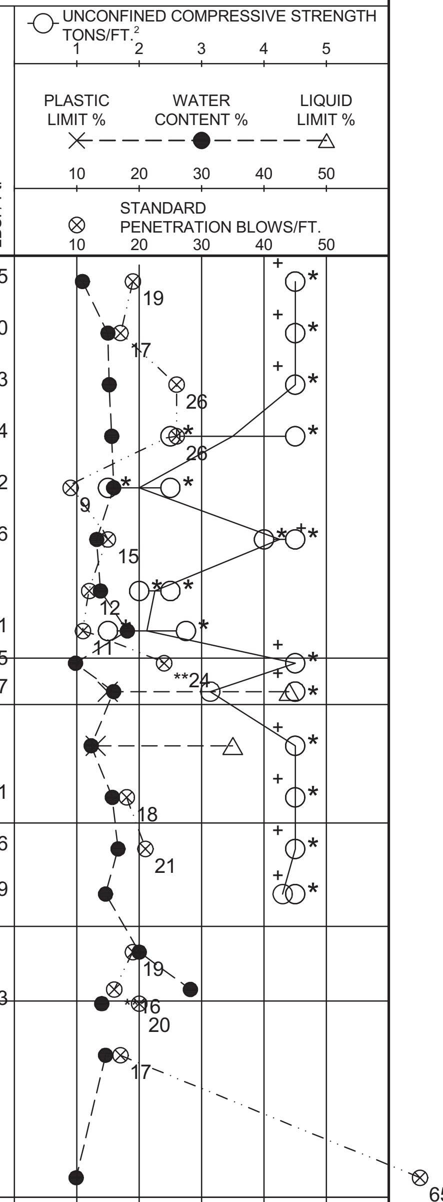
| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-3-1** |
| PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.3

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | UNIT DRY WT. LBS. / Ft.³ |
|---|---|---|---|
| | 1 | SS | 114.5 |
| 2.0 | 2 | SS | 114.0 |
| 4.0 | 3 | SS | 115.3 |
| 6.0 | 4 | SS | 110.4 |
| 8.0 | 5 | SS | 112.2 |
| 10.0 | 6 | SS | 124.6 |
| 12.0 | 7 | SS | |
| 14.0 | 8 | SS | 106.1 |
| 16.0 | 8A | SS | 121.5 |
| | 9 | ST | 113.7 |
| 18.0 | 10 | SS | |
| 20.0 | 11 | SS | 109.1 |
| 22.0 | 12 | SS | 113.6 |
| 24.0 | 13 | SS | 117.9 |
| 26.0 | 14 | SS | |
| 28.0 | 15 | SS | |
| | 15A | SS | 111.3 |
| 30.0 | 16 | SS | |
| 32.0 | | | |
| 34.0 | | | |
| 36.0 | 17 | SS | |
| 36.5 | | | |

| Depth to (ft) | DESCRIPTION OF MATERIAL |
|---|---|
| 15.6 | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, occasional irregular thin silty sand seams and lenses, trace caliche nodules and layers - moist to wet - stiff to hard. Note: Saturated silty sand seams encountered from 10.5 feet to 10.9 feet, 12.5 feet to 12.7 feet, and from 15.4 feet to 15.5 feet |
| 17.4 | Gray clayey fine to medium sand (SC), trace caliche nodules, trace thin silty sand seams - moist to wet - very stiff to hard |
| 22.0 | Dark brown clayey sand (SC), trace caliche nodules - moist to wet - hard |
| 26.0 | Light gray silty sandy clay (CL), occasional irregular silty clayey caliche (CL-caliche) layers and lenses - moist to wet - hard |
| 28.9 | Light gray clayey sand (SC), occasional silty clay (CL-caliche) layers and lenses, trace fine gravel - moist to wet - medium dense. Note: Saturated zone encountered from 28.0 feet to 28.5 feet |
| 36.5 | Light gray silty fine to coarse and (SM), trace to little clay, trace fine gravel, trace caliche nodules - moist to wet - medium dense to very dense |




*Calibrated Penetrometer

End of Boring
Boring advanced to 6.0 feet with solid-stem auger
HW casing driven to 5.0 feet
Boring advanced from 6.0 feet to 30.0 feet with 4-inch rock bit and drilling fluid
Boring advanced from 30.0 feet to 35.0 feet with 3-inch rock bit and drilling fluid
Boring abandoned with bentonite quick grout using tremie method
Split-spoons were driven with cathead and rope

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | |
|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/8/11 | AECOM OFFICE 1035 Kepler Drive, Green Bay, Wisconsin 54311 |
| WL 8.0 to 10.0 feet WS | BORING COMPLETED 11/8/11 | ENTERED BY CAH; SHEET NO. 1 OF 1 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT; AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

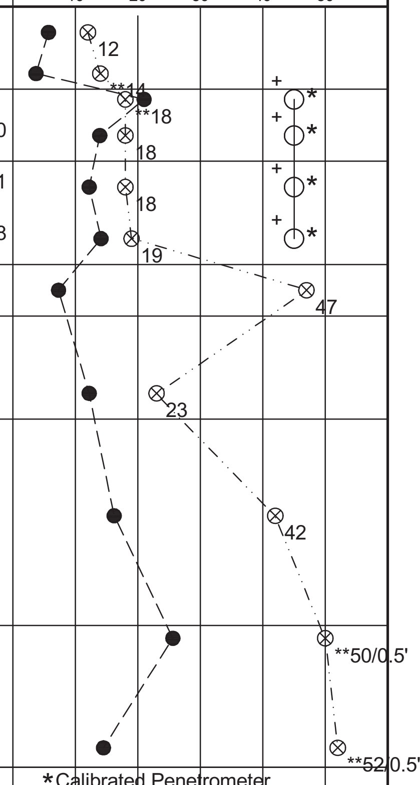
**AECOM**

| | |
|---|---|
| CLIENT | **IPR-GDF SUEZ North America** |
| LOG OF BORING NUMBER | **B-3-2** |
| PROJECT NAME | **Coleto Creek Energy Facility Ash Pond** |
| ARCHITECT/ENGINEER | |
| SITE LOCATION | **Goliad County, Fannin, Texas** |

SURFACE ELEVATION: +122.8

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$: 1, 2, 3, 4, 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10, 20, 30, 40, 50
STANDARD PENETRATION BLOWS/FT.: 10, 20, 30, 40, 50

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | STRATUM DEPTH | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 2.0 | 1 | SS | | Fill: Dark brown or brown silty fine sand (SM), trace clay, trace roots - moist - medium dense | |
| | 2 | SS | 3.2 | | |
| 4.0 | 2A | SS | | Fill: Brown and gray mottled silty sandy clay (CL), trace fine gravel, trace roots - desiccated - hard | |
| 6.0 | 3 | SS | 6.0 | | 117.0 |
| 8.0 | 4 | SS | | Light gray and white silty sandy clay (CL-caliche), trace to little fine gravel - moist - hard | 122.1 |
| 10.0 | 5 | SS | 10.0 | | 113.8 |
| 12.0 | 6 | SS | 12.0 | White silty fine sand (SM-caliche), trace to little clay - moist - dense | |
| 14.0 | | | | Light brown fine to coarse sand (SP), trace fine gravel - wet - dense to medium dense | |
| 16.0 | 7 | SS | 16.0 | | |
| 18.0 | | | | Brown sitly fine to coarse sand (SM), trace to little fine gravel - wet - dense<br><br>Drillers noted gravel while drilling from 16.0 feet to 19.0 feet and 23.0 feet and 24.0 feet | |
| 20.0 | 8 | SS | | | |
| 22.0 | | | | | |
| 24.0 | | | 24.0 | | |
| 26.0 | 9 | SS | | Light brown fine to coarse sand (SP) - wet - extremely dense | |
| 28.0 | | | | | |
| | 10 | SS | 29.5 | | |
| 29.5 | | | | End of Boring<br>Boring advanced to 10.0 feet with solid-stem auger<br>HW casing driven to 10.0 feet<br>Boring advanced from 10.0 feet to 20.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL: **Dry before casing installation** | BORING STARTED: **11/2/11** | AECOM OFFICE: **1035 Kepler Drive Green Bay, Wisconsin 54311** | |
| WL: **14.0 feet WS** | BORING COMPLETED: **11/2/11** | ENTERED BY: **CAH** | SHEET NO. **1** OF **1** |
| WL | RIG/FOREMAN: **D-25/BZ** | APP'D BY: **TMT** | AECOM JOB NO. **60225561** |

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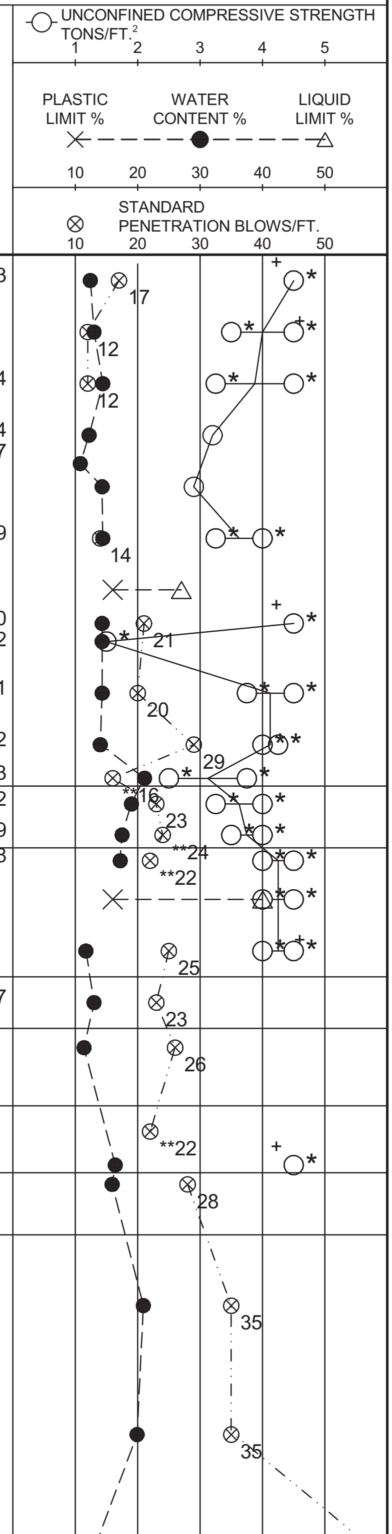
| | | |
|---|---|---|
| **AECOM** | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-4-1** |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | UNIT DRY WT. LBS./Ft.$^3$ |
|---|---|---|---|
| 0.0–2.0 | 1 | SS | 117.3 |
| 2.0–4.0 | 2 | SS | |
| 4.0–6.0 | 3 | SS | 111.4 |
| 6.0–8.0 | 4 | ST | 124.4 |
| 8.0–10.0 | 5 | ST | 117.7 |
| 10.0–12.0 | 6 | SS | 114.9 |
| 12.0–14.0 | 7 | 3" ST | |
| 14.0–15.0 | 8 | SS | 122.0 / 118.2 |
| 16.0–18.0 | 9 | SS | 110.1 |
| 18.0–20.0 | 10 | SS | 115.2 |
| 20.0–21.0 | 11 | SS | 102.3 |
| 21.0–22.0 | 11A | SS | 110.2 |
| 22.0–23.0 | 12 | SS | 107.9 |
| 23.0–24.0 | 12A | SS | 110.8 |
| 24.0–26.0 | 13 | 3" ST | |
| 26.0–28.0 | 14 | SS | |
| 28.0–30.0 | 15 | SS | 115.7 |
| 30.0–32.0 | 16 | SS | |
| 35.0–36.0 | 17 | SS | |
| 36.0–37.0 | 17A | SS | |
| 40.0–42.0 | 18 | SS | |
| 45.0–47.0 | 19 | SS | |

| DEPTH (FT) | DESCRIPTION OF MATERIAL |
|---|---|
| 0.0–20.6 | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, trace thin irregular silty sand seams and lenses, trace silty clay caliche nodules and layers - moist - very stiff to hard |
| 20.6–23.0 | Light brown silty sandy clay (CL) with caliche - moist to wet - very stiff to hard |
| 23.0–28.0 | Light brown, dark brown, and gray mottled clayey sand (SC), trace organics, trace fine gravel, trace thin irregular silty sand seams and lenses - moist - hard<br><br>**Triaxial Test S-14**<br>**Dry Unit Weight = 121 pcf** **Ø' = 27 deg** |
| 28.0–30.0 | Light brown clayey sand (SC) - moist to wet - medium dense |
| 30.0–33.0 | Light brown silty fine to coarse sand (SM), trace clay - moist to wet - medium dense |
| 33.0–35.6 | Light brown silty sandy clay (CL) with caliche, trace fine gravel - moist to wet - hard |
| 35.6–38.0 | Light brown fine to coarse sand (SP) - wet - medium dense |
| 38.0–50.0 | Grayish brown fine to coarse sand (SP) - wet - dense<br><br>Drillers noted sporadic, thin gravel layers while drilling from 35.0 to 50.0 feet |

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* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

STS060701 60225561.GPJ STS.GDT 1/4/12

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| IPR-GDF SUEZ North America | B-4-1 |
| PROJECT NAME: Coleto Creek Energy Facility Ash Pond | ARCHITECT/ENGINEER |

AECOM

SITE LOCATION: Goliad County, Fannin, Texas

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS./Ft.$^3$ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ / WATER CONTENT % / STANDARD PENETRATION BLOWS/FT. |
|---|---|---|---|---|---|---|---|---|
| 51.5 | | 20 | SS | | | 51.5 Grayish bown fine to coarse sand (SP), trace to little fine gravel, occasional thin layers of gray silty clay and caliche - moist to wet - very dense | | 60 |

End of Boring
Boring advanced to 6.0 feet with solid-stem auger
HW casing driven to 5.5 feet
Boring advanced from 6.0 feet to 30.0 feet with 4-inch rock bit and drilling fluid
Boring advanced from 30.0 feet to 50.0 feet with 3-inch rock bit and drilling fluid
Boring abandoned with bentonite quick grout using tremie method
Split-spoons were driven with cathead and rope

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | |
|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/7/11 | AECOM OFFICE 1035 Kepler Drive Green Bay, Wisconsin 54311 |
| WL 10.0 to 12.0 feet | BORING COMPLETED 11/7/11 | ENTERED BY CAH / SHEET NO. 2 OF 2 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT / AECOM JOB NO. 60225561 |

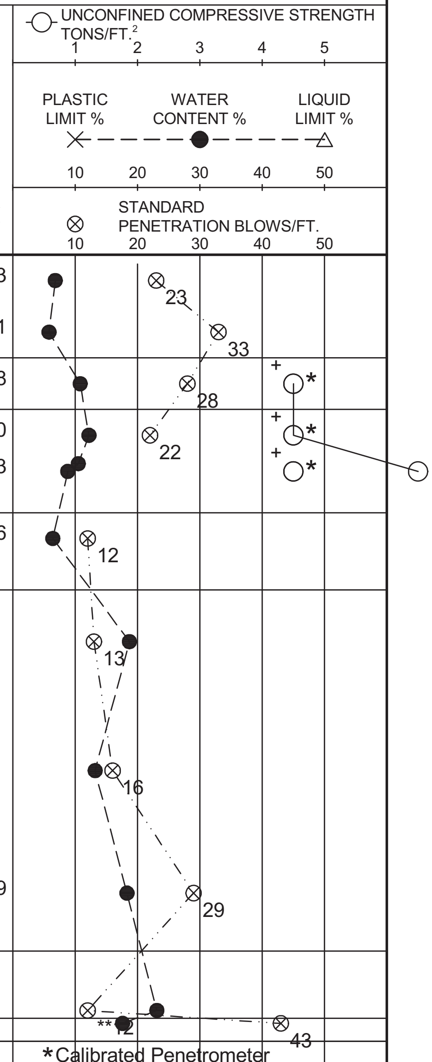
STS060701 60225561.GPJ STS.GDT 1/4/12

| AECOM | CLIENT: **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-4-2** |
|---|---|---|
| | PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +119.6

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.³ | STANDARD PENETRATION BLOWS/FT. |
|---|---|---|---|---|---|
| 2.0 | 1 | SS | Fill: Dark brown and brown silty fine to medium sand (SM), trace fine gravel, trace roots, trace clay - moist - medium dense | 115.3 | 23 |
| 4.0 | 2 | SS | (4.0) | 122.1 | 33 |
| 6.0 | 3 | SS | Buried Topsoil: Dark brown and black organic silty clay (OL), trace to little sand - desiccated - hard (6.0) | 125.8 | 28 |
| 8.0 | 4 | SS | Light brown and light gray mottled silty clayey sand (SC), trace fine gravel, trace irregular caliche nodules - moist - hard | 126.0 | 22 |
| | 5 | ST | Note: Dark gray silty sandy clay (CL) layer from 8.0 feet to 8.3 feet | 129.3 | |
| 10.0 | | | (10.0) | | |
| 12.0 | 6 | SS | Light brown silty fine sand (SM), trace clay - moist - medium dense<br>Note: Plastic liner was used within split-spoon for Sample 6 (13.0) | 124.6 | 12 |
| 14.0 | | | | | |
| 16.0 | 7 | SS | Light brown fine to coarse sand (SP) - wet - medium dense | | 13 |
| 18.0 | | | | | |
| 20.0 | 8 | SS | | | 16 |
| 22.0 | | | Drillers noted hard drilling at 22.0 feet | | |
| 24.0 | | | | | |
| 26.0 | 9 | SS | Note: White silty clay (CL-caliche) layer from 24.7 feet to 25.1 feet (27.0) | 106.9 | 29 |
| 28.0 | | | Light gray silty fine sand (SM), trace clay - wet - medium dense (29.6) | | |
| 30.0 | 10 | SS | | | 12** |
| | 10A | SS | Light brown fine to coarse sand (SP) - wet - dense (30.5) | | 43 |
| 30.5 | | | End of Boring<br>Boring advanced to 10.0 feet with solid-stem auger<br>HW casing driven to 8.0 feet<br>Boring advanced from 10.0 feet to 29.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | |
|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/2/11** | AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **14.0 feet WS** | BORING COMPLETED **11/2/11** | ENTERED BY **CAH** / SHEET NO. **1** OF **1** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** / AECOM JOB NO. **60225561** |

STS060701 60225561.GPJ STS.GDT 1/4/12

AECOM

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| IPR-GDF SUEZ North America | B-5-1 |
| PROJECT NAME | ARCHITECT/ENGINEER |
| Coleto Creek Energy Facility Ash Pond | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.6

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| 2.0 | 1 | SS | Fill: Light gray and brown mottled clayey sand (SC), trace fine gravel, occasional thin irregular silty sand seams, trace silty clay caliche nodules and layers - moist to wet - very stiff to hard | 128.2 |
| 4.0 | 2 | SS | | 124.7 |
| 6.0 | 3 | SS | | 127.5 |
| 8.0 | 4 | SS | | 111.9 |
| 10.0 | 5 | SS | | |
| 12.0 | 6 | SS | | 118.7 |
| | 7 | SS | | |
| 14.0 | 7A | SS | | 108.9 |
| 16.0 | 8 | SS | | |
| 18.0 | 9 | SS | | 111.3 |
| | 10 | SS | | |
| 20.0 | 11 | SS | 20.8 | |
| 22.0 | 11A | SS | Gray and brown silty clay (CL), trace organics, trace sand, trace thin saturated silty sand seams and lenses - moist to wet - very stiff to hard | 116.1<br>118.2 |
| 24.0 | 12 | ST | 24.0 | |
| 26.0 | 13 | SS | White and gray silty clay (CL-caliche), little sand - moist to wet - stiff to hard | 107.5 |
| | 14 | ST | | 99.1 |
| 28.0 | | | | |
| 30.0 | 15 | SS | | 102.5 |
| 32.0 | 16 | SS | 32.0 | 103.6 |
| 34.0 | 17 | SS | Gray silty fine to coarse sand (SM), trace fine gravel, trace clay - wet - dense | |
| | | | 35.0 | |
| 36.0 | 18 | SS | Gray fine to coarse sand (SP), trace fine gravel - wet - extremely dense to very dense<br>Note: Hard white silty clay (CL-caliche) in tip of Sample 18 | |
| 38.0 | | | | |
| 40.0 | | | | |
| 42.0 | 19 | SS | 43.0 | |
| 44.0 | | | Gray silty fine sand (SM) - wet - dense to extremely dense | |
| 46.0 | 20 | SS | Drillers noted hard drilling and gravel and cobbles from 43.0 to 45.0 feet | |
| 48.0 | | | | |
| 50.0 | | | | |

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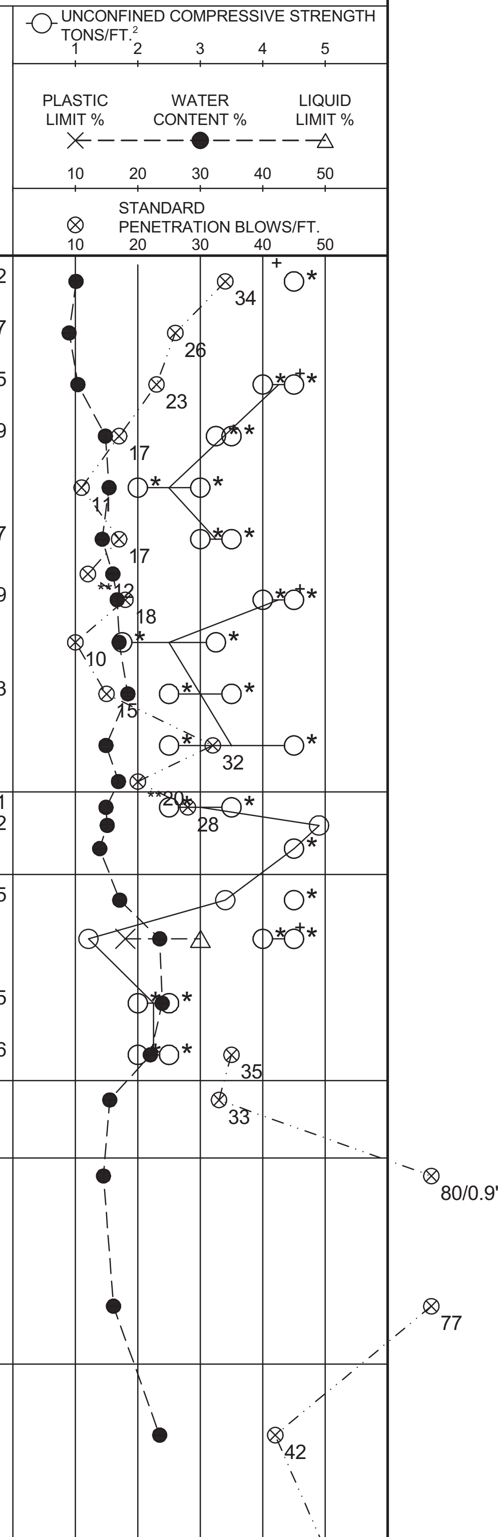



* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

STS060701 60225561.GPJ STS.GDT 1/4/12

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-5-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

SURFACE ELEVATION: +139.6 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ | Tests / SPT |
|---|---|---|---|---|---|---|---|---|
| | | 21 | SS | | | 50.4 No recovery Sample 21 | | 50/0.4' |
| 50.4 | | | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 32.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 32.0 feet to 50.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | | *Calibrated Penetrometer |

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/7/11** | AECOM OFFICE | **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **8.0 to 10.0 feet WS** | BORING COMPLETED **11/7/11** | ENTERED BY **CAH** | SHEET NO. **2** OF **2** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-1-1 ______ Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location
13453086.8 ft. ☒ N. ☐ S., 2543146.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ______ ft. N. ______ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID:

License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date 11/5/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ______

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) 121.0

Casing Diameter (in.) 4.0

Casing Depth (ft.) 5.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) 14.0

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☐ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 121.0 | 50 gallons | |
| | | | | |
| | | | | |

(6) Comments ______

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/6/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/6/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-2-1 ____ Gov't Lot (if applicable)

Grid Location: ___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

13453065.2 ft. ☒ N. ☐ S., 2543576.6 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ___ ft. N. ___ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID:

License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/3/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ___

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 119.5

Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) ___

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

| | Yes | No | Not Applicable |
|---|---|---|---|
| Pump & Piping Removed? | ☐ | ☐ | ☒ |
| Liner(s) Removed? | ☐ | ☐ | ☒ |
| Screen Removed? | ☐ | ☐ | ☒ |
| Casing Left in Place? | ☐ | ☐ | |

| | Yes | No |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ | ☒ |
| Did Sealing Material Rise to Surface? | ☒ | ☐ |
| Did Material Settle After 24 Hours? | ☐ | ☒ |
| If Yes, Was Hole Retopped? | ☐ | ☒ |

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only

☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 19.5 | 50 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.

Date of Abandonment: 11/4/11

Signature of Person Doing Work:

Date Signed: 11/4/11

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

## WELL/DRILLHOLE/BOREHOLE ABANDONMENT

### (1) GENERAL INFORMATION

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-2-2 ____ Gov't Lot (if applicable)

Grid Location: ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

13452977.2 ft. ☒ N. ☐ S., 2543676.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

### (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

### (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/1/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 70.5

Casing Diameter (in.): 4.0

Casing Depth (ft.): 10.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): 3.5

### (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only

☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

### (5)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 70.5 | 30 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.

Date of Abandonment: 11/2/11

Signature of Person Doing Work:

Date Signed: 11/2/11

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-3-1 ____ Gov't Lot (if applicable)

Grid Location ___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

13451245.3 ft. ☒ N. ☐ S., 2543663.1 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ___ ft. N. ___ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID:

License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date 11/8/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) ____ Casing Diameter (in.) 4.0

Casing Depth (ft.) 5.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 36.5 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.

Date of Abandonment: 11/8/11

Signature of Person Doing Work:

Date Signed: 11/8/11

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-3-2 ______ Gov't Lot (if applicable)

Grid Location: ___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

1341251.3 ft. ☒ N. ☐ S., 2543721.2 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ______ ft. N. ______ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/2/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ______

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 29.5

Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): 14.0

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only

☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 29.5 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ______

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.

Date of Abandonment: 11/2/11

Signature of Person Doing Work

Date Signed: 11/2/11

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-4-1 ____ Gov't Lot (if applicable)

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location: 1340613.7 ft. ☒ N. ☐ S., 2543740.9 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/7/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 51.5
Casing Diameter (in.): 5.0
Casing Depth (ft.): 4.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet): N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

| | Yes | No | Not Applicable |
|---|---|---|---|
| Pump & Piping Removed? | ☐ | ☐ | ☒ |
| Liner(s) Removed? | ☐ | ☐ | ☒ |
| Screen Removed? | ☐ | ☐ | ☒ |
| Casing Left in Place? | ☐ | ☒ | |

| | Yes | No |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ | ☒ |
| Did Sealing Material Rise to Surface? | ☒ | ☐ |
| Did Material Settle After 24 Hours? | ☐ | ☒ |
| If Yes, Was Hole Retopped? | ☐ | ☒ |

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 51.5 | 25 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.
Date of Abandonment: 11/7/11

Signature of Person Doing Work:
Date Signed: 11/7/11

Street or Route: 1035 Kepler Drive
Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

## (1) GENERAL INFORMATION

Unique Well No.: | Well ID No.: | County: Goliad

Common Well Name: B-4-2 | Gov't Lot (if applicable):

Grid Location: ___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

13450619.3 ft. ☒ N. ☐ S., 2543806.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ___ ft. N. ___ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well:

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/2/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ___

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 31.0 | Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): 14.0

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

## (5)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 31.0 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/2/11

Signature of Person Doing Work: | Date Signed: 11/2/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-5-1 ______ Gov't Lot (if applicable)

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location

13451003.7 ft. ☒ N. ☐ S., 2543693.8 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ______ ft. N. ______ ft. E. ☐ S ☐ C ☐ N Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date 11/7/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ______

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) 50.9 Casing Diameter (in.) 4.0

Casing Depth (ft.) 5.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

| | Yes | No | Not Applicable |
|---|---|---|---|
| Pump & Piping Removed? | ☐ | ☐ | ☒ |
| Liner(s) Removed? | ☐ | ☐ | ☒ |
| Screen Removed? | ☐ | ☐ | ☒ |
| Casing Left in Place? | ☐ | ☒ | |

| | Yes | No |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ | ☒ |
| Did Sealing Material Rise to Surface? | ☒ | ☐ |
| Did Material Settle After 24 Hours? | ☐ | ☒ |
| If Yes, Was Hole Retopped? | ☐ | ☒ |

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only

☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 50.9 | 25 gallons | |
| | | | | |
| | | | | |

(6) Comments ______

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/7/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/7/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

# AECOM General Notes

## Drilling and Sampling Symbols:

| | |
|---|---|
| SS : Split Spoon - 1-3/8" I.D. 2" O.D. (Unless otherwise noted) | HS : Hollow Stem Auger |
| ST : Shelby Tube-2" O.D. (Unless otherwise noted) | WS : Wash Sample |
| PA : Power Auger | FT : Fish Tail |
| DB : Diamond Bit-NX, BX, AX | RB : Rock Bit |
| AS : Auger Sample | BS : Bulk Sample |
| JS : Jar Sample | PM : Pressuremeter Test |
| VS : Vane Shear | GS : Giddings Sampler |
| OS : Osterberg Sampler | |

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

## Water Level Measurement Symbols:

| | |
|---|---|
| WL : Water Level | WCI : Wet Cave In |
| WS : While Sampling | DCI : Dry Cave In |
| WD : While Drilling | BCR : Before Casing Removal |
| AB : After Boring | ACR : After Casing Removal |

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

## Gradation Description and Terminology:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

| **Major Component of Sample** | **Size Range** | **Description of Other Components Present in Sample** | **Percent Dry Weight** |
|---|---|---|---|
| Boulders | Over 8 in. (200 mm) | Trace | 1-9 |
| Cobbles | 8 inches to 3 inches (200 mm to 75 mm) | Little | 10-19 |
| Gravel | 3 inches to #4 sieve (75 mm to 4.76 mm) | Some | 20-34 |
| Sand | #4 to #200 sieve (4.76 mm to 0.074 mm) | And | 35-50 |
| Silt | Passing #200 sieve (0.074 mm to 0.005 mm) | | |
| Clay | Smaller than 0.005 mm | | |

## Consistency of Cohesive Soils: / Relative Density of Granular Soils:

| **Unconfined Compressive Strength, Qu, tsf** | **Consistency** | **N-Blows per foot** | **Relative Density** |
|---|---|---|---|
| <0.25 | Very Soft | 0 - 3 | Very Loose |
| 0.25 - 0.49 | Soft | 4 - 9 | Loose |
| 0.50 - 0.99 | Medium (firm) | 10 - 29 | Medium Dense |
| 1.00 - 1.99 | Stiff | 30 - 49 | Dense |
| 2.00 - 3.99 | Very Stiff | 50 - 80 | Very Dense |
| 4.00 - 8.00 | Hard | >80 | Extremely Dense |
| >8.00 | Very Hard | | |

# AECOM Field and Laboratory Procedures

Field Sampling Procedures

## Auger Sampling (AS)

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

## Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

## Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

## Giddings Sampler (GS)

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.

# AECOM Field and Laboratory Procedures

Subsurface Exploration Procedures

## Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

## Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

## Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

## Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

## Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

# AECOM Laboratory Procedures

## Water Content (Wc)
The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

## Hand Penetrometer (Qp)
In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

## Unconfined Compression Tests (Qu)
In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

## Dry Density ($\gamma d$)
The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

## Classification of Samples
In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the AECOM Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "AECOM General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the AECOM Soil Classification System.

# AECOM Standard Boring Log Procedures

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

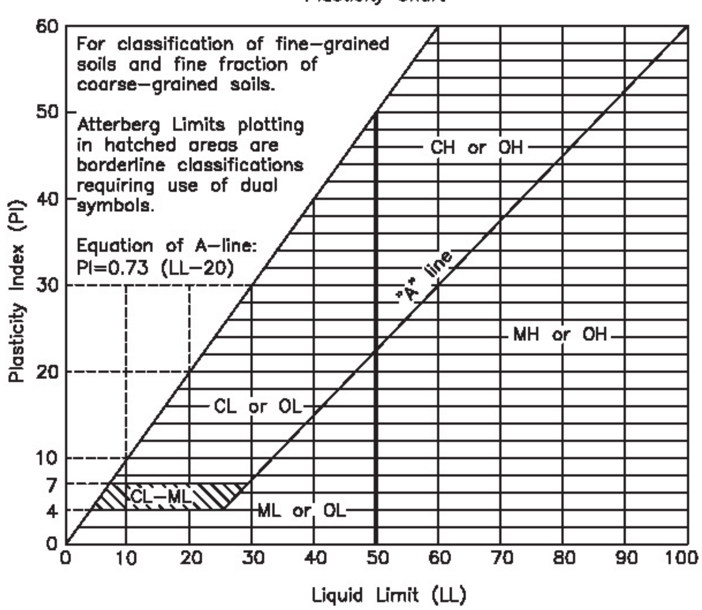
Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.

AECOM

# AECOM Soil Classification System [1]

| Major Divisions | | | Group Symbols | Typical Names | Laboratory Classification Criteria | | |
|---|---|---|---|---|---|---|---|
| Coarse-grained soils (More than half of material is ***larger*** than No. 200 sieve size) | Gravel (More than half of coarse fraction is larger than No. 4 sieve size) | Clean gravel (Little or no fines) | GW | Well-graded, gravel, gravel-sand mixtures, little or no fines | Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent . . . . . GW, GP, SW, SP; More than 12 percent . . . . . GM, GC, SM, SC; 5 to 12 percent . . . . . Borderline cases ***requiring*** dual symbols [3] | $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3 | |
| | | | GP | Poorly graded gravel, gravel-sand mixtures, little or no fines | | Not meeting all gradation requirements for GW | |
| | | Gravel with fines (Appreciable amount of fines) | GM | Silty gravel, gravel-sand-silt mixtures | | Atterberg limits below "A" line or PI less than 4 | Above "A" line with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols |
| | | | GC | Clayey gravel, gravel-sand-clay mixtures | | Atterberg limits above "A" line or PI greater than 7 | |
| | Sand (More than half of coarse fraction is smaller than No. 4 sieve size) | Clean sand (Little or no fines) | SW | Well-graded sand, gravelly sand, little or no fines | | $C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3 | |
| | | | SP | Poorly graded sand, gravelly sand, little or no fines | | Not meeting all gradation requirements for SW | |
| | | Sand with fines (Appreciable amount of fines) | SM | Silty sand, sand-silt mixtures | | Atterberg limits below "A" line or PI less than 4 | Limits plotting in hatched zone with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols |
| | | | SC | Clayey sand, sand-clay mixtures | | Atterberg limits above "A" line or PI greater than 7 | |
| Fine-grained soils (More than half of material is ***smaller*** than No. 200 sieve size) | Silt and clay (Liquid limit less than 50) | | ML | Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity | Plasticity Chart [2] (see chart below) | | |
| | | | CL | Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay | | | |
| | | | OL | Organic silt and organic silty clay of low plasticity | | | |
| | Silt and clay (Liquid limit greater than 50) | | MH | Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt | | | |
| | | | CH | Inorganic clay of high plasticity, fat clay | | | |
| | | | OH | Organic clay of medium to high plasticity, organic silt | | | |
| | Highly organic soils | | PT | Peat and other highly organic soil | | | |

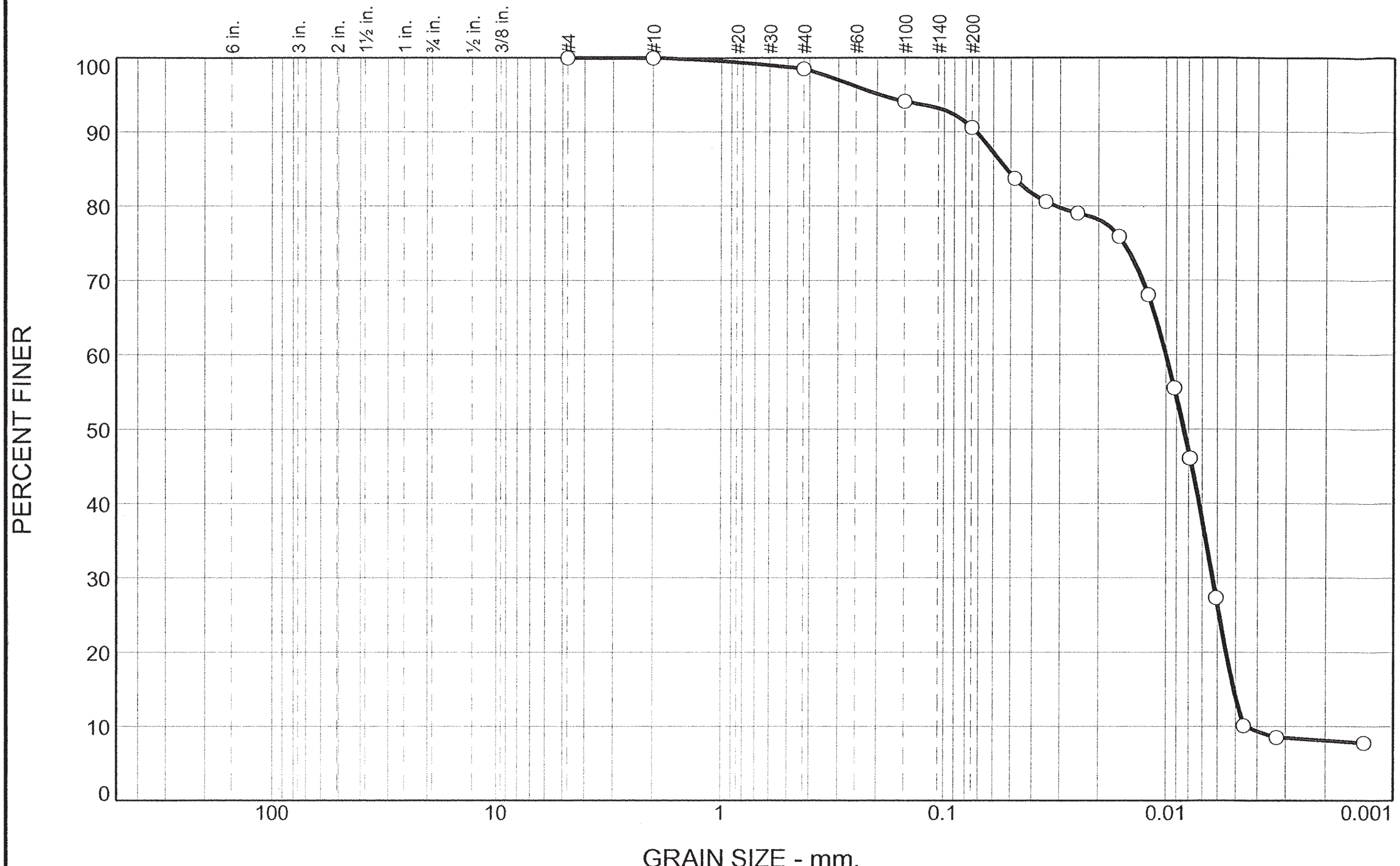
Plasticity Chart [2]




1. See AECOM General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
2. Reference: Unified Soil Classification Systems
3. Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

# APPENDIX B: GEOTECHNICAL LABORATORY DATA

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 7.9 | 76.7 | 13.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 100.0 | | |
| #40 | 98.5 | | |
| #100 | 94.1 | | |
| #200 | 90.6 | | |

* (no specification provided)

**Material Description**

LIGHT GRAY SILTY CLAY, TRACE SAND

**Atterberg Limits**

PL= 14 LL= 22 PI= 8

**Coefficients**

$D_{90}$= 0.0716 $D_{85}$= 0.0523 $D_{60}$= 0.0100
$D_{50}$= 0.0084 $D_{30}$= 0.0063 $D_{15}$= 0.0051
$D_{10}$= 0.0045 $C_u$= 2.21 $C_c$= 0.88

**Classification**

USCS= CL AASHTO= A-4(5)

**Remarks**

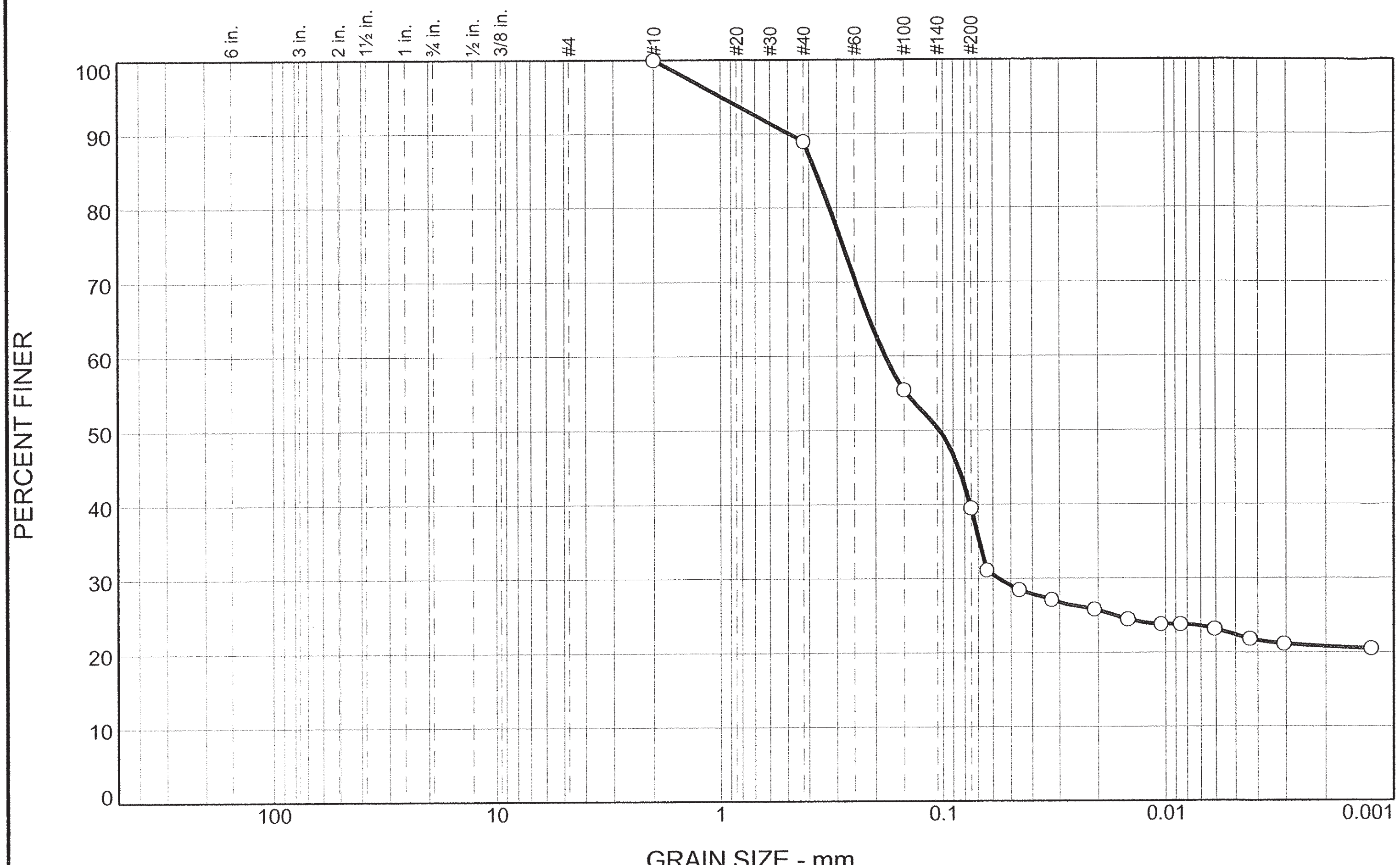
**Source of Sample:** B-1-1 **Depth:** 8'-10'
**Sample Number:** B-1-1 S-5 **Date:** 12/09/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 11.0 | 49.5 | 17.1 | 22.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 89.0 | | |
| #100 | 55.5 | | |
| #200 | 39.5 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, BROWNISH GRAY

**Atterberg Limits**

PL= 14 LL= 38 PI= 24

**Coefficients**

$D_{90}$= 0.4902 $D_{85}$= 0.3732 $D_{60}$= 0.1816
$D_{50}$= 0.1036 $D_{30}$= 0.0564 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(4)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 20'-22'
**Sample Number:** B-1-1 S-11

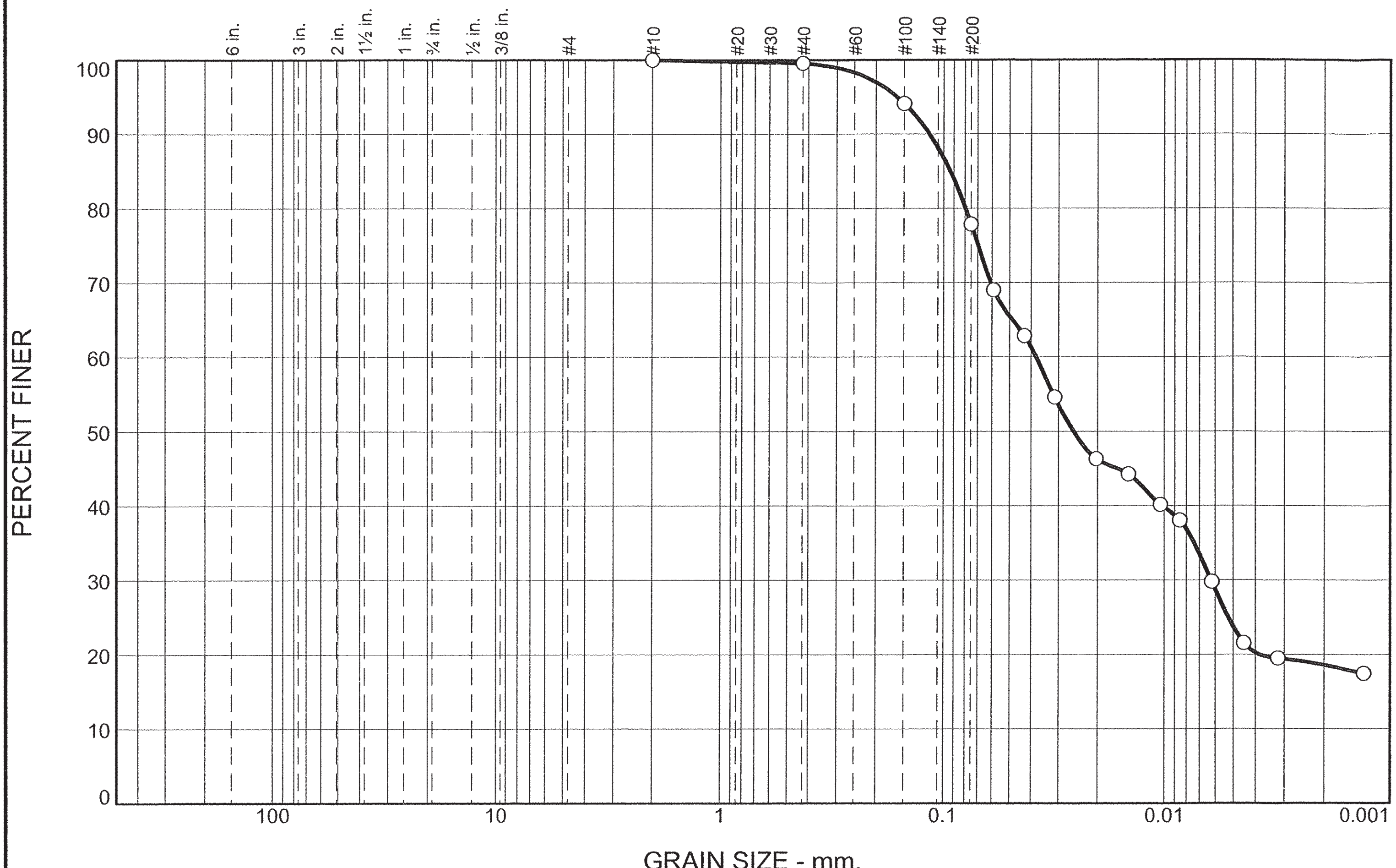
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 21.7 | 54.2 | 23.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 99.6 | | |
| #100 | 94.1 | | |
| #200 | 77.9 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, SOME SAND, LIGHT GRAY

**Atterberg Limits**

PL= 17 LL= 42 PI= 25

**Coefficients**

$D_{90}$= 0.1156 $D_{85}$= 0.0934 $D_{60}$= 0.0380
$D_{50}$= 0.0258 $D_{30}$= 0.0062 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-7-6(18)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 90'-90.4'
**Sample Number:** B-1-1 S-34

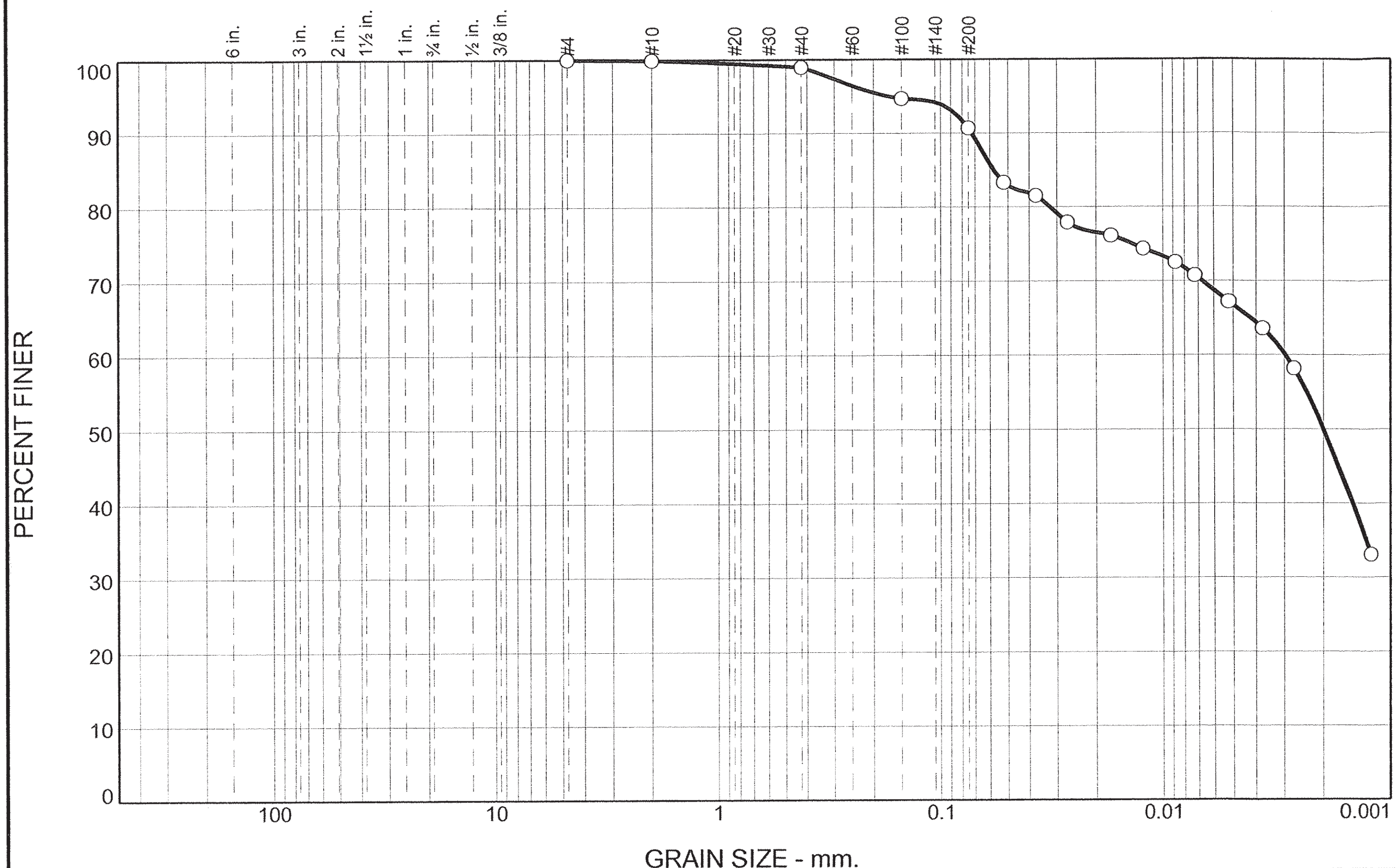
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 8.2 | 23.9 | 66.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #40 | 98.9 | | |
| #100 | 94.7 | | |
| #200 | 90.7 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, TRACE SAND, BROWN

**Atterberg Limits**

PL= 28 LL= 79 PI= 51

**Coefficients**

$D_{90}$= 0.0724 $D_{85}$= 0.0576 $D_{60}$= 0.0030
$D_{50}$= 0.0020 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CH AASHTO= A-7-6(53)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 120'-121'
**Sample Number:** B-1-1 S-40

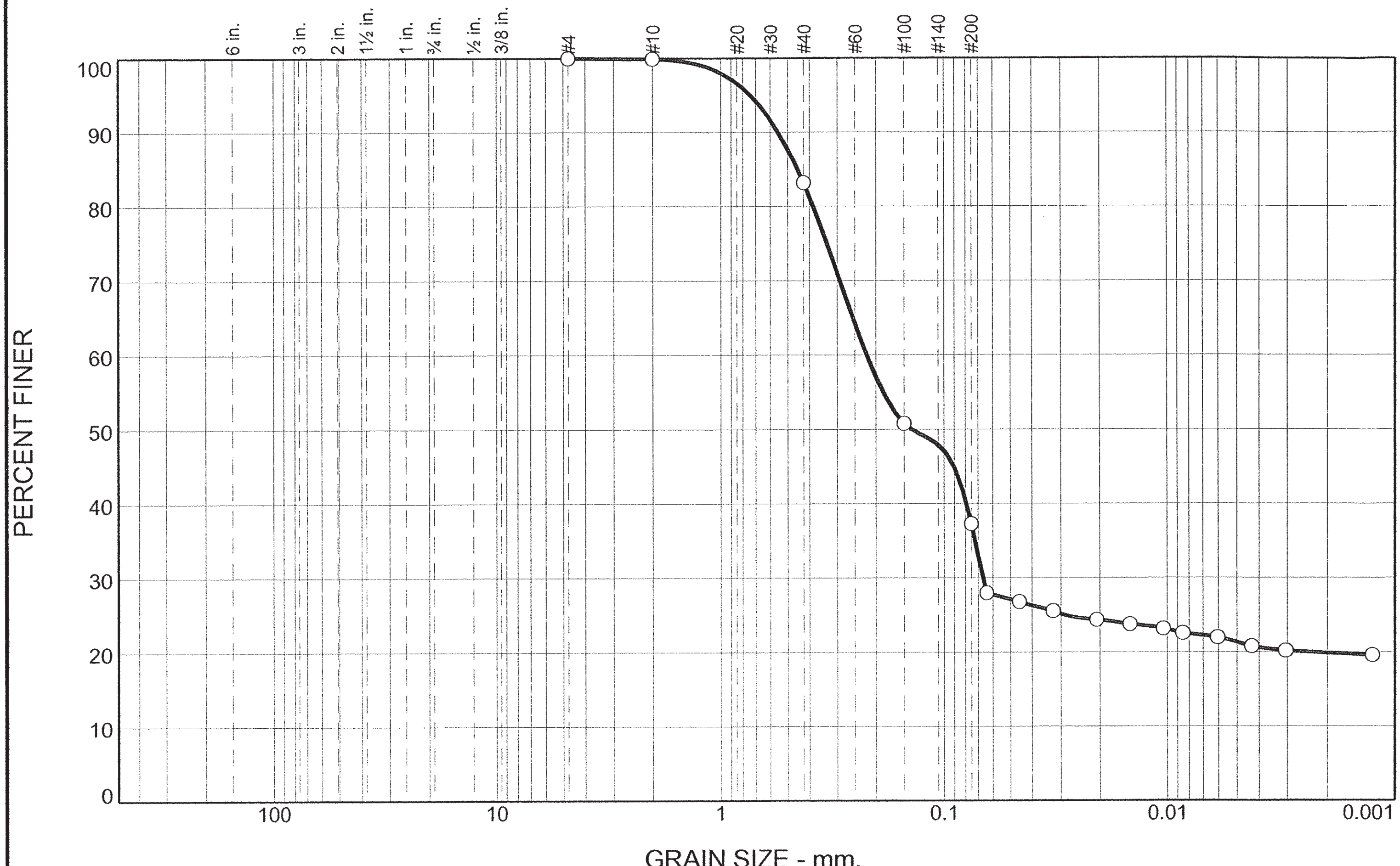
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 16.7 | 45.9 | 15.9 | 21.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #40 | 83.2 | | |
| #100 | 50.8 | | |
| #200 | 37.3 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAYISH BROWN

**Atterberg Limits**

PL= 14 LL= 38 PI= 24

**Coefficients**

$D_{90}$= 0.5520 $D_{85}$= 0.4512 $D_{60}$= 0.2202
$D_{50}$= 0.1389 $D_{30}$= 0.0666 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(3)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 10'-12'
**Sample Number:** B-2-1 S-6

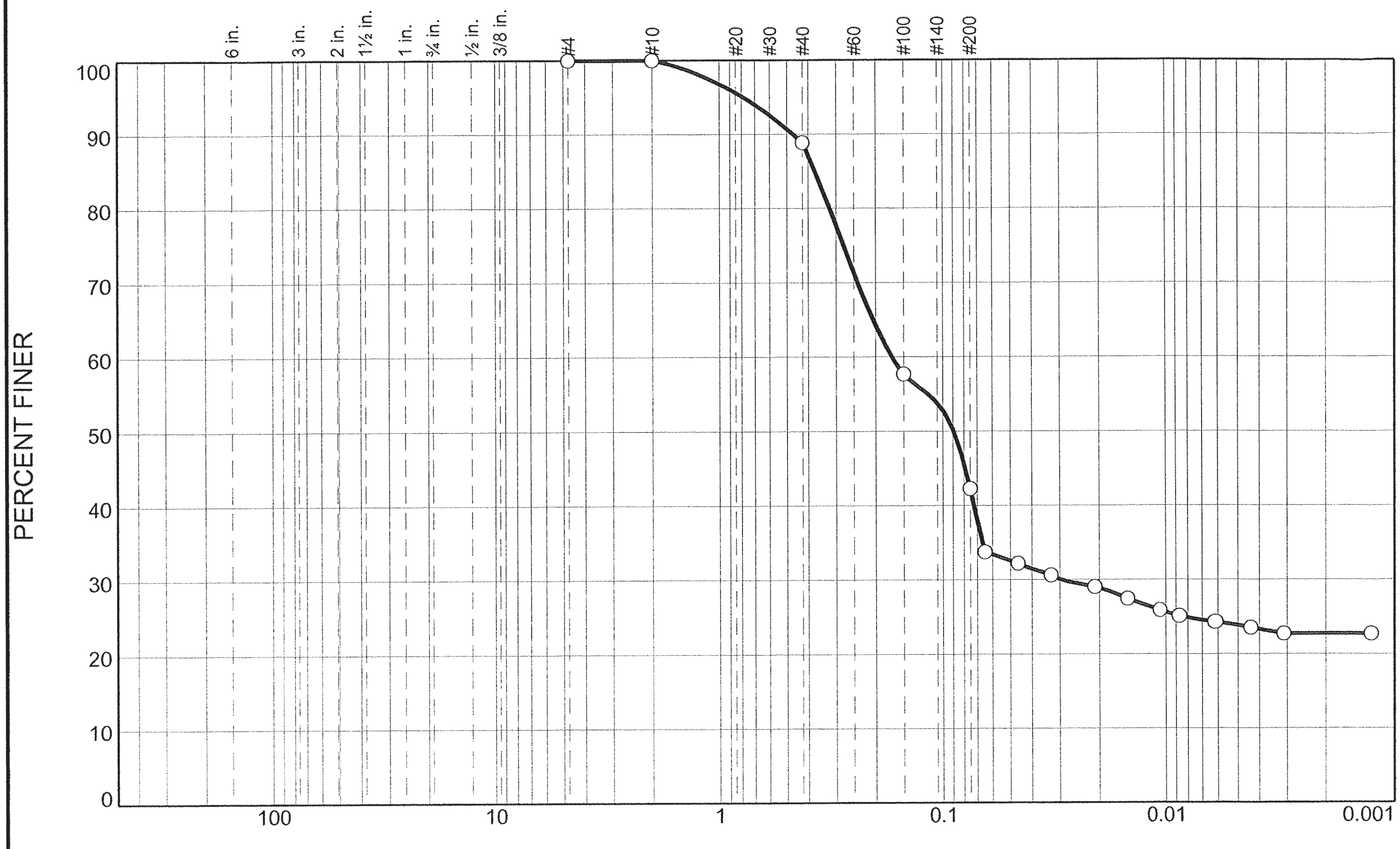
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 11.1 | 46.6 | 18.4 | 23.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 100.0 | | |
| #40 | 88.9 | | |
| #100 | 57.7 | | |
| #200 | 42.3 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAYISH BROWN

**Atterberg Limits**

PL= 13 LL= 41 PI= 28

**Coefficients**

$D_{90}$= 0.4679 $D_{85}$= 0.3722 $D_{60}$= 0.1697
$D_{50}$= 0.0893 $D_{30}$= 0.0293 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-7-6(6)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 18'-20'
**Sample Number:** B-2-1 S-10

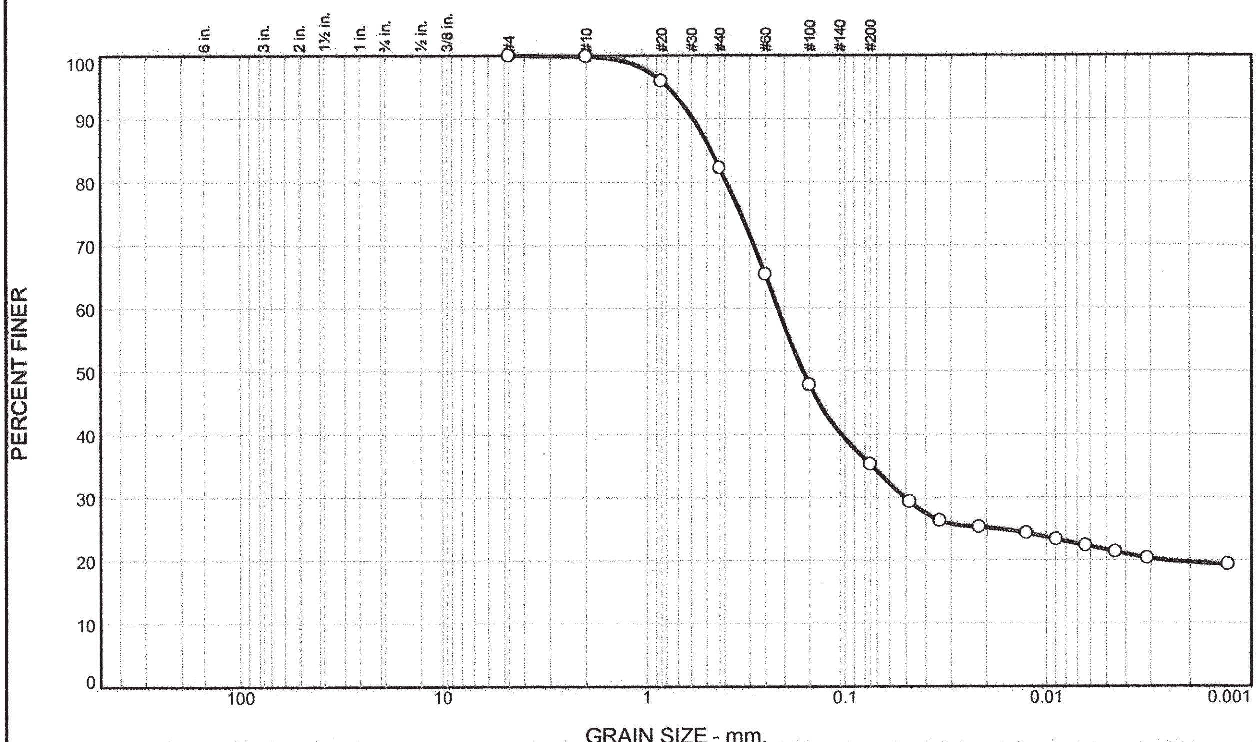
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 17.7 | 47.0 | 13.6 | 21.6 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #20 | 96.0 | | |
| #40 | 82.2 | | |
| #60 | 65.3 | | |
| #100 | 47.8 | | |
| #200 | 35.2 | | |

* (no specification provided)

**Material Description**

Clayey F-M Sand Little Silt - Brownish Gray

**Atterberg Limits**

PL= 18 LL= 42 PI= 24

**Coefficients**

$D_{90}$= 0.5889 $D_{85}$= 0.4733 $D_{60}$= 0.2159
$D_{50}$= 0.1616 $D_{30}$= 0.0509 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-2-7(3)

**Remarks**

**Source of Sample:** Boring 2-1 **Depth:** 26.0-28.0
**Sample Number:** S-14

**Date:** 12/7/2011

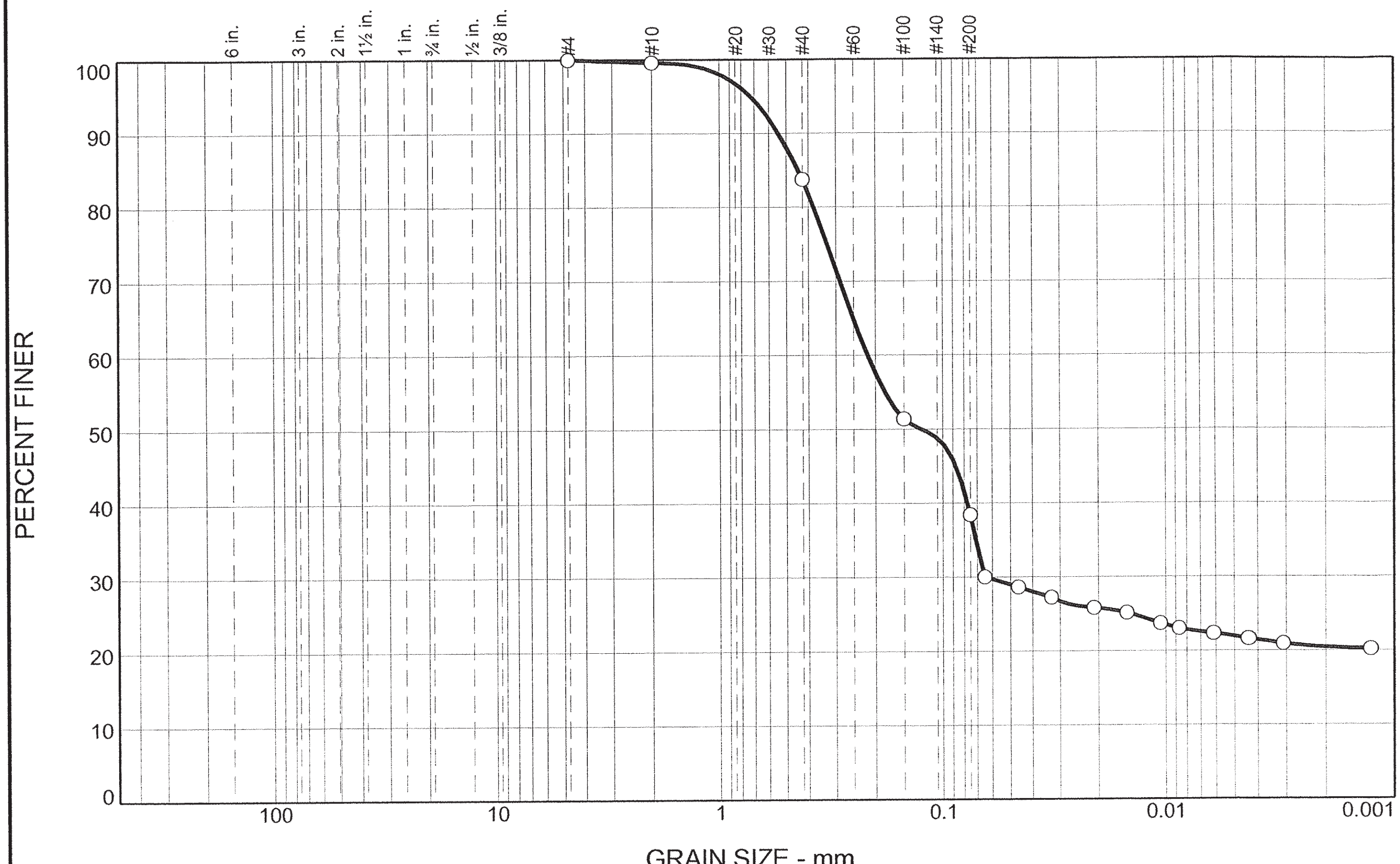
AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility

**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.4 | 15.8 | 45.4 | 16.4 | 22.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.6 | | |
| #40 | 83.8 | | |
| #100 | 51.4 | | |
| #200 | 38.4 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAY

**Atterberg Limits**

PL= 14 LL= 29 PI= 15

**Coefficients**

$D_{90}$= 0.5414 $D_{85}$= 0.4433 $D_{60}$= 0.2165
$D_{50}$= 0.1251 $D_{30}$= 0.0637 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(2)

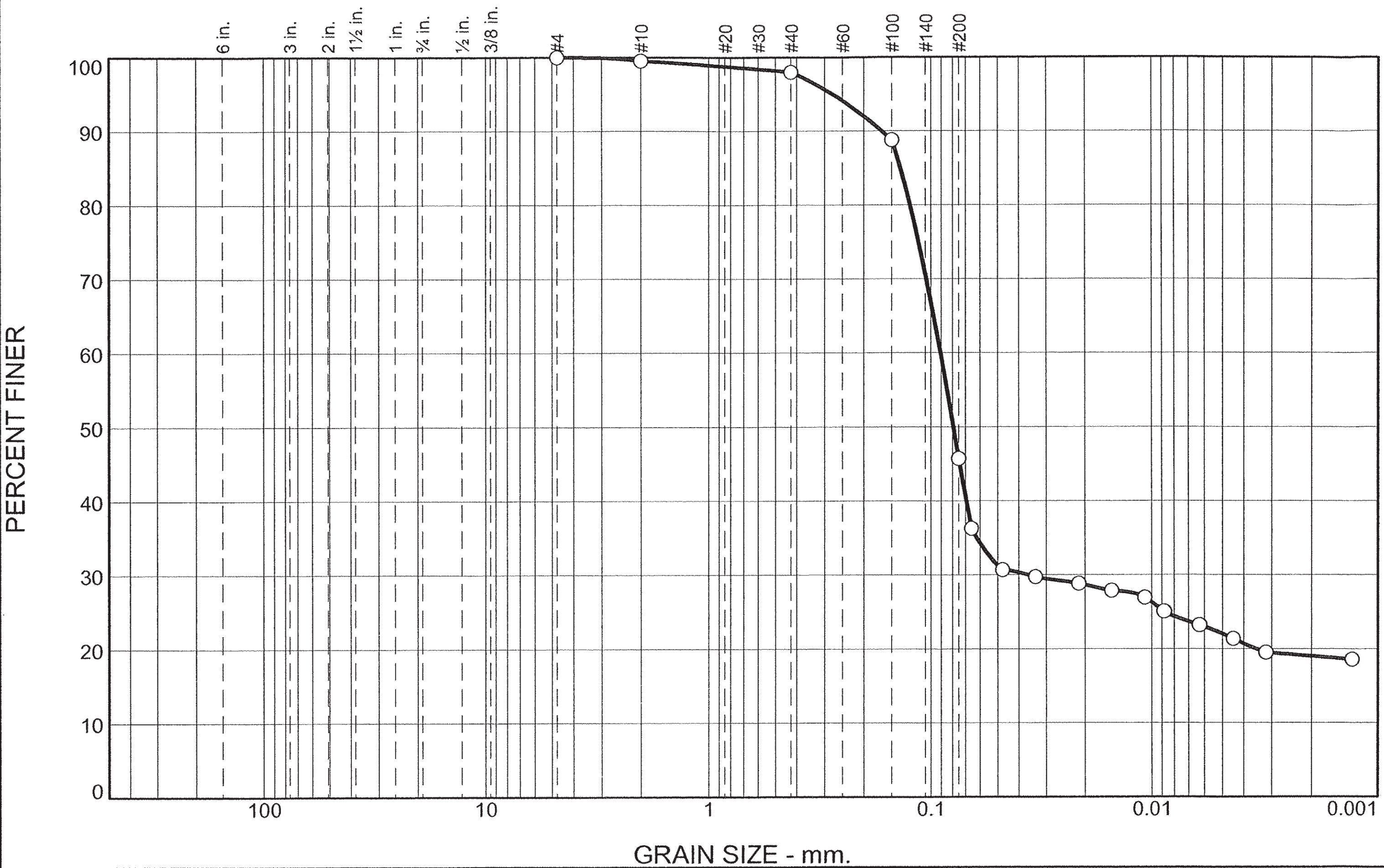
**Remarks**

**Source of Sample:** B-2-1 **Depth:** 32'-34'
**Sample Number:** B-2-1 S-17 **Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.5 | 1.5 | 52.3 | 23.7 | 22.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.5 | | |
| #40 | 98.0 | | |
| #100 | 88.8 | | |
| #200 | 45.7 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE SAND, LIGHT GRAY

**Atterberg Limits**

PL= 17 LL= 28 PI= 11

**Coefficients**

$D_{90}$= 0.1663 $D_{85}$= 0.1371 $D_{60}$= 0.0906
$D_{50}$= 0.0793 $D_{30}$= 0.0362 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(2)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 55.0'-56.6'
**Sample Number:** B-2-1 S-27

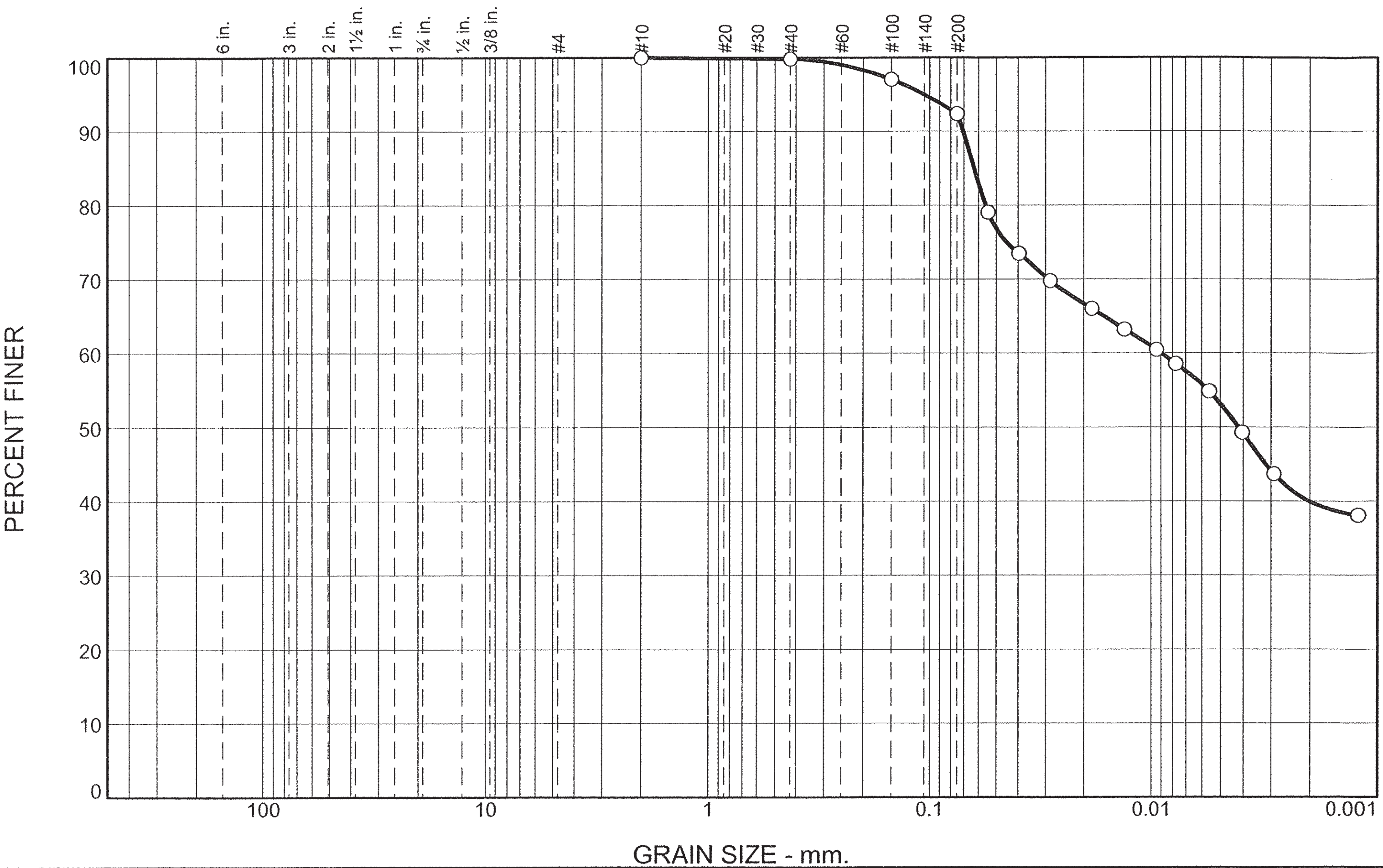
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 7.4 | 39.2 | 53.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 99.8 | | |
| #100 | 97.0 | | |
| #200 | 92.4 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, TRACE SAND, LIGHT GRAYISH BROWN

**Atterberg Limits**

PL= 25 LL= 59 PI= 34

**Coefficients**

$D_{90}$= 0.0705 $D_{85}$= 0.0630 $D_{60}$= 0.0090
$D_{50}$= 0.0042 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CH AASHTO= A-7-6(35)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 85.0'-86.5'
**Sample Number:** B-2-1 S-33

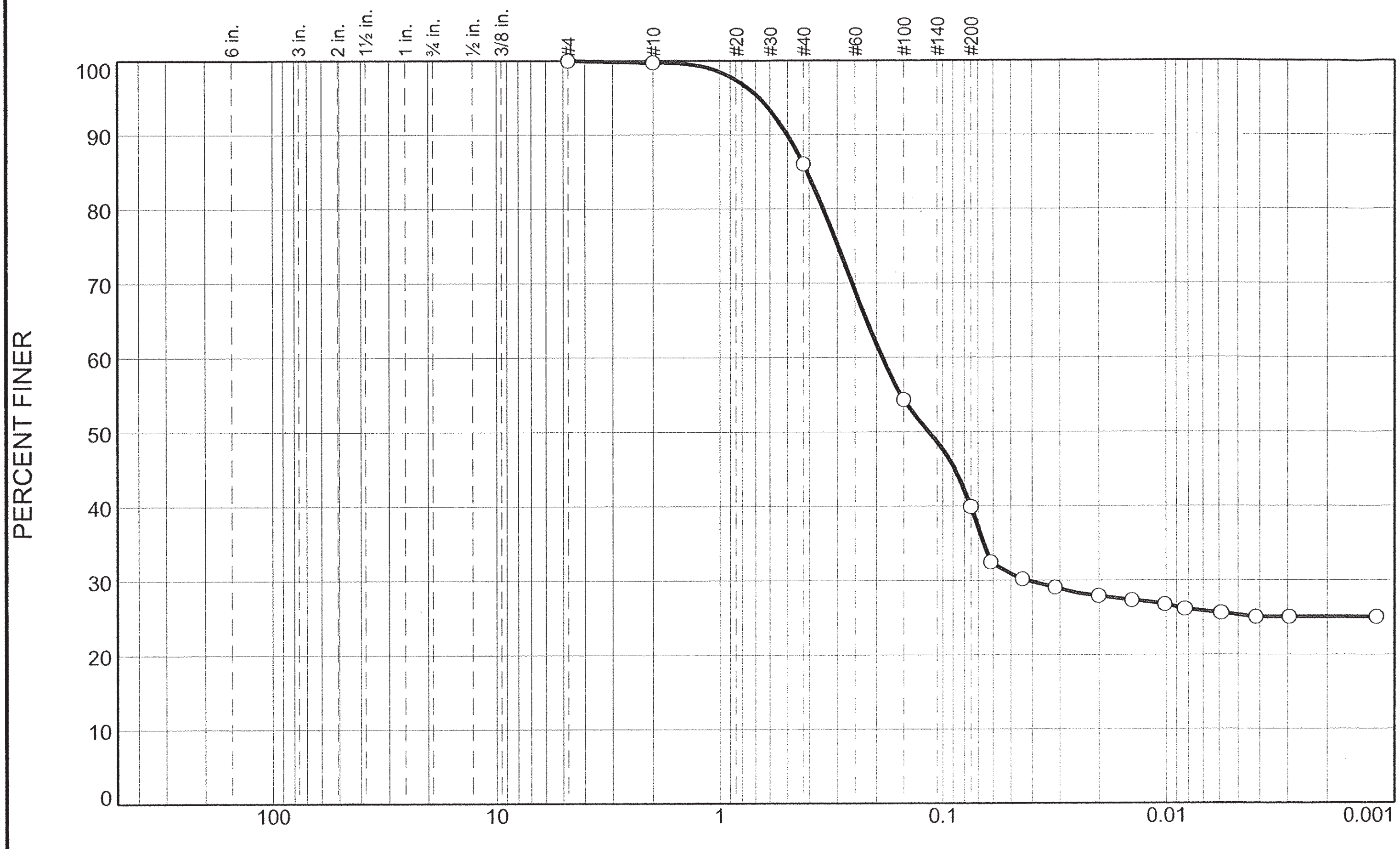
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.3 | 13.6 | 46.1 | 14.6 | 25.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.7 | | |
| #40 | 86.1 | | |
| #100 | 54.4 | | |
| #200 | 40.0 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAY

**Atterberg Limits**

PL= 15 LL= 44 PI= 29

**Coefficients**

$D_{90}$= 0.5011 $D_{85}$= 0.4085 $D_{60}$= 0.1882
$D_{50}$= 0.1152 $D_{30}$= 0.0416 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-7-6(6)

**Remarks**

**Source of Sample:** B-3-1 **Depth:** 16.0'-17.8'
**Sample Number:** B-3-1 S-9

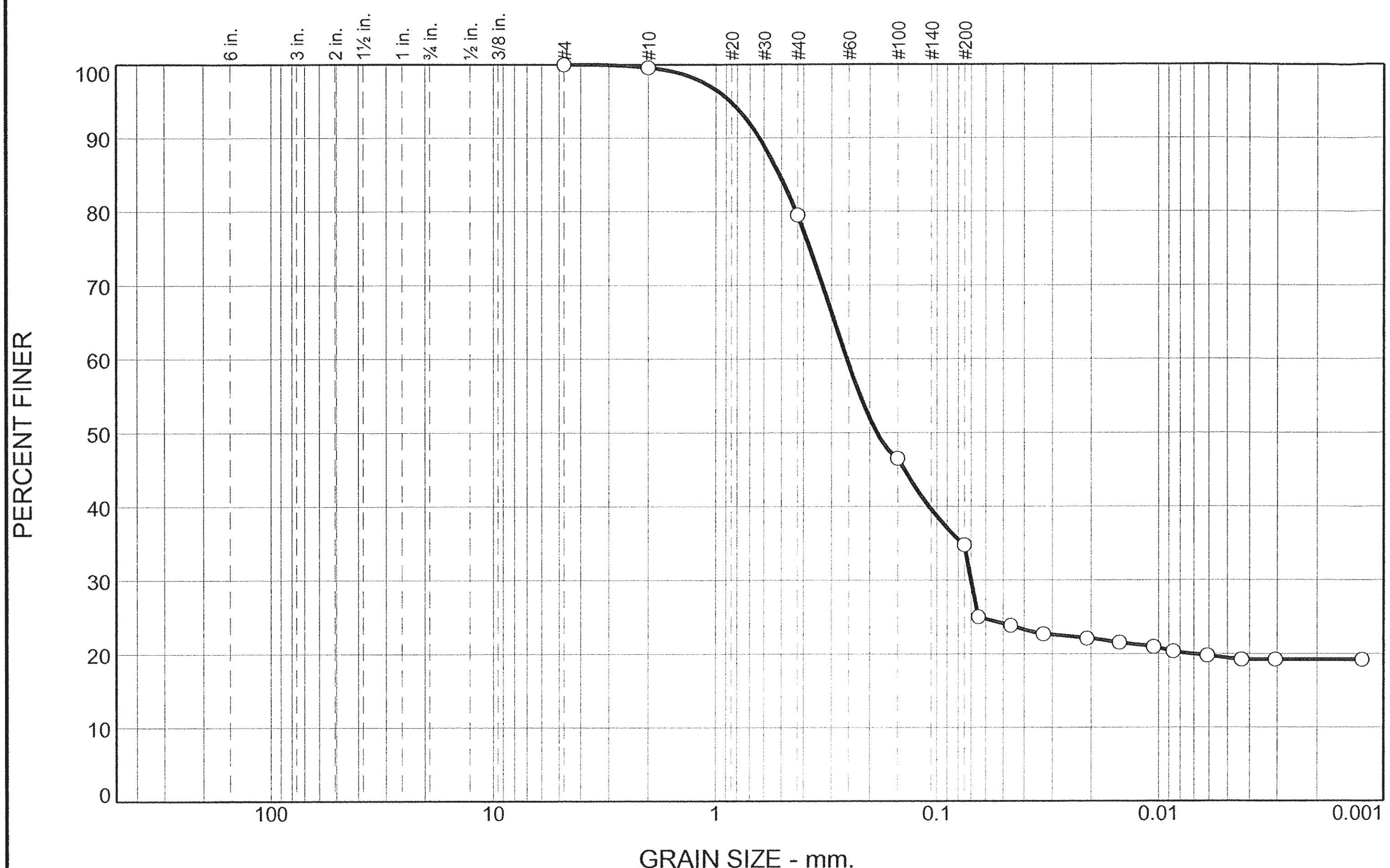
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.4 | 20.1 | 44.7 | 15.4 | 19.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.6 | | |
| #40 | 79.5 | | |
| #100 | 46.5 | | |
| #200 | 34.8 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, DARK BROWN

**Atterberg Limits**

PL= 13 LL= 35 PI= 22

**Coefficients**

$D_{90}$= 0.6299 $D_{85}$= 0.5094 $D_{60}$= 0.2547
$D_{50}$= 0.1856 $D_{30}$= 0.0701 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-2-6(2)

**Remarks**

**Source of Sample:** B-3-1 **Depth:** 18'-20'
**Sample Number:** B-3-1 S-10

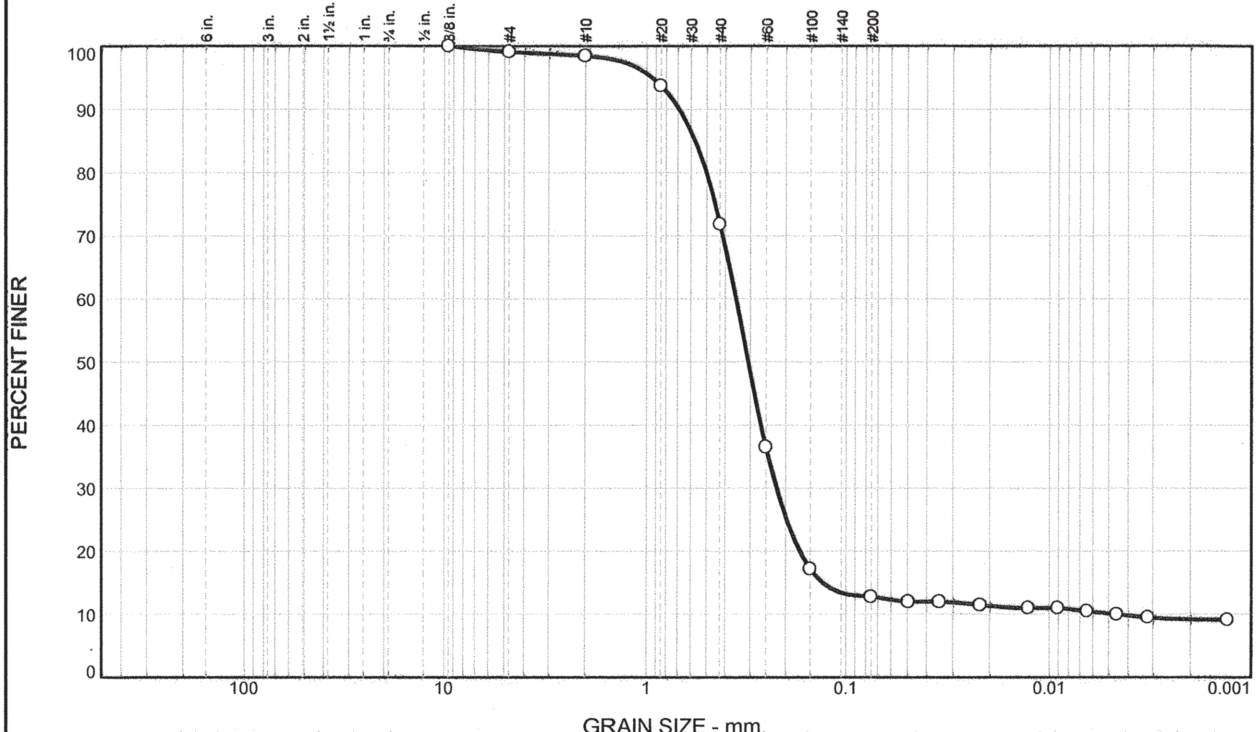
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.9 | 0.6 | 26.7 | 59.0 | 2.7 | 10.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| .375 | 100.0 | | |
| #4 | 99.1 | | |
| #10 | 98.5 | | |
| #20 | 93.7 | | |
| #40 | 71.8 | | |
| #60 | 36.5 | | |
| #100 | 17.2 | | |
| #200 | 12.8 | | |

* (no specification provided)

**Material Description**

F-M Sand Little Clay Trace Silt - Brownish Gray

**Atterberg Limits**

PL= 16 LL= 27 PI= 11

**Coefficients**

$D_{90}$= 0.6879 $D_{85}$= 0.5721 $D_{60}$= 0.3538
$D_{50}$= 0.3070 $D_{30}$= 0.2214 $D_{15}$= 0.1304
$D_{10}$= 0.0046 $C_u$= 76.58 $C_c$= 29.98

**Classification**

USCS= SC AASHTO= A-2-6(0)

**Remarks**

**Source of Sample:** Boring 4-1 **Depth:** 12.0-14.0
**Sample Number:** S-7

**Date:** 12/7/11

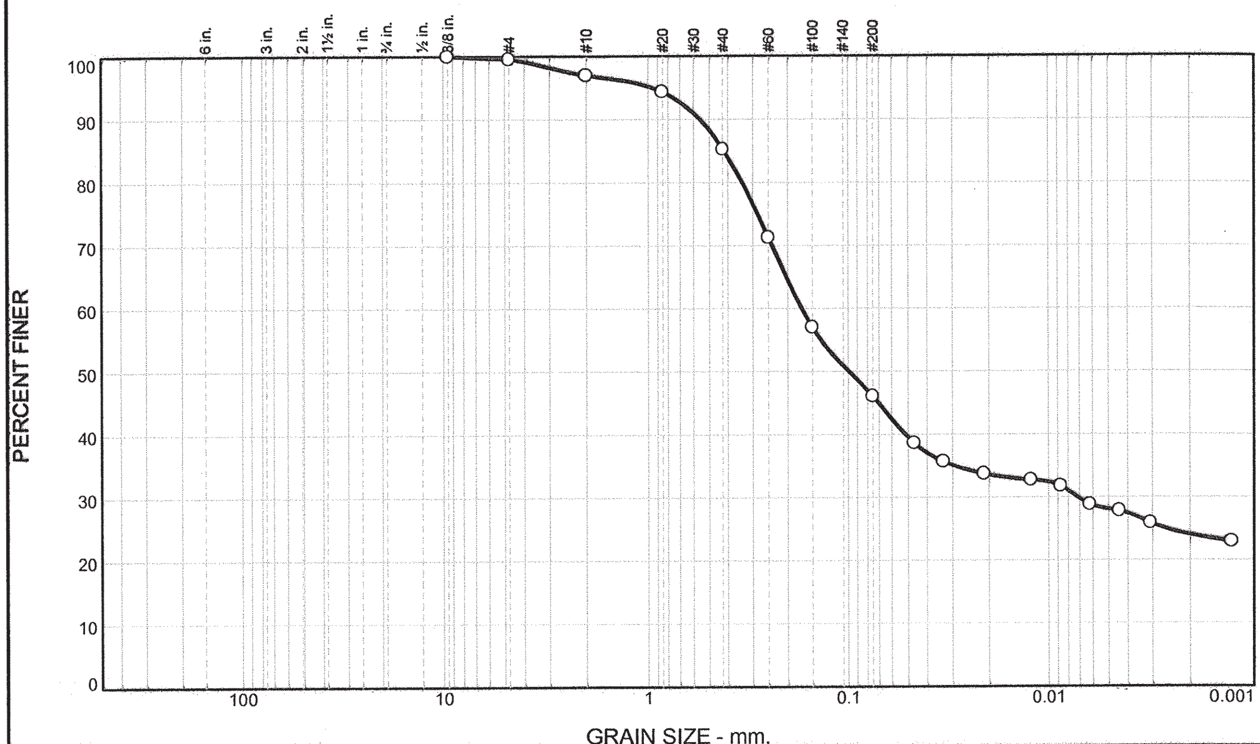
AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility

**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.4 | 2.6 | 11.8 | 39.2 | 17.9 | 28.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| .375 | 100.0 | | |
| #4 | 99.6 | | |
| #10 | 97.0 | | |
| #20 | 94.3 | | |
| #40 | 85.2 | | |
| #60 | 71.3 | | |
| #100 | 57.0 | | |
| #200 | 46.0 | | |

* (no specification provided)

**Material Description**

Clayey F-M Sand Little Silt - Brownish Gray

**Atterberg Limits**

PL= 16 LL= 40 PI= 24

**Coefficients**

$D_{90}$= 0.5576 $D_{85}$= 0.4206 $D_{60}$= 0.1695
$D_{50}$= 0.0994 $D_{30}$= 0.0071 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(7)

**Remarks**

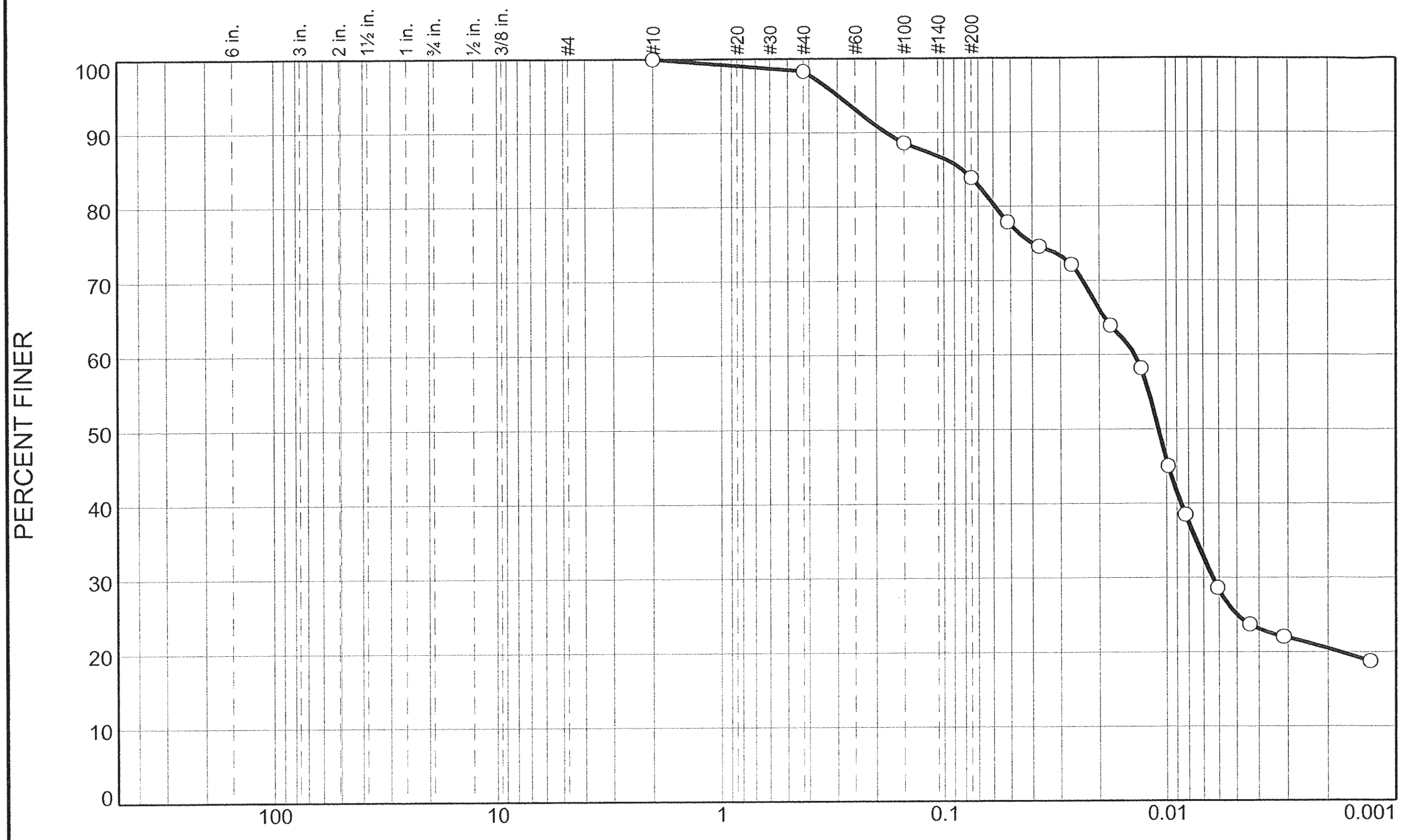
**Source of Sample:** Boring 4-1 **Depth:** 24.0-26.0
**Sample Number:** S-13 **Date:** 12/7/11

AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility
**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 14.4 | 58.8 | 25.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 98.3 | | |
| #100 | 88.6 | | |
| #200 | 83.9 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, LITTLE FINE TO MEDIUM SAND, WHITE AND GRAY

**Atterberg Limits**

PL= 18 LL= 30 PI= 12

**Coefficients**

$D_{90}$= 0.1803 $D_{85}$= 0.0826 $D_{60}$= 0.0138
$D_{50}$= 0.0108 $D_{30}$= 0.0064 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-6(9)

**Remarks**

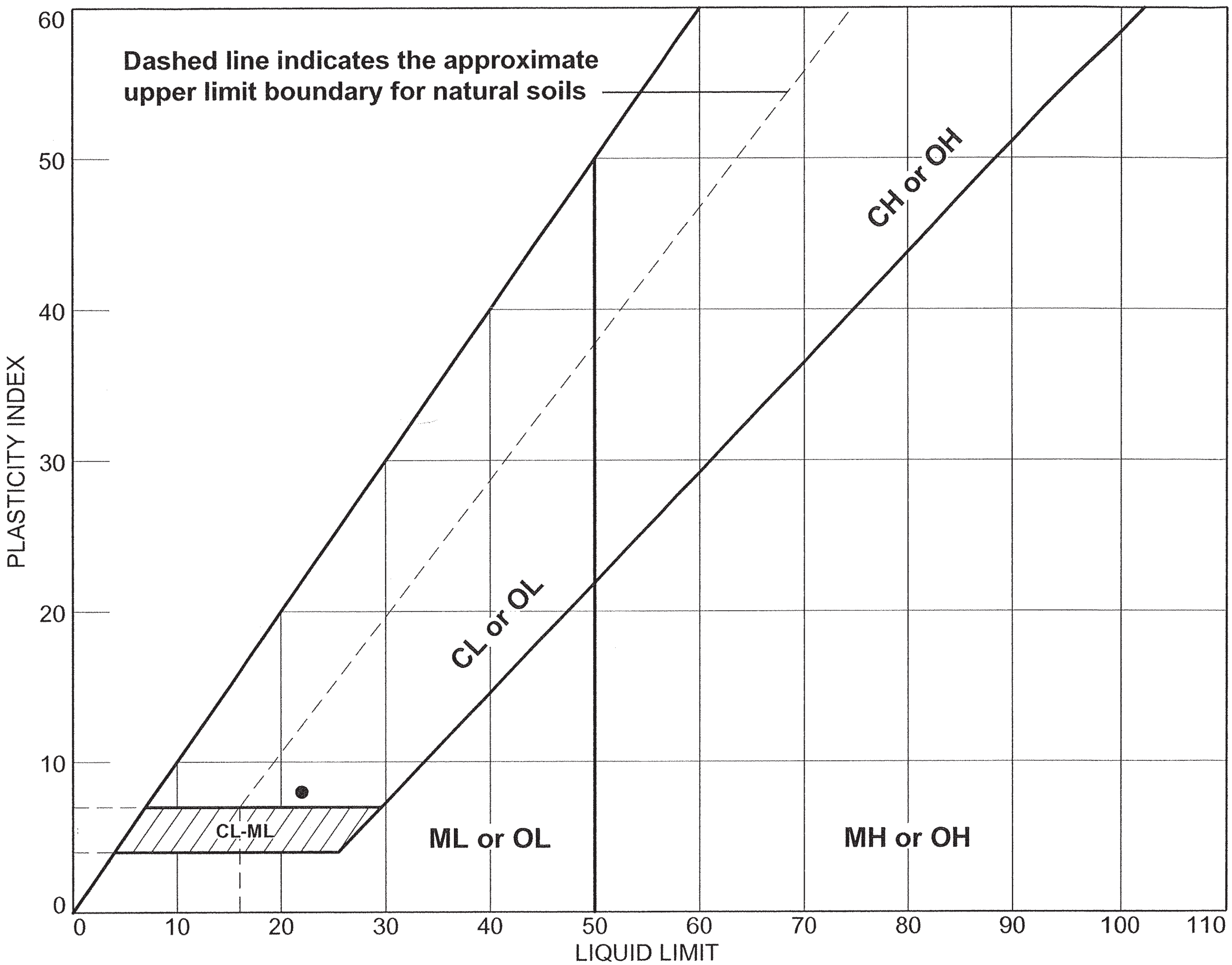
**Source of Sample:** B-5-1 **Depth:** 26'-27'
**Sample Number:** B-5-1 S-14 **Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-5 | 8'-10' | | 14 | 22 | 8 | CL |

AECOM

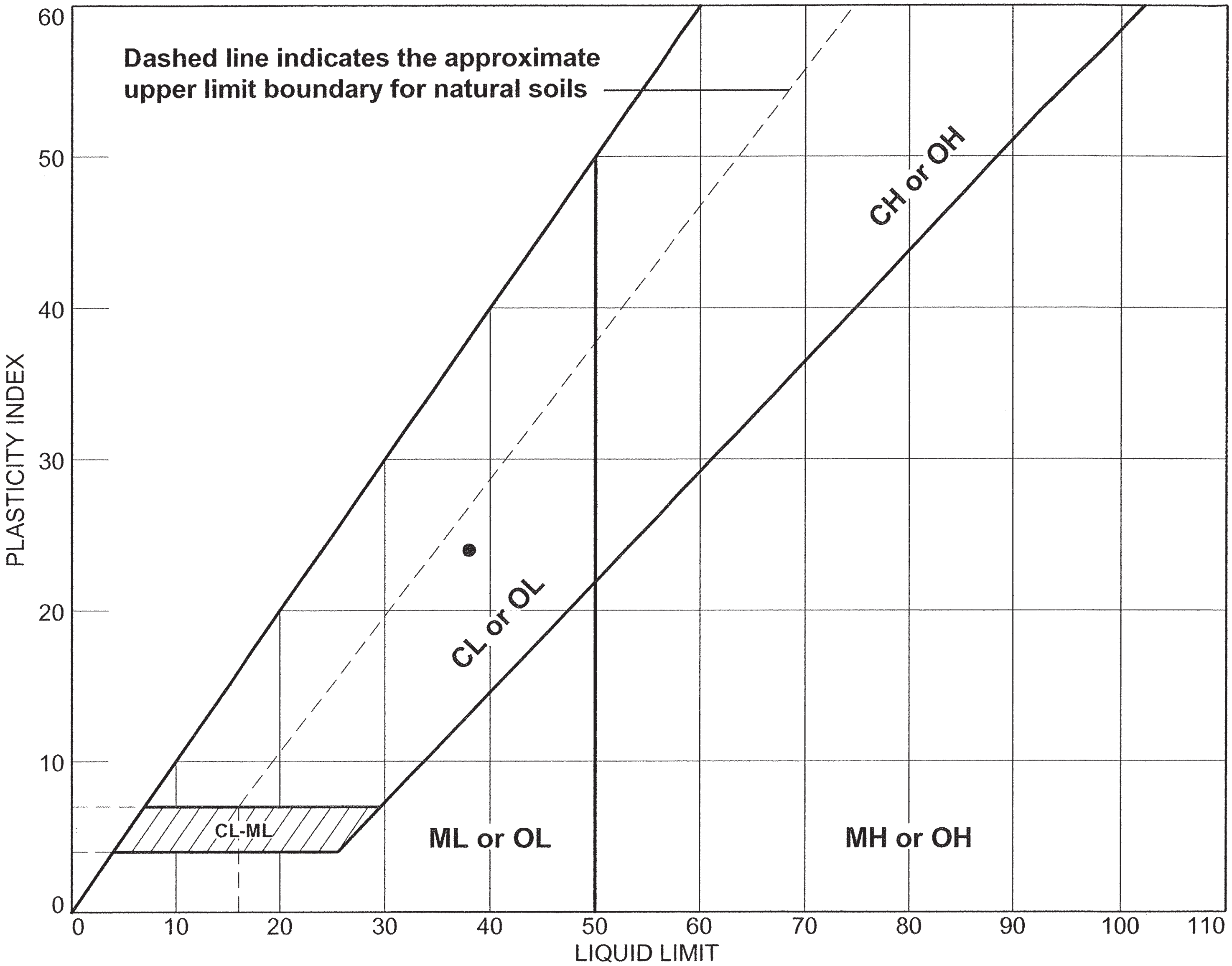
**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561

**Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



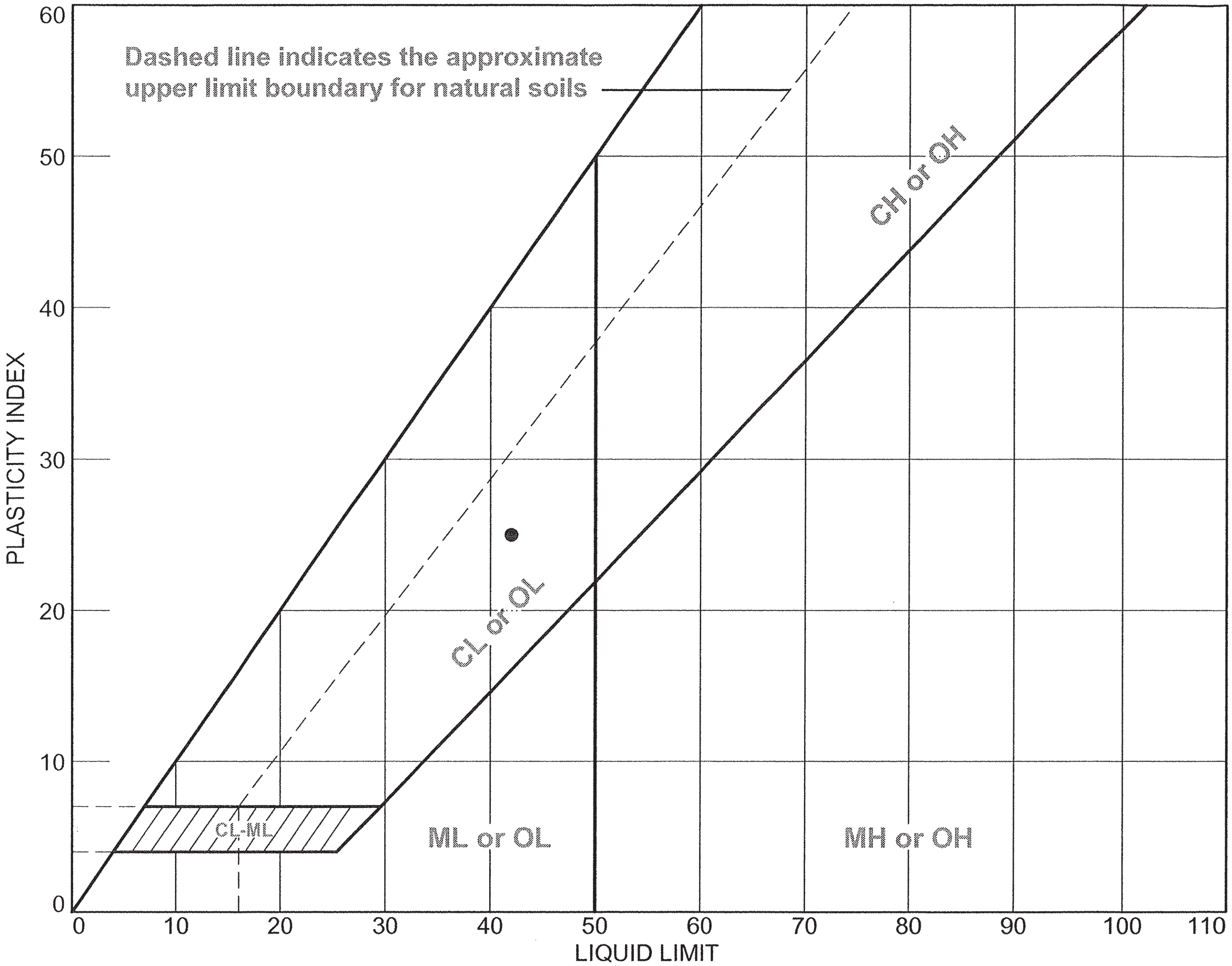

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-11 | 20'-22' | | 14 | 38 | 24 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




## SOIL DATA

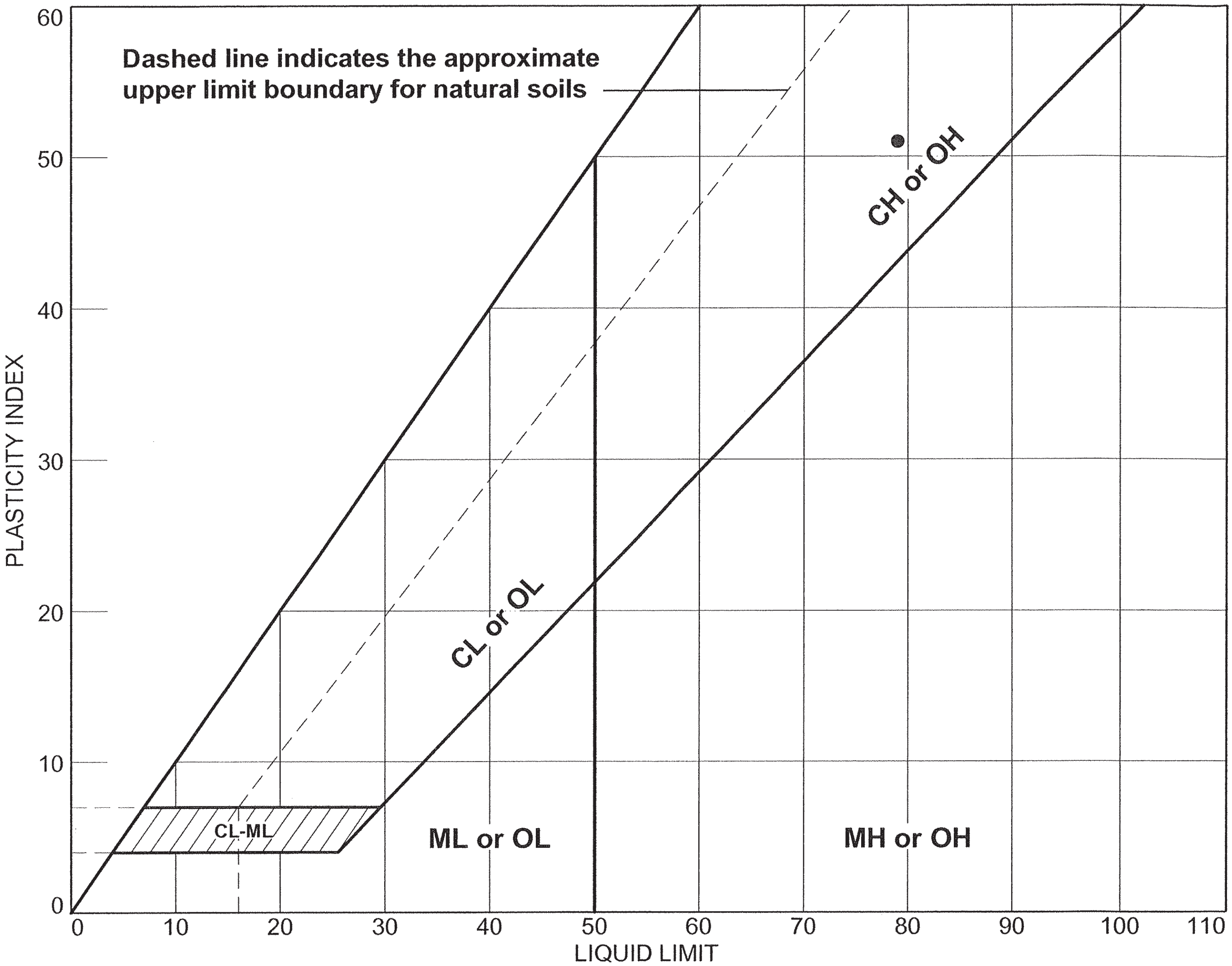
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | B-1-1 | B-1-1 S-34 | 90'-90.4' | | 17 | 42 | 25 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



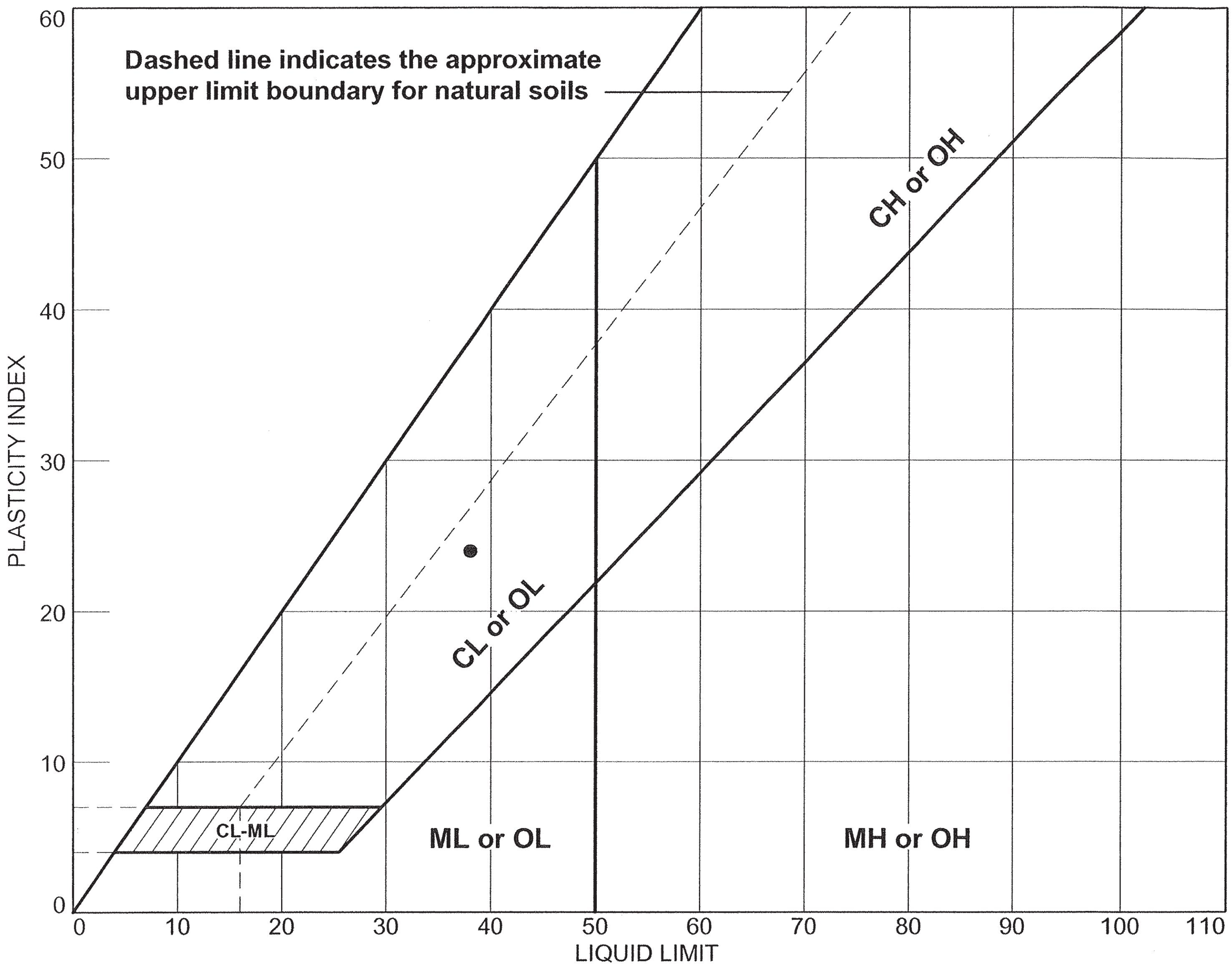

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-40 | 120'-121' | | 28 | 79 | 51 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



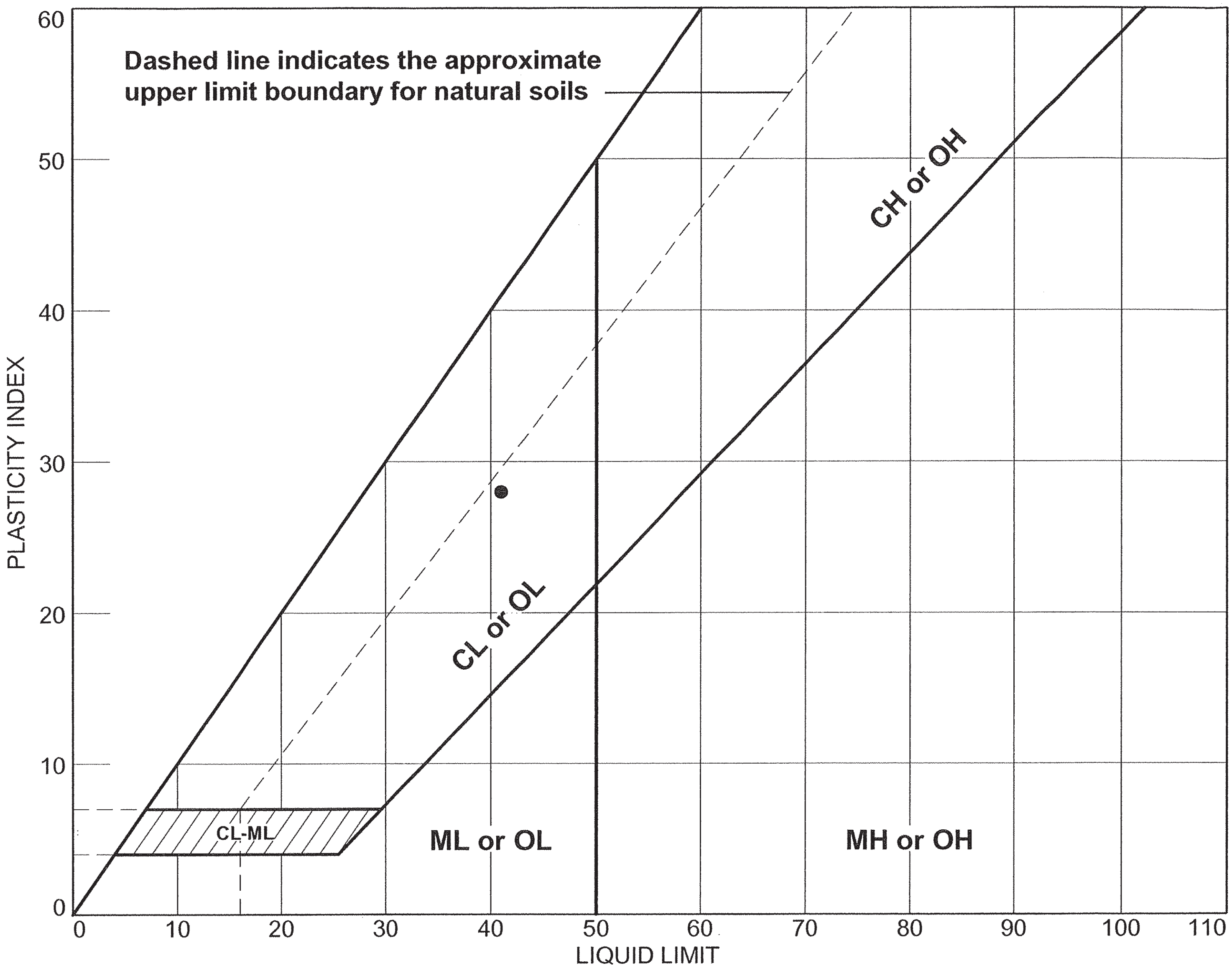

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-6 | 10'-12' | | 14 | 38 | 24 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



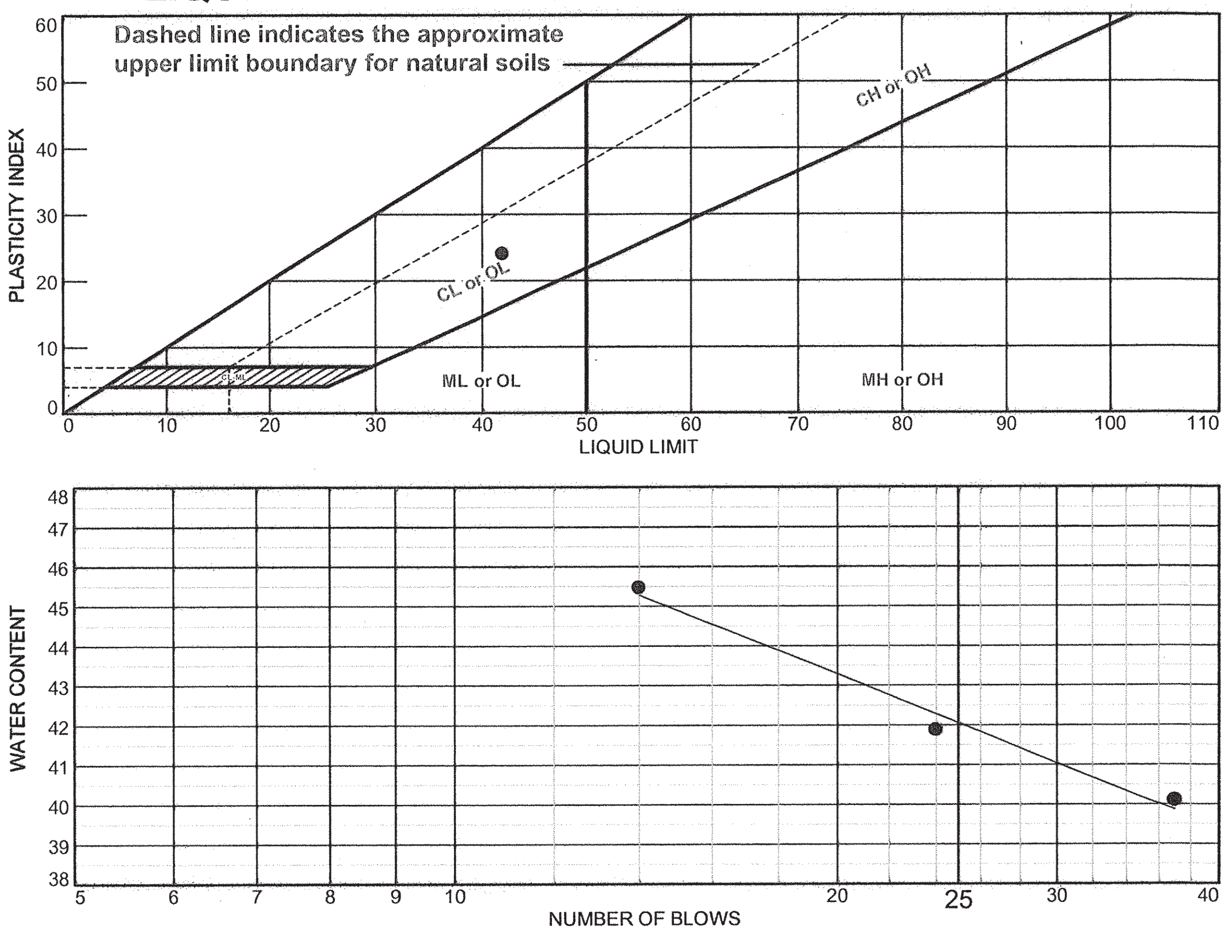

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-10 | 18'-20' | | 13 | 41 | 28 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Clayey F-M Sand Little Silt - Brownish Gray | 42 | 18 | 24 | 82.2 | 35.2 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

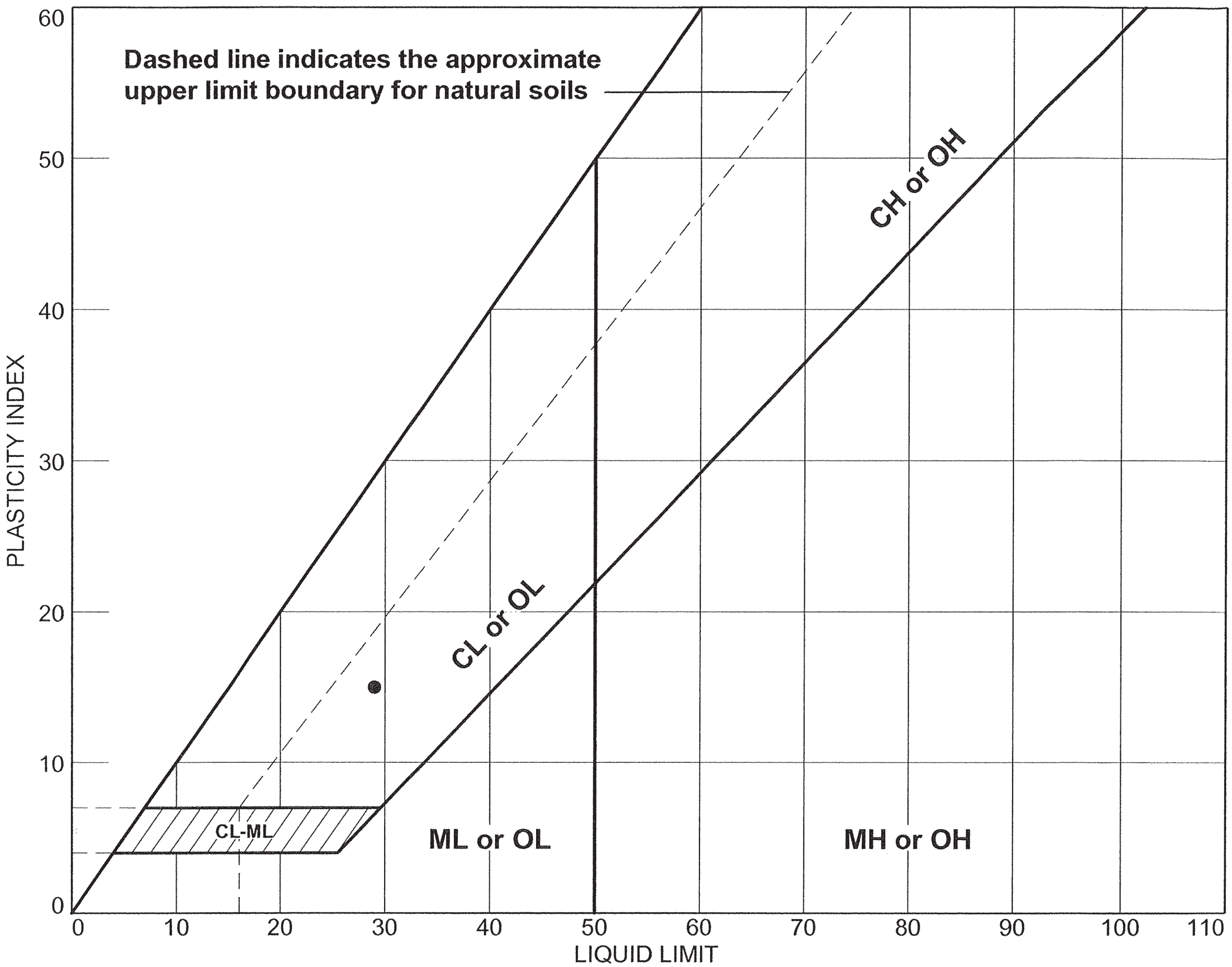
**Project:** Coleto Creek Facility

●**Source of Sample:** Boring 2-1 **Depth:** 26.0-28.0 **Sample Number:** S-14

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST REPORT



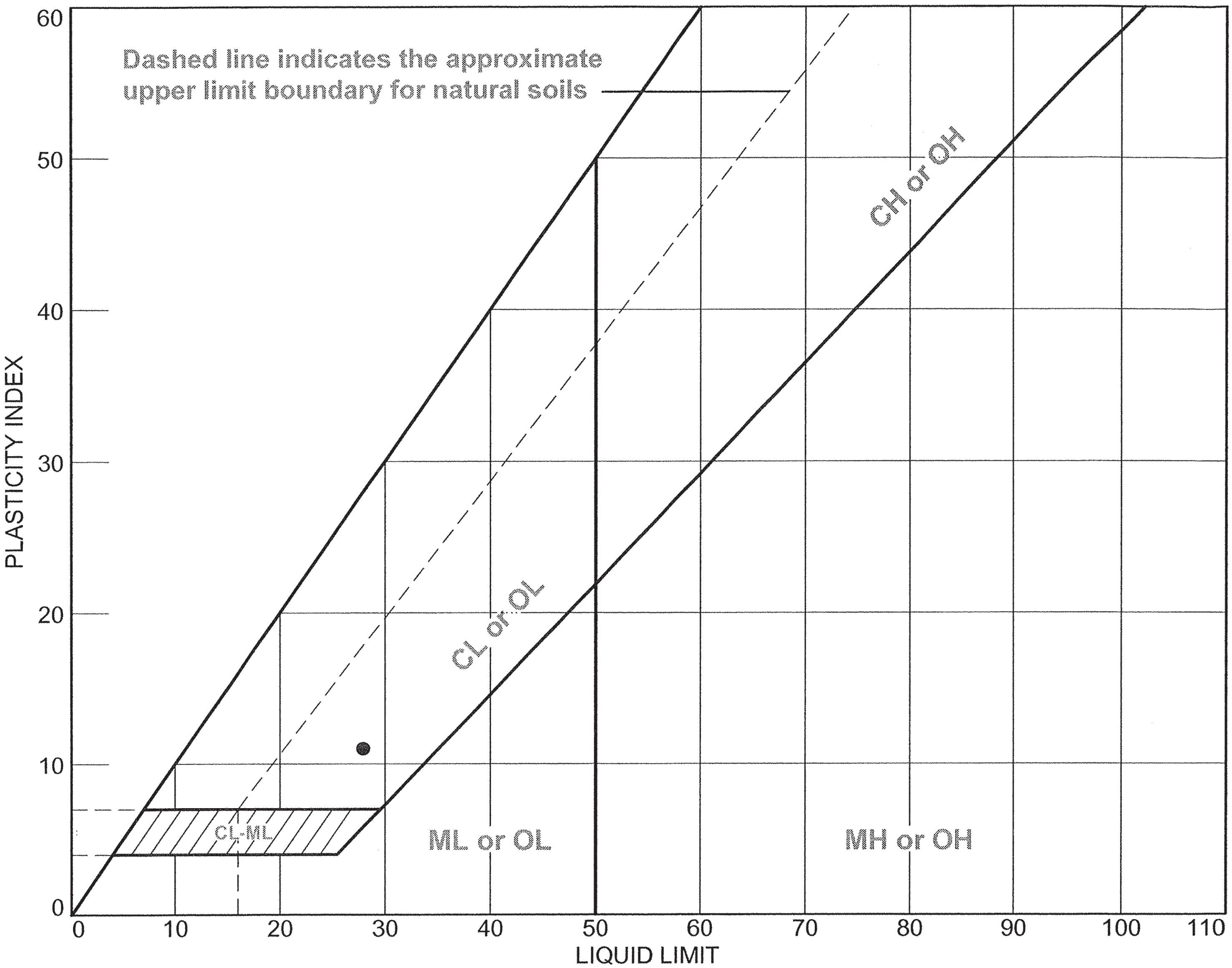

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-17 | 32'-34' | | 14 | 29 | 15 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




## SOIL DATA

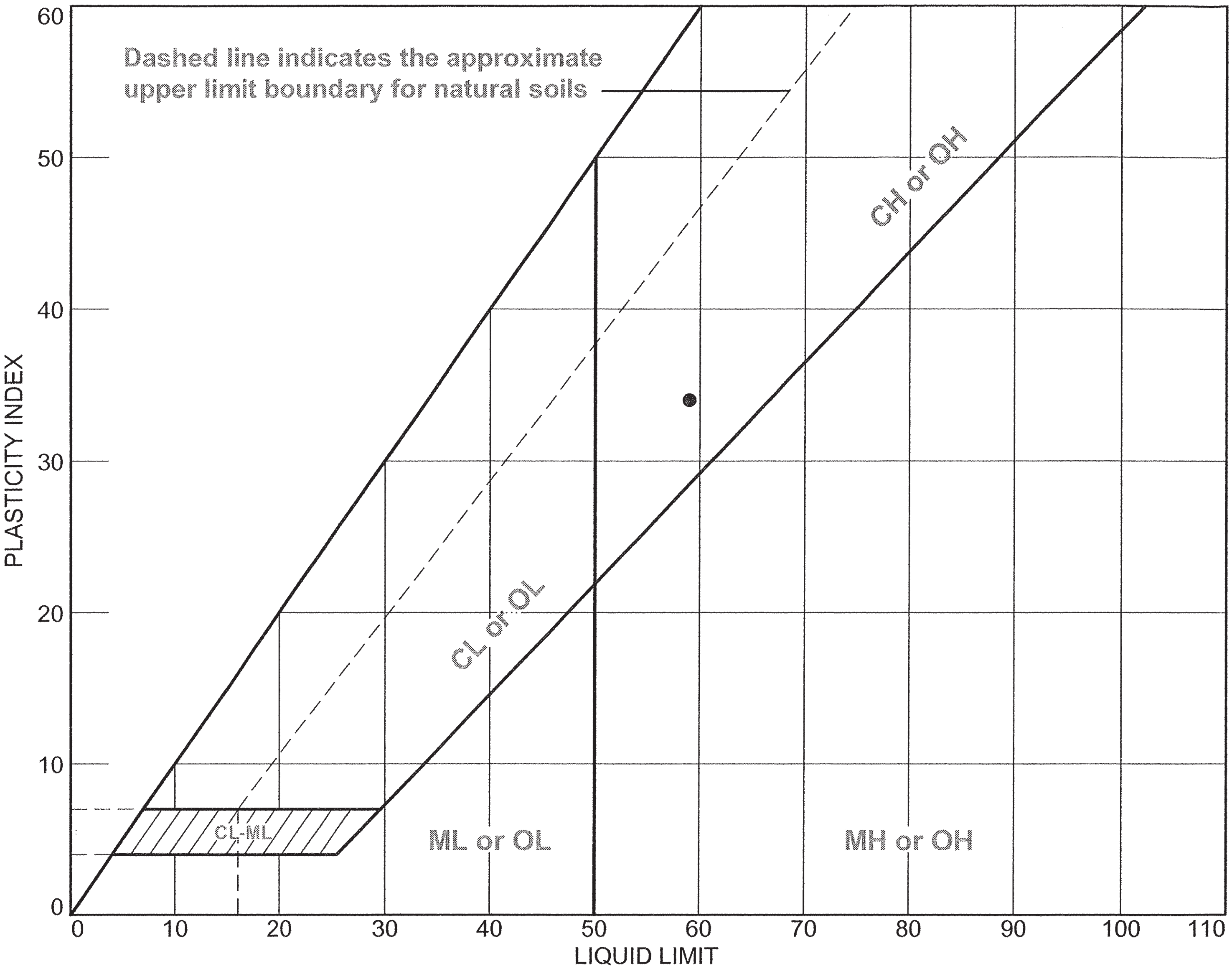
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | B-2-1 | B-2-1 S-27 | 55.0'-56.6' | | 17 | 28 | 11 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




## SOIL DATA

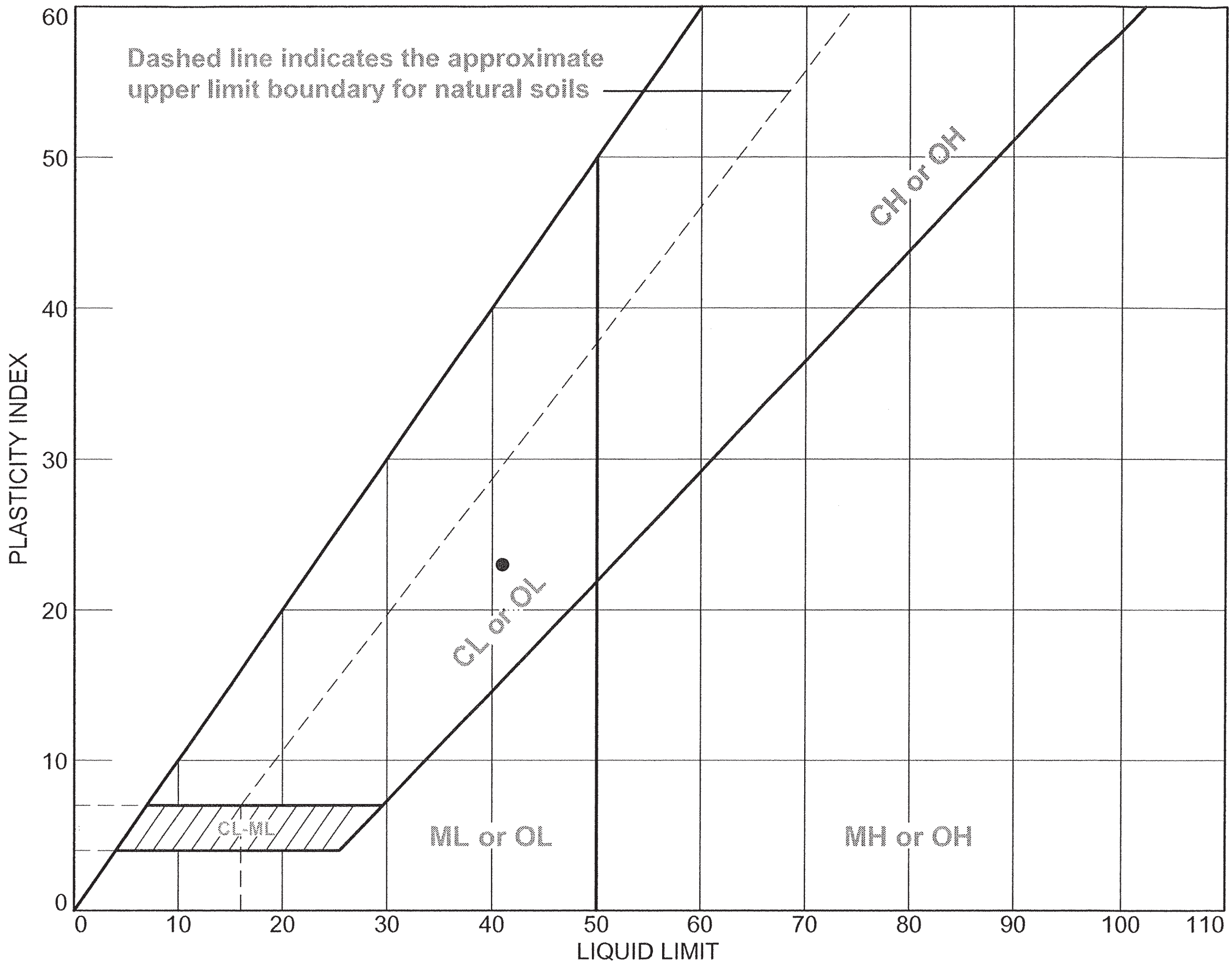
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | B-2-1 | B-2-1 S-33 | 85.0'-86.5' | | 25 | 59 | 34 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



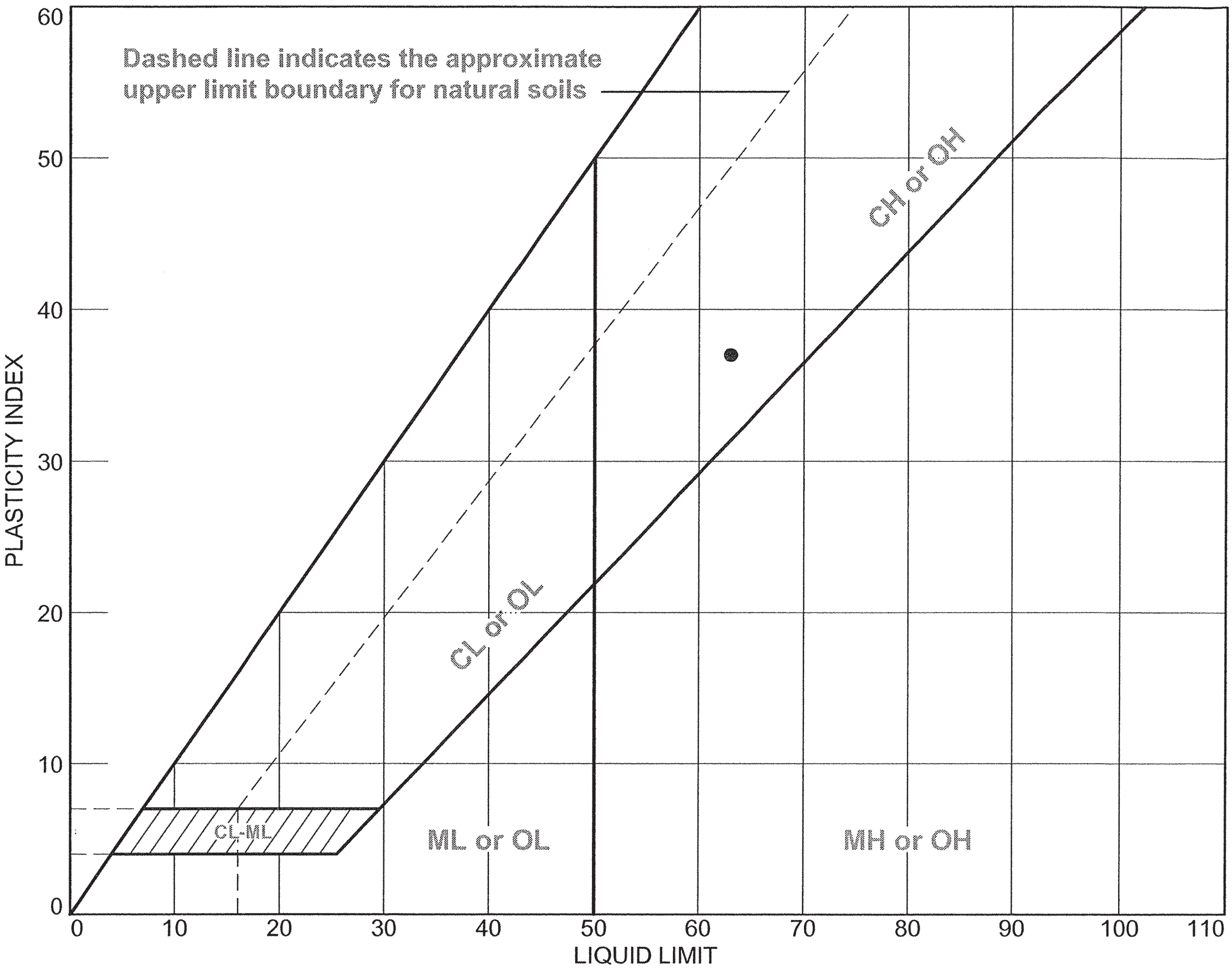

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-2 | B-2-2 S-16 | 59.0'-60.5' | | 18 | 41 | 23 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-2 | B-2-2 S-18 | 69.0'-70.5' | | 26 | 63 | 37 | CH |

AECOM

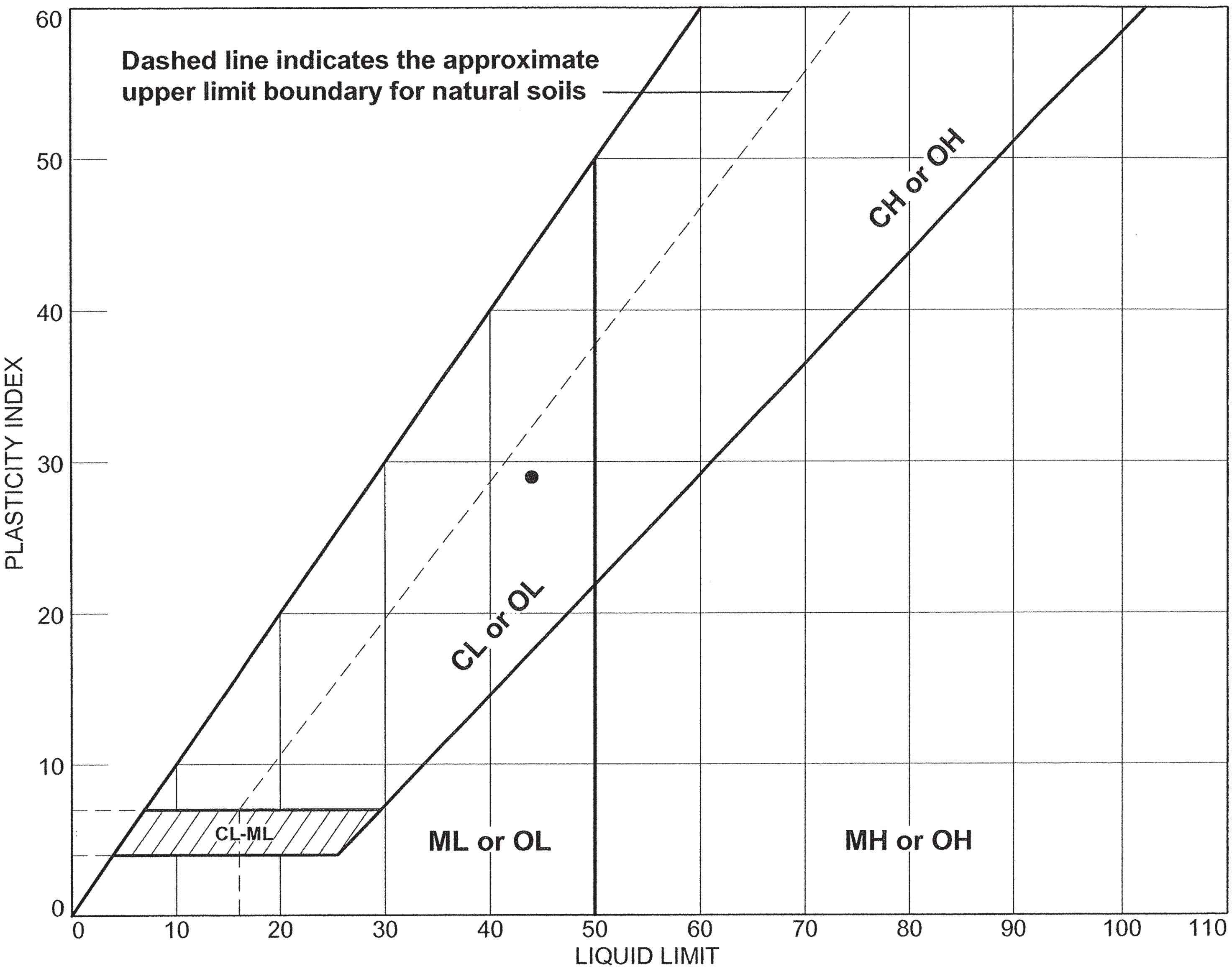
**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561

**Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



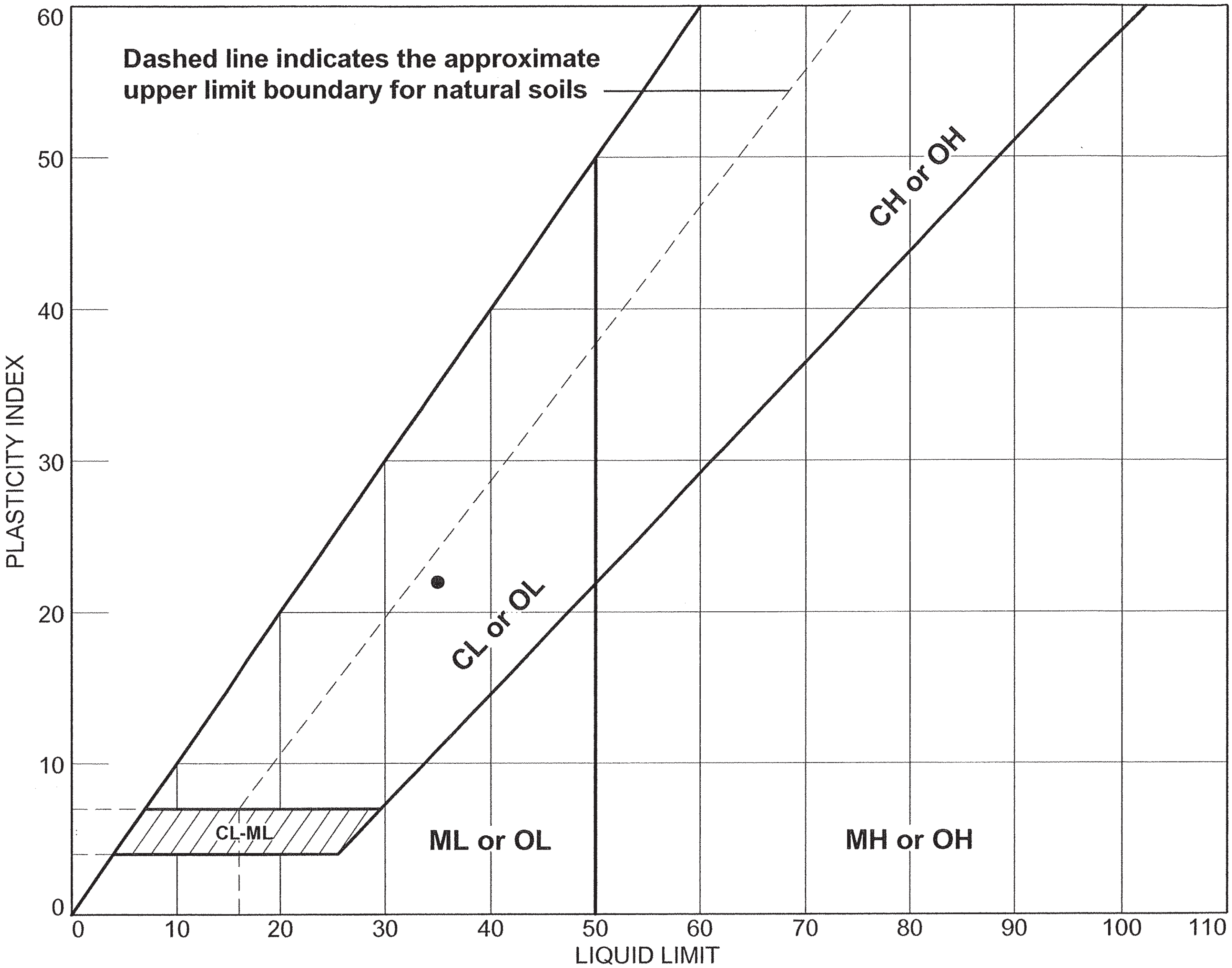

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-3-1 | B-3-1 S-9 | 16.0'-17.8' | | 15 | 44 | 29 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-3-1 | B-3-1 S-10 | 18'-20' | | 13 | 35 | 22 | SC |

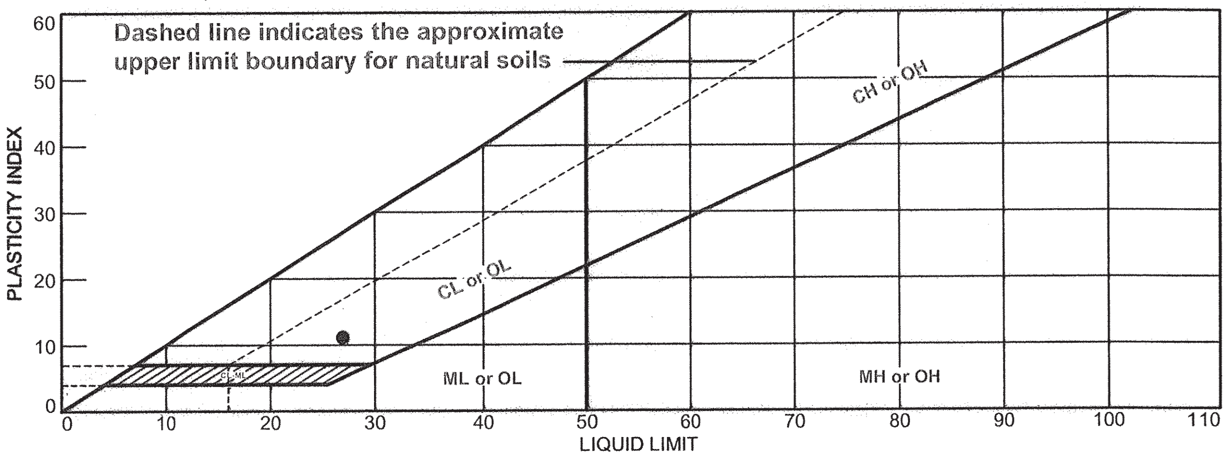
AECOM

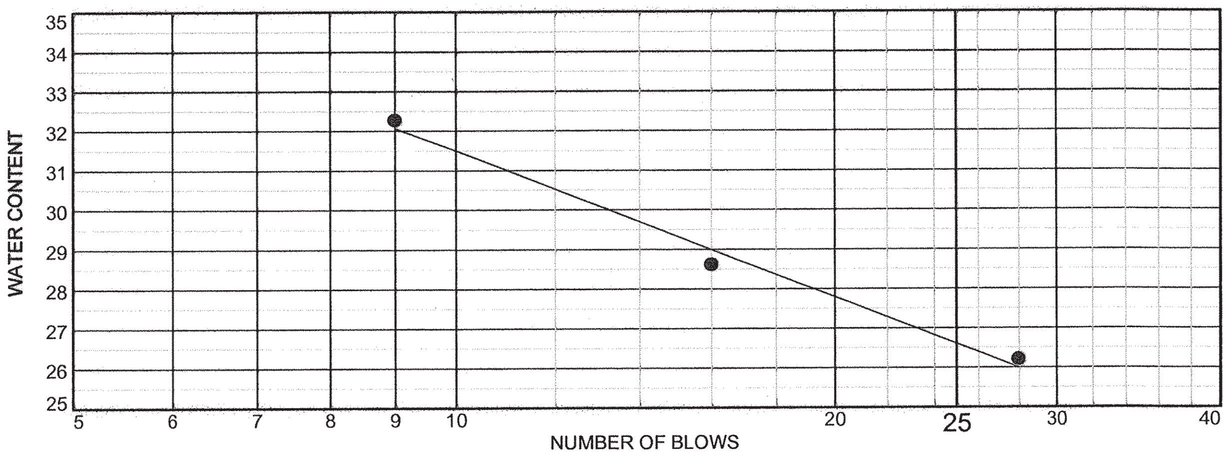
**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | F-M Sand Little Clay Trace Silt - Brownish Gray | 27 | 16 | 11 | 71.8 | 12.8 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

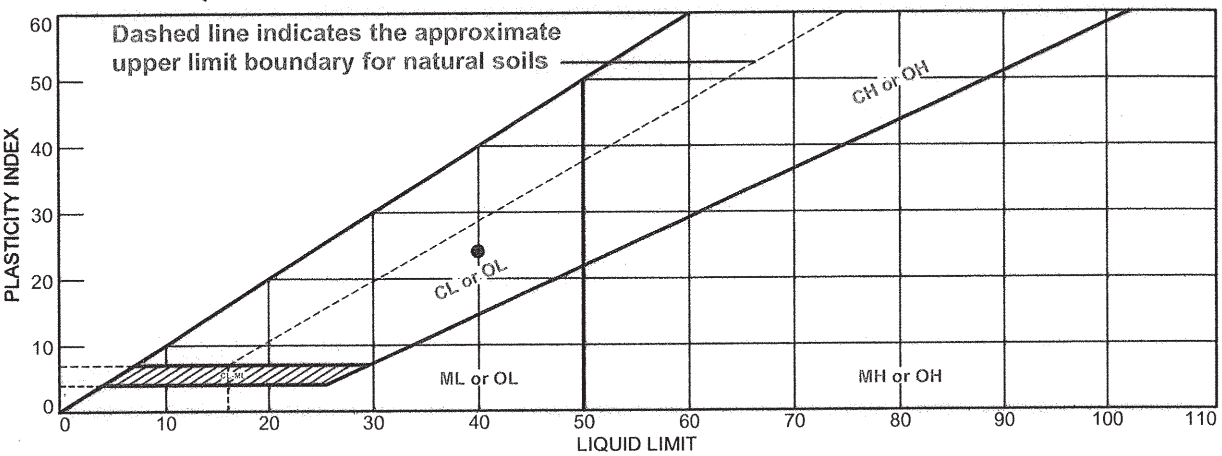
**Project:** Coleto Creek Facility

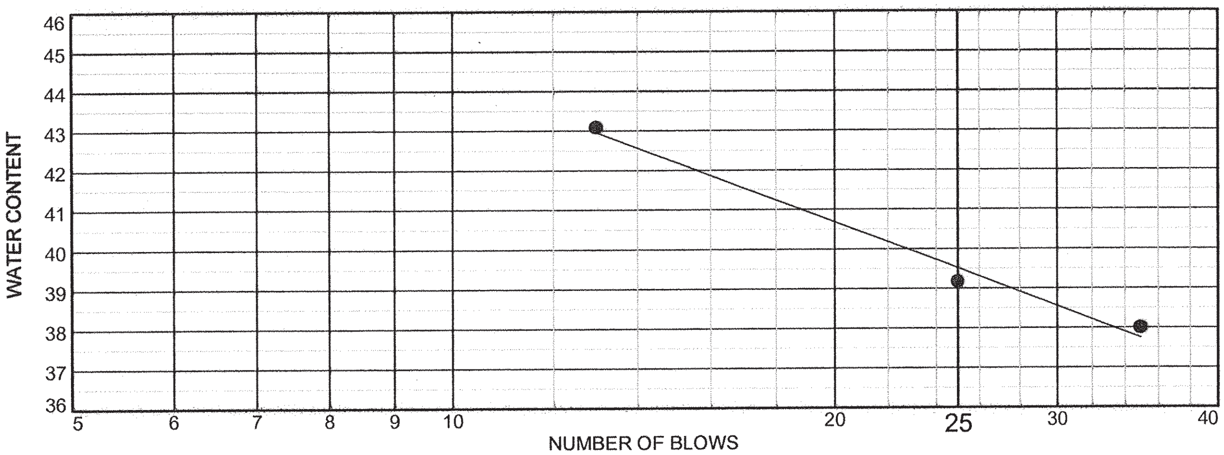
●**Source of Sample:** Boring 4-1 **Depth:** 12.0-14.0 **Sample Number:** S-7

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Clayey F-M Sand Little Silt - Brownish Gray | 40 | 16 | 24 | 85.2 | 46.0 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

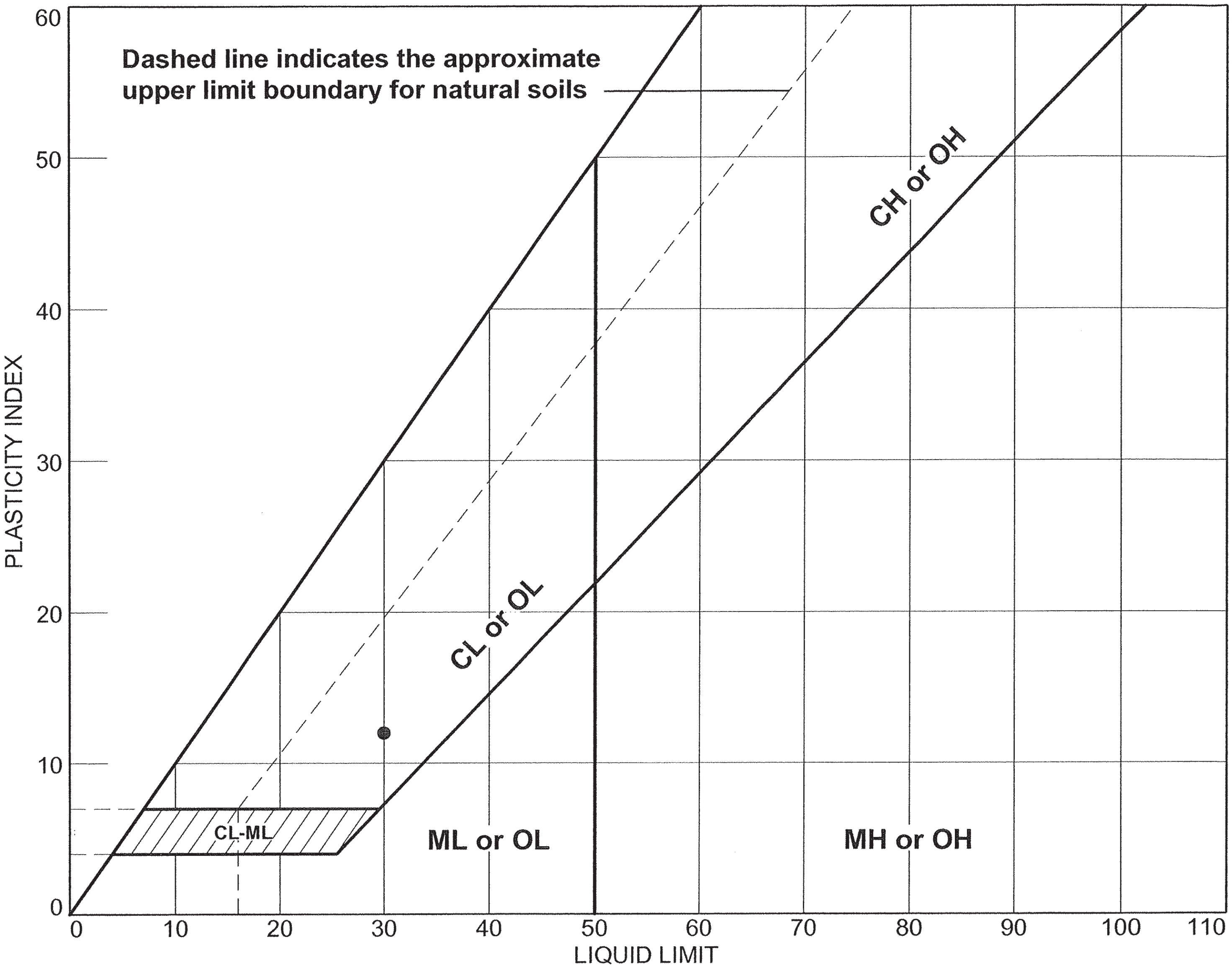
**Project:** Coleto Creek Facility

●**Source of Sample:** Boring 4-1 **Depth:** 24.0-26.0 **Sample Number:** S-13

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-5-1 | B-5-1 S-14 | 26'-27' | | 18 | 30 | 12 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

AECOM

# SPECIFIC GRAVITY OF SOIL SOLIDS
## ASTM D-854

*Laboratory Services Group* *750 Corporate Woods Parkway* *Vernon Hills, IL 60061* *Phone: (847) 279-2500* *Fax: (847) 279-2550*

**AECOM Project No.: 60225561** **Test Date: 12/6/2011**
**Project Name: Coleto Creek Facility**
**IPR-GDP Suez**

Boring/Source: 1-1
Sample No.: 16,17,18
Depth (ft.): 30.0-36.7
Description: Caliche - White

| | Test 1 |
|---|---|
| **Flask No.** | **SG-3** |
| **Wt. Flask + Soil + Water (W2)** | 742.20 |
| **Wt. Flask + Water (W3)** | 677.46 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-4** |
| **Wt. Tare** | 578.17 |
| **Wt. Tare + Soil** | 681.20 |
| **Wt. Soil (W2-W3)** | 103.03 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.690** |

Boring/Source: 4-1
Sample No.: 7
Depth (ft.): 12.0-14.0
Description: F-M Sand Little Clay Trace Silt - Brownish Gray SC

| | Test 2 |
|---|---|
| **Flask No.** | **SG-10** |
| **Wt. Flask + Soil + Water (W2)** | 742.38 |
| **Wt. Flask + Water (W3)** | 668.44 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-4** |
| **Wt. Tare** | 576.51 |
| **Wt. Tare + Soil** | 695.11 |
| **Wt. Soil (W2-W3)** | 118.60 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.655** |

Boring/Source: 4-1
Sample No.: 13
Depth (ft.): 24.0-26.0
Description: Clayey F-M Sand Little Silt - Brownish Gray SC

| | Test 3 |
|---|---|
| **Flask No.** | **SG-1** |
| **Wt. Flask + Soil + Water (W2)** | 726.62 |
| **Wt. Flask + Water (W3)** | 675.32 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-6** |
| **Wt. Tare** | 602.23 |
| **Wt. Tare + Soil** | 684.30 |
| **Wt. Soil (W2-W3)** | 82.07 |
| **(k) Temp. Correction** | 0.99680 |
| **Specific Gravity (Gs)** | **2.659** |

Boring/Source: 2-1
Sample No.: 14
Depth (ft.): 26.0-28..0
Description: Clayey F-M Sand Little Silt - Brownish Gray SC

| | Test 4 |
|---|---|
| **Flask No.** | **SG-2** |
| **Wt. Flask + Soil + Water (W2)** | 738.44 |
| **Wt. Flask + Water (W3)** | 668.48 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-10** |
| **Wt. Tare** | 619.18 |
| **Wt. Tare + Soil** | 730.96 |
| **Wt. Soil (W2-W3)** | 111.78 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.672** |

Technician **BCM** Date **12/2/11**
Calculated **BCM** Date **12/2/11**
Checked **WPQ** Date **12/6/11**

AECOM

# ORGANIC CONTENT TEST

**ASTM D-2974**

**Method C**

*Laboratory Services Group* | *750 Corporate Woods Parkway, Vernon Hills, Illinois 60061* | *Phone: (847) 279-2500 Fax:(847) 279-2550*

| | |
|---|---|
| **AECOM Project No.:** | 60225561 |
| **Project Name:** | Coleto Creek Facility - IPR-GDP Suez |
| **Date Tested:** | 12/6/2011 |

## Sample Information

| | |
|---|---|
| Boring / Source: | B-4-1 |
| Sample No.: | 13 |
| Depth (ft.): | 24.0-26.0 |

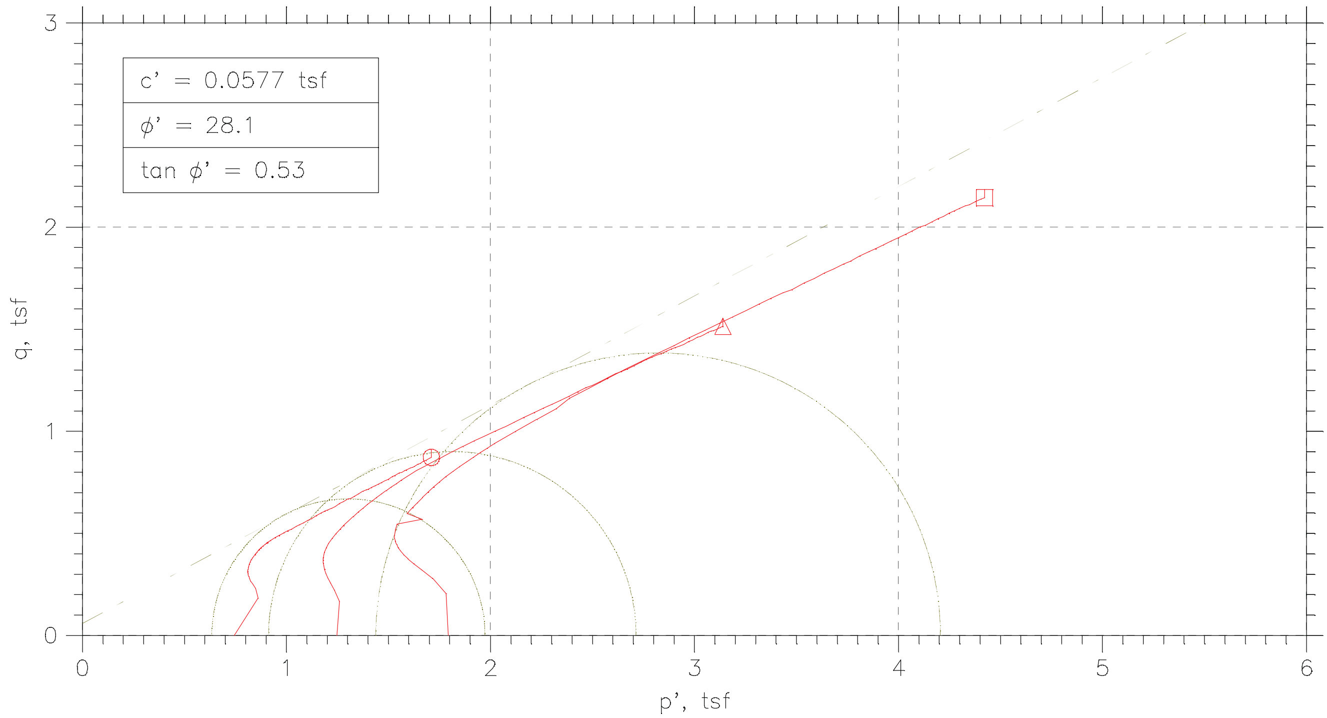
## Organic Content Test Data

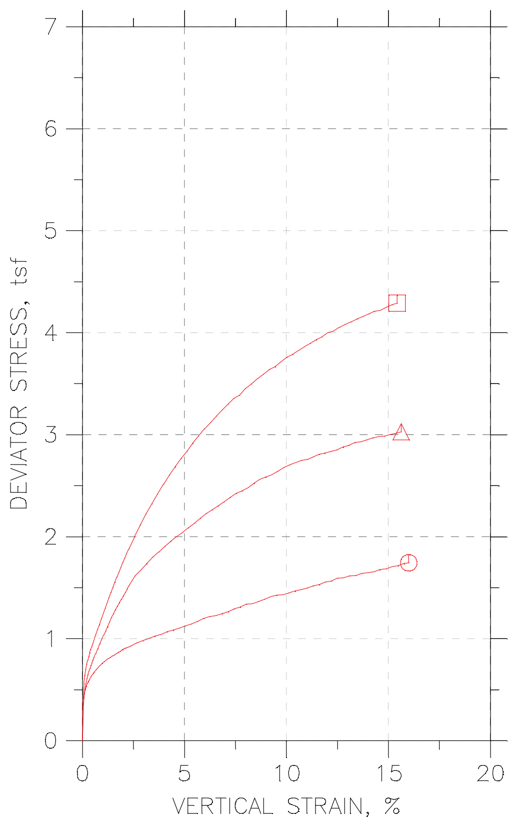
| | |
|---|---|
| Tare No.: | N |
| Tare Wt. (gm): T | 17.71 |
| Wet Wt. + Tare (gm): A+T | 48.27 |
| Dry Wt. + Tare (gm): B+T | 44.70 |
| **Moisture Content (%):** | **13.23** |
| Wt. of Ash + Tare (gm): D+T | 44.65 |
| Percent Ash: (D-T/B-T)x100 = E | 99.81 |
| **Organic Content (%):** | **0.19** |

** Note: Test performed by heating the sample to 440 degrees centigrade for a period of three hours.

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|
| | Test No. | 10.4 PSI | 17.4 PSI | 24.3 PSI | |
| Initial | Diameter, in | 2.8362 | 2.8441 | 2.8457 | |
| | Height, in | 5.9134 | 6.0831 | 6.0173 | |
| | Water Content, % | 21.81 | 14.93 | 13.70 | |
| | Dry Density, pcf | 105.5 | 115.9 | 120.2 | |
| | Saturation, % | 100.17 | 90.88 | 94.34 | |
| | Void Ratio | 0.58172 | 0.4389 | 0.38805 | |
| Before Shear | Water Content, % | 21.39 | 15.80 | 14.06 | |
| | Dry Density, pcf | 106.1 | 117.3 | 121.3 | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.57165 | 0.42209 | 0.37567 | |
| | Back Press., tsf | 5.0449 | 5.0454 | 5.0404 | |
| | Minor Prin. Stress, tsf | 0.74395 | 1.2474 | 1.7924 | |
| | Max. Dev. Stress, tsf | 1.7444 | 3.0288 | 4.2889 | |
| | Time to Failure, min | 1612.1 | 1613.1 | 1614.3 | |
| | Strain Rate, %/min | 0.02 | 0.02 | 0.03 | |
| | B-Value | .98 | .97 | .95 | |
| | Measured Specific Gravity | 2.67 | 2.67 | 2.67 | |
| | Liquid Limit | 42 | 42 | 42 | |
| | Plastic Limit | 24 | 24 | 24 | |
| | Plasticity Index | 18 | 18 | 18 | |

Failure Sketch

| | |
|---|---|
| Project: COLETO CREEK FACILITY | |
| Location: IPR-GDF SUEZ | |
| Project No.: 60225561 | |
| Boring No.: B-2-1 S-14 | |
| Sample Type: 3" ST | |

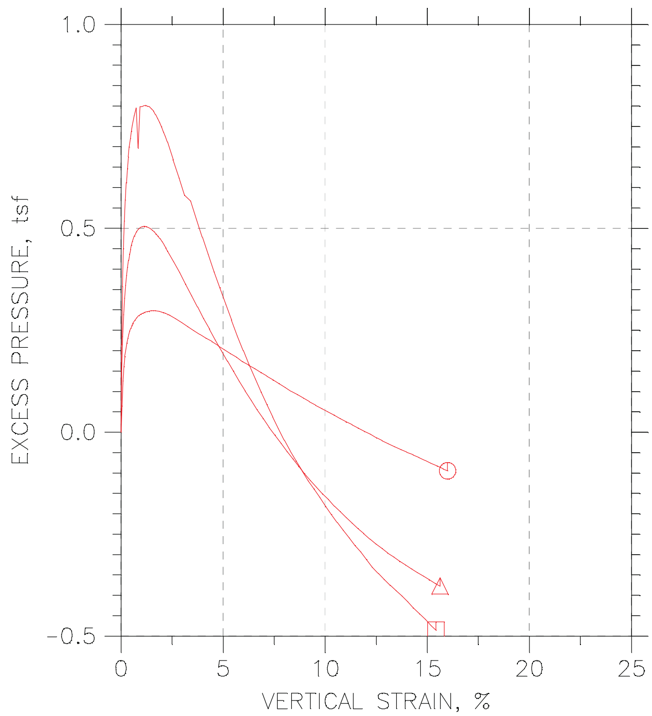
Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC

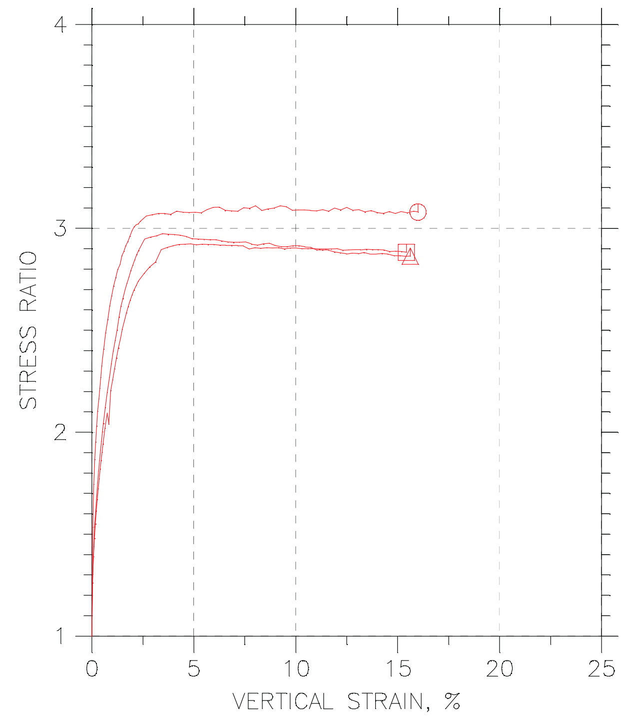
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

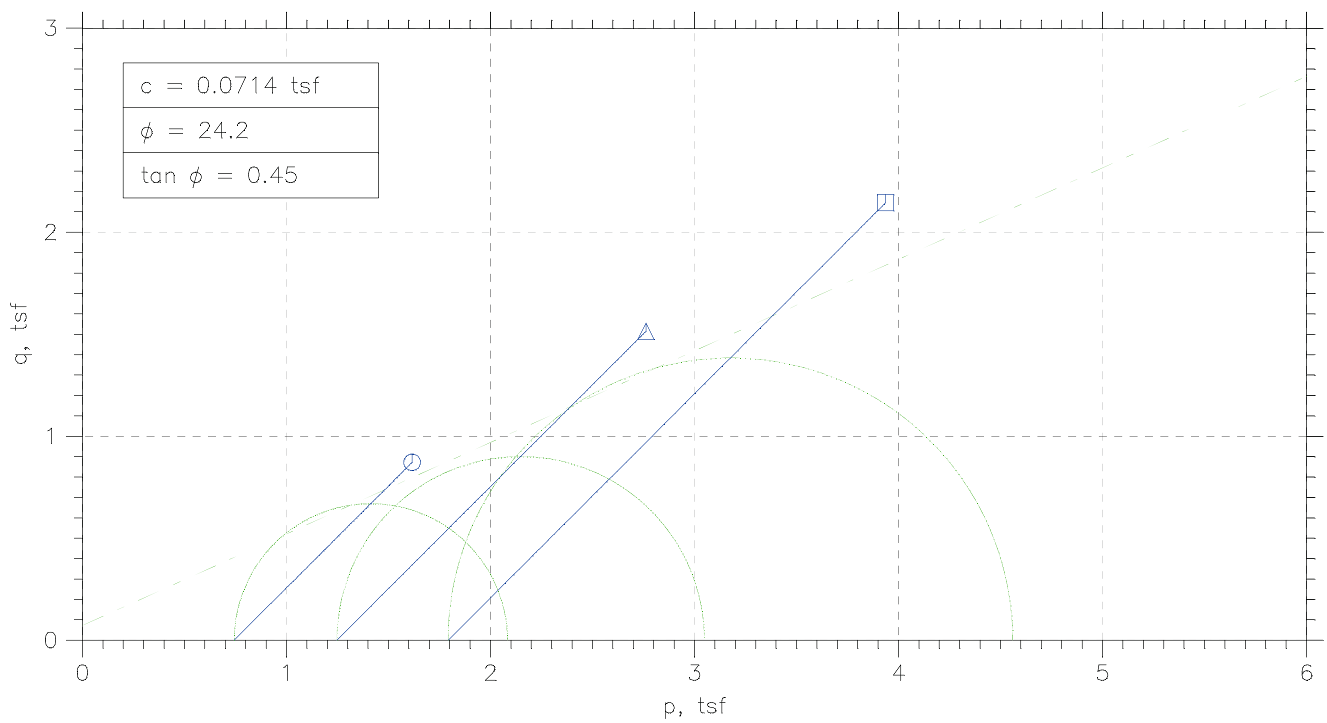
Mon, 12-DEC-2011 10:07:19

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-2-1 S-14 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-14 | Test Date: 12/5/11 | Depth: 26.0'-28.0' |
| Test No.: B-2-1 S-14 | Sample Type: 3" ST | Elevation: ---- |
| Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | | |
| | | |

Mon, 12-DEC-2011 10:08:34

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.91 in
Specimen Area: 6.32 in^2
Specimen Volume: 37.36 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3179 | 0 | 0 | 5.0449 | 5.7888 | 5.7888 |
| 2 | 5.0001 | 0.045204 | 6.3207 | 31.887 | 0.36323 | 5.1097 | 5.7888 | 6.152 |
| 3 | 10 | 0.094782 | 6.3239 | 40.44 | 0.46042 | 5.1704 | 5.7888 | 6.2492 |
| 4 | 15 | 0.14144 | 6.3268 | 44.344 | 0.50464 | 5.2061 | 5.7888 | 6.2934 |
| 5 | 20 | 0.18956 | 6.3299 | 46.761 | 0.53189 | 5.2306 | 5.7888 | 6.3207 |
| 6 | 25 | 0.23768 | 6.3329 | 48.992 | 0.557 | 5.2487 | 5.7888 | 6.3458 |
| 7 | 30.001 | 0.28726 | 6.3361 | 51.038 | 0.57997 | 5.2633 | 5.7888 | 6.3688 |
| 8 | 35.001 | 0.33538 | 6.3391 | 52.618 | 0.59764 | 5.275 | 5.7888 | 6.3864 |
| 9 | 40.001 | 0.3835 | 6.3422 | 54.012 | 0.61318 | 5.2849 | 5.7888 | 6.402 |
| 10 | 45.001 | 0.43308 | 6.3453 | 55.5 | 0.62975 | 5.2931 | 5.7888 | 6.4186 |
| 11 | 50.001 | 0.4812 | 6.3484 | 57.08 | 0.64737 | 5.3001 | 5.7888 | 6.4362 |
| 12 | 55.001 | 0.53078 | 6.3516 | 58.289 | 0.66075 | 5.3066 | 5.7888 | 6.4495 |
| 13 | 60.001 | 0.5789 | 6.3546 | 59.311 | 0.67202 | 5.3112 | 5.7888 | 6.4608 |
| 14 | 70.001 | 0.6766 | 6.3609 | 61.636 | 0.69766 | 5.3194 | 5.7888 | 6.4865 |
| 15 | 80.001 | 0.77576 | 6.3673 | 63.588 | 0.71904 | 5.3258 | 5.7888 | 6.5078 |
| 16 | 90.002 | 0.87346 | 6.3735 | 65.633 | 0.74144 | 5.3311 | 5.7888 | 6.5302 |
| 17 | 100 | 0.97115 | 6.3798 | 67.213 | 0.75854 | 5.3346 | 5.7888 | 6.5473 |
| 18 | 110 | 1.0703 | 6.3862 | 68.794 | 0.7756 | 5.3369 | 5.7888 | 6.5644 |
| 19 | 120 | 1.1695 | 6.3926 | 70.281 | 0.79158 | 5.3387 | 5.7888 | 6.5804 |
| 20 | 130 | 1.2701 | 6.3991 | 71.676 | 0.80646 | 5.3404 | 5.7888 | 6.5953 |
| 21 | 140 | 1.3707 | 6.4057 | 72.605 | 0.81609 | 5.341 | 5.7888 | 6.6049 |
| 22 | 150 | 1.4699 | 6.4121 | 74.093 | 0.83197 | 5.3428 | 5.7888 | 6.6208 |
| 23 | 160 | 1.5676 | 6.4185 | 75.023 | 0.84157 | 5.3428 | 5.7888 | 6.6304 |
| 24 | 170 | 1.6682 | 6.425 | 76.231 | 0.85426 | 5.3428 | 5.7888 | 6.6431 |
| 25 | 180 | 1.7688 | 6.4316 | 77.254 | 0.86483 | 5.3422 | 5.7888 | 6.6536 |
| 26 | 190 | 1.8694 | 6.4382 | 78.462 | 0.87746 | 5.3416 | 5.7888 | 6.6663 |
| 27 | 200 | 1.9715 | 6.4449 | 79.95 | 0.89316 | 5.3399 | 5.7888 | 6.682 |
| 28 | 210 | 2.0706 | 6.4514 | 81.065 | 0.90471 | 5.3381 | 5.7888 | 6.6935 |
| 29 | 220 | 2.1712 | 6.4581 | 81.809 | 0.91207 | 5.3369 | 5.7888 | 6.7009 |
| 30 | 230 | 2.2719 | 6.4647 | 82.553 | 0.91942 | 5.334 | 5.7888 | 6.7082 |
| 31 | 240 | 2.3725 | 6.4714 | 83.575 | 0.92985 | 5.3317 | 5.7888 | 6.7186 |
| 32 | 270 | 2.6699 | 6.4912 | 86.457 | 0.95898 | 5.3235 | 5.7888 | 6.7478 |
| 33 | 300 | 2.9674 | 6.5111 | 88.688 | 0.98072 | 5.3142 | 5.7888 | 6.7695 |
| 34 | 330 | 3.2678 | 6.5313 | 91.198 | 1.0054 | 5.3036 | 5.7888 | 6.7942 |
| 35 | 360 | 3.5609 | 6.5511 | 93.244 | 1.0248 | 5.2943 | 5.7888 | 6.8136 |
| 36 | 390 | 3.8584 | 6.5714 | 95.103 | 1.042 | 5.2849 | 5.7888 | 6.8308 |
| 37 | 420 | 4.1602 | 6.5921 | 97.892 | 1.0692 | 5.2756 | 5.7888 | 6.858 |
| 38 | 450 | 4.4621 | 6.6129 | 99.658 | 1.0851 | 5.2668 | 5.7888 | 6.8739 |
| 39 | 480 | 4.761 | 6.6337 | 101.8 | 1.1049 | 5.2569 | 5.7888 | 6.8937 |
| 40 | 510 | 5.0585 | 6.6545 | 104.03 | 1.1256 | 5.2476 | 5.7888 | 6.9144 |
| 41 | 540 | 5.3574 | 6.6755 | 106.07 | 1.1441 | 5.2376 | 5.7888 | 6.9329 |
| 42 | 570 | 5.6505 | 6.6962 | 108.95 | 1.1715 | 5.2289 | 5.7888 | 6.9603 |
| 43 | 600 | 5.9465 | 6.7173 | 111.93 | 1.1997 | 5.2184 | 5.7888 | 6.9885 |
| 44 | 630 | 6.244 | 6.7386 | 114.07 | 1.2188 | 5.2096 | 5.7888 | 7.0076 |
| 45 | 660 | 6.5458 | 6.7604 | 115.28 | 1.2277 | 5.2008 | 5.7888 | 7.0165 |
| 46 | 690 | 6.8477 | 6.7823 | 117.32 | 1.2455 | 5.1915 | 5.7888 | 7.0343 |
| 47 | 720 | 7.1466 | 6.8041 | 119.46 | 1.2641 | 5.1821 | 5.7888 | 7.0529 |
| 48 | 750 | 7.4441 | 6.826 | 122.62 | 1.2934 | 5.1734 | 5.7888 | 7.0822 |
| 49 | 780 | 7.7386 | 6.8478 | 124.67 | 1.3108 | 5.164 | 5.7888 | 7.0996 |
| 50 | 810 | 8.0332 | 6.8697 | 127.73 | 1.3387 | 5.1547 | 5.7888 | 7.1275 |
| 51 | 840 | 8.3306 | 6.892 | 128.57 | 1.3432 | 5.1453 | 5.7888 | 7.132 |
| 52 | 870 | 8.6296 | 6.9146 | 131.08 | 1.3649 | 5.1372 | 5.7888 | 7.1537 |
| 53 | 900 | 8.9329 | 6.9376 | 133.59 | 1.3864 | 5.1284 | 5.7888 | 7.1752 |
| 54 | 930 | 9.2333 | 6.9605 | 136.57 | 1.4126 | 5.1196 | 5.7888 | 7.2014 |
| 55 | 960 | 9.5336 | 6.9837 | 138.42 | 1.4271 | 5.1109 | 5.7888 | 7.2159 |
| 56 | 990 | 9.8282 | 7.0065 | 139.35 | 1.432 | 5.1033 | 5.7888 | 7.2208 |
| 57 | 1020 | 10.121 | 7.0293 | 141.59 | 1.4502 | 5.0951 | 5.7888 | 7.239 |
| 58 | 1050 | 10.419 | 7.0527 | 143.72 | 1.4673 | 5.0869 | 5.7888 | 7.2561 |
| 59 | 1080 | 10.718 | 7.0763 | 145.68 | 1.4822 | 5.0787 | 5.7888 | 7.271 |
| 60 | 1110 | 11.017 | 7.1 | 147.72 | 1.498 | 5.0706 | 5.7888 | 7.2868 |
| 61 | 1140 | 11.317 | 7.1241 | 150.23 | 1.5183 | 5.063 | 5.7888 | 7.3071 |
| 62 | 1170 | 11.613 | 7.148 | 151.9 | 1.5301 | 5.0548 | 5.7888 | 7.3189 |
| 63 | 1200 | 11.91 | 7.1721 | 155.16 | 1.5576 | 5.0472 | 5.7888 | 7.3464 |
| 64 | 1230 | 12.205 | 7.1962 | 156.37 | 1.5645 | 5.0402 | 5.7888 | 7.3533 |
| 65 | 1260 | 12.5 | 7.2204 | 159.71 | 1.5926 | 5.0314 | 5.7888 | 7.3814 |
| 66 | 1290 | 12.794 | 7.2448 | 160.74 | 1.5974 | 5.0238 | 5.7888 | 7.3862 |
| 67 | 1320 | 13.092 | 7.2696 | 163.06 | 1.615 | 5.0168 | 5.7888 | 7.4038 |
| 68 | 1350 | 13.395 | 7.295 | 164.18 | 1.6204 | 5.0098 | 5.7888 | 7.4092 |
| 69 | 1380 | 13.697 | 7.3205 | 166.87 | 1.6412 | 5.0022 | 5.7888 | 7.43 |
| 70 | 1410 | 13.996 | 7.346 | 168.08 | 1.6474 | 4.9958 | 5.7888 | 7.4362 |
| 71 | 1440 | 14.293 | 7.3715 | 169.66 | 1.6571 | 4.9894 | 5.7888 | 7.4459 |
| 72 | 1470 | 14.589 | 7.397 | 172.36 | 1.6777 | 4.9829 | 5.7888 | 7.4665 |
| 73 | 1500 | 14.881 | 7.4224 | 173.75 | 1.6855 | 4.9759 | 5.7888 | 7.4743 |
| 74 | 1530 | 15.174 | 7.448 | 176.63 | 1.7075 | 4.9689 | 5.7888 | 7.4963 |
| 75 | 1560 | 15.473 | 7.4744 | 178.03 | 1.7149 | 4.9625 | 5.7888 | 7.5037 |
| 76 | 1590 | 15.773 | 7.501 | 181 | 1.7374 | 4.9549 | 5.7888 | 7.5262 |
| 77 | 1612.1 | 15.995 | 7.5208 | 182.21 | 1.7444 | 4.9502 | 5.7888 | 7.5332 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.91 in
Specimen Area: 6.32 in^2
Specimen Volume: 37.36 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.7888 | 5.7888 | 0 | 0.000 | 0.74395 | 0.74395 | 1.000 | 0.74395 | 0 |
| 2 | 0.05 | 6.152 | 5.7888 | 0.064842 | 0.179 | 1.0423 | 0.6791 | 1.535 | 0.86072 | 0.18161 |
| 3 | 0.09 | 6.2492 | 5.7888 | 0.1256 | 0.273 | 1.0788 | 0.61835 | 1.745 | 0.84856 | 0.23021 |
| 4 | 0.14 | 6.2934 | 5.7888 | 0.16123 | 0.319 | 1.0874 | 0.58272 | 1.866 | 0.83504 | 0.25232 |
| 5 | 0.19 | 6.3207 | 5.7888 | 0.18576 | 0.349 | 1.0901 | 0.55818 | 1.953 | 0.82413 | 0.26595 |
| 6 | 0.24 | 6.3458 | 5.7888 | 0.20387 | 0.366 | 1.0971 | 0.54007 | 2.031 | 0.81857 | 0.2785 |
| 7 | 0.29 | 6.3688 | 5.7888 | 0.21848 | 0.377 | 1.1054 | 0.52547 | 2.104 | 0.81545 | 0.28998 |
| 8 | 0.34 | 6.3864 | 5.7888 | 0.23016 | 0.385 | 1.1114 | 0.51379 | 2.163 | 0.8126 | 0.29882 |
| 9 | 0.38 | 6.402 | 5.7888 | 0.24009 | 0.392 | 1.117 | 0.50385 | 2.217 | 0.81044 | 0.30659 |
| 10 | 0.43 | 6.4186 | 5.7888 | 0.24827 | 0.394 | 1.1254 | 0.49568 | 2.270 | 0.81055 | 0.31488 |
| 11 | 0.48 | 6.4362 | 5.7888 | 0.25528 | 0.394 | 1.136 | 0.48867 | 2.325 | 0.81235 | 0.32369 |
| 12 | 0.53 | 6.4495 | 5.7888 | 0.26171 | 0.396 | 1.143 | 0.48224 | 2.370 | 0.81262 | 0.33037 |
| 13 | 0.58 | 6.4608 | 5.7888 | 0.26638 | 0.396 | 1.1496 | 0.47757 | 2.407 | 0.81358 | 0.33601 |
| 14 | 0.68 | 6.4865 | 5.7888 | 0.27456 | 0.394 | 1.1671 | 0.46939 | 2.486 | 0.81822 | 0.34883 |
| 15 | 0.78 | 6.5078 | 5.7888 | 0.28098 | 0.391 | 1.182 | 0.46296 | 2.553 | 0.82248 | 0.35952 |
| 16 | 0.87 | 6.5302 | 5.7888 | 0.28624 | 0.386 | 1.1991 | 0.45771 | 2.620 | 0.82842 | 0.37072 |
| 17 | 0.97 | 6.5473 | 5.7888 | 0.28975 | 0.382 | 1.2127 | 0.4542 | 2.670 | 0.83347 | 0.37927 |
| 18 | 1.07 | 6.5644 | 5.7888 | 0.29208 | 0.377 | 1.2275 | 0.45186 | 2.716 | 0.83966 | 0.3878 |
| 19 | 1.17 | 6.5804 | 5.7888 | 0.29384 | 0.371 | 1.2417 | 0.45011 | 2.759 | 0.8459 | 0.39579 |
| 20 | 1.27 | 6.5953 | 5.7888 | 0.29559 | 0.367 | 1.2548 | 0.44836 | 2.799 | 0.85159 | 0.40323 |
| 21 | 1.37 | 6.6049 | 5.7888 | 0.29617 | 0.363 | 1.2639 | 0.44777 | 2.823 | 0.85582 | 0.40804 |
| 22 | 1.47 | 6.6208 | 5.7888 | 0.29792 | 0.358 | 1.278 | 0.44602 | 2.865 | 0.86201 | 0.41599 |
| 23 | 1.57 | 6.6304 | 5.7888 | 0.29792 | 0.354 | 1.2876 | 0.44602 | 2.887 | 0.86681 | 0.42079 |
| 24 | 1.67 | 6.6431 | 5.7888 | 0.29792 | 0.349 | 1.3003 | 0.44602 | 2.915 | 0.87315 | 0.42713 |
| 25 | 1.77 | 6.6536 | 5.7888 | 0.29734 | 0.344 | 1.3114 | 0.44661 | 2.936 | 0.87902 | 0.43242 |
| 26 | 1.87 | 6.6663 | 5.7888 | 0.29676 | 0.338 | 1.3247 | 0.44719 | 2.962 | 0.88592 | 0.43873 |
| 27 | 1.97 | 6.682 | 5.7888 | 0.295 | 0.330 | 1.3421 | 0.44894 | 2.989 | 0.89553 | 0.44658 |
| 28 | 2.07 | 6.6935 | 5.7888 | 0.29325 | 0.324 | 1.3554 | 0.4507 | 3.007 | 0.90305 | 0.45236 |
| 29 | 2.17 | 6.7009 | 5.7888 | 0.29208 | 0.320 | 1.3639 | 0.45186 | 3.018 | 0.9079 | 0.45604 |
| 30 | 2.27 | 6.7082 | 5.7888 | 0.28916 | 0.315 | 1.3742 | 0.45478 | 3.022 | 0.91449 | 0.45971 |
| 31 | 2.37 | 6.7186 | 5.7888 | 0.28683 | 0.308 | 1.387 | 0.45712 | 3.034 | 0.92205 | 0.46492 |
| 32 | 2.67 | 6.7478 | 5.7888 | 0.27865 | 0.291 | 1.4243 | 0.4653 | 3.061 | 0.94479 | 0.47949 |
| 33 | 2.97 | 6.7695 | 5.7888 | 0.2693 | 0.275 | 1.4554 | 0.47465 | 3.066 | 0.96501 | 0.49036 |
| 34 | 3.27 | 6.7942 | 5.7888 | 0.25879 | 0.257 | 1.4905 | 0.48516 | 3.072 | 0.98784 | 0.50268 |
| 35 | 3.56 | 6.8136 | 5.7888 | 0.24944 | 0.243 | 1.5193 | 0.49451 | 3.072 | 1.0069 | 0.51239 |
| 36 | 3.86 | 6.8308 | 5.7888 | 0.24009 | 0.230 | 1.5459 | 0.50385 | 3.068 | 1.0249 | 0.521 |
| 37 | 4.16 | 6.858 | 5.7888 | 0.23075 | 0.216 | 1.5824 | 0.5132 | 3.083 | 1.0478 | 0.5346 |
| 38 | 4.46 | 6.8739 | 5.7888 | 0.22198 | 0.205 | 1.607 | 0.52196 | 3.079 | 1.0645 | 0.54253 |
| 39 | 4.76 | 6.8937 | 5.7888 | 0.21205 | 0.192 | 1.6368 | 0.53189 | 3.077 | 1.0843 | 0.55243 |
| 40 | 5.06 | 6.9144 | 5.7888 | 0.20271 | 0.180 | 1.6668 | 0.54124 | 3.080 | 1.104 | 0.56278 |
| 41 | 5.36 | 6.9329 | 5.7888 | 0.19277 | 0.168 | 1.6952 | 0.55117 | 3.076 | 1.1232 | 0.57204 |
| 42 | 5.65 | 6.9603 | 5.7888 | 0.18401 | 0.157 | 1.7314 | 0.55993 | 3.092 | 1.1457 | 0.58576 |
| 43 | 5.95 | 6.9885 | 5.7888 | 0.1735 | 0.145 | 1.7702 | 0.57045 | 3.103 | 1.1703 | 0.59986 |
| 44 | 6.24 | 7.0076 | 5.7888 | 0.16473 | 0.135 | 1.798 | 0.57921 | 3.104 | 1.1886 | 0.60939 |
| 45 | 6.55 | 7.0165 | 5.7888 | 0.15597 | 0.127 | 1.8157 | 0.58797 | 3.088 | 1.2018 | 0.61386 |
| 46 | 6.85 | 7.0343 | 5.7888 | 0.14663 | 0.118 | 1.8428 | 0.59732 | 3.085 | 1.2201 | 0.62274 |
| 47 | 7.15 | 7.0529 | 5.7888 | 0.13728 | 0.109 | 1.8708 | 0.60667 | 3.084 | 1.2387 | 0.63205 |
| 48 | 7.44 | 7.0822 | 5.7888 | 0.12852 | 0.099 | 1.9088 | 0.61543 | 3.102 | 1.2621 | 0.6467 |
| 49 | 7.74 | 7.0996 | 5.7888 | 0.11917 | 0.091 | 1.9356 | 0.62478 | 3.098 | 1.2802 | 0.65539 |
| 50 | 8.03 | 7.1275 | 5.7888 | 0.10982 | 0.082 | 1.9729 | 0.63412 | 3.111 | 1.3035 | 0.66937 |
| 51 | 8.33 | 7.132 | 5.7888 | 0.10048 | 0.075 | 1.9866 | 0.64347 | 3.087 | 1.315 | 0.67158 |
| 52 | 8.63 | 7.1537 | 5.7888 | 0.092298 | 0.068 | 2.0166 | 0.65165 | 3.095 | 1.3341 | 0.68246 |
| 53 | 8.93 | 7.1752 | 5.7888 | 0.083536 | 0.060 | 2.0468 | 0.66041 | 3.099 | 1.3536 | 0.69322 |
| 54 | 9.23 | 7.2014 | 5.7888 | 0.074773 | 0.053 | 2.0818 | 0.66917 | 3.111 | 1.3755 | 0.70632 |
| 55 | 9.53 | 7.2159 | 5.7888 | 0.066011 | 0.046 | 2.1051 | 0.67794 | 3.105 | 1.3915 | 0.71356 |
| 56 | 9.83 | 7.2208 | 5.7888 | 0.058417 | 0.041 | 2.1176 | 0.68553 | 3.089 | 1.4015 | 0.71602 |
| 57 | 10.12 | 7.239 | 5.7888 | 0.050238 | 0.035 | 2.1439 | 0.69371 | 3.091 | 1.4188 | 0.72512 |
| 58 | 10.42 | 7.2561 | 5.7888 | 0.04206 | 0.029 | 2.1691 | 0.70189 | 3.090 | 1.4355 | 0.73363 |
| 59 | 10.72 | 7.271 | 5.7888 | 0.033882 | 0.023 | 2.1923 | 0.71006 | 3.087 | 1.4512 | 0.74111 |
| 60 | 11.02 | 7.2868 | 5.7888 | 0.025703 | 0.017 | 2.2162 | 0.71824 | 3.086 | 1.4672 | 0.749 |
| 61 | 11.32 | 7.3071 | 5.7888 | 0.018109 | 0.012 | 2.2442 | 0.72584 | 3.092 | 1.485 | 0.75916 |
| 62 | 11.61 | 7.3189 | 5.7888 | 0.0099308 | 0.006 | 2.2641 | 0.73402 | 3.085 | 1.4991 | 0.76505 |
| 63 | 11.91 | 7.3464 | 5.7888 | 0.0023367 | 0.002 | 2.2992 | 0.74161 | 3.100 | 1.5204 | 0.77881 |
| 64 | 12.21 | 7.3533 | 5.7888 | -0.0046733 | -0.003 | 2.3131 | 0.74862 | 3.090 | 1.5309 | 0.78225 |
| 65 | 12.50 | 7.3814 | 5.7888 | -0.013436 | -0.008 | 2.35 | 0.75738 | 3.103 | 1.5537 | 0.79631 |
| 66 | 12.79 | 7.3862 | 5.7888 | -0.02103 | -0.013 | 2.3624 | 0.76498 | 3.088 | 1.5637 | 0.79871 |
| 67 | 13.09 | 7.4038 | 5.7888 | -0.02804 | -0.017 | 2.387 | 0.77199 | 3.092 | 1.5795 | 0.8075 |
| 68 | 13.39 | 7.4092 | 5.7888 | -0.03505 | -0.022 | 2.3994 | 0.779 | 3.080 | 1.5892 | 0.81019 |
| 69 | 13.70 | 7.43 | 5.7888 | -0.042644 | -0.026 | 2.4278 | 0.78659 | 3.087 | 1.6072 | 0.82062 |
| 70 | 14.00 | 7.4362 | 5.7888 | -0.04907 | -0.030 | 2.4404 | 0.79302 | 3.077 | 1.6167 | 0.8237 |
| 71 | 14.29 | 7.4459 | 5.7888 | -0.055496 | -0.033 | 2.4566 | 0.79944 | 3.073 | 1.628 | 0.82857 |
| 72 | 14.59 | 7.4665 | 5.7888 | -0.061922 | -0.037 | 2.4835 | 0.80587 | 3.082 | 1.6447 | 0.83883 |
| 73 | 14.88 | 7.4743 | 5.7888 | -0.068932 | -0.041 | 2.4983 | 0.81288 | 3.073 | 1.6556 | 0.84273 |
| 74 | 15.17 | 7.4963 | 5.7888 | -0.075942 | -0.044 | 2.5274 | 0.81989 | 3.083 | 1.6736 | 0.85376 |
| 75 | 15.47 | 7.5037 | 5.7888 | -0.082367 | -0.048 | 2.5412 | 0.82631 | 3.075 | 1.6838 | 0.85746 |
| 76 | 15.77 | 7.5262 | 5.7888 | -0.089961 | -0.052 | 2.5713 | 0.83391 | 3.083 | 1.7026 | 0.86869 |
| 77 | 15.99 | 7.5332 | 5.7888 | -0.094635 | -0.054 | 2.583 | 0.83858 | 3.080 | 1.7108 | 0.87219 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.08 in
Specimen Area: 6.35 in^2
Specimen Volume: 38.65 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.353 | 0 | 0 | 5.0454 | 6.2928 | 6.2928 |
| 2 | 5.0038 | 0.0388 | 6.3555 | 29.35 | 0.3325 | 5.1985 | 6.2928 | 6.6253 |
| 3 | 10.004 | 0.085062 | 6.3584 | 39.31 | 0.44513 | 5.2806 | 6.2928 | 6.7379 |
| 4 | 15.004 | 0.13132 | 6.3613 | 45.38 | 0.51363 | 5.3339 | 6.2928 | 6.8064 |
| 5 | 20.004 | 0.17908 | 6.3644 | 50.036 | 0.56606 | 5.3744 | 6.2928 | 6.8589 |
| 6 | 25 | 0.22683 | 6.3674 | 53.985 | 0.61044 | 5.4054 | 6.2928 | 6.9032 |
| 7 | 30 | 0.27459 | 6.3705 | 57.344 | 0.64811 | 5.4298 | 6.2928 | 6.9409 |
| 8 | 35 | 0.32234 | 6.3735 | 60.35 | 0.68176 | 5.4504 | 6.2928 | 6.9746 |
| 9 | 40 | 0.37159 | 6.3767 | 62.884 | 0.71004 | 5.4676 | 6.2928 | 7.0028 |
| 10 | 45 | 0.42083 | 6.3798 | 65.477 | 0.73895 | 5.482 | 6.2928 | 7.0317 |
| 11 | 50 | 0.46859 | 6.3829 | 67.658 | 0.76319 | 5.4936 | 6.2928 | 7.056 |
| 12 | 55.001 | 0.51634 | 6.386 | 70.074 | 0.79007 | 5.5042 | 6.2928 | 7.0829 |
| 13 | 60.001 | 0.5641 | 6.389 | 72.196 | 0.8136 | 5.513 | 6.2928 | 7.1064 |
| 14 | 70.001 | 0.65961 | 6.3952 | 76.204 | 0.85794 | 5.5269 | 6.2928 | 7.1507 |
| 15 | 80.001 | 0.75512 | 6.4013 | 80.27 | 0.90285 | 5.5375 | 6.2928 | 7.1957 |
| 16 | 90.001 | 0.85361 | 6.4077 | 84.573 | 0.9503 | 5.5436 | 6.2928 | 7.2431 |
| 17 | 100 | 0.95061 | 6.414 | 88.698 | 0.99568 | 5.5474 | 6.2928 | 7.2885 |
| 18 | 110 | 1.0491 | 6.4203 | 92.706 | 1.0396 | 5.5497 | 6.2928 | 7.3324 |
| 19 | 120 | 1.1446 | 6.4265 | 96.124 | 1.0769 | 5.5502 | 6.2928 | 7.3697 |
| 20 | 130 | 1.2401 | 6.4328 | 99.719 | 1.1161 | 5.5497 | 6.2928 | 7.4089 |
| 21 | 140 | 1.3356 | 6.439 | 104.26 | 1.1658 | 5.5474 | 6.2928 | 7.4586 |
| 22 | 150 | 1.4326 | 6.4453 | 108.32 | 1.2101 | 5.5452 | 6.2928 | 7.5029 |
| 23 | 160 | 1.5266 | 6.4515 | 111.57 | 1.2451 | 5.5408 | 6.2928 | 7.5379 |
| 24 | 170 | 1.6251 | 6.4579 | 115.28 | 1.2852 | 5.5369 | 6.2928 | 7.578 |
| 25 | 180 | 1.7206 | 6.4642 | 118.28 | 1.3175 | 5.5314 | 6.2928 | 7.6103 |
| 26 | 190 | 1.8162 | 6.4705 | 121.41 | 1.351 | 5.5258 | 6.2928 | 7.6438 |
| 27 | 200 | 1.9102 | 6.4767 | 124.71 | 1.3863 | 5.5197 | 6.2928 | 7.6791 |
| 28 | 210 | 2.0057 | 6.483 | 127.83 | 1.4197 | 5.5125 | 6.2928 | 7.7125 |
| 29 | 220 | 2.1012 | 6.4893 | 131.01 | 1.4536 | 5.5053 | 6.2928 | 7.7464 |
| 30 | 230 | 2.1967 | 6.4957 | 134.2 | 1.4875 | 5.4975 | 6.2928 | 7.7803 |
| 31 | 240 | 2.2907 | 6.5019 | 137.2 | 1.5193 | 5.4892 | 6.2928 | 7.8121 |
| 32 | 270 | 2.5817 | 6.5213 | 146.28 | 1.615 | 5.4637 | 6.2928 | 7.9078 |
| 33 | 300 | 2.8757 | 6.5411 | 152.23 | 1.6757 | 5.4365 | 6.2928 | 7.9685 |
| 34 | 330 | 3.1682 | 6.5608 | 158.3 | 1.7372 | 5.4082 | 6.2928 | 8.03 |
| 35 | 360 | 3.4592 | 6.5806 | 164.61 | 1.801 | 5.3805 | 6.2928 | 8.0938 |
| 36 | 390 | 3.7502 | 6.6005 | 169.79 | 1.8521 | 5.3527 | 6.2928 | 8.1449 |
| 37 | 420 | 4.0397 | 6.6204 | 175.22 | 1.9055 | 5.325 | 6.2928 | 8.1983 |
| 38 | 450 | 4.3292 | 6.6405 | 180.28 | 1.9547 | 5.2989 | 6.2928 | 8.2475 |
| 39 | 480 | 4.6202 | 6.6607 | 185.23 | 2.0023 | 5.2712 | 6.2928 | 8.2951 |
| 40 | 510 | 4.9127 | 6.6812 | 189.48 | 2.0419 | 5.2451 | 6.2928 | 8.3347 |
| 41 | 540 | 5.2082 | 6.702 | 194.43 | 2.0887 | 5.2201 | 6.2928 | 8.3815 |
| 42 | 570 | 5.5007 | 6.7228 | 199.32 | 2.1347 | 5.1957 | 6.2928 | 8.4275 |
| 43 | 600 | 5.7902 | 6.7434 | 204.39 | 2.1823 | 5.1702 | 6.2928 | 8.4751 |
| 44 | 630 | 6.0782 | 6.7641 | 209.28 | 2.2277 | 5.1469 | 6.2928 | 8.5205 |
| 45 | 660 | 6.3692 | 6.7851 | 213.41 | 2.2645 | 5.1242 | 6.2928 | 8.5573 |
| 46 | 690 | 6.6587 | 6.8062 | 217.65 | 2.3024 | 5.1014 | 6.2928 | 8.5952 |
| 47 | 720 | 6.9497 | 6.8275 | 222.13 | 2.3425 | 5.0798 | 6.2928 | 8.6353 |
| 48 | 750 | 7.2407 | 6.8489 | 226.9 | 2.3853 | 5.0582 | 6.2928 | 8.6781 |
| 49 | 780 | 7.5362 | 6.8708 | 231.56 | 2.4265 | 5.0382 | 6.2928 | 8.7193 |
| 50 | 810 | 7.8302 | 6.8927 | 234.5 | 2.4496 | 5.0188 | 6.2928 | 8.7424 |
| 51 | 840 | 8.1197 | 6.9144 | 238.39 | 2.4824 | 4.9982 | 6.2928 | 8.7752 |
| 52 | 870 | 8.4107 | 6.9364 | 243.17 | 2.5241 | 4.9805 | 6.2928 | 8.8169 |
| 53 | 900 | 8.6987 | 6.9583 | 247.82 | 2.5643 | 4.9622 | 6.2928 | 8.8571 |
| 54 | 930 | 8.9883 | 6.9804 | 250.54 | 2.5842 | 4.9444 | 6.2928 | 8.877 |
| 55 | 960 | 9.2793 | 7.0028 | 253.72 | 2.6086 | 4.9267 | 6.2928 | 8.9014 |
| 56 | 990 | 9.5718 | 7.0254 | 257.61 | 2.6401 | 4.9106 | 6.2928 | 8.9329 |
| 57 | 1020 | 9.8643 | 7.0482 | 261.97 | 2.6761 | 4.8945 | 6.2928 | 8.9689 |
| 58 | 1050 | 10.157 | 7.0712 | 265.5 | 2.7034 | 4.8806 | 6.2928 | 8.9962 |
| 59 | 1080 | 10.446 | 7.094 | 268.63 | 2.7264 | 4.8646 | 6.2928 | 9.0192 |
| 60 | 1110 | 10.736 | 7.1171 | 271.69 | 2.7486 | 4.8507 | 6.2928 | 9.0414 |
| 61 | 1140 | 11.024 | 7.1401 | 273.58 | 2.7587 | 4.8363 | 6.2928 | 9.0515 |
| 62 | 1170 | 11.31 | 7.1632 | 277 | 2.7842 | 4.8224 | 6.2928 | 9.077 |
| 63 | 1200 | 11.6 | 7.1866 | 280.18 | 2.807 | 4.8096 | 6.2928 | 9.0998 |
| 64 | 1230 | 11.889 | 7.2102 | 282.3 | 2.819 | 4.7969 | 6.2928 | 9.1118 |
| 65 | 1260 | 12.183 | 7.2344 | 285.01 | 2.8366 | 4.7836 | 6.2928 | 9.1294 |
| 66 | 1290 | 12.477 | 7.2587 | 287.49 | 2.8516 | 4.7714 | 6.2928 | 9.1444 |
| 67 | 1320 | 12.771 | 7.2831 | 291.2 | 2.8788 | 4.7608 | 6.2928 | 9.1716 |
| 68 | 1350 | 13.064 | 7.3076 | 293.85 | 2.8952 | 4.7492 | 6.2928 | 9.188 |
| 69 | 1380 | 13.355 | 7.3322 | 297.62 | 2.9226 | 4.7392 | 6.2928 | 9.2154 |
| 70 | 1410 | 13.643 | 7.3566 | 299.45 | 2.9308 | 4.7292 | 6.2928 | 9.2236 |
| 71 | 1440 | 13.932 | 7.3814 | 302.28 | 2.9485 | 4.7198 | 6.2928 | 9.2413 |
| 72 | 1470 | 14.226 | 7.4067 | 305.4 | 2.9688 | 4.7109 | 6.2928 | 9.2616 |
| 73 | 1500 | 14.519 | 7.432 | 307.76 | 2.9815 | 4.7015 | 6.2928 | 9.2743 |
| 74 | 1530 | 14.814 | 7.4578 | 309.29 | 2.986 | 4.6926 | 6.2928 | 9.2788 |
| 75 | 1560 | 15.107 | 7.4835 | 312.12 | 3.003 | 4.6837 | 6.2928 | 9.2958 |
| 76 | 1590 | 15.398 | 7.5092 | 314.54 | 3.0159 | 4.6743 | 6.2928 | 9.3087 |
| 77 | 1613.1 | 15.62 | 7.529 | 316.72 | 3.0288 | 4.6682 | 6.2928 | 9.3216 |

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.08 in
Specimen Area: 6.35 in^2
Specimen Volume: 38.65 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.2928 | 6.2928 | 0 | 0.000 | 1.2474 | 1.2474 | 1.000 | 1.2474 | 0 |
| 2 | 0.04 | 6.6253 | 6.2928 | 0.15311 | 0.460 | 1.4268 | 1.0943 | 1.304 | 1.2605 | 0.16625 |
| 3 | 0.09 | 6.7379 | 6.2928 | 0.23521 | 0.528 | 1.4573 | 1.0122 | 1.440 | 1.2348 | 0.22257 |
| 4 | 0.13 | 6.8064 | 6.2928 | 0.28847 | 0.562 | 1.4726 | 0.95893 | 1.536 | 1.2158 | 0.25682 |
| 5 | 0.18 | 6.8589 | 6.2928 | 0.32896 | 0.581 | 1.4845 | 0.91844 | 1.616 | 1.2015 | 0.28303 |
| 6 | 0.23 | 6.9032 | 6.2928 | 0.36003 | 0.590 | 1.4978 | 0.88737 | 1.688 | 1.1926 | 0.30522 |
| 7 | 0.27 | 6.9409 | 6.2928 | 0.38444 | 0.593 | 1.5111 | 0.86296 | 1.751 | 1.187 | 0.32406 |
| 8 | 0.32 | 6.9746 | 6.2928 | 0.40496 | 0.594 | 1.5242 | 0.84244 | 1.809 | 1.1833 | 0.34088 |
| 9 | 0.37 | 7.0028 | 6.2928 | 0.42216 | 0.595 | 1.5353 | 0.82524 | 1.860 | 1.1803 | 0.35502 |
| 10 | 0.42 | 7.0317 | 6.2928 | 0.43658 | 0.591 | 1.5498 | 0.81082 | 1.911 | 1.1803 | 0.36947 |
| 11 | 0.47 | 7.056 | 6.2928 | 0.44823 | 0.587 | 1.5624 | 0.79917 | 1.955 | 1.1808 | 0.3816 |
| 12 | 0.52 | 7.0829 | 6.2928 | 0.45877 | 0.581 | 1.5787 | 0.78863 | 2.002 | 1.1837 | 0.39504 |
| 13 | 0.56 | 7.1064 | 6.2928 | 0.46765 | 0.575 | 1.5934 | 0.77975 | 2.043 | 1.1866 | 0.4068 |
| 14 | 0.66 | 7.1507 | 6.2928 | 0.48152 | 0.561 | 1.6238 | 0.76588 | 2.120 | 1.1949 | 0.42897 |
| 15 | 0.76 | 7.1957 | 6.2928 | 0.49206 | 0.545 | 1.6582 | 0.75534 | 2.195 | 1.2068 | 0.45143 |
| 16 | 0.85 | 7.2431 | 6.2928 | 0.49816 | 0.524 | 1.6995 | 0.74924 | 2.268 | 1.2244 | 0.47515 |
| 17 | 0.95 | 7.2885 | 6.2928 | 0.50204 | 0.504 | 1.741 | 0.74536 | 2.336 | 1.2432 | 0.49784 |
| 18 | 1.05 | 7.3324 | 6.2928 | 0.50426 | 0.485 | 1.7828 | 0.74314 | 2.399 | 1.263 | 0.51982 |
| 19 | 1.14 | 7.3697 | 6.2928 | 0.50482 | 0.469 | 1.8195 | 0.74258 | 2.450 | 1.281 | 0.53846 |
| 20 | 1.24 | 7.4089 | 6.2928 | 0.50426 | 0.452 | 1.8593 | 0.74314 | 2.502 | 1.3012 | 0.55806 |
| 21 | 1.34 | 7.4586 | 6.2928 | 0.50204 | 0.431 | 1.9111 | 0.74536 | 2.564 | 1.3283 | 0.5829 |
| 22 | 1.43 | 7.5029 | 6.2928 | 0.49982 | 0.413 | 1.9576 | 0.74758 | 2.619 | 1.3526 | 0.60504 |
| 23 | 1.53 | 7.5379 | 6.2928 | 0.49539 | 0.398 | 1.9971 | 0.75202 | 2.656 | 1.3746 | 0.62255 |
| 24 | 1.63 | 7.578 | 6.2928 | 0.4915 | 0.382 | 2.0411 | 0.7559 | 2.700 | 1.3985 | 0.64262 |
| 25 | 1.72 | 7.6103 | 6.2928 | 0.48596 | 0.369 | 2.0789 | 0.76145 | 2.730 | 1.4202 | 0.65874 |
| 26 | 1.82 | 7.6438 | 6.2928 | 0.48041 | 0.356 | 2.1179 | 0.76699 | 2.761 | 1.4425 | 0.67548 |
| 27 | 1.91 | 7.6791 | 6.2928 | 0.47431 | 0.342 | 2.1594 | 0.7731 | 2.793 | 1.4663 | 0.69317 |
| 28 | 2.01 | 7.7125 | 6.2928 | 0.46709 | 0.329 | 2.2 | 0.78031 | 2.819 | 1.4902 | 0.70984 |
| 29 | 2.10 | 7.7464 | 6.2928 | 0.45988 | 0.316 | 2.2411 | 0.78752 | 2.846 | 1.5143 | 0.72681 |
| 30 | 2.20 | 7.7803 | 6.2928 | 0.45212 | 0.304 | 2.2828 | 0.79529 | 2.870 | 1.539 | 0.74374 |
| 31 | 2.29 | 7.8121 | 6.2928 | 0.4438 | 0.292 | 2.3229 | 0.80361 | 2.891 | 1.5633 | 0.75966 |
| 32 | 2.58 | 7.9078 | 6.2928 | 0.41828 | 0.259 | 2.4441 | 0.82912 | 2.948 | 1.6366 | 0.8075 |
| 33 | 2.88 | 7.9685 | 6.2928 | 0.39109 | 0.233 | 2.532 | 0.85631 | 2.957 | 1.6941 | 0.83783 |
| 34 | 3.17 | 8.03 | 6.2928 | 0.3628 | 0.209 | 2.6218 | 0.8846 | 2.964 | 1.7532 | 0.86861 |
| 35 | 3.46 | 8.0938 | 6.2928 | 0.33507 | 0.186 | 2.7133 | 0.91234 | 2.974 | 1.8128 | 0.9005 |
| 36 | 3.75 | 8.1449 | 6.2928 | 0.30733 | 0.166 | 2.7922 | 0.94007 | 2.970 | 1.8661 | 0.92607 |
| 37 | 4.04 | 8.1983 | 6.2928 | 0.27959 | 0.147 | 2.8734 | 0.96781 | 2.969 | 1.9206 | 0.95277 |
| 38 | 4.33 | 8.2475 | 6.2928 | 0.25352 | 0.130 | 2.9486 | 0.99388 | 2.967 | 1.9713 | 0.97737 |
| 39 | 4.62 | 8.2951 | 6.2928 | 0.22578 | 0.113 | 3.0239 | 1.0216 | 2.960 | 2.0228 | 1.0012 |
| 40 | 4.91 | 8.3347 | 6.2928 | 0.19971 | 0.098 | 3.0896 | 1.0477 | 2.949 | 2.0686 | 1.021 |
| 41 | 5.21 | 8.3815 | 6.2928 | 0.17474 | 0.084 | 3.1614 | 1.0727 | 2.947 | 2.117 | 1.0444 |
| 42 | 5.50 | 8.4275 | 6.2928 | 0.15034 | 0.070 | 3.2318 | 1.0971 | 2.946 | 2.1644 | 1.0673 |
| 43 | 5.79 | 8.4751 | 6.2928 | 0.12482 | 0.057 | 3.3048 | 1.1226 | 2.944 | 2.2137 | 1.0911 |
| 44 | 6.08 | 8.5205 | 6.2928 | 0.10152 | 0.046 | 3.3735 | 1.1459 | 2.944 | 2.2597 | 1.1138 |
| 45 | 6.37 | 8.5573 | 6.2928 | 0.078774 | 0.035 | 3.4332 | 1.1686 | 2.938 | 2.3009 | 1.1323 |
| 46 | 6.66 | 8.5952 | 6.2928 | 0.056029 | 0.024 | 3.4938 | 1.1914 | 2.933 | 2.3426 | 1.1512 |
| 47 | 6.95 | 8.6353 | 6.2928 | 0.034394 | 0.015 | 3.5555 | 1.213 | 2.931 | 2.3842 | 1.1712 |
| 48 | 7.24 | 8.6781 | 6.2928 | 0.012759 | 0.005 | 3.62 | 1.2346 | 2.932 | 2.4273 | 1.1927 |
| 49 | 7.54 | 8.7193 | 6.2928 | -0.0072117 | -0.003 | 3.6811 | 1.2546 | 2.934 | 2.4679 | 1.2133 |
| 50 | 7.83 | 8.7424 | 6.2928 | -0.026628 | -0.011 | 3.7236 | 1.274 | 2.923 | 2.4988 | 1.2248 |
| 51 | 8.12 | 8.7752 | 6.2928 | -0.047153 | -0.019 | 3.777 | 1.2946 | 2.918 | 2.5358 | 1.2412 |
| 52 | 8.41 | 8.8169 | 6.2928 | -0.064905 | -0.026 | 3.8364 | 1.3123 | 2.923 | 2.5744 | 1.262 |
| 53 | 8.70 | 8.8571 | 6.2928 | -0.083212 | -0.032 | 3.895 | 1.3306 | 2.927 | 2.6128 | 1.2822 |
| 54 | 8.99 | 8.877 | 6.2928 | -0.10096 | -0.039 | 3.9325 | 1.3484 | 2.917 | 2.6404 | 1.2921 |
| 55 | 9.28 | 8.9014 | 6.2928 | -0.11872 | -0.046 | 3.9747 | 1.3661 | 2.910 | 2.6704 | 1.3043 |
| 56 | 9.57 | 8.9329 | 6.2928 | -0.1348 | -0.051 | 4.0223 | 1.3822 | 2.910 | 2.7022 | 1.32 |
| 57 | 9.86 | 8.9689 | 6.2928 | -0.15089 | -0.056 | 4.0744 | 1.3983 | 2.914 | 2.7363 | 1.338 |
| 58 | 10.16 | 8.9962 | 6.2928 | -0.16476 | -0.061 | 4.1156 | 1.4122 | 2.914 | 2.7639 | 1.3517 |
| 59 | 10.45 | 9.0192 | 6.2928 | -0.18085 | -0.066 | 4.1547 | 1.4282 | 2.909 | 2.7915 | 1.3632 |
| 60 | 10.74 | 9.0414 | 6.2928 | -0.19472 | -0.071 | 4.1907 | 1.4421 | 2.906 | 2.8164 | 1.3743 |
| 61 | 11.02 | 9.0515 | 6.2928 | -0.20914 | -0.076 | 4.2153 | 1.4565 | 2.894 | 2.8359 | 1.3794 |
| 62 | 11.31 | 9.077 | 6.2928 | -0.22301 | -0.080 | 4.2546 | 1.4704 | 2.893 | 2.8625 | 1.3921 |
| 63 | 11.60 | 9.0998 | 6.2928 | -0.23577 | -0.084 | 4.2902 | 1.4832 | 2.893 | 2.8867 | 1.4035 |
| 64 | 11.89 | 9.1118 | 6.2928 | -0.24853 | -0.088 | 4.3149 | 1.4959 | 2.884 | 2.9054 | 1.4095 |
| 65 | 12.18 | 9.1294 | 6.2928 | -0.26184 | -0.092 | 4.3458 | 1.5092 | 2.879 | 2.9275 | 1.4183 |
| 66 | 12.48 | 9.1444 | 6.2928 | -0.27404 | -0.096 | 4.3731 | 1.5214 | 2.874 | 2.9473 | 1.4258 |
| 67 | 12.77 | 9.1716 | 6.2928 | -0.28458 | -0.099 | 4.4108 | 1.532 | 2.879 | 2.9714 | 1.4394 |
| 68 | 13.06 | 9.188 | 6.2928 | -0.29623 | -0.102 | 4.4389 | 1.5436 | 2.876 | 2.9913 | 1.4476 |
| 69 | 13.35 | 9.2154 | 6.2928 | -0.30622 | -0.105 | 4.4762 | 1.5536 | 2.881 | 3.0149 | 1.4613 |
| 70 | 13.64 | 9.2236 | 6.2928 | -0.3162 | -0.108 | 4.4944 | 1.5636 | 2.874 | 3.029 | 1.4654 |
| 71 | 13.93 | 9.2413 | 6.2928 | -0.32563 | -0.110 | 4.5216 | 1.573 | 2.874 | 3.0473 | 1.4743 |
| 72 | 14.23 | 9.2616 | 6.2928 | -0.33451 | -0.113 | 4.5507 | 1.5819 | 2.877 | 3.0663 | 1.4844 |
| 73 | 14.52 | 9.2743 | 6.2928 | -0.34394 | -0.115 | 4.5729 | 1.5913 | 2.874 | 3.0821 | 1.4908 |
| 74 | 14.81 | 9.2788 | 6.2928 | -0.35282 | -0.118 | 4.5862 | 1.6002 | 2.866 | 3.0932 | 1.493 |
| 75 | 15.11 | 9.2958 | 6.2928 | -0.36169 | -0.120 | 4.6121 | 1.6091 | 2.866 | 3.1106 | 1.5015 |
| 76 | 15.40 | 9.3087 | 6.2928 | -0.37112 | -0.123 | 4.6344 | 1.6185 | 2.863 | 3.1265 | 1.5079 |
| 77 | 15.62 | 9.3216 | 6.2928 | -0.37723 | -0.125 | 4.6534 | 1.6246 | 2.864 | 3.139 | 1.5144 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.02 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.27 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.36 | 0 | 0 | 5.0404 | 6.8328 | 6.8328 |
| 2 | 5.0037 | 0.032682 | 6.3621 | 36.347 | 0.41134 | 5.2561 | 6.8328 | 7.2441 |
| 3 | 10.004 | 0.078153 | 6.365 | 49.512 | 0.56007 | 5.3969 | 6.8328 | 7.3929 |
| 4 | 15.004 | 0.12504 | 6.368 | 56.855 | 0.64283 | 5.4904 | 6.8328 | 7.4756 |
| 5 | 20.004 | 0.17194 | 6.371 | 61.995 | 0.70062 | 5.5581 | 6.8328 | 7.5334 |
| 6 | 25.004 | 0.22025 | 6.3741 | 66.401 | 0.75005 | 5.6109 | 6.8328 | 7.5828 |
| 7 | 30 | 0.26714 | 6.3771 | 70.072 | 0.79115 | 5.6527 | 6.8328 | 7.6239 |
| 8 | 35 | 0.31261 | 6.38 | 73.376 | 0.82808 | 5.6874 | 6.8328 | 7.6609 |
| 9 | 40 | 0.3595 | 6.383 | 76.366 | 0.86141 | 5.716 | 6.8328 | 7.6942 |
| 10 | 45 | 0.40924 | 6.3862 | 79.355 | 0.89468 | 5.7402 | 6.8328 | 7.7275 |
| 11 | 50 | 0.45755 | 6.3893 | 81.978 | 0.9238 | 5.7605 | 6.8328 | 7.7566 |
| 12 | 55 | 0.50444 | 6.3923 | 84.443 | 0.95113 | 5.7781 | 6.8328 | 7.7839 |
| 13 | 60.001 | 0.55133 | 6.3953 | 86.961 | 0.97903 | 5.793 | 6.8328 | 7.8118 |
| 14 | 70.001 | 0.64512 | 6.4013 | 92.153 | 1.0365 | 5.8172 | 6.8328 | 7.8693 |
| 15 | 80.001 | 0.74458 | 6.4077 | 97.083 | 1.0909 | 5.8354 | 6.8328 | 7.9237 |
| 16 | 90.001 | 0.83695 | 6.4137 | 101.44 | 1.1387 | 5.7374 | 6.8328 | 7.9715 |
| 17 | 100 | 0.92789 | 6.4196 | 106.63 | 1.1959 | 5.8392 | 6.8328 | 8.0287 |
| 18 | 110 | 1.0217 | 6.4257 | 111.51 | 1.2494 | 5.8392 | 6.8328 | 8.0822 |
| 19 | 120 | 1.1169 | 6.4319 | 116.07 | 1.2993 | 5.8414 | 6.8328 | 8.1321 |
| 20 | 130 | 1.2107 | 6.438 | 120.95 | 1.3526 | 5.842 | 6.8328 | 8.1854 |
| 21 | 140 | 1.3059 | 6.4442 | 125.67 | 1.4041 | 5.8398 | 6.8328 | 8.2369 |
| 22 | 150 | 1.4039 | 6.4506 | 130.28 | 1.4542 | 5.8381 | 6.8328 | 8.287 |
| 23 | 160 | 1.4949 | 6.4565 | 134.85 | 1.5037 | 5.8337 | 6.8328 | 8.3365 |
| 24 | 170 | 1.5943 | 6.4631 | 139.57 | 1.5548 | 5.8282 | 6.8328 | 8.3876 |
| 25 | 180 | 1.6924 | 6.4695 | 144.34 | 1.6064 | 5.8194 | 6.8328 | 8.4392 |
| 26 | 190 | 1.7862 | 6.4757 | 148.8 | 1.6544 | 5.8101 | 6.8328 | 8.4872 |
| 27 | 200 | 1.8814 | 6.482 | 153.15 | 1.7012 | 5.8002 | 6.8328 | 8.534 |
| 28 | 210 | 1.9794 | 6.4885 | 157.5 | 1.7478 | 5.7892 | 6.8328 | 8.5806 |
| 29 | 220 | 2.076 | 6.4949 | 161.7 | 1.7926 | 5.777 | 6.8328 | 8.6254 |
| 30 | 230 | 2.1727 | 6.5013 | 165.74 | 1.8355 | 5.766 | 6.8328 | 8.6683 |
| 31 | 240 | 2.2707 | 6.5078 | 169.99 | 1.8807 | 5.7523 | 6.8328 | 8.7135 |
| 32 | 270 | 2.5577 | 6.527 | 181.26 | 1.9996 | 5.7083 | 6.8328 | 8.8324 |
| 33 | 300 | 2.8433 | 6.5462 | 192.44 | 2.1166 | 5.6637 | 6.8328 | 8.9494 |
| 34 | 330 | 3.1219 | 6.565 | 202.56 | 2.2215 | 5.6214 | 6.8328 | 9.0543 |
| 35 | 360 | 3.406 | 6.5843 | 212.47 | 2.3234 | 5.6076 | 6.8328 | 9.1562 |
| 36 | 390 | 3.6945 | 6.604 | 222.12 | 2.4217 | 5.5625 | 6.8328 | 9.2545 |
| 37 | 420 | 3.9815 | 6.6238 | 231.46 | 2.5159 | 5.519 | 6.8328 | 9.3487 |
| 38 | 450 | 4.2714 | 6.6438 | 240.43 | 2.6055 | 5.4761 | 6.8328 | 9.4383 |
| 39 | 480 | 4.557 | 6.6637 | 248.71 | 2.6873 | 5.4343 | 6.8328 | 9.5201 |
| 40 | 510 | 4.8398 | 6.6835 | 256.9 | 2.7675 | 5.3947 | 6.8328 | 9.6003 |
| 41 | 540 | 5.1254 | 6.7036 | 264.34 | 2.8392 | 5.354 | 6.8328 | 9.672 |
| 42 | 570 | 5.411 | 6.7239 | 272.37 | 2.9166 | 5.316 | 6.8328 | 9.7494 |
| 43 | 600 | 5.6995 | 6.7444 | 280.03 | 2.9894 | 5.2759 | 6.8328 | 9.8222 |
| 44 | 630 | 5.9894 | 6.7652 | 287.37 | 3.0584 | 5.2401 | 6.8328 | 9.8912 |
| 45 | 660 | 6.2778 | 6.786 | 294.03 | 3.1197 | 5.2054 | 6.8328 | 9.9525 |
| 46 | 690 | 6.5705 | 6.8073 | 301.01 | 3.1837 | 5.1713 | 6.8328 | 10.016 |
| 47 | 720 | 6.8604 | 6.8285 | 307.77 | 3.2452 | 5.1389 | 6.8328 | 10.078 |
| 48 | 750 | 7.1432 | 6.8493 | 314.07 | 3.3015 | 5.1086 | 6.8328 | 10.134 |
| 49 | 780 | 7.426 | 6.8702 | 320.31 | 3.3568 | 5.0784 | 6.8328 | 10.19 |
| 50 | 810 | 7.7101 | 6.8914 | 324.19 | 3.3871 | 5.0492 | 6.8328 | 10.22 |
| 51 | 840 | 7.9943 | 6.9126 | 331.48 | 3.4526 | 5.0212 | 6.8328 | 10.285 |
| 52 | 870 | 8.2828 | 6.9344 | 336.93 | 3.4984 | 4.9942 | 6.8328 | 10.331 |
| 53 | 900 | 8.5741 | 6.9565 | 342.91 | 3.5492 | 4.9705 | 6.8328 | 10.382 |
| 54 | 930 | 8.8668 | 6.9788 | 348.21 | 3.5925 | 4.9458 | 6.8328 | 10.425 |
| 55 | 960 | 9.1609 | 7.0014 | 353.93 | 3.6396 | 4.9216 | 6.8328 | 10.472 |
| 56 | 990 | 9.448 | 7.0236 | 357.76 | 3.6674 | 4.9012 | 6.8328 | 10.5 |
| 57 | 1020 | 9.7336 | 7.0458 | 363.58 | 3.7153 | 4.8809 | 6.8328 | 10.548 |
| 58 | 1050 | 10.022 | 7.0684 | 368.98 | 3.7585 | 4.8589 | 6.8328 | 10.591 |
| 59 | 1080 | 10.301 | 7.0904 | 373.02 | 3.7879 | 4.8391 | 6.8328 | 10.621 |
| 60 | 1110 | 10.585 | 7.1129 | 377.95 | 3.8258 | 4.8192 | 6.8328 | 10.659 |
| 61 | 1140 | 10.877 | 7.1363 | 382.93 | 3.8635 | 4.8005 | 6.8328 | 10.696 |
| 62 | 1170 | 11.167 | 7.1596 | 387.34 | 3.8952 | 4.7813 | 6.8328 | 10.728 |
| 63 | 1200 | 11.457 | 7.183 | 392.06 | 3.9299 | 4.7626 | 6.8328 | 10.763 |
| 64 | 1230 | 11.743 | 7.2062 | 396.36 | 3.9601 | 4.7472 | 6.8328 | 10.793 |
| 65 | 1260 | 12.027 | 7.2295 | 401.76 | 4.0012 | 4.7279 | 6.8328 | 10.834 |
| 66 | 1290 | 12.308 | 7.2527 | 404.59 | 4.0165 | 4.7098 | 6.8328 | 10.849 |
| 67 | 1320 | 12.591 | 7.2762 | 409.47 | 4.0518 | 4.6944 | 6.8328 | 10.885 |
| 68 | 1350 | 12.88 | 7.3003 | 413.98 | 4.0829 | 4.6795 | 6.8328 | 10.916 |
| 69 | 1380 | 13.172 | 7.3249 | 417.76 | 4.1063 | 4.6652 | 6.8328 | 10.939 |
| 70 | 1410 | 13.464 | 7.3495 | 422.16 | 4.1357 | 4.6526 | 6.8328 | 10.969 |
| 71 | 1440 | 13.758 | 7.3746 | 425.99 | 4.1591 | 4.6388 | 6.8328 | 10.992 |
| 72 | 1470 | 14.042 | 7.399 | 429.93 | 4.1836 | 4.625 | 6.8328 | 11.016 |
| 73 | 1500 | 14.323 | 7.4233 | 434.02 | 4.2096 | 4.6096 | 6.8328 | 11.042 |
| 74 | 1530 | 14.609 | 7.4481 | 436.53 | 4.2199 | 4.5953 | 6.8328 | 11.053 |
| 75 | 1560 | 14.897 | 7.4734 | 441.31 | 4.2516 | 4.5816 | 6.8328 | 11.084 |
| 76 | 1590 | 15.19 | 7.4992 | 445.29 | 4.2753 | 4.5662 | 6.8328 | 11.108 |
| 77 | 1614.3 | 15.429 | 7.5203 | 447.97 | 4.2889 | 4.5552 | 6.8328 | 11.122 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.02 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.27 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

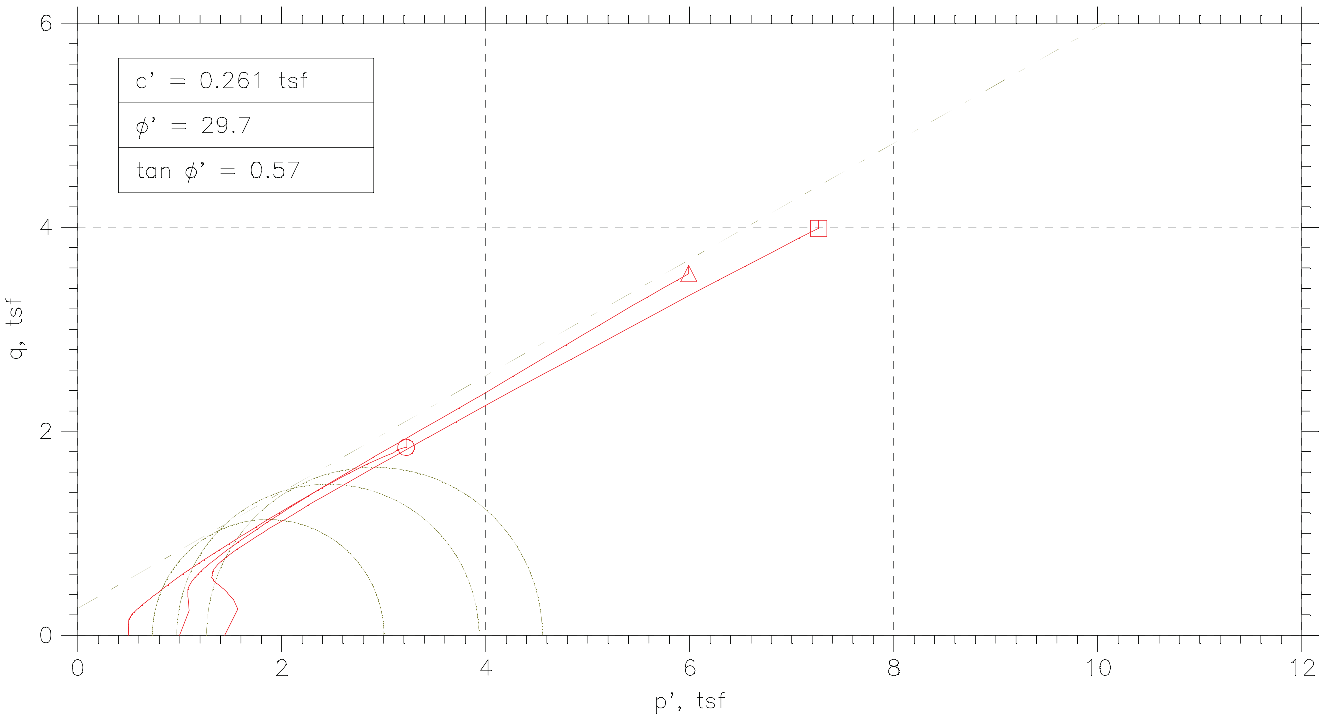
Plastic Limit: 24

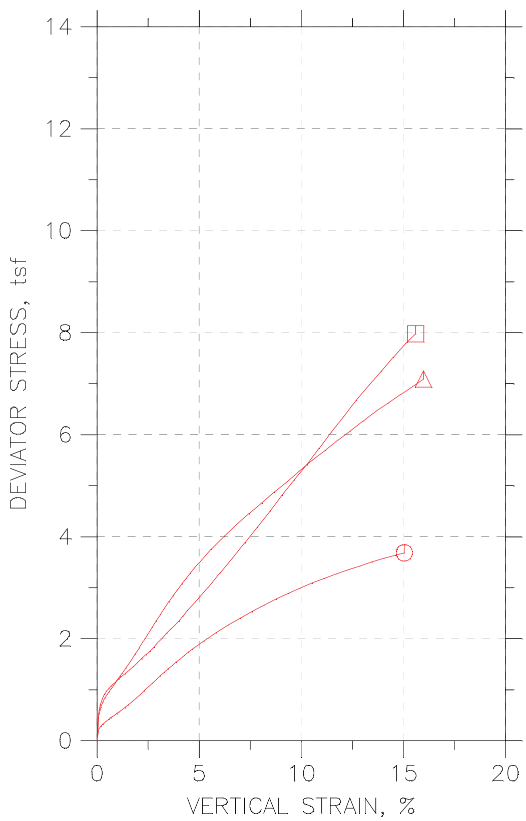
Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.8328 | 6.8328 | 0 | 0.000 | 1.7924 | 1.7924 | 1.000 | 1.7924 | 0 |
| 2 | 0.03 | 7.2441 | 6.8328 | 0.21566 | 0.524 | 1.9881 | 1.5767 | 1.261 | 1.7824 | 0.20567 |
| 3 | 0.08 | 7.3929 | 6.8328 | 0.35649 | 0.637 | 1.996 | 1.4359 | 1.390 | 1.7159 | 0.28004 |
| 4 | 0.13 | 7.4756 | 6.8328 | 0.45002 | 0.700 | 1.9852 | 1.3424 | 1.479 | 1.6638 | 0.32142 |
| 5 | 0.17 | 7.5334 | 6.8328 | 0.51768 | 0.739 | 1.9753 | 1.2747 | 1.550 | 1.625 | 0.35031 |
| 6 | 0.22 | 7.5828 | 6.8328 | 0.5705 | 0.761 | 1.9719 | 1.2219 | 1.614 | 1.5969 | 0.37502 |
| 7 | 0.27 | 7.6239 | 6.8328 | 0.61231 | 0.774 | 1.9712 | 1.1801 | 1.670 | 1.5757 | 0.39557 |
| 8 | 0.31 | 7.6609 | 6.8328 | 0.64697 | 0.781 | 1.9735 | 1.1454 | 1.723 | 1.5595 | 0.41404 |
| 9 | 0.36 | 7.6942 | 6.8328 | 0.67558 | 0.784 | 1.9782 | 1.1168 | 1.771 | 1.5475 | 0.4307 |
| 10 | 0.41 | 7.7275 | 6.8328 | 0.69978 | 0.782 | 1.9873 | 1.0926 | 1.819 | 1.54 | 0.44734 |
| 11 | 0.46 | 7.7566 | 6.8328 | 0.72014 | 0.780 | 1.9961 | 1.0723 | 1.862 | 1.5342 | 0.4619 |
| 12 | 0.50 | 7.7839 | 6.8328 | 0.73774 | 0.776 | 2.0058 | 1.0547 | 1.902 | 1.5302 | 0.47557 |
| 13 | 0.55 | 7.8118 | 6.8328 | 0.7526 | 0.769 | 2.0188 | 1.0398 | 1.942 | 1.5293 | 0.48951 |
| 14 | 0.65 | 7.8693 | 6.8328 | 0.7768 | 0.749 | 2.0521 | 1.0156 | 2.021 | 1.5338 | 0.51825 |
| 15 | 0.74 | 7.9237 | 6.8328 | 0.79496 | 0.729 | 2.0883 | 0.99744 | 2.094 | 1.5429 | 0.54543 |
| 16 | 0.84 | 7.9715 | 6.8328 | 0.69703 | 0.612 | 2.2341 | 1.0954 | 2.040 | 1.6647 | 0.56936 |
| 17 | 0.93 | 8.0287 | 6.8328 | 0.79881 | 0.668 | 2.1895 | 0.99359 | 2.204 | 1.5915 | 0.59796 |
| 18 | 1.02 | 8.0822 | 6.8328 | 0.79881 | 0.639 | 2.243 | 0.99359 | 2.258 | 1.6183 | 0.62472 |
| 19 | 1.12 | 8.1321 | 6.8328 | 0.80101 | 0.616 | 2.2907 | 0.99139 | 2.311 | 1.641 | 0.64966 |
| 20 | 1.21 | 8.1854 | 6.8328 | 0.80156 | 0.593 | 2.3435 | 0.99084 | 2.365 | 1.6672 | 0.67632 |
| 21 | 1.31 | 8.2369 | 6.8328 | 0.79936 | 0.569 | 2.3971 | 0.99304 | 2.414 | 1.6951 | 0.70204 |
| 22 | 1.40 | 8.287 | 6.8328 | 0.79771 | 0.549 | 2.4489 | 0.99469 | 2.462 | 1.7218 | 0.7271 |
| 23 | 1.49 | 8.3365 | 6.8328 | 0.79331 | 0.528 | 2.5028 | 0.99909 | 2.505 | 1.751 | 0.75187 |
| 24 | 1.59 | 8.3876 | 6.8328 | 0.7878 | 0.507 | 2.5594 | 1.0046 | 2.548 | 1.782 | 0.7774 |
| 25 | 1.69 | 8.4392 | 6.8328 | 0.779 | 0.485 | 2.6198 | 1.0134 | 2.585 | 1.8166 | 0.80319 |
| 26 | 1.79 | 8.4872 | 6.8328 | 0.76965 | 0.465 | 2.6772 | 1.0227 | 2.618 | 1.8499 | 0.82721 |
| 27 | 1.88 | 8.534 | 6.8328 | 0.75975 | 0.447 | 2.7338 | 1.0326 | 2.647 | 1.8832 | 0.85058 |
| 28 | 1.98 | 8.5806 | 6.8328 | 0.74874 | 0.428 | 2.7914 | 1.0436 | 2.675 | 1.9175 | 0.87389 |
| 29 | 2.08 | 8.6254 | 6.8328 | 0.73664 | 0.411 | 2.8483 | 1.0558 | 2.698 | 1.952 | 0.89628 |
| 30 | 2.17 | 8.6683 | 6.8328 | 0.72564 | 0.395 | 2.9023 | 1.0668 | 2.721 | 1.9845 | 0.91776 |
| 31 | 2.27 | 8.7135 | 6.8328 | 0.71188 | 0.379 | 2.9612 | 1.0805 | 2.741 | 2.0209 | 0.94034 |
| 32 | 2.56 | 8.8324 | 6.8328 | 0.66787 | 0.334 | 3.1241 | 1.1245 | 2.778 | 2.1243 | 0.99978 |
| 33 | 2.84 | 8.9494 | 6.8328 | 0.62331 | 0.294 | 3.2856 | 1.1691 | 2.810 | 2.2274 | 1.0583 |
| 34 | 3.12 | 9.0543 | 6.8328 | 0.58095 | 0.262 | 3.433 | 1.2114 | 2.834 | 2.3222 | 1.1108 |
| 35 | 3.41 | 9.1562 | 6.8328 | 0.5672 | 0.244 | 3.5486 | 1.2252 | 2.896 | 2.3869 | 1.1617 |
| 36 | 3.69 | 9.2545 | 6.8328 | 0.52209 | 0.216 | 3.692 | 1.2703 | 2.906 | 2.4811 | 1.2108 |
| 37 | 3.98 | 9.3487 | 6.8328 | 0.47862 | 0.190 | 3.8297 | 1.3138 | 2.915 | 2.5717 | 1.258 |
| 38 | 4.27 | 9.4383 | 6.8328 | 0.43571 | 0.167 | 3.9622 | 1.3567 | 2.921 | 2.6595 | 1.3028 |
| 39 | 4.56 | 9.5201 | 6.8328 | 0.3939 | 0.147 | 4.0858 | 1.3985 | 2.922 | 2.7421 | 1.3437 |
| 40 | 4.84 | 9.6003 | 6.8328 | 0.35429 | 0.128 | 4.2056 | 1.4381 | 2.924 | 2.8218 | 1.3837 |
| 41 | 5.13 | 9.672 | 6.8328 | 0.31358 | 0.110 | 4.318 | 1.4788 | 2.920 | 2.8984 | 1.4196 |
| 42 | 5.41 | 9.7494 | 6.8328 | 0.27562 | 0.095 | 4.4333 | 1.5168 | 2.923 | 2.9751 | 1.4583 |
| 43 | 5.70 | 9.8222 | 6.8328 | 0.23546 | 0.079 | 4.5463 | 1.5569 | 2.920 | 3.0516 | 1.4947 |
| 44 | 5.99 | 9.8912 | 6.8328 | 0.1997 | 0.065 | 4.6511 | 1.5927 | 2.920 | 3.1219 | 1.5292 |
| 45 | 6.28 | 9.9525 | 6.8328 | 0.16504 | 0.053 | 4.747 | 1.6274 | 2.917 | 3.1872 | 1.5598 |
| 46 | 6.57 | 10.016 | 6.8328 | 0.13093 | 0.041 | 4.8452 | 1.6615 | 2.916 | 3.2533 | 1.5918 |
| 47 | 6.86 | 10.078 | 6.8328 | 0.098476 | 0.030 | 4.9391 | 1.6939 | 2.916 | 3.3165 | 1.6226 |
| 48 | 7.14 | 10.134 | 6.8328 | 0.068218 | 0.021 | 5.0256 | 1.7242 | 2.915 | 3.3749 | 1.6507 |
| 49 | 7.43 | 10.19 | 6.8328 | 0.03796 | 0.011 | 5.1113 | 1.7544 | 2.913 | 3.4328 | 1.6784 |
| 50 | 7.71 | 10.22 | 6.8328 | 0.0088023 | 0.003 | 5.1707 | 1.7836 | 2.899 | 3.4771 | 1.6935 |
| 51 | 7.99 | 10.285 | 6.8328 | -0.019255 | -0.006 | 5.2642 | 1.8116 | 2.906 | 3.5379 | 1.7263 |
| 52 | 8.28 | 10.331 | 6.8328 | -0.046212 | -0.013 | 5.337 | 1.8386 | 2.903 | 3.5878 | 1.7492 |
| 53 | 8.57 | 10.382 | 6.8328 | -0.069868 | -0.020 | 5.4114 | 1.8623 | 2.906 | 3.6368 | 1.7746 |
| 54 | 8.87 | 10.425 | 6.8328 | -0.094625 | -0.026 | 5.4795 | 1.887 | 2.904 | 3.6832 | 1.7962 |
| 55 | 9.16 | 10.472 | 6.8328 | -0.11883 | -0.033 | 5.5509 | 1.9112 | 2.904 | 3.731 | 1.8198 |
| 56 | 9.45 | 10.5 | 6.8328 | -0.13919 | -0.038 | 5.599 | 1.9316 | 2.899 | 3.7653 | 1.8337 |
| 57 | 9.73 | 10.548 | 6.8328 | -0.15954 | -0.043 | 5.6673 | 1.9519 | 2.903 | 3.8096 | 1.8577 |
| 58 | 10.02 | 10.591 | 6.8328 | -0.18155 | -0.048 | 5.7324 | 1.9739 | 2.904 | 3.8532 | 1.8792 |
| 59 | 10.30 | 10.621 | 6.8328 | -0.20135 | -0.053 | 5.7816 | 1.9937 | 2.900 | 3.8877 | 1.8939 |
| 60 | 10.58 | 10.659 | 6.8328 | -0.22116 | -0.058 | 5.8393 | 2.0136 | 2.900 | 3.9264 | 1.9129 |
| 61 | 10.88 | 10.696 | 6.8328 | -0.23986 | -0.062 | 5.8958 | 2.0323 | 2.901 | 3.964 | 1.9318 |
| 62 | 11.17 | 10.728 | 6.8328 | -0.25912 | -0.067 | 5.9468 | 2.0515 | 2.899 | 3.9991 | 1.9476 |
| 63 | 11.46 | 10.763 | 6.8328 | -0.27782 | -0.071 | 6.0001 | 2.0702 | 2.898 | 4.0351 | 1.9649 |
| 64 | 11.74 | 10.793 | 6.8328 | -0.29323 | -0.074 | 6.0458 | 2.0856 | 2.899 | 4.0657 | 1.9801 |
| 65 | 12.03 | 10.834 | 6.8328 | -0.31248 | -0.078 | 6.1061 | 2.1049 | 2.901 | 4.1055 | 2.0006 |
| 66 | 12.31 | 10.849 | 6.8328 | -0.33064 | -0.082 | 6.1395 | 2.123 | 2.892 | 4.1313 | 2.0083 |
| 67 | 12.59 | 10.885 | 6.8328 | -0.34604 | -0.085 | 6.1903 | 2.1384 | 2.895 | 4.1643 | 2.0259 |
| 68 | 12.88 | 10.916 | 6.8328 | -0.36089 | -0.088 | 6.2362 | 2.1533 | 2.896 | 4.1948 | 2.0415 |
| 69 | 13.17 | 10.939 | 6.8328 | -0.3752 | -0.091 | 6.2739 | 2.1676 | 2.894 | 4.2208 | 2.0532 |
| 70 | 13.46 | 10.969 | 6.8328 | -0.38785 | -0.094 | 6.316 | 2.1802 | 2.897 | 4.2481 | 2.0679 |
| 71 | 13.76 | 10.992 | 6.8328 | -0.4016 | -0.097 | 6.3531 | 2.194 | 2.896 | 4.2735 | 2.0795 |
| 72 | 14.04 | 11.016 | 6.8328 | -0.41536 | -0.099 | 6.3914 | 2.2078 | 2.895 | 4.2996 | 2.0918 |
| 73 | 14.32 | 11.042 | 6.8328 | -0.43076 | -0.102 | 6.4328 | 2.2232 | 2.894 | 4.328 | 2.1048 |
| 74 | 14.61 | 11.053 | 6.8328 | -0.44507 | -0.105 | 6.4574 | 2.2375 | 2.886 | 4.3474 | 2.11 |
| 75 | 14.90 | 11.084 | 6.8328 | -0.45882 | -0.108 | 6.5029 | 2.2512 | 2.889 | 4.377 | 2.1258 |
| 76 | 15.19 | 11.108 | 6.8328 | -0.47422 | -0.111 | 6.5419 | 2.2666 | 2.886 | 4.4043 | 2.1376 |
| 77 | 15.43 | 11.122 | 6.8328 | -0.48523 | -0.113 | 6.5665 | 2.2776 | 2.883 | 4.4221 | 2.1444 |

# TRIAXIAL COMPRESSION TEST REPORT

AECOM



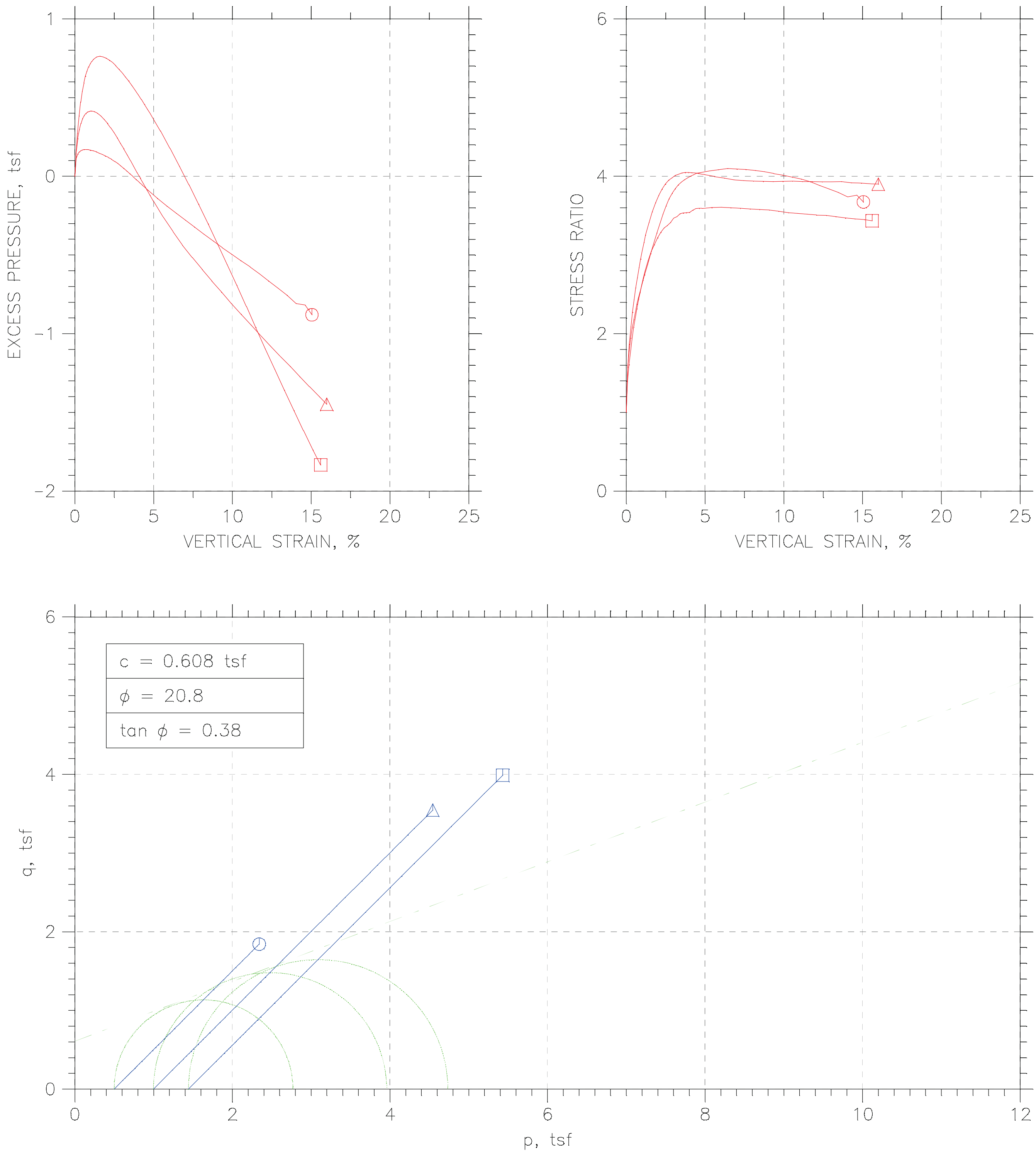

| | | | | | |
|---|---|---|---|---|---|
| Symbol | | ○ | △ | □ | |
| Test No. | | 7 PSI | 13.9 PSI | 20.8 PSI | |
| Initial | Diameter, in | 2.8457 | 2.8382 | 2.837 | |
| | Height, in | 5.9839 | 5.9646 | 5.7075 | |
| | Water Content, % | 13.01 | 13.76 | 17.65 | |
| | Dry Density, pcf | 117.3 | 118. | 109.8 | |
| | Saturation, % | 83.50 | 90.24 | 92.02 | |
| | Void Ratio | 0.41352 | 0.40495 | 0.50912 | |
| Before Shear | Water Content, % | 15.40 | 14.54 | 18.60 | |
| | Dry Density, pcf | 117.7 | 119.6 | 111. | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.40877 | 0.3861 | 0.49381 | |
| | Back Press., tsf | 5.046 | 5.0443 | 5.0958 | |
| Minor Prin. Stress, tsf | | 0.49798 | 0.99651 | 1.4418 | |
| Max. Dev. Stress, tsf | | 3.6849 | 7.0909 | 7.9769 | |
| Time to Failure, min | | 770.98 | 772.22 | 773.86 | |
| Strain Rate, %/min | | 0.02 | 0.02 | 0.02 | |
| B-Value | | .97 | .95 | .99 | |
| Measured Specific Gravity | | 2.65 | 2.65 | 2.65 | |
| Liquid Limit | | 27 | 27 | 27 | |
| Plastic Limit | | 11 | 11 | 11 | |
| Plasticity Index | | 16 | 16 | 16 | |
| Failure Sketch | |  |  |  | |

| |
|---|
| Project: COLETO CREEK FACILITY |
| Location: IPR-GDF SUEZ |
| Project No.: 60225561 |
| Boring No.: B-4-1 S-7 |
| Sample Type: 3" ST |
| Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767 |

Mon, 12-DEC-2011 10:34:18

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-4-1 S-7 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-7 | Test Date: 12/1/11 | Depth: 12.0'-14.0' |
| Test No.: B-4-1 S-7 | Sample Type: 3" ST | Elevation: ---- |
| Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767 | | |
| | | |

Mon, 12-DEC-2011 10:34:58

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 7 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.06 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.36 | 0 | 0 | 5.046 | 5.544 | 5.544 |
| 2 | 5 | 0.086461 | 6.3655 | 19.795 | 0.2239 | 5.1593 | 5.544 | 5.7679 |
| 3 | 10 | 0.18589 | 6.3719 | 24.744 | 0.2796 | 5.1856 | 5.544 | 5.8236 |
| 4 | 15 | 0.28388 | 6.3781 | 28.64 | 0.3233 | 5.2008 | 5.544 | 5.8673 |
| 5 | 20 | 0.38187 | 6.3844 | 31.851 | 0.3592 | 5.209 | 5.544 | 5.9032 |
| 6 | 25 | 0.47842 | 6.3906 | 34.536 | 0.38911 | 5.2137 | 5.544 | 5.9331 |
| 7 | 30.001 | 0.57785 | 6.397 | 37.116 | 0.41775 | 5.216 | 5.544 | 5.9618 |
| 8 | 35.001 | 0.6744 | 6.4032 | 40.064 | 0.4505 | 5.2166 | 5.544 | 5.9945 |
| 9 | 40.001 | 0.77094 | 6.4094 | 42.433 | 0.47667 | 5.216 | 5.544 | 6.0207 |
| 10 | 45.001 | 0.86893 | 6.4158 | 44.961 | 0.50456 | 5.2148 | 5.544 | 6.0486 |
| 11 | 50.001 | 0.96692 | 6.4221 | 47.488 | 0.5324 | 5.2125 | 5.544 | 6.0764 |
| 12 | 55.001 | 1.0649 | 6.4285 | 50.015 | 0.56017 | 5.2102 | 5.544 | 6.1042 |
| 13 | 60.001 | 1.1629 | 6.4349 | 52.436 | 0.58671 | 5.2078 | 5.544 | 6.1307 |
| 14 | 70.001 | 1.3589 | 6.4476 | 57.701 | 0.64434 | 5.2014 | 5.544 | 6.1883 |
| 15 | 80.001 | 1.5549 | 6.4605 | 63.545 | 0.70819 | 5.1932 | 5.544 | 6.2522 |
| 16 | 90.002 | 1.7494 | 6.4733 | 69.652 | 0.77472 | 5.1851 | 5.544 | 6.3187 |
| 17 | 100 | 1.9454 | 6.4862 | 75.812 | 0.84155 | 5.1751 | 5.544 | 6.3855 |
| 18 | 110 | 2.1399 | 6.4991 | 82.287 | 0.91162 | 5.1652 | 5.544 | 6.4556 |
| 19 | 120 | 2.333 | 6.5119 | 89.026 | 0.98433 | 5.1535 | 5.544 | 6.5283 |
| 20 | 130 | 2.5261 | 6.5248 | 95.87 | 1.0579 | 5.1407 | 5.544 | 6.6019 |
| 21 | 140 | 2.7178 | 6.5377 | 102.5 | 1.1289 | 5.1278 | 5.544 | 6.6729 |
| 22 | 150 | 2.9109 | 6.5507 | 109.3 | 1.2013 | 5.1126 | 5.544 | 6.7453 |
| 23 | 160 | 3.1054 | 6.5639 | 115.93 | 1.2716 | 5.0963 | 5.544 | 6.8156 |
| 24 | 170 | 3.2999 | 6.5771 | 122.56 | 1.3417 | 5.0793 | 5.544 | 6.8857 |
| 25 | 180 | 3.4959 | 6.5904 | 129.2 | 1.4115 | 5.0618 | 5.544 | 6.9555 |
| 26 | 190 | 3.6904 | 6.6037 | 135.46 | 1.4769 | 5.0443 | 5.544 | 7.0209 |
| 27 | 200 | 3.8879 | 6.6173 | 141.83 | 1.5432 | 5.0262 | 5.544 | 7.0872 |
| 28 | 210 | 4.0838 | 6.6308 | 148.15 | 1.6087 | 5.0081 | 5.544 | 7.1527 |
| 29 | 220 | 4.2798 | 6.6444 | 154.31 | 1.6721 | 4.9905 | 5.544 | 7.2161 |
| 30 | 230 | 4.4744 | 6.6579 | 160.52 | 1.7359 | 4.973 | 5.544 | 7.2799 |
| 31 | 240 | 4.6675 | 6.6714 | 166.1 | 1.7926 | 4.9555 | 5.544 | 7.3366 |
| 32 | 270 | 5.2482 | 6.7123 | 182.69 | 1.9596 | 4.9052 | 5.544 | 7.5036 |
| 33 | 300 | 5.839 | 6.7544 | 198.8 | 2.1191 | 4.8568 | 5.544 | 7.6631 |
| 34 | 330 | 6.4298 | 6.7971 | 214.22 | 2.2692 | 4.8118 | 5.544 | 7.8132 |
| 35 | 360 | 7.012 | 6.8396 | 228.12 | 2.4014 | 4.7674 | 5.544 | 7.9454 |
| 36 | 390 | 7.597 | 6.8829 | 242.18 | 2.5333 | 4.723 | 5.544 | 8.0773 |
| 37 | 420 | 8.1879 | 6.9272 | 255.97 | 2.6605 | 4.6786 | 5.544 | 8.2045 |
| 38 | 450 | 8.7758 | 6.9719 | 269.13 | 2.7794 | 4.6354 | 5.544 | 8.3234 |
| 39 | 480 | 9.3565 | 7.0165 | 281.45 | 2.8881 | 4.5921 | 5.544 | 8.4321 |
| 40 | 510 | 9.943 | 7.0622 | 293.66 | 2.9939 | 4.5506 | 5.544 | 8.5379 |
| 41 | 540 | 10.532 | 7.1087 | 305.19 | 3.0911 | 4.5098 | 5.544 | 8.6351 |
| 42 | 570 | 11.116 | 7.1554 | 316.25 | 3.1822 | 4.47 | 5.544 | 8.7262 |
| 43 | 600 | 11.698 | 7.2026 | 326.89 | 3.2677 | 4.428 | 5.544 | 8.8117 |
| 44 | 630 | 12.285 | 7.2508 | 337.63 | 3.3526 | 4.3812 | 5.544 | 8.8966 |
| 45 | 660 | 12.874 | 7.2998 | 347.58 | 3.4282 | 4.3368 | 5.544 | 8.9722 |
| 46 | 690 | 13.463 | 7.3495 | 357.84 | 3.5056 | 4.2901 | 5.544 | 9.0496 |
| 47 | 720 | 14.047 | 7.3994 | 367.48 | 3.5757 | 4.2381 | 5.544 | 9.1197 |
| 48 | 750 | 14.632 | 7.4501 | 376.32 | 3.6369 | 4.2264 | 5.544 | 9.1809 |
| 49 | 770.98 | 15.049 | 7.4867 | 383.16 | 3.6849 | 4.1663 | 5.544 | 9.2289 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 7 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.06 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.544 | 5.544 | 0 | 0.000 | 0.49798 | 0.49798 | 1.000 | 0.49798 | 0 |
| 2 | 0.09 | 5.7679 | 5.544 | 0.11333 | 0.506 | 0.60855 | 0.38465 | 1.582 | 0.4966 | 0.11195 |
| 3 | 0.19 | 5.8236 | 5.544 | 0.13962 | 0.499 | 0.63796 | 0.35836 | 1.780 | 0.49816 | 0.1398 |
| 4 | 0.28 | 5.8673 | 5.544 | 0.1548 | 0.479 | 0.66648 | 0.34317 | 1.942 | 0.50483 | 0.16165 |
| 5 | 0.38 | 5.9032 | 5.544 | 0.16298 | 0.454 | 0.6942 | 0.335 | 2.072 | 0.5146 | 0.1796 |
| 6 | 0.48 | 5.9331 | 5.544 | 0.16766 | 0.431 | 0.71943 | 0.33032 | 2.178 | 0.52488 | 0.19455 |
| 7 | 0.58 | 5.9618 | 5.544 | 0.16999 | 0.407 | 0.74574 | 0.32799 | 2.274 | 0.53686 | 0.20888 |
| 8 | 0.67 | 5.9945 | 5.544 | 0.17058 | 0.379 | 0.7779 | 0.3274 | 2.376 | 0.55265 | 0.22525 |
| 9 | 0.77 | 6.0207 | 5.544 | 0.16999 | 0.357 | 0.80466 | 0.32799 | 2.453 | 0.56632 | 0.23834 |
| 10 | 0.87 | 6.0486 | 5.544 | 0.16882 | 0.335 | 0.83372 | 0.32915 | 2.533 | 0.58144 | 0.25228 |
| 11 | 0.97 | 6.0764 | 5.544 | 0.16649 | 0.313 | 0.86389 | 0.33149 | 2.606 | 0.59769 | 0.2662 |
| 12 | 1.06 | 6.1042 | 5.544 | 0.16415 | 0.293 | 0.894 | 0.33383 | 2.678 | 0.61391 | 0.28009 |
| 13 | 1.16 | 6.1307 | 5.544 | 0.16181 | 0.276 | 0.92288 | 0.33616 | 2.745 | 0.62952 | 0.29336 |
| 14 | 1.36 | 6.1883 | 5.544 | 0.15539 | 0.241 | 0.98693 | 0.34259 | 2.881 | 0.66476 | 0.32217 |
| 15 | 1.55 | 6.2522 | 5.544 | 0.14721 | 0.208 | 1.059 | 0.35077 | 3.019 | 0.70486 | 0.35409 |
| 16 | 1.75 | 6.3187 | 5.544 | 0.13903 | 0.179 | 1.1337 | 0.35895 | 3.158 | 0.7463 | 0.38736 |
| 17 | 1.95 | 6.3855 | 5.544 | 0.1291 | 0.153 | 1.2104 | 0.36888 | 3.281 | 0.78965 | 0.42077 |
| 18 | 2.14 | 6.4556 | 5.544 | 0.11917 | 0.131 | 1.2904 | 0.37881 | 3.407 | 0.83462 | 0.45581 |
| 19 | 2.33 | 6.5283 | 5.544 | 0.10749 | 0.109 | 1.3748 | 0.39049 | 3.521 | 0.88265 | 0.49216 |
| 20 | 2.53 | 6.6019 | 5.544 | 0.094635 | 0.089 | 1.4612 | 0.40334 | 3.623 | 0.93229 | 0.52895 |
| 21 | 2.72 | 6.6729 | 5.544 | 0.081783 | 0.072 | 1.5451 | 0.4162 | 3.712 | 0.98063 | 0.56444 |
| 22 | 2.91 | 6.7453 | 5.544 | 0.066595 | 0.055 | 1.6327 | 0.43138 | 3.785 | 1.032 | 0.60064 |
| 23 | 3.11 | 6.8156 | 5.544 | 0.050238 | 0.040 | 1.7194 | 0.44774 | 3.840 | 1.0836 | 0.63582 |
| 24 | 3.30 | 6.8857 | 5.544 | 0.033297 | 0.025 | 1.8064 | 0.46468 | 3.887 | 1.1355 | 0.67085 |
| 25 | 3.50 | 6.9555 | 5.544 | 0.015772 | 0.011 | 1.8937 | 0.48221 | 3.927 | 1.1879 | 0.70573 |
| 26 | 3.69 | 7.0209 | 5.544 | -0.0017525 | -0.001 | 1.9766 | 0.49973 | 3.955 | 1.2382 | 0.73846 |
| 27 | 3.89 | 7.0872 | 5.544 | -0.019862 | -0.013 | 2.061 | 0.51784 | 3.980 | 1.2894 | 0.7716 |
| 28 | 4.08 | 7.1527 | 5.544 | -0.037971 | -0.024 | 2.1446 | 0.53595 | 4.002 | 1.3403 | 0.80433 |
| 29 | 4.28 | 7.2161 | 5.544 | -0.055496 | -0.033 | 2.2256 | 0.55347 | 4.021 | 1.3895 | 0.83606 |
| 30 | 4.47 | 7.2799 | 5.544 | -0.073021 | -0.042 | 2.3069 | 0.571 | 4.040 | 1.4389 | 0.86795 |
| 31 | 4.67 | 7.3366 | 5.544 | -0.090546 | -0.051 | 2.3811 | 0.58852 | 4.046 | 1.4848 | 0.89631 |
| 32 | 5.25 | 7.5036 | 5.544 | -0.14078 | -0.072 | 2.5983 | 0.63876 | 4.068 | 1.6186 | 0.97979 |
| 33 | 5.84 | 7.6631 | 5.544 | -0.18927 | -0.089 | 2.8063 | 0.68725 | 4.083 | 1.7468 | 1.0595 |
| 34 | 6.43 | 7.8132 | 5.544 | -0.23425 | -0.103 | 3.0014 | 0.73223 | 4.099 | 1.8668 | 1.1346 |
| 35 | 7.01 | 7.9454 | 5.544 | -0.27865 | -0.116 | 3.178 | 0.77663 | 4.092 | 1.9773 | 1.2007 |
| 36 | 7.60 | 8.0773 | 5.544 | -0.32304 | -0.128 | 3.3543 | 0.82102 | 4.086 | 2.0877 | 1.2667 |
| 37 | 8.19 | 8.2045 | 5.544 | -0.36744 | -0.138 | 3.5259 | 0.86542 | 4.074 | 2.1957 | 1.3302 |
| 38 | 8.78 | 8.3234 | 5.544 | -0.41067 | -0.148 | 3.688 | 0.90865 | 4.059 | 2.2983 | 1.3897 |
| 39 | 9.36 | 8.4321 | 5.544 | -0.4539 | -0.157 | 3.84 | 0.95187 | 4.034 | 2.3959 | 1.4441 |
| 40 | 9.94 | 8.5379 | 5.544 | -0.49537 | -0.165 | 3.9873 | 0.99335 | 4.014 | 2.4903 | 1.497 |
| 41 | 10.53 | 8.6351 | 5.544 | -0.53626 | -0.173 | 4.1254 | 1.0342 | 3.989 | 2.5798 | 1.5456 |
| 42 | 11.12 | 8.7262 | 5.544 | -0.57599 | -0.181 | 4.2562 | 1.074 | 3.963 | 2.6651 | 1.5911 |
| 43 | 11.70 | 8.8117 | 5.544 | -0.61805 | -0.189 | 4.3837 | 1.116 | 3.928 | 2.7499 | 1.6338 |
| 44 | 12.28 | 8.8966 | 5.544 | -0.66478 | -0.198 | 4.5154 | 1.1628 | 3.883 | 2.8391 | 1.6763 |
| 45 | 12.87 | 8.9722 | 5.544 | -0.70918 | -0.207 | 4.6354 | 1.2072 | 3.840 | 2.9213 | 1.7141 |
| 46 | 13.46 | 9.0496 | 5.544 | -0.75591 | -0.216 | 4.7595 | 1.2539 | 3.796 | 3.0067 | 1.7528 |
| 47 | 14.05 | 9.1197 | 5.544 | -0.8079 | -0.226 | 4.8816 | 1.3059 | 3.738 | 3.0937 | 1.7879 |
| 48 | 14.63 | 9.1809 | 5.544 | -0.81958 | -0.225 | 4.9544 | 1.3176 | 3.760 | 3.136 | 1.8184 |
| 49 | 15.05 | 9.2289 | 5.544 | -0.87975 | -0.239 | 5.0627 | 1.3777 | 3.675 | 3.2202 | 1.8425 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 13.9 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.96 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.74 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3266 | 0 | 0 | 5.0443 | 6.0408 | 6.0408 |
| 2 | 5.0001 | 0.088226 | 6.3322 | 42.594 | 0.48432 | 5.1902 | 6.0408 | 6.5251 |
| 3 | 10 | 0.18929 | 6.3386 | 57.838 | 0.65698 | 5.2828 | 6.0408 | 6.6978 |
| 4 | 15 | 0.29035 | 6.3451 | 67.028 | 0.76059 | 5.3416 | 6.0408 | 6.8014 |
| 5 | 20 | 0.39301 | 6.3516 | 74.03 | 0.83918 | 5.381 | 6.0408 | 6.88 |
| 6 | 25 | 0.49407 | 6.358 | 79.864 | 0.9044 | 5.4104 | 6.0408 | 6.9452 |
| 7 | 30.001 | 0.59834 | 6.3647 | 85.335 | 0.96534 | 5.4304 | 6.0408 | 7.0061 |
| 8 | 35.001 | 0.7026 | 6.3714 | 90.44 | 1.022 | 5.4431 | 6.0408 | 7.0628 |
| 9 | 40.001 | 0.80687 | 6.3781 | 95.837 | 1.0819 | 5.4526 | 6.0408 | 7.1227 |
| 10 | 45.001 | 0.91274 | 6.3849 | 101.02 | 1.1391 | 5.4565 | 6.0408 | 7.1799 |
| 11 | 50.001 | 1.0154 | 6.3915 | 106.41 | 1.1987 | 5.4587 | 6.0408 | 7.2395 |
| 12 | 55.001 | 1.1213 | 6.3984 | 111.81 | 1.2582 | 5.4581 | 6.0408 | 7.299 |
| 13 | 60.001 | 1.2223 | 6.4049 | 117.43 | 1.32 | 5.4554 | 6.0408 | 7.3608 |
| 14 | 70.001 | 1.4357 | 6.4188 | 128 | 1.4358 | 5.4448 | 6.0408 | 7.4766 |
| 15 | 80.002 | 1.649 | 6.4327 | 139.67 | 1.5633 | 5.4271 | 6.0408 | 7.6041 |
| 16 | 90.002 | 1.8576 | 6.4464 | 151.49 | 1.692 | 5.406 | 6.0408 | 7.7328 |
| 17 | 100 | 2.0661 | 6.4601 | 163.52 | 1.8225 | 5.3805 | 6.0408 | 7.8633 |
| 18 | 110 | 2.273 | 6.4738 | 175.56 | 1.9525 | 5.3527 | 6.0408 | 7.9933 |
| 19 | 120 | 2.4816 | 6.4876 | 187.81 | 2.0843 | 5.3222 | 6.0408 | 8.1251 |
| 20 | 130 | 2.6885 | 6.5014 | 200.21 | 2.2172 | 5.2895 | 6.0408 | 8.258 |
| 21 | 140 | 2.8954 | 6.5153 | 212.32 | 2.3463 | 5.2534 | 6.0408 | 8.3871 |
| 22 | 150 | 3.1056 | 6.5294 | 224.42 | 2.4747 | 5.219 | 6.0408 | 8.5155 |
| 23 | 160 | 3.3157 | 6.5436 | 236.46 | 2.6018 | 5.1813 | 6.0408 | 8.6426 |
| 24 | 170 | 3.5242 | 6.5577 | 248.35 | 2.7267 | 5.1441 | 6.0408 | 8.7675 |
| 25 | 180 | 3.736 | 6.5722 | 259.8 | 2.8461 | 5.107 | 6.0408 | 8.8869 |
| 26 | 190 | 3.9461 | 6.5865 | 270.88 | 2.9611 | 5.0693 | 6.0408 | 9.0019 |
| 27 | 200 | 4.1563 | 6.601 | 281.75 | 3.0732 | 5.0321 | 6.0408 | 9.114 |
| 28 | 210 | 4.3648 | 6.6154 | 292.4 | 3.1824 | 4.9949 | 6.0408 | 9.2232 |
| 29 | 220 | 4.5717 | 6.6297 | 302.54 | 3.2856 | 4.9583 | 6.0408 | 9.3264 |
| 30 | 230 | 4.7787 | 6.6441 | 312.53 | 3.3868 | 4.9222 | 6.0408 | 9.4276 |
| 31 | 240 | 4.984 | 6.6585 | 322.3 | 3.4851 | 4.8873 | 6.0408 | 9.5259 |
| 32 | 270 | 5.6016 | 6.7021 | 349.8 | 3.7579 | 4.7863 | 6.0408 | 9.7987 |
| 33 | 300 | 6.224 | 6.7465 | 375.84 | 4.011 | 4.6926 | 6.0408 | 10.052 |
| 34 | 330 | 6.8335 | 6.7907 | 399.69 | 4.2378 | 4.6066 | 6.0408 | 10.279 |
| 35 | 360 | 7.4495 | 6.8359 | 422.95 | 4.4548 | 4.5289 | 6.0408 | 10.496 |
| 36 | 390 | 8.0687 | 6.8819 | 445.56 | 4.6616 | 4.454 | 6.0408 | 10.702 |
| 37 | 420 | 8.6911 | 6.9288 | 468.98 | 4.8733 | 4.3803 | 6.0408 | 10.914 |
| 38 | 450 | 9.3087 | 6.976 | 492.1 | 5.079 | 4.3087 | 6.0408 | 11.12 |
| 39 | 480 | 9.9279 | 7.024 | 516.31 | 5.2925 | 4.2377 | 6.0408 | 11.333 |
| 40 | 510 | 10.552 | 7.073 | 540.67 | 5.5038 | 4.1678 | 6.0408 | 11.545 |
| 41 | 540 | 11.176 | 7.1226 | 563.06 | 5.6918 | 4.1007 | 6.0408 | 11.733 |
| 42 | 570 | 11.797 | 7.1728 | 587.2 | 5.8943 | 4.0319 | 6.0408 | 11.935 |
| 43 | 600 | 12.416 | 7.2235 | 609.6 | 6.0761 | 3.9659 | 6.0408 | 12.117 |
| 44 | 630 | 13.033 | 7.2748 | 633.59 | 6.2708 | 3.9004 | 6.0408 | 12.312 |
| 45 | 660 | 13.659 | 7.3275 | 657.66 | 6.4622 | 3.8366 | 6.0408 | 12.503 |
| 46 | 690 | 14.283 | 7.3808 | 679.18 | 6.6254 | 3.7706 | 6.0408 | 12.666 |
| 47 | 720 | 14.902 | 7.4345 | 701.93 | 6.7979 | 3.7068 | 6.0408 | 12.839 |
| 48 | 750 | 15.525 | 7.4893 | 724.47 | 6.9648 | 3.643 | 6.0408 | 13.006 |
| 49 | 772.22 | 15.991 | 7.5309 | 741.68 | 7.0909 | 3.5959 | 6.0408 | 13.132 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 13.9 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.96 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.74 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.0408 | 6.0408 | 0 | 0.000 | 0.99651 | 0.99651 | 1.000 | 0.99651 | 0 |
| 2 | 0.09 | 6.5251 | 6.0408 | 0.1459 | 0.301 | 1.3349 | 0.85061 | 1.569 | 1.0928 | 0.24216 |
| 3 | 0.19 | 6.6978 | 6.0408 | 0.23854 | 0.363 | 1.4149 | 0.75797 | 1.867 | 1.0865 | 0.32849 |
| 4 | 0.29 | 6.8014 | 6.0408 | 0.29734 | 0.391 | 1.4598 | 0.69917 | 2.088 | 1.0795 | 0.3803 |
| 5 | 0.39 | 6.88 | 6.0408 | 0.33673 | 0.401 | 1.499 | 0.65978 | 2.272 | 1.0794 | 0.41959 |
| 6 | 0.49 | 6.9452 | 6.0408 | 0.36613 | 0.405 | 1.5348 | 0.63038 | 2.435 | 1.0826 | 0.4522 |
| 7 | 0.60 | 7.0061 | 6.0408 | 0.3861 | 0.400 | 1.5757 | 0.61041 | 2.581 | 1.0931 | 0.48267 |
| 8 | 0.70 | 7.0628 | 6.0408 | 0.39886 | 0.390 | 1.6197 | 0.59765 | 2.710 | 1.1087 | 0.51101 |
| 9 | 0.81 | 7.1227 | 6.0408 | 0.40829 | 0.377 | 1.6701 | 0.58822 | 2.839 | 1.1292 | 0.54094 |
| 10 | 0.91 | 7.1799 | 6.0408 | 0.41217 | 0.362 | 1.7235 | 0.58434 | 2.949 | 1.1539 | 0.56956 |
| 11 | 1.02 | 7.2395 | 6.0408 | 0.41439 | 0.346 | 1.7809 | 0.58212 | 3.059 | 1.1815 | 0.59937 |
| 12 | 1.12 | 7.299 | 6.0408 | 0.41384 | 0.329 | 1.8409 | 0.58267 | 3.159 | 1.2118 | 0.62909 |
| 13 | 1.22 | 7.3608 | 6.0408 | 0.41107 | 0.311 | 1.9055 | 0.58545 | 3.255 | 1.2455 | 0.66002 |
| 14 | 1.44 | 7.4766 | 6.0408 | 0.40053 | 0.279 | 2.0318 | 0.59599 | 3.409 | 1.3139 | 0.7179 |
| 15 | 1.65 | 7.6041 | 6.0408 | 0.38277 | 0.245 | 2.1771 | 0.61374 | 3.547 | 1.3954 | 0.78166 |
| 16 | 1.86 | 7.7328 | 6.0408 | 0.36169 | 0.214 | 2.3268 | 0.63482 | 3.665 | 1.4808 | 0.84599 |
| 17 | 2.07 | 7.8633 | 6.0408 | 0.33617 | 0.184 | 2.4828 | 0.66034 | 3.760 | 1.5716 | 0.91125 |
| 18 | 2.27 | 7.9933 | 6.0408 | 0.30844 | 0.158 | 2.6406 | 0.68807 | 3.838 | 1.6643 | 0.97625 |
| 19 | 2.48 | 8.1251 | 6.0408 | 0.27793 | 0.133 | 2.8029 | 0.71858 | 3.901 | 1.7607 | 1.0422 |
| 20 | 2.69 | 8.258 | 6.0408 | 0.2452 | 0.111 | 2.9685 | 0.75131 | 3.951 | 1.8599 | 1.1086 |
| 21 | 2.90 | 8.3871 | 6.0408 | 0.20914 | 0.089 | 3.1337 | 0.78737 | 3.980 | 1.9605 | 1.1731 |
| 22 | 3.11 | 8.5155 | 6.0408 | 0.17474 | 0.071 | 3.2965 | 0.82177 | 4.011 | 2.0591 | 1.2374 |
| 23 | 3.32 | 8.6426 | 6.0408 | 0.13702 | 0.053 | 3.4613 | 0.85949 | 4.027 | 2.1604 | 1.3009 |
| 24 | 3.52 | 8.7675 | 6.0408 | 0.099854 | 0.037 | 3.6233 | 0.89666 | 4.041 | 2.26 | 1.3633 |
| 25 | 3.74 | 8.8869 | 6.0408 | 0.062686 | 0.022 | 3.78 | 0.93383 | 4.048 | 2.3569 | 1.4231 |
| 26 | 3.95 | 9.0019 | 6.0408 | 0.024963 | 0.008 | 3.9327 | 0.97155 | 4.048 | 2.4521 | 1.4806 |
| 27 | 4.16 | 9.114 | 6.0408 | -0.012204 | -0.004 | 4.0819 | 1.0087 | 4.047 | 2.5453 | 1.5366 |
| 28 | 4.36 | 9.2232 | 6.0408 | -0.049372 | -0.016 | 4.2283 | 1.0459 | 4.043 | 2.6371 | 1.5912 |
| 29 | 4.57 | 9.3264 | 6.0408 | -0.085985 | -0.026 | 4.3681 | 1.0825 | 4.035 | 2.7253 | 1.6428 |
| 30 | 4.78 | 9.4276 | 6.0408 | -0.12204 | -0.036 | 4.5053 | 1.1186 | 4.028 | 2.8119 | 1.6934 |
| 31 | 4.98 | 9.5259 | 6.0408 | -0.15699 | -0.045 | 4.6386 | 1.1535 | 4.021 | 2.8961 | 1.7426 |
| 32 | 5.60 | 9.7987 | 6.0408 | -0.25796 | -0.069 | 5.0124 | 1.2545 | 3.996 | 3.1334 | 1.8789 |
| 33 | 6.22 | 10.052 | 6.0408 | -0.35171 | -0.088 | 5.3592 | 1.3482 | 3.975 | 3.3537 | 2.0055 |
| 34 | 6.83 | 10.279 | 6.0408 | -0.43769 | -0.103 | 5.672 | 1.4342 | 3.955 | 3.5531 | 2.1189 |
| 35 | 7.45 | 10.496 | 6.0408 | -0.51536 | -0.116 | 5.9667 | 1.5119 | 3.947 | 3.7393 | 2.2274 |
| 36 | 8.07 | 10.702 | 6.0408 | -0.59025 | -0.127 | 6.2483 | 1.5868 | 3.938 | 3.9175 | 2.3308 |
| 37 | 8.69 | 10.914 | 6.0408 | -0.66403 | -0.136 | 6.5338 | 1.6605 | 3.935 | 4.0972 | 2.4367 |
| 38 | 9.31 | 11.12 | 6.0408 | -0.73559 | -0.145 | 6.8111 | 1.7321 | 3.932 | 4.2716 | 2.5395 |
| 39 | 9.93 | 11.333 | 6.0408 | -0.8066 | -0.152 | 7.0956 | 1.8031 | 3.935 | 4.4494 | 2.6463 |
| 40 | 10.55 | 11.545 | 6.0408 | -0.8765 | -0.159 | 7.3768 | 1.873 | 3.938 | 4.6249 | 2.7519 |
| 41 | 11.18 | 11.733 | 6.0408 | -0.94362 | -0.166 | 7.6319 | 1.9401 | 3.934 | 4.786 | 2.8459 |
| 42 | 11.80 | 11.935 | 6.0408 | -1.0124 | -0.172 | 7.9032 | 2.0089 | 3.934 | 4.9561 | 2.9472 |
| 43 | 12.42 | 12.117 | 6.0408 | -1.0784 | -0.177 | 8.1511 | 2.0749 | 3.928 | 5.113 | 3.0381 |
| 44 | 13.03 | 12.312 | 6.0408 | -1.1439 | -0.182 | 8.4112 | 2.1404 | 3.930 | 5.2758 | 3.1354 |
| 45 | 13.66 | 12.503 | 6.0408 | -1.2077 | -0.187 | 8.6664 | 2.2042 | 3.932 | 5.4353 | 3.2311 |
| 46 | 14.28 | 12.666 | 6.0408 | -1.2737 | -0.192 | 8.8956 | 2.2702 | 3.918 | 5.5829 | 3.3127 |
| 47 | 14.90 | 12.839 | 6.0408 | -1.3375 | -0.197 | 9.1319 | 2.334 | 3.913 | 5.7329 | 3.3989 |
| 48 | 15.52 | 13.006 | 6.0408 | -1.4013 | -0.201 | 9.3626 | 2.3978 | 3.905 | 5.8802 | 3.4824 |
| 49 | 15.99 | 13.132 | 6.0408 | -1.4484 | -0.204 | 9.5358 | 2.4449 | 3.900 | 5.9904 | 3.5454 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 20.8 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.71 in
Specimen Area: 6.32 in^2
Specimen Volume: 36.08 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3214 | 0 | 0 | 5.0958 | 6.5376 | 6.5376 |
| 2 | 5.0038 | 0.074905 | 6.3261 | 45.054 | 0.51278 | 5.2246 | 6.5376 | 7.0504 |
| 3 | 10.004 | 0.17378 | 6.3324 | 62.257 | 0.70787 | 5.3665 | 6.5376 | 7.2455 |
| 4 | 15.004 | 0.27265 | 6.3386 | 72.957 | 0.82871 | 5.4806 | 6.5376 | 7.3663 |
| 5 | 20.004 | 0.37303 | 6.345 | 80.614 | 0.91477 | 5.5686 | 6.5376 | 7.4524 |
| 6 | 25.004 | 0.4749 | 6.3515 | 86.279 | 0.97804 | 5.636 | 6.5376 | 7.5156 |
| 7 | 30 | 0.57677 | 6.358 | 90.422 | 1.024 | 5.6898 | 6.5376 | 7.5616 |
| 8 | 35 | 0.67415 | 6.3643 | 93.779 | 1.0609 | 5.7316 | 6.5376 | 7.5985 |
| 9 | 40 | 0.77752 | 6.3709 | 97.975 | 1.1073 | 5.7648 | 6.5376 | 7.6449 |
| 10 | 45.002 | 0.87939 | 6.3774 | 100.65 | 1.1363 | 5.7909 | 6.5376 | 7.6739 |
| 11 | 50.003 | 0.97976 | 6.3839 | 104.95 | 1.1837 | 5.8104 | 6.5376 | 7.7213 |
| 12 | 55.003 | 1.0801 | 6.3904 | 107.84 | 1.215 | 5.8262 | 6.5376 | 7.7526 |
| 13 | 60.003 | 1.1835 | 6.3971 | 111.51 | 1.255 | 5.8387 | 6.5376 | 7.7926 |
| 14 | 70.003 | 1.3842 | 6.4101 | 117.22 | 1.3167 | 5.8539 | 6.5376 | 7.8543 |
| 15 | 80.004 | 1.5895 | 6.4235 | 123.99 | 1.3898 | 5.8583 | 6.5376 | 7.9274 |
| 16 | 90.004 | 1.7887 | 6.4365 | 130.13 | 1.4556 | 5.855 | 6.5376 | 7.9932 |
| 17 | 100 | 1.9925 | 6.4499 | 137.42 | 1.534 | 5.8463 | 6.5376 | 8.0716 |
| 18 | 110 | 2.1962 | 6.4633 | 144.6 | 1.6108 | 5.8338 | 6.5376 | 8.1484 |
| 19 | 120 | 2.3955 | 6.4765 | 151.58 | 1.6851 | 5.8186 | 6.5376 | 8.2227 |
| 20 | 130 | 2.5992 | 6.4901 | 158.24 | 1.7555 | 5.7979 | 6.5376 | 8.2931 |
| 21 | 140 | 2.8059 | 6.5039 | 165.9 | 1.8365 | 5.7762 | 6.5376 | 8.3741 |
| 22 | 150 | 3.0097 | 6.5175 | 175.55 | 1.9393 | 5.7523 | 6.5376 | 8.4769 |
| 23 | 160 | 3.2119 | 6.5311 | 182.73 | 2.0145 | 5.7278 | 6.5376 | 8.5521 |
| 24 | 170 | 3.4142 | 6.5448 | 191.81 | 2.1101 | 5.7018 | 6.5376 | 8.6477 |
| 25 | 180 | 3.6119 | 6.5582 | 199.36 | 2.1887 | 5.6735 | 6.5376 | 8.7263 |
| 26 | 190 | 3.8127 | 6.5719 | 206.81 | 2.2657 | 5.6442 | 6.5376 | 8.8033 |
| 27 | 200 | 4.0164 | 6.5859 | 214.52 | 2.3452 | 5.6148 | 6.5376 | 8.8828 |
| 28 | 210 | 4.2187 | 6.5998 | 224.32 | 2.4473 | 5.5849 | 6.5376 | 8.9849 |
| 29 | 220 | 4.4164 | 6.6134 | 234.24 | 2.5501 | 5.5534 | 6.5376 | 9.0877 |
| 30 | 230 | 4.6187 | 6.6275 | 242.73 | 2.637 | 5.5208 | 6.5376 | 9.1746 |
| 31 | 240 | 4.8209 | 6.6415 | 250.97 | 2.7207 | 5.4876 | 6.5376 | 9.2583 |
| 32 | 270 | 5.4291 | 6.6843 | 278.4 | 2.9988 | 5.3849 | 6.5376 | 9.5364 |
| 33 | 300 | 6.0389 | 6.7276 | 307.61 | 3.2921 | 5.2746 | 6.5376 | 9.8297 |
| 34 | 330 | 6.6411 | 6.771 | 336.99 | 3.5833 | 5.1589 | 6.5376 | 10.121 |
| 35 | 360 | 7.2433 | 6.815 | 367.41 | 3.8816 | 5.0409 | 6.5376 | 10.419 |
| 36 | 390 | 7.8605 | 6.8607 | 398.56 | 4.1827 | 4.9187 | 6.5376 | 10.72 |
| 37 | 420 | 8.4643 | 6.9059 | 431.13 | 4.4949 | 4.7937 | 6.5376 | 11.033 |
| 38 | 450 | 9.0605 | 6.9512 | 464.49 | 4.8112 | 4.6665 | 6.5376 | 11.349 |
| 39 | 480 | 9.6658 | 6.9978 | 497.43 | 5.118 | 4.535 | 6.5376 | 11.656 |
| 40 | 510 | 10.283 | 7.0459 | 529.79 | 5.4138 | 4.4035 | 6.5376 | 11.951 |
| 41 | 540 | 10.887 | 7.0936 | 564.88 | 5.7335 | 4.2698 | 6.5376 | 12.271 |
| 42 | 570 | 11.48 | 7.1412 | 599.97 | 6.0491 | 4.1361 | 6.5376 | 12.587 |
| 43 | 600 | 12.084 | 7.1902 | 634.95 | 6.3581 | 4.0008 | 6.5376 | 12.896 |
| 44 | 630 | 12.699 | 7.2409 | 671.35 | 6.6755 | 3.8687 | 6.5376 | 13.213 |
| 45 | 660 | 13.303 | 7.2913 | 704.92 | 6.9608 | 3.7378 | 6.5376 | 13.498 |
| 46 | 690 | 13.902 | 7.3421 | 738.01 | 7.2373 | 3.6073 | 6.5376 | 13.775 |
| 47 | 720 | 14.505 | 7.3938 | 771.63 | 7.514 | 3.4807 | 6.5376 | 14.052 |
| 48 | 750 | 15.119 | 7.4473 | 805.72 | 7.7897 | 3.3563 | 6.5376 | 14.327 |
| 49 | 773.86 | 15.606 | 7.4903 | 829.85 | 7.9769 | 3.2617 | 6.5376 | 14.514 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 20.8 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

AECOM

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.71 in
Specimen Area: 6.32 in^2
Specimen Volume: 36.08 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

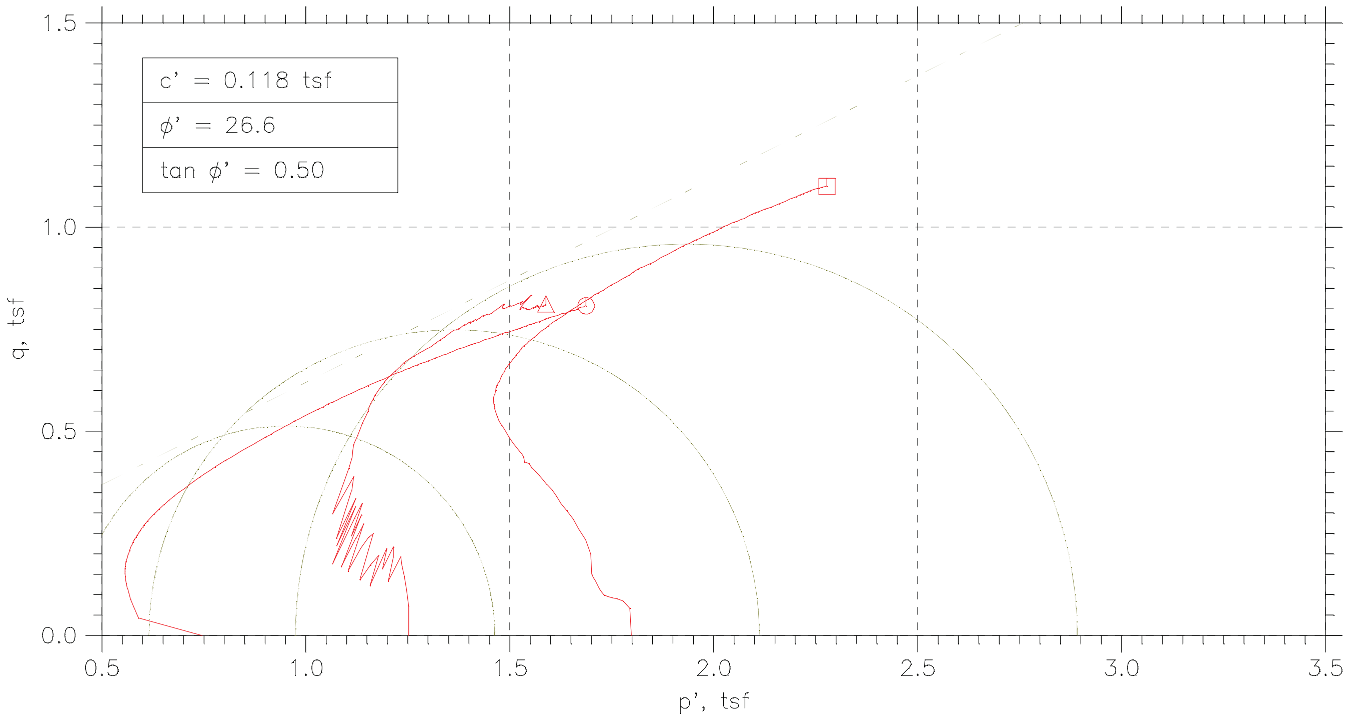
Plastic Limit: 11

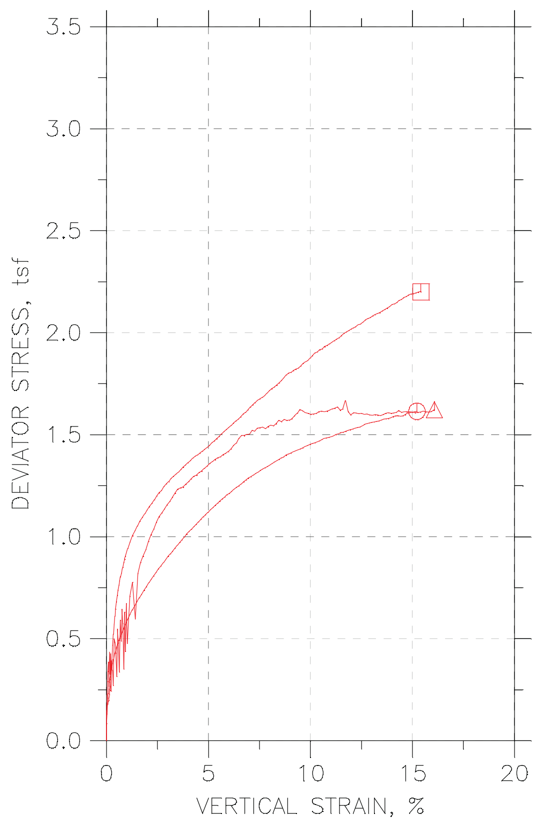
Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.5376 | 6.5376 | 0 | 0.000 | 1.4418 | 1.4418 | 1.000 | 1.4418 | 0 |
| 2 | 0.07 | 7.0504 | 6.5376 | 0.12879 | 0.251 | 1.8258 | 1.313 | 1.391 | 1.5694 | 0.25639 |
| 3 | 0.17 | 7.2455 | 6.5376 | 0.27063 | 0.382 | 1.879 | 1.1711 | 1.604 | 1.5251 | 0.35394 |
| 4 | 0.27 | 7.3663 | 6.5376 | 0.38475 | 0.464 | 1.8857 | 1.057 | 1.784 | 1.4714 | 0.41435 |
| 5 | 0.37 | 7.4524 | 6.5376 | 0.47279 | 0.517 | 1.8838 | 0.96898 | 1.944 | 1.4264 | 0.45738 |
| 6 | 0.47 | 7.5156 | 6.5376 | 0.54018 | 0.552 | 1.8796 | 0.9016 | 2.085 | 1.3906 | 0.48902 |
| 7 | 0.58 | 7.5616 | 6.5376 | 0.59398 | 0.580 | 1.8718 | 0.8478 | 2.208 | 1.3598 | 0.51198 |
| 8 | 0.67 | 7.5985 | 6.5376 | 0.63582 | 0.599 | 1.8669 | 0.80595 | 2.316 | 1.3364 | 0.53047 |
| 9 | 0.78 | 7.6449 | 6.5376 | 0.66897 | 0.604 | 1.8801 | 0.7728 | 2.433 | 1.3264 | 0.55363 |
| 10 | 0.88 | 7.6739 | 6.5376 | 0.69506 | 0.612 | 1.883 | 0.74672 | 2.522 | 1.3149 | 0.56816 |
| 11 | 0.98 | 7.7213 | 6.5376 | 0.71462 | 0.604 | 1.9108 | 0.72715 | 2.628 | 1.319 | 0.59183 |
| 12 | 1.08 | 7.7526 | 6.5376 | 0.73038 | 0.601 | 1.9264 | 0.71139 | 2.708 | 1.3189 | 0.60749 |
| 13 | 1.18 | 7.7926 | 6.5376 | 0.74288 | 0.592 | 1.9539 | 0.69889 | 2.796 | 1.3264 | 0.62751 |
| 14 | 1.38 | 7.8543 | 6.5376 | 0.7581 | 0.576 | 2.0004 | 0.68368 | 2.926 | 1.342 | 0.65834 |
| 15 | 1.59 | 7.9274 | 6.5376 | 0.76244 | 0.549 | 2.0691 | 0.67933 | 3.046 | 1.3742 | 0.69489 |
| 16 | 1.79 | 7.9932 | 6.5376 | 0.75918 | 0.522 | 2.1382 | 0.68259 | 3.132 | 1.4104 | 0.72781 |
| 17 | 1.99 | 8.0716 | 6.5376 | 0.75049 | 0.489 | 2.2253 | 0.69129 | 3.219 | 1.4583 | 0.76699 |
| 18 | 2.20 | 8.1484 | 6.5376 | 0.73799 | 0.458 | 2.3146 | 0.70379 | 3.289 | 1.5092 | 0.80542 |
| 19 | 2.40 | 8.2227 | 6.5376 | 0.72277 | 0.429 | 2.4041 | 0.719 | 3.344 | 1.5616 | 0.84255 |
| 20 | 2.60 | 8.2931 | 6.5376 | 0.70212 | 0.400 | 2.4951 | 0.73965 | 3.373 | 1.6174 | 0.87774 |
| 21 | 2.81 | 8.3741 | 6.5376 | 0.68039 | 0.370 | 2.5979 | 0.76139 | 3.412 | 1.6797 | 0.91827 |
| 22 | 3.01 | 8.4769 | 6.5376 | 0.65647 | 0.339 | 2.7246 | 0.7853 | 3.469 | 1.7549 | 0.96965 |
| 23 | 3.21 | 8.5521 | 6.5376 | 0.63202 | 0.314 | 2.8242 | 0.80976 | 3.488 | 1.817 | 1.0072 |
| 24 | 3.41 | 8.6477 | 6.5376 | 0.60593 | 0.287 | 2.9459 | 0.83584 | 3.524 | 1.8909 | 1.055 |
| 25 | 3.61 | 8.7263 | 6.5376 | 0.57768 | 0.264 | 3.0528 | 0.8641 | 3.533 | 1.9584 | 1.0943 |
| 26 | 3.81 | 8.8033 | 6.5376 | 0.54833 | 0.242 | 3.1592 | 0.89345 | 3.536 | 2.0263 | 1.1329 |
| 27 | 4.02 | 8.8828 | 6.5376 | 0.51898 | 0.221 | 3.268 | 0.92279 | 3.541 | 2.0954 | 1.1726 |
| 28 | 4.22 | 8.9849 | 6.5376 | 0.48909 | 0.200 | 3.3999 | 0.95268 | 3.569 | 2.1763 | 1.2236 |
| 29 | 4.42 | 9.0877 | 6.5376 | 0.45758 | 0.179 | 3.5343 | 0.9842 | 3.591 | 2.2593 | 1.2751 |
| 30 | 4.62 | 9.1746 | 6.5376 | 0.42497 | 0.161 | 3.6538 | 1.0168 | 3.593 | 2.3353 | 1.3185 |
| 31 | 4.82 | 9.2583 | 6.5376 | 0.39182 | 0.144 | 3.7707 | 1.05 | 3.591 | 2.4103 | 1.3604 |
| 32 | 5.43 | 9.5364 | 6.5376 | 0.28911 | 0.096 | 4.1515 | 1.1527 | 3.602 | 2.6521 | 1.4994 |
| 33 | 6.04 | 9.8297 | 6.5376 | 0.17879 | 0.054 | 4.5551 | 1.263 | 3.607 | 2.909 | 1.6461 |
| 34 | 6.64 | 10.121 | 6.5376 | 0.063039 | 0.018 | 4.9621 | 1.3787 | 3.599 | 3.1704 | 1.7917 |
| 35 | 7.24 | 10.419 | 6.5376 | -0.054887 | -0.014 | 5.3783 | 1.4967 | 3.594 | 3.4375 | 1.9408 |
| 36 | 7.86 | 10.72 | 6.5376 | -0.17716 | -0.042 | 5.8017 | 1.6189 | 3.584 | 3.7103 | 2.0914 |
| 37 | 8.46 | 11.033 | 6.5376 | -0.30215 | -0.067 | 6.2388 | 1.7439 | 3.577 | 3.9914 | 2.2475 |
| 38 | 9.06 | 11.349 | 6.5376 | -0.42932 | -0.089 | 6.6822 | 1.8711 | 3.571 | 4.2767 | 2.4056 |
| 39 | 9.67 | 11.656 | 6.5376 | -0.56083 | -0.110 | 7.1206 | 2.0026 | 3.556 | 4.5616 | 2.559 |
| 40 | 10.28 | 11.951 | 6.5376 | -0.69234 | -0.128 | 7.5479 | 2.1341 | 3.537 | 4.841 | 2.7069 |
| 41 | 10.89 | 12.271 | 6.5376 | -0.82603 | -0.144 | 8.0013 | 2.2678 | 3.528 | 5.1345 | 2.8667 |
| 42 | 11.48 | 12.587 | 6.5376 | -0.95971 | -0.159 | 8.4506 | 2.4015 | 3.519 | 5.426 | 3.0245 |
| 43 | 12.08 | 12.896 | 6.5376 | -1.095 | -0.172 | 8.8949 | 2.5368 | 3.506 | 5.7159 | 3.1791 |
| 44 | 12.70 | 13.213 | 6.5376 | -1.2271 | -0.184 | 9.3444 | 2.6689 | 3.501 | 6.0066 | 3.3378 |
| 45 | 13.30 | 13.498 | 6.5376 | -1.3581 | -0.195 | 9.7607 | 2.7998 | 3.486 | 6.2803 | 3.4804 |
| 46 | 13.90 | 13.775 | 6.5376 | -1.4885 | -0.206 | 10.168 | 2.9303 | 3.470 | 6.5489 | 3.6186 |
| 47 | 14.50 | 14.052 | 6.5376 | -1.6151 | -0.215 | 10.571 | 3.0569 | 3.458 | 6.8139 | 3.757 |
| 48 | 15.12 | 14.327 | 6.5376 | -1.7395 | -0.223 | 10.971 | 3.1813 | 3.449 | 7.0762 | 3.8948 |
| 49 | 15.61 | 14.514 | 6.5376 | -1.8341 | -0.230 | 11.253 | 3.2759 | 3.435 | 7.2643 | 3.9884 |

# TRIAXIAL COMPRESSION TEST REPORT

AECOM



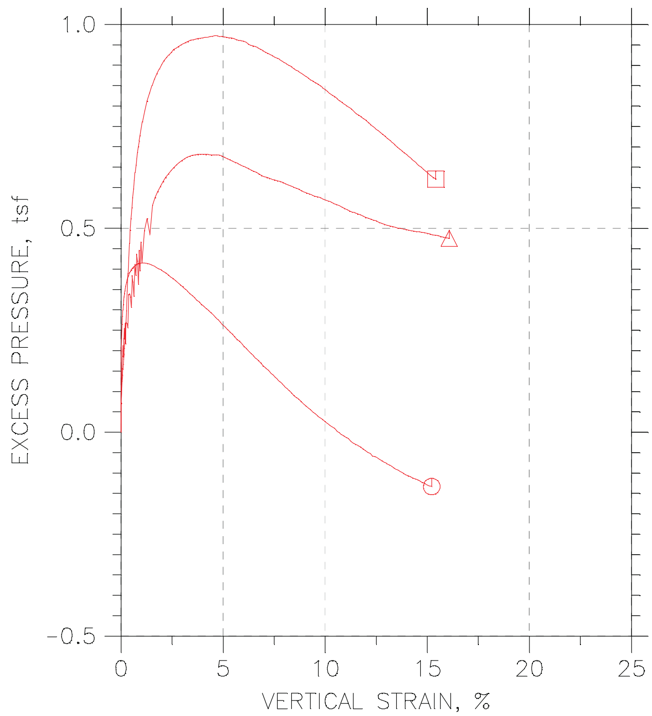

| | | ○ | △ | □ | |
|---|---|---|---|---|---|
| Symbol | | ○ | △ | □ | |
| Test No. | | 10.4 PSI | 17.4 PSI | 24.3 PSI | |
| Initial | Diameter, in | 2.722 | 2.8299 | 2.6157 | |
| | Height, in | 6.0571 | 5.4106 | 5.9323 | |
| | Water Content, % | 5.02 | 7.46 | 5.91 | |
| | Dry Density, pcf | 121.2 | 121.3 | 120.9 | |
| | Saturation, % | 36.18 | 53.82 | 42.11 | |
| | Void Ratio | 0.36923 | 0.3684 | 0.37292 | |
| Before Shear | Water Content, % | 13.55 | 13.79 | 12.58 | |
| | Dry Density, pcf | 122. | 121.5 | 124.4 | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.36021 | 0.36668 | 0.33456 | |
| | Back Press., tsf | 5.0425 | 5.0399 | 5.042 | |
| Minor Prin. Stress, tsf | | 0.74626 | 1.2529 | 1.798 | |
| Max. Dev. Stress, tsf | | 1.6147 | 1.6669 | 2.202 | |
| Time to Failure, min | | 3930 | 2700 | 3930 | |
| Strain Rate, %/min | | 0.006 | 0.006 | 0.006 | |
| B-Value | | .95 | .95 | .97 | |
| Measured Specific Gravity | | 2.66 | 2.66 | 2.66 | |
| Liquid Limit | | 40 | 40 | 40 | |
| Plastic Limit | | 24 | 24 | 24 | |
| Plasticity Index | | 16 | 16 | 16 | |
| Failure Sketch | |  |  |  | |

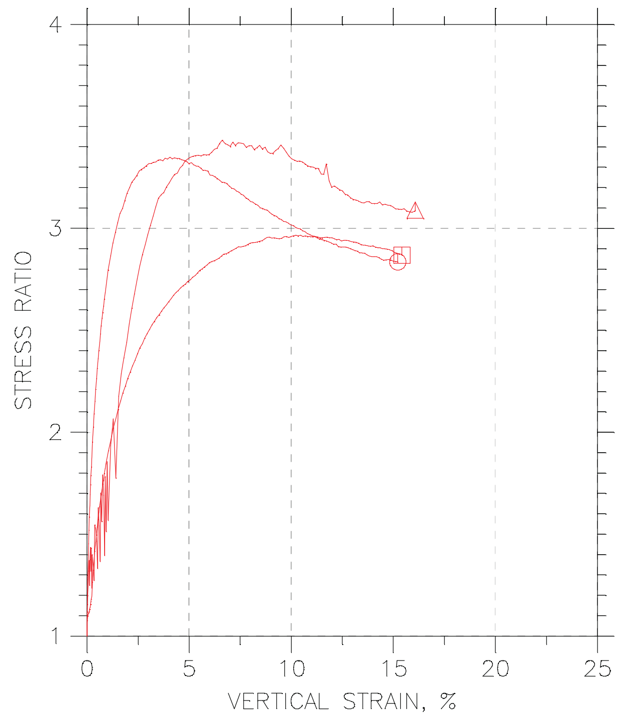
| | |
|---|---|
| Project: COLETO CREEK FACILITY | |
| Location: IPR-GDF SUEZ | |
| Project No.: 60225561 | |
| Boring No.: B-4-1 S-13 | |
| Sample Type: 3" ST | |
| Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | |

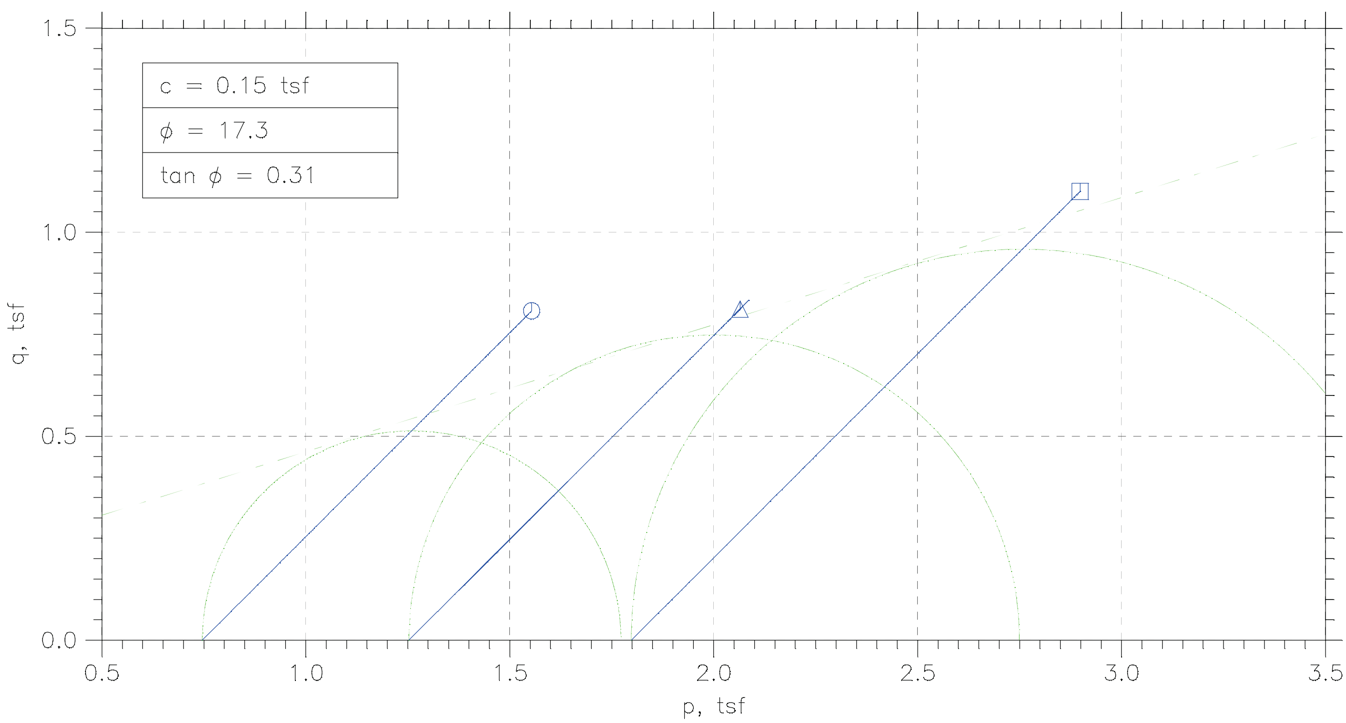
Mon, 12-DEC-2011 10:51:49

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-4-1 S-13 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-13 | Test Date: 12/2/11 | Depth: 24.0'-26.0' |
| Test No.: B-4-1 S-13 | Sample Type: 3" ST | Elevation: ----- |
| Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | | |
| | | |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: -----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.06 in
Specimen Area: 5.82 in^2
Specimen Volume: 35.25 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5.8194 | 0 | 0 | 5.0425 | 5.7888 | 5.7888 |
| 2 | 5.0041 | 0.017083 | 5.8204 | 6.8968 | 0.085314 | 5.2419 | 5.7888 | 5.8741 |
| 3 | 10 | 0.037013 | 5.8216 | 11.372 | 0.14064 | 5.2811 | 5.7888 | 5.9294 |
| 4 | 15 | 0.056944 | 5.8228 | 14.478 | 0.17902 | 5.308 | 5.7888 | 5.9678 |
| 5 | 20 | 0.075451 | 5.8238 | 16.9 | 0.20893 | 5.3273 | 5.7888 | 5.9977 |
| 6 | 25 | 0.093957 | 5.8249 | 18.795 | 0.23232 | 5.3425 | 5.7888 | 6.0211 |
| 7 | 30 | 0.11389 | 5.8261 | 20.48 | 0.25309 | 5.3553 | 5.7888 | 6.0419 |
| 8 | 35.001 | 0.13239 | 5.8272 | 21.901 | 0.27061 | 5.3658 | 5.7888 | 6.0594 |
| 9 | 40.001 | 0.1509 | 5.8282 | 23.27 | 0.28747 | 5.3746 | 5.7888 | 6.0763 |
| 10 | 45.001 | 0.17083 | 5.8294 | 24.428 | 0.30172 | 5.3828 | 5.7888 | 6.0905 |
| 11 | 50.001 | 0.19076 | 5.8306 | 25.481 | 0.31466 | 5.3892 | 5.7888 | 6.1035 |
| 12 | 55.001 | 0.21069 | 5.8317 | 26.481 | 0.32695 | 5.3951 | 5.7888 | 6.1157 |
| 13 | 60.001 | 0.2292 | 5.8328 | 27.482 | 0.33923 | 5.4003 | 5.7888 | 6.128 |
| 14 | 70.001 | 0.26764 | 5.8351 | 29.272 | 0.36119 | 5.4097 | 5.7888 | 6.15 |
| 15 | 80.001 | 0.3075 | 5.8374 | 30.904 | 0.38118 | 5.4173 | 5.7888 | 6.17 |
| 16 | 90.002 | 0.34593 | 5.8396 | 32.325 | 0.39856 | 5.4231 | 5.7888 | 6.1874 |
| 17 | 100 | 0.38579 | 5.842 | 33.694 | 0.41527 | 5.4284 | 5.7888 | 6.2041 |
| 18 | 110 | 0.42281 | 5.8441 | 34.905 | 0.43003 | 5.4337 | 5.7888 | 6.2188 |
| 19 | 120 | 0.46124 | 5.8464 | 36.063 | 0.44413 | 5.4372 | 5.7888 | 6.2329 |
| 20 | 130 | 0.50111 | 5.8487 | 37.116 | 0.45691 | 5.4407 | 5.7888 | 6.2457 |
| 21 | 140 | 0.54097 | 5.8511 | 38.169 | 0.46969 | 5.4436 | 5.7888 | 6.2585 |
| 22 | 150 | 0.5794 | 5.8534 | 39.117 | 0.48116 | 5.4454 | 5.7888 | 6.27 |
| 23 | 160 | 0.61784 | 5.8556 | 40.012 | 0.49198 | 5.4477 | 5.7888 | 6.2808 |
| 24 | 170 | 0.65628 | 5.8579 | 40.907 | 0.50279 | 5.4494 | 5.7888 | 6.2916 |
| 25 | 180 | 0.69471 | 5.8602 | 41.802 | 0.51359 | 5.4512 | 5.7888 | 6.3024 |
| 26 | 190 | 0.73457 | 5.8625 | 42.644 | 0.52373 | 5.453 | 5.7888 | 6.3125 |
| 27 | 200 | 0.77159 | 5.8647 | 43.276 | 0.53129 | 5.4541 | 5.7888 | 6.3201 |
| 28 | 210 | 0.81145 | 5.867 | 44.013 | 0.54012 | 5.4553 | 5.7888 | 6.3289 |
| 29 | 220 | 0.84846 | 5.8692 | 44.75 | 0.54896 | 5.4565 | 5.7888 | 6.3378 |
| 30 | 230 | 0.8869 | 5.8715 | 45.645 | 0.55973 | 5.4565 | 5.7888 | 6.3485 |
| 31 | 270 | 1.0406 | 5.8806 | 48.593 | 0.59495 | 5.4576 | 5.7888 | 6.3838 |
| 32 | 300 | 1.156 | 5.8875 | 50.541 | 0.61808 | 5.4576 | 5.7888 | 6.4069 |
| 33 | 330 | 1.2713 | 5.8944 | 52.489 | 0.64116 | 5.4565 | 5.7888 | 6.43 |
| 34 | 360 | 1.3866 | 5.9013 | 54.174 | 0.66096 | 5.4553 | 5.7888 | 6.4498 |
| 35 | 390 | 1.5005 | 5.9081 | 55.911 | 0.68137 | 5.453 | 5.7888 | 6.4702 |
| 36 | 420 | 1.6172 | 5.9151 | 57.596 | 0.70107 | 5.4506 | 5.7888 | 6.4899 |
| 37 | 450 | 1.7325 | 5.922 | 59.07 | 0.71817 | 5.4465 | 5.7888 | 6.507 |
| 38 | 480 | 1.8492 | 5.9291 | 60.702 | 0.73714 | 5.4436 | 5.7888 | 6.5259 |
| 39 | 510 | 1.966 | 5.9361 | 62.334 | 0.75606 | 5.4407 | 5.7888 | 6.5449 |
| 40 | 540 | 2.0841 | 5.9433 | 63.966 | 0.77492 | 5.4366 | 5.7888 | 6.5637 |
| 41 | 570 | 2.2009 | 5.9504 | 65.44 | 0.79183 | 5.4331 | 5.7888 | 6.5806 |
| 42 | 600 | 2.3176 | 5.9575 | 66.862 | 0.80806 | 5.4284 | 5.7888 | 6.5969 |
| 43 | 630 | 2.4358 | 5.9647 | 68.388 | 0.82551 | 5.4231 | 5.7888 | 6.6143 |
| 44 | 660 | 2.5539 | 5.972 | 69.863 | 0.84229 | 5.4196 | 5.7888 | 6.6311 |
| 45 | 690 | 2.6721 | 5.9792 | 71.179 | 0.85711 | 5.4144 | 5.7888 | 6.6459 |
| 46 | 720 | 2.7902 | 5.9865 | 72.548 | 0.87254 | 5.4091 | 5.7888 | 6.6613 |
| 47 | 750 | 2.9056 | 5.9936 | 73.916 | 0.88795 | 5.4038 | 5.7888 | 6.6767 |
| 48 | 780 | 3.0223 | 6.0008 | 75.285 | 0.9033 | 5.3992 | 5.7888 | 6.6921 |
| 49 | 810 | 3.1376 | 6.0079 | 76.391 | 0.91548 | 5.3939 | 5.7888 | 6.7043 |
| 50 | 840 | 3.2515 | 6.015 | 77.707 | 0.93016 | 5.3886 | 5.7888 | 6.719 |
| 51 | 870 | 3.3654 | 6.0221 | 78.971 | 0.94417 | 5.3828 | 5.7888 | 6.733 |
| 52 | 900 | 3.4807 | 6.0293 | 80.287 | 0.95876 | 5.3781 | 5.7888 | 6.7476 |
| 53 | 930 | 3.5946 | 6.0364 | 81.498 | 0.97207 | 5.3729 | 5.7888 | 6.7609 |
| 54 | 960 | 3.7085 | 6.0436 | 82.656 | 0.98472 | 5.3664 | 5.7888 | 6.7735 |
| 55 | 990 | 3.8238 | 6.0508 | 84.025 | 0.99983 | 5.3623 | 5.7888 | 6.7886 |
| 56 | 1020 | 3.9377 | 6.058 | 85.235 | 1.013 | 5.3559 | 5.7888 | 6.8018 |
| 57 | 1050 | 4.053 | 6.0653 | 86.446 | 1.0262 | 5.3518 | 5.7888 | 6.815 |
| 58 | 1080 | 4.1683 | 6.0726 | 87.447 | 1.0368 | 5.346 | 5.7888 | 6.8256 |
| 59 | 1110 | 4.285 | 6.08 | 88.658 | 1.0499 | 5.3413 | 5.7888 | 6.8387 |
| 60 | 1140 | 4.4018 | 6.0874 | 89.658 | 1.0604 | 5.336 | 5.7888 | 6.8492 |
| 61 | 1170 | 4.5185 | 6.0948 | 90.816 | 1.0728 | 5.3308 | 5.7888 | 6.8616 |
| 62 | 1200 | 4.6352 | 6.1023 | 91.974 | 1.0852 | 5.3243 | 5.7888 | 6.874 |
| 63 | 1230 | 4.752 | 6.1098 | 93.133 | 1.0975 | 5.3185 | 5.7888 | 6.8863 |
| 64 | 1260 | 4.8701 | 6.1174 | 94.185 | 1.1085 | 5.3126 | 5.7888 | 6.8973 |
| 65 | 1290 | 4.9883 | 6.125 | 95.238 | 1.1195 | 5.3056 | 5.7888 | 6.9083 |
| 66 | 1320 | 5.1064 | 6.1326 | 96.502 | 1.133 | 5.301 | 5.7888 | 6.9218 |
| 67 | 1350 | 5.2232 | 6.1402 | 97.45 | 1.1427 | 5.2945 | 5.7888 | 6.9315 |
| 68 | 1380 | 5.3385 | 6.1476 | 98.555 | 1.1543 | 5.2881 | 5.7888 | 6.9431 |
| 69 | 1410 | 5.4552 | 6.1552 | 99.555 | 1.1645 | 5.2834 | 5.7888 | 6.9533 |
| 70 | 1440 | 5.5705 | 6.1627 | 100.56 | 1.1748 | 5.277 | 5.7888 | 6.9636 |
| 71 | 1470 | 5.683 | 6.1701 | 101.61 | 1.1857 | 5.27 | 5.7888 | 6.9745 |
| 72 | 1500 | 5.7983 | 6.1776 | 102.45 | 1.1941 | 5.2659 | 5.7888 | 6.9829 |
| 73 | 1530 | 5.9136 | 6.1852 | 103.61 | 1.2061 | 5.26 | 5.7888 | 6.9949 |
| 74 | 1560 | 6.0275 | 6.1927 | 104.35 | 1.2132 | 5.2524 | 5.7888 | 7.002 |
| 75 | 1590 | 6.1428 | 6.2003 | 105.29 | 1.2227 | 5.2477 | 5.7888 | 7.0115 |
| 76 | 1620 | 6.2581 | 6.2079 | 106.35 | 1.2334 | 5.2413 | 5.7888 | 7.0222 |
| 77 | 1650 | 6.372 | 6.2155 | 107.24 | 1.2423 | 5.2355 | 5.7888 | 7.0311 |
| 78 | 1680 | 6.4887 | 6.2233 | 107.98 | 1.2493 | 5.2302 | 5.7888 | 7.0381 |
| 79 | 1710 | 6.6041 | 6.2309 | 108.87 | 1.2581 | 5.2238 | 5.7888 | 7.0469 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1740 | 6.7236 | 6.2389 | 109.93 | 1.2686 | 5.2185 | 5.7888 | 7.0574 |
| 81 | 1770 | 6.8418 | 6.2468 | 110.98 | 1.2791 | 5.2127 | 5.7888 | 7.0679 |
| 82 | 1800 | 6.9585 | 6.2547 | 111.82 | 1.2872 | 5.2057 | 5.7888 | 7.076 |
| 83 | 1830 | 7.0767 | 6.2626 | 112.56 | 1.2941 | 5.1998 | 5.7888 | 7.0829 |
| 84 | 1860 | 7.1948 | 6.2706 | 113.45 | 1.3027 | 5.1951 | 5.7888 | 7.0915 |
| 85 | 1890 | 7.3144 | 6.2787 | 114.24 | 1.3101 | 5.1887 | 5.7888 | 7.0989 |
| 86 | 1920 | 7.4326 | 6.2867 | 114.98 | 1.3168 | 5.184 | 5.7888 | 7.1056 |
| 87 | 1950 | 7.5493 | 6.2946 | 115.82 | 1.3248 | 5.1776 | 5.7888 | 7.1136 |
| 88 | 1980 | 7.6646 | 6.3025 | 116.61 | 1.3322 | 5.1723 | 5.7888 | 7.121 |
| 89 | 2010 | 7.7814 | 6.3105 | 117.24 | 1.3377 | 5.1665 | 5.7888 | 7.1265 |
| 90 | 2040 | 7.8953 | 6.3183 | 118.03 | 1.3451 | 5.1612 | 5.7888 | 7.1339 |
| 91 | 2070 | 8.0077 | 6.326 | 118.72 | 1.3512 | 5.1548 | 5.7888 | 7.14 |
| 92 | 2100 | 8.1216 | 6.3339 | 119.56 | 1.3591 | 5.1501 | 5.7888 | 7.1479 |
| 93 | 2130 | 8.2369 | 6.3418 | 120.35 | 1.3664 | 5.1443 | 5.7888 | 7.1552 |
| 94 | 2160 | 8.3522 | 6.3498 | 121.09 | 1.373 | 5.139 | 5.7888 | 7.1618 |
| 95 | 2190 | 8.4647 | 6.3576 | 121.77 | 1.3791 | 5.1326 | 5.7888 | 7.1679 |
| 96 | 2220 | 8.58 | 6.3656 | 122.56 | 1.3863 | 5.1279 | 5.7888 | 7.1751 |
| 97 | 2250 | 8.6939 | 6.3735 | 123.14 | 1.3911 | 5.1238 | 5.7888 | 7.1799 |
| 98 | 2280 | 8.8092 | 6.3816 | 124.14 | 1.4006 | 5.1185 | 5.7888 | 7.1894 |
| 99 | 2310 | 8.9259 | 6.3898 | 124.77 | 1.4059 | 5.1127 | 5.7888 | 7.1947 |
| 100 | 2340 | 9.0441 | 6.3981 | 125.3 | 1.41 | 5.1074 | 5.7888 | 7.1988 |
| 101 | 2370 | 9.1608 | 6.4063 | 126.04 | 1.4165 | 5.1022 | 5.7888 | 7.2053 |
| 102 | 2400 | 9.279 | 6.4147 | 126.67 | 1.4218 | 5.0981 | 5.7888 | 7.2106 |
| 103 | 2430 | 9.3957 | 6.4229 | 127.25 | 1.4264 | 5.0922 | 5.7888 | 7.2152 |
| 104 | 2460 | 9.5139 | 6.4313 | 127.83 | 1.4311 | 5.0881 | 5.7888 | 7.2199 |
| 105 | 2490 | 9.632 | 6.4397 | 128.41 | 1.4357 | 5.0829 | 5.7888 | 7.2245 |
| 106 | 2520 | 9.7516 | 6.4482 | 129.25 | 1.4432 | 5.0782 | 5.7888 | 7.232 |
| 107 | 2550 | 9.8698 | 6.4567 | 129.88 | 1.4483 | 5.0735 | 5.7888 | 7.2371 |
| 108 | 2580 | 9.9837 | 6.4649 | 130.35 | 1.4518 | 5.0688 | 5.7888 | 7.2406 |
| 109 | 2610 | 10.102 | 6.4734 | 131.04 | 1.4575 | 5.0648 | 5.7888 | 7.2463 |
| 110 | 2640 | 10.219 | 6.4818 | 131.46 | 1.4603 | 5.0601 | 5.7888 | 7.2491 |
| 111 | 2670 | 10.332 | 6.49 | 132.09 | 1.4654 | 5.056 | 5.7888 | 7.2542 |
| 112 | 2700 | 10.448 | 6.4984 | 132.72 | 1.4705 | 5.0525 | 5.7888 | 7.2593 |
| 113 | 2730 | 10.562 | 6.5066 | 133.46 | 1.4768 | 5.046 | 5.7888 | 7.2656 |
| 114 | 2760 | 10.677 | 6.515 | 134.2 | 1.4831 | 5.0414 | 5.7888 | 7.2719 |
| 115 | 2790 | 10.792 | 6.5235 | 134.46 | 1.484 | 5.0373 | 5.7888 | 7.2728 |
| 116 | 2820 | 10.909 | 6.532 | 134.88 | 1.4867 | 5.0338 | 5.7888 | 7.2755 |
| 117 | 2850 | 11.024 | 6.5405 | 135.41 | 1.4906 | 5.0297 | 5.7888 | 7.2794 |
| 118 | 2880 | 11.14 | 6.549 | 135.99 | 1.4951 | 5.0268 | 5.7888 | 7.2839 |
| 119 | 2910 | 11.256 | 6.5576 | 136.67 | 1.5006 | 5.0209 | 5.7888 | 7.2894 |
| 120 | 2940 | 11.373 | 6.5662 | 137.2 | 1.5044 | 5.0162 | 5.7888 | 7.2932 |
| 121 | 2970 | 11.491 | 6.575 | 137.88 | 1.5099 | 5.0127 | 5.7888 | 7.2987 |
| 122 | 3000 | 11.609 | 6.5838 | 138.25 | 1.5119 | 5.0098 | 5.7888 | 7.3007 |
| 123 | 3030 | 11.73 | 6.5928 | 138.83 | 1.5162 | 5.0063 | 5.7888 | 7.305 |
| 124 | 3060 | 11.847 | 6.6015 | 139.57 | 1.5222 | 5.0016 | 5.7888 | 7.311 |
| 125 | 3090 | 11.965 | 6.6104 | 139.94 | 1.5242 | 4.9981 | 5.7888 | 7.313 |
| 126 | 3120 | 12.083 | 6.6193 | 140.51 | 1.5284 | 4.9934 | 5.7888 | 7.3172 |
| 127 | 3150 | 12.2 | 6.6281 | 141.15 | 1.5333 | 4.9911 | 5.7888 | 7.3221 |
| 128 | 3180 | 12.317 | 6.6369 | 141.62 | 1.5364 | 4.9841 | 5.7888 | 7.3252 |
| 129 | 3210 | 12.432 | 6.6456 | 141.94 | 1.5378 | 4.9829 | 5.7888 | 7.3266 |
| 130 | 3240 | 12.55 | 6.6546 | 142.67 | 1.5437 | 4.98 | 5.7888 | 7.3325 |
| 131 | 3270 | 12.666 | 6.6634 | 143.52 | 1.5507 | 4.9759 | 5.7888 | 7.3395 |
| 132 | 3300 | 12.78 | 6.6721 | 144.09 | 1.555 | 4.9724 | 5.7888 | 7.3438 |
| 133 | 3330 | 12.893 | 6.6808 | 144.57 | 1.558 | 4.9689 | 5.7888 | 7.3468 |
| 134 | 3360 | 13.009 | 6.6897 | 144.99 | 1.5605 | 4.966 | 5.7888 | 7.3493 |
| 135 | 3390 | 13.124 | 6.6986 | 145.36 | 1.5624 | 4.9624 | 5.7888 | 7.3512 |
| 136 | 3420 | 13.238 | 6.7074 | 145.83 | 1.5654 | 4.9595 | 5.7888 | 7.3542 |
| 137 | 3450 | 13.355 | 6.7164 | 146.2 | 1.5673 | 4.9554 | 5.7888 | 7.3561 |
| 138 | 3480 | 13.471 | 6.7255 | 146.89 | 1.5725 | 4.9519 | 5.7888 | 7.3613 |
| 139 | 3510 | 13.588 | 6.7345 | 147.46 | 1.5766 | 4.9496 | 5.7888 | 7.3654 |
| 140 | 3540 | 13.706 | 6.7438 | 147.78 | 1.5778 | 4.9455 | 5.7888 | 7.3666 |
| 141 | 3570 | 13.823 | 6.7529 | 148.1 | 1.579 | 4.942 | 5.7888 | 7.3678 |
| 142 | 3600 | 13.938 | 6.7619 | 148.68 | 1.5831 | 4.9385 | 5.7888 | 7.3719 |
| 143 | 3630 | 14.058 | 6.7714 | 149.41 | 1.5887 | 4.9355 | 5.7888 | 7.3775 |
| 144 | 3660 | 14.175 | 6.7806 | 149.89 | 1.5916 | 4.9338 | 5.7888 | 7.3804 |
| 145 | 3690 | 14.291 | 6.7898 | 150.25 | 1.5933 | 4.9303 | 5.7888 | 7.3821 |
| 146 | 3720 | 14.411 | 6.7993 | 150.25 | 1.5911 | 4.9279 | 5.7888 | 7.3799 |
| 147 | 3750 | 14.529 | 6.8087 | 150.52 | 1.5917 | 4.9256 | 5.7888 | 7.3805 |
| 148 | 3780 | 14.645 | 6.8179 | 151.31 | 1.5979 | 4.9227 | 5.7888 | 7.3867 |
| 149 | 3810 | 14.76 | 6.8271 | 152.36 | 1.6068 | 4.9192 | 5.7888 | 7.3956 |
| 150 | 3840 | 14.875 | 6.8364 | 152.73 | 1.6085 | 4.9168 | 5.7888 | 7.3973 |
| 151 | 3870 | 14.99 | 6.8456 | 153.04 | 1.6097 | 4.9133 | 5.7888 | 7.3985 |
| 152 | 3900 | 15.104 | 6.8548 | 153.57 | 1.613 | 4.911 | 5.7888 | 7.4018 |
| 153 | 3930 | 15.218 | 6.864 | 153.94 | 1.6147 | 4.9092 | 5.7888 | 7.4035 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: -----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.06 in
Specimen Area: 5.82 in^2
Specimen Volume: 35.25 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.7888 | 5.7888 | 0 | 0.000 | 0.74626 | 0.74626 | 1.000 | 0.74626 | 0 |
| 2 | 0.02 | 5.8741 | 5.7888 | 0.19936 | 2.337 | 0.63221 | 0.5469 | 1.156 | 0.58956 | 0.042657 |
| 3 | 0.04 | 5.9294 | 5.7888 | 0.23853 | 1.696 | 0.64837 | 0.50773 | 1.277 | 0.57805 | 0.070321 |
| 4 | 0.06 | 5.9678 | 5.7888 | 0.26543 | 1.483 | 0.65986 | 0.48083 | 1.372 | 0.57035 | 0.089512 |
| 5 | 0.08 | 5.9977 | 5.7888 | 0.28472 | 1.363 | 0.67047 | 0.46154 | 1.453 | 0.56601 | 0.10447 |
| 6 | 0.09 | 6.0211 | 5.7888 | 0.29992 | 1.291 | 0.67866 | 0.44634 | 1.520 | 0.5625 | 0.11616 |
| 7 | 0.11 | 6.0419 | 5.7888 | 0.31278 | 1.236 | 0.68657 | 0.43348 | 1.584 | 0.56002 | 0.12655 |
| 8 | 0.13 | 6.0594 | 5.7888 | 0.32331 | 1.195 | 0.69356 | 0.42295 | 1.640 | 0.55826 | 0.1353 |
| 9 | 0.15 | 6.0763 | 5.7888 | 0.33208 | 1.155 | 0.70165 | 0.41418 | 1.694 | 0.55792 | 0.14373 |
| 10 | 0.17 | 6.0905 | 5.7888 | 0.34026 | 1.128 | 0.70772 | 0.406 | 1.743 | 0.55686 | 0.15086 |
| 11 | 0.19 | 6.1035 | 5.7888 | 0.34669 | 1.102 | 0.71423 | 0.39957 | 1.787 | 0.5569 | 0.15733 |
| 12 | 0.21 | 6.1157 | 5.7888 | 0.35254 | 1.078 | 0.72067 | 0.39372 | 1.830 | 0.5572 | 0.16347 |
| 13 | 0.23 | 6.128 | 5.7888 | 0.3578 | 1.055 | 0.72769 | 0.38846 | 1.873 | 0.55808 | 0.16962 |
| 14 | 0.27 | 6.15 | 5.7888 | 0.36716 | 1.017 | 0.7403 | 0.37911 | 1.953 | 0.5597 | 0.1806 |
| 15 | 0.31 | 6.17 | 5.7888 | 0.37476 | 0.983 | 0.75268 | 0.37151 | 2.026 | 0.56209 | 0.19059 |
| 16 | 0.35 | 6.1874 | 5.7888 | 0.3806 | 0.955 | 0.76421 | 0.36566 | 2.090 | 0.56494 | 0.19928 |
| 17 | 0.39 | 6.2041 | 5.7888 | 0.38586 | 0.929 | 0.77566 | 0.3604 | 2.152 | 0.56803 | 0.20763 |
| 18 | 0.42 | 6.2188 | 5.7888 | 0.39113 | 0.910 | 0.78517 | 0.35514 | 2.211 | 0.57015 | 0.21501 |
| 19 | 0.46 | 6.2329 | 5.7888 | 0.39463 | 0.889 | 0.79576 | 0.35163 | 2.263 | 0.57369 | 0.22206 |
| 20 | 0.50 | 6.2457 | 5.7888 | 0.39814 | 0.871 | 0.80503 | 0.34812 | 2.313 | 0.57658 | 0.22846 |
| 21 | 0.54 | 6.2585 | 5.7888 | 0.40106 | 0.854 | 0.81488 | 0.3452 | 2.361 | 0.58004 | 0.23484 |
| 22 | 0.58 | 6.27 | 5.7888 | 0.40282 | 0.837 | 0.8246 | 0.34344 | 2.401 | 0.58402 | 0.24058 |
| 23 | 0.62 | 6.2808 | 5.7888 | 0.40516 | 0.824 | 0.83308 | 0.3411 | 2.442 | 0.58709 | 0.24599 |
| 24 | 0.66 | 6.2916 | 5.7888 | 0.40691 | 0.809 | 0.84214 | 0.33935 | 2.482 | 0.59075 | 0.25139 |
| 25 | 0.69 | 6.3024 | 5.7888 | 0.40866 | 0.796 | 0.85119 | 0.3376 | 2.521 | 0.59439 | 0.2568 |
| 26 | 0.73 | 6.3125 | 5.7888 | 0.41042 | 0.784 | 0.85957 | 0.33584 | 2.559 | 0.59771 | 0.26187 |
| 27 | 0.77 | 6.3201 | 5.7888 | 0.41159 | 0.775 | 0.86596 | 0.33467 | 2.587 | 0.60032 | 0.26565 |
| 28 | 0.81 | 6.3289 | 5.7888 | 0.41276 | 0.764 | 0.87363 | 0.3335 | 2.620 | 0.60357 | 0.27006 |
| 29 | 0.85 | 6.3378 | 5.7888 | 0.41393 | 0.754 | 0.8813 | 0.33233 | 2.652 | 0.60682 | 0.27448 |
| 30 | 0.89 | 6.3485 | 5.7888 | 0.41393 | 0.740 | 0.89206 | 0.33233 | 2.684 | 0.6122 | 0.27986 |
| 31 | 1.04 | 6.3838 | 5.7888 | 0.4151 | 0.698 | 0.92612 | 0.33117 | 2.797 | 0.62864 | 0.29748 |
| 32 | 1.16 | 6.4069 | 5.7888 | 0.4151 | 0.672 | 0.94925 | 0.33117 | 2.866 | 0.64021 | 0.30904 |
| 33 | 1.27 | 6.43 | 5.7888 | 0.41393 | 0.646 | 0.97349 | 0.33233 | 2.929 | 0.65291 | 0.32058 |
| 34 | 1.39 | 6.4498 | 5.7888 | 0.41276 | 0.624 | 0.99447 | 0.3335 | 2.982 | 0.66398 | 0.33048 |
| 35 | 1.50 | 6.4702 | 5.7888 | 0.41042 | 0.602 | 1.0172 | 0.33584 | 3.029 | 0.67653 | 0.34069 |
| 36 | 1.62 | 6.4899 | 5.7888 | 0.40808 | 0.582 | 1.0393 | 0.33818 | 3.073 | 0.68872 | 0.35054 |
| 37 | 1.73 | 6.507 | 5.7888 | 0.40399 | 0.563 | 1.0604 | 0.34227 | 3.098 | 0.70136 | 0.35909 |
| 38 | 1.85 | 6.5259 | 5.7888 | 0.40106 | 0.544 | 1.0823 | 0.3452 | 3.135 | 0.71377 | 0.36857 |
| 39 | 1.97 | 6.5449 | 5.7888 | 0.39814 | 0.527 | 1.1042 | 0.34812 | 3.172 | 0.72615 | 0.37803 |
| 40 | 2.08 | 6.5637 | 5.7888 | 0.39405 | 0.509 | 1.1271 | 0.35221 | 3.200 | 0.73967 | 0.38746 |
| 41 | 2.20 | 6.5806 | 5.7888 | 0.39054 | 0.493 | 1.1475 | 0.35572 | 3.226 | 0.75163 | 0.39591 |
| 42 | 2.32 | 6.5969 | 5.7888 | 0.38586 | 0.478 | 1.1685 | 0.3604 | 3.242 | 0.76443 | 0.40403 |
| 43 | 2.44 | 6.6143 | 5.7888 | 0.3806 | 0.461 | 1.1912 | 0.36566 | 3.258 | 0.77842 | 0.41276 |
| 44 | 2.55 | 6.6311 | 5.7888 | 0.37709 | 0.448 | 1.2115 | 0.36917 | 3.282 | 0.79031 | 0.42114 |
| 45 | 2.67 | 6.6459 | 5.7888 | 0.37183 | 0.434 | 1.2315 | 0.37443 | 3.289 | 0.80299 | 0.42856 |
| 46 | 2.79 | 6.6613 | 5.7888 | 0.36657 | 0.420 | 1.2522 | 0.37969 | 3.298 | 0.81596 | 0.43627 |
| 47 | 2.91 | 6.6767 | 5.7888 | 0.36131 | 0.407 | 1.2729 | 0.38495 | 3.307 | 0.82893 | 0.44397 |
| 48 | 3.02 | 6.6921 | 5.7888 | 0.35663 | 0.395 | 1.2929 | 0.38963 | 3.318 | 0.84128 | 0.45165 |
| 49 | 3.14 | 6.7043 | 5.7888 | 0.35137 | 0.384 | 1.3104 | 0.39489 | 3.318 | 0.85263 | 0.45774 |
| 50 | 3.25 | 6.719 | 5.7888 | 0.34611 | 0.372 | 1.3303 | 0.40015 | 3.324 | 0.86523 | 0.46508 |
| 51 | 3.37 | 6.733 | 5.7888 | 0.34026 | 0.360 | 1.3502 | 0.406 | 3.326 | 0.87808 | 0.47208 |
| 52 | 3.48 | 6.7476 | 5.7888 | 0.33558 | 0.350 | 1.3694 | 0.41068 | 3.335 | 0.89006 | 0.47938 |
| 53 | 3.59 | 6.7609 | 5.7888 | 0.33032 | 0.340 | 1.388 | 0.41594 | 3.337 | 0.90197 | 0.48603 |
| 54 | 3.71 | 6.7735 | 5.7888 | 0.32389 | 0.329 | 1.4071 | 0.42237 | 3.331 | 0.91473 | 0.49236 |
| 55 | 3.82 | 6.7886 | 5.7888 | 0.3198 | 0.320 | 1.4263 | 0.42646 | 3.344 | 0.92638 | 0.49991 |
| 56 | 3.94 | 6.8018 | 5.7888 | 0.31337 | 0.309 | 1.4459 | 0.43289 | 3.340 | 0.93941 | 0.50652 |
| 57 | 4.05 | 6.815 | 5.7888 | 0.30928 | 0.301 | 1.4632 | 0.43699 | 3.348 | 0.95008 | 0.5131 |
| 58 | 4.17 | 6.8256 | 5.7888 | 0.30343 | 0.293 | 1.4797 | 0.44283 | 3.341 | 0.96124 | 0.51841 |
| 59 | 4.29 | 6.8387 | 5.7888 | 0.29875 | 0.285 | 1.4974 | 0.44751 | 3.346 | 0.97246 | 0.52495 |
| 60 | 4.40 | 6.8492 | 5.7888 | 0.29349 | 0.277 | 1.5132 | 0.45277 | 3.342 | 0.983 | 0.53022 |
| 61 | 4.52 | 6.8616 | 5.7888 | 0.28823 | 0.269 | 1.5309 | 0.45803 | 3.342 | 0.99445 | 0.53642 |
| 62 | 4.64 | 6.874 | 5.7888 | 0.2818 | 0.260 | 1.5497 | 0.46446 | 3.336 | 1.0071 | 0.5426 |
| 63 | 4.75 | 6.8863 | 5.7888 | 0.27595 | 0.251 | 1.5678 | 0.47031 | 3.334 | 1.0191 | 0.54876 |
| 64 | 4.87 | 6.8973 | 5.7888 | 0.2701 | 0.244 | 1.5847 | 0.47616 | 3.328 | 1.0304 | 0.55427 |
| 65 | 4.99 | 6.9083 | 5.7888 | 0.26309 | 0.235 | 1.6027 | 0.48317 | 3.317 | 1.0429 | 0.55977 |
| 66 | 5.11 | 6.9218 | 5.7888 | 0.25841 | 0.228 | 1.6208 | 0.48785 | 3.322 | 1.0543 | 0.56649 |
| 67 | 5.22 | 6.9315 | 5.7888 | 0.25198 | 0.221 | 1.637 | 0.49428 | 3.312 | 1.0656 | 0.57135 |
| 68 | 5.34 | 6.9431 | 5.7888 | 0.24555 | 0.213 | 1.655 | 0.50071 | 3.305 | 1.0778 | 0.57713 |
| 69 | 5.46 | 6.9533 | 5.7888 | 0.24087 | 0.207 | 1.6699 | 0.50539 | 3.304 | 1.0877 | 0.58227 |
| 70 | 5.57 | 6.9636 | 5.7888 | 0.23444 | 0.200 | 1.6866 | 0.51182 | 3.295 | 1.0992 | 0.5874 |
| 71 | 5.68 | 6.9745 | 5.7888 | 0.22743 | 0.192 | 1.7045 | 0.51884 | 3.285 | 1.1117 | 0.59285 |
| 72 | 5.80 | 6.9829 | 5.7888 | 0.22333 | 0.187 | 1.717 | 0.52293 | 3.283 | 1.12 | 0.59703 |
| 73 | 5.91 | 6.9949 | 5.7888 | 0.21749 | 0.180 | 1.7349 | 0.52877 | 3.281 | 1.1318 | 0.60304 |
| 74 | 6.03 | 7.002 | 5.7888 | 0.20989 | 0.173 | 1.7496 | 0.53637 | 3.262 | 1.143 | 0.6066 |
| 75 | 6.14 | 7.0115 | 5.7888 | 0.20521 | 0.168 | 1.7638 | 0.54105 | 3.260 | 1.1524 | 0.61135 |
| 76 | 6.26 | 7.0222 | 5.7888 | 0.19878 | 0.161 | 1.7809 | 0.54748 | 3.253 | 1.1642 | 0.61671 |
| 77 | 6.37 | 7.0311 | 5.7888 | 0.19293 | 0.155 | 1.7956 | 0.55333 | 3.245 | 1.1745 | 0.62114 |
| 78 | 6.49 | 7.0381 | 5.7888 | 0.18767 | 0.150 | 1.8079 | 0.55859 | 3.236 | 1.1832 | 0.62463 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 6.60 | 7.0469 | 5.7888 | 0.18124 | 0.144 | 1.8231 | 0.56502 | 3.227 | 1.1941 | 0.62903 |
| 80 | 6.72 | 7.0574 | 5.7888 | 0.17598 | 0.139 | 1.8389 | 0.57028 | 3.225 | 1.2046 | 0.6343 |
| 81 | 6.84 | 7.0679 | 5.7888 | 0.17013 | 0.133 | 1.8553 | 0.57613 | 3.220 | 1.2157 | 0.63957 |
| 82 | 6.96 | 7.076 | 5.7888 | 0.16312 | 0.127 | 1.8704 | 0.58315 | 3.207 | 1.2268 | 0.64361 |
| 83 | 7.08 | 7.0829 | 5.7888 | 0.15727 | 0.122 | 1.8831 | 0.58899 | 3.197 | 1.236 | 0.64703 |
| 84 | 7.19 | 7.0915 | 5.7888 | 0.15259 | 0.117 | 1.8964 | 0.59367 | 3.194 | 1.245 | 0.65135 |
| 85 | 7.31 | 7.0989 | 5.7888 | 0.14616 | 0.112 | 1.9102 | 0.6001 | 3.183 | 1.2551 | 0.65504 |
| 86 | 7.43 | 7.1056 | 5.7888 | 0.14148 | 0.107 | 1.9216 | 0.60478 | 3.177 | 1.2632 | 0.65842 |
| 87 | 7.55 | 7.1136 | 5.7888 | 0.13505 | 0.102 | 1.936 | 0.61121 | 3.168 | 1.2736 | 0.66241 |
| 88 | 7.66 | 7.121 | 5.7888 | 0.12979 | 0.097 | 1.9487 | 0.61647 | 3.161 | 1.2826 | 0.6661 |
| 89 | 7.78 | 7.1265 | 5.7888 | 0.12394 | 0.093 | 1.96 | 0.62232 | 3.150 | 1.2912 | 0.66886 |
| 90 | 7.90 | 7.1339 | 5.7888 | 0.11868 | 0.088 | 1.9726 | 0.62758 | 3.143 | 1.3001 | 0.67253 |
| 91 | 8.01 | 7.14 | 5.7888 | 0.11225 | 0.083 | 1.9852 | 0.63401 | 3.131 | 1.3096 | 0.67561 |
| 92 | 8.12 | 7.1479 | 5.7888 | 0.10757 | 0.079 | 1.9978 | 0.63869 | 3.128 | 1.3182 | 0.67956 |
| 93 | 8.24 | 7.1552 | 5.7888 | 0.10173 | 0.074 | 2.0109 | 0.64453 | 3.120 | 1.3277 | 0.68319 |
| 94 | 8.35 | 7.1618 | 5.7888 | 0.096466 | 0.070 | 2.0228 | 0.6498 | 3.113 | 1.3363 | 0.68651 |
| 95 | 8.46 | 7.1679 | 5.7888 | 0.090035 | 0.065 | 2.0353 | 0.65623 | 3.102 | 1.3458 | 0.68954 |
| 96 | 8.58 | 7.1751 | 5.7888 | 0.085358 | 0.062 | 2.0472 | 0.6609 | 3.098 | 1.354 | 0.69314 |
| 97 | 8.69 | 7.1799 | 5.7888 | 0.081265 | 0.058 | 2.0561 | 0.665 | 3.092 | 1.3605 | 0.69554 |
| 98 | 8.81 | 7.1894 | 5.7888 | 0.076003 | 0.054 | 2.0709 | 0.67026 | 3.090 | 1.3706 | 0.70031 |
| 99 | 8.93 | 7.1947 | 5.7888 | 0.070157 | 0.050 | 2.082 | 0.6761 | 3.079 | 1.3791 | 0.70297 |
| 100 | 9.04 | 7.1988 | 5.7888 | 0.064895 | 0.046 | 2.0914 | 0.68137 | 3.069 | 1.3864 | 0.70502 |
| 101 | 9.16 | 7.2053 | 5.7888 | 0.059634 | 0.042 | 2.1031 | 0.68663 | 3.063 | 1.3949 | 0.70826 |
| 102 | 9.28 | 7.2106 | 5.7888 | 0.055541 | 0.039 | 2.1125 | 0.69072 | 3.058 | 1.4016 | 0.71088 |
| 103 | 9.40 | 7.2152 | 5.7888 | 0.049695 | 0.035 | 2.123 | 0.69657 | 3.048 | 1.4098 | 0.71321 |
| 104 | 9.51 | 7.2199 | 5.7888 | 0.045602 | 0.032 | 2.1317 | 0.70066 | 3.042 | 1.4162 | 0.71553 |
| 105 | 9.63 | 7.2245 | 5.7888 | 0.04034 | 0.028 | 2.1416 | 0.70592 | 3.034 | 1.4238 | 0.71783 |
| 106 | 9.75 | 7.232 | 5.7888 | 0.035663 | 0.025 | 2.1538 | 0.7106 | 3.031 | 1.4322 | 0.72158 |
| 107 | 9.87 | 7.2371 | 5.7888 | 0.030986 | 0.021 | 2.1636 | 0.71528 | 3.025 | 1.4394 | 0.72416 |
| 108 | 9.98 | 7.2406 | 5.7888 | 0.026309 | 0.018 | 2.1717 | 0.71995 | 3.016 | 1.4458 | 0.72588 |
| 109 | 10.10 | 7.2463 | 5.7888 | 0.022216 | 0.015 | 2.1815 | 0.72404 | 3.013 | 1.4528 | 0.72874 |
| 110 | 10.22 | 7.2491 | 5.7888 | 0.017539 | 0.012 | 2.189 | 0.72872 | 3.004 | 1.4589 | 0.73013 |
| 111 | 10.33 | 7.2542 | 5.7888 | 0.013447 | 0.009 | 2.1982 | 0.73281 | 3.000 | 1.4655 | 0.73271 |
| 112 | 10.45 | 7.2593 | 5.7888 | 0.0099389 | 0.007 | 2.2069 | 0.73632 | 2.997 | 1.4716 | 0.73527 |
| 113 | 10.56 | 7.2656 | 5.7888 | 0.0035079 | 0.002 | 2.2196 | 0.74275 | 2.988 | 1.4812 | 0.73841 |
| 114 | 10.68 | 7.2719 | 5.7888 | -0.0011693 | -0.001 | 2.2305 | 0.74743 | 2.984 | 1.489 | 0.74153 |
| 115 | 10.79 | 7.2728 | 5.7888 | -0.0052618 | -0.004 | 2.2356 | 0.75152 | 2.975 | 1.4935 | 0.74202 |
| 116 | 10.91 | 7.2755 | 5.7888 | -0.0087696 | -0.006 | 2.2418 | 0.75503 | 2.969 | 1.4984 | 0.74337 |
| 117 | 11.02 | 7.2794 | 5.7888 | -0.012862 | -0.009 | 2.2497 | 0.75912 | 2.964 | 1.5044 | 0.74531 |
| 118 | 11.14 | 7.2839 | 5.7888 | -0.015785 | -0.011 | 2.2571 | 0.76205 | 2.962 | 1.5096 | 0.74753 |
| 119 | 11.26 | 7.2894 | 5.7888 | -0.021632 | -0.014 | 2.2685 | 0.76789 | 2.954 | 1.5182 | 0.7503 |
| 120 | 11.37 | 7.2932 | 5.7888 | -0.026309 | -0.017 | 2.277 | 0.77257 | 2.947 | 1.5248 | 0.7522 |
| 121 | 11.49 | 7.2987 | 5.7888 | -0.029817 | -0.020 | 2.286 | 0.77608 | 2.946 | 1.531 | 0.75495 |
| 122 | 11.61 | 7.3007 | 5.7888 | -0.03274 | -0.022 | 2.2909 | 0.779 | 2.941 | 1.535 | 0.75595 |
| 123 | 11.73 | 7.305 | 5.7888 | -0.036248 | -0.024 | 2.2987 | 0.78251 | 2.938 | 1.5406 | 0.75808 |
| 124 | 11.85 | 7.311 | 5.7888 | -0.040925 | -0.027 | 2.3094 | 0.78719 | 2.934 | 1.5483 | 0.7611 |
| 125 | 11.97 | 7.313 | 5.7888 | -0.044433 | -0.029 | 2.3149 | 0.79069 | 2.928 | 1.5528 | 0.76209 |
| 126 | 12.08 | 7.3172 | 5.7888 | -0.04911 | -0.032 | 2.3238 | 0.79537 | 2.922 | 1.5596 | 0.76421 |
| 127 | 12.20 | 7.3221 | 5.7888 | -0.051449 | -0.034 | 2.331 | 0.79771 | 2.922 | 1.5643 | 0.76663 |
| 128 | 12.32 | 7.3252 | 5.7888 | -0.058464 | -0.038 | 2.3411 | 0.80473 | 2.909 | 1.5729 | 0.76818 |
| 129 | 12.43 | 7.3266 | 5.7888 | -0.059634 | -0.039 | 2.3437 | 0.80589 | 2.908 | 1.5748 | 0.76888 |
| 130 | 12.55 | 7.3325 | 5.7888 | -0.062557 | -0.041 | 2.3525 | 0.80882 | 2.909 | 1.5806 | 0.77183 |
| 131 | 12.67 | 7.3395 | 5.7888 | -0.066649 | -0.043 | 2.3636 | 0.81291 | 2.908 | 1.5883 | 0.77536 |
| 132 | 12.78 | 7.3438 | 5.7888 | -0.070157 | -0.045 | 2.3714 | 0.81642 | 2.905 | 1.5939 | 0.77748 |
| 133 | 12.89 | 7.3468 | 5.7888 | -0.073665 | -0.047 | 2.378 | 0.81993 | 2.900 | 1.5989 | 0.77902 |
| 134 | 13.01 | 7.3493 | 5.7888 | -0.076588 | -0.049 | 2.3834 | 0.82285 | 2.896 | 1.6031 | 0.78025 |
| 135 | 13.12 | 7.3512 | 5.7888 | -0.080096 | -0.051 | 2.3888 | 0.82636 | 2.891 | 1.6076 | 0.7812 |
| 136 | 13.24 | 7.3542 | 5.7888 | -0.083019 | -0.053 | 2.3947 | 0.82928 | 2.888 | 1.612 | 0.78272 |
| 137 | 13.35 | 7.3561 | 5.7888 | -0.087112 | -0.056 | 2.4006 | 0.83337 | 2.881 | 1.617 | 0.78364 |
| 138 | 13.47 | 7.3613 | 5.7888 | -0.09062 | -0.058 | 2.4094 | 0.83688 | 2.879 | 1.6231 | 0.78625 |
| 139 | 13.59 | 7.3654 | 5.7888 | -0.092958 | -0.059 | 2.4158 | 0.83922 | 2.879 | 1.6275 | 0.78828 |
| 140 | 13.71 | 7.3666 | 5.7888 | -0.097051 | -0.062 | 2.4211 | 0.84331 | 2.871 | 1.6322 | 0.78889 |
| 141 | 13.82 | 7.3678 | 5.7888 | -0.10056 | -0.064 | 2.4258 | 0.84682 | 2.865 | 1.6363 | 0.78951 |
| 142 | 13.94 | 7.3719 | 5.7888 | -0.10407 | -0.066 | 2.4334 | 0.85033 | 2.862 | 1.6419 | 0.79153 |
| 143 | 14.06 | 7.3775 | 5.7888 | -0.10699 | -0.067 | 2.442 | 0.85325 | 2.862 | 1.6476 | 0.79435 |
| 144 | 14.17 | 7.3804 | 5.7888 | -0.10874 | -0.068 | 2.4466 | 0.855 | 2.861 | 1.6508 | 0.79579 |
| 145 | 14.29 | 7.3821 | 5.7888 | -0.11225 | -0.070 | 2.4518 | 0.85851 | 2.856 | 1.6552 | 0.79666 |
| 146 | 14.41 | 7.3799 | 5.7888 | -0.11459 | -0.072 | 2.4519 | 0.86085 | 2.848 | 1.6564 | 0.79555 |
| 147 | 14.53 | 7.3805 | 5.7888 | -0.11693 | -0.073 | 2.4549 | 0.86319 | 2.844 | 1.659 | 0.79584 |
| 148 | 14.64 | 7.3867 | 5.7888 | -0.11985 | -0.075 | 2.464 | 0.86611 | 2.845 | 1.6651 | 0.79894 |
| 149 | 14.76 | 7.3956 | 5.7888 | -0.12336 | -0.077 | 2.4764 | 0.86962 | 2.848 | 1.673 | 0.80341 |
| 150 | 14.88 | 7.3973 | 5.7888 | -0.1257 | -0.078 | 2.4805 | 0.87196 | 2.845 | 1.6762 | 0.80426 |
| 151 | 14.99 | 7.3985 | 5.7888 | -0.12921 | -0.080 | 2.4851 | 0.87547 | 2.839 | 1.6803 | 0.80484 |
| 152 | 15.10 | 7.4018 | 5.7888 | -0.13154 | -0.082 | 2.4909 | 0.87781 | 2.838 | 1.6843 | 0.80652 |
| 153 | 15.22 | 7.4035 | 5.7888 | -0.1333 | -0.083 | 2.4943 | 0.87956 | 2.836 | 1.6869 | 0.80737 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3 " ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.41 in
Specimen Area: 6.29 in^2
Specimen Volume: 34.03 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.2898 | 0 | 0 | 5.0399 | 6.2928 | 6.2928 |
| 2 | 5.0042 | 0.0151 | 6.2908 | 12.364 | 0.14151 | 5.111 | 6.2928 | 6.4343 |
| 3 | 10 | 0.035234 | 6.292 | 19.701 | 0.22544 | 5.1588 | 6.2928 | 6.5182 |
| 4 | 15 | 0.057045 | 6.2934 | 25.408 | 0.29068 | 5.1965 | 6.2928 | 6.5835 |
| 5 | 20 | 0.078856 | 6.2948 | 29.756 | 0.34035 | 5.2265 | 6.2928 | 6.6331 |
| 6 | 25 | 0.10067 | 6.2962 | 33.696 | 0.38533 | 5.2526 | 6.2928 | 6.6781 |
| 7 | 30 | 0.12248 | 6.2975 | 23.234 | 0.26563 | 5.2232 | 6.2928 | 6.5584 |
| 8 | 35.001 | 0.14261 | 6.2988 | 33.628 | 0.38439 | 5.2704 | 6.2928 | 6.6772 |
| 9 | 40.001 | 0.16442 | 6.3002 | 37.976 | 0.434 | 5.2948 | 6.2928 | 6.7268 |
| 10 | 45.001 | 0.18623 | 6.3016 | 28.533 | 0.32601 | 5.2676 | 6.2928 | 6.6188 |
| 11 | 50.001 | 0.20637 | 6.3028 | 37.297 | 0.42606 | 5.307 | 6.2928 | 6.7189 |
| 12 | 55.001 | 0.23154 | 6.3044 | 21.332 | 0.24362 | 5.2565 | 6.2928 | 6.5364 |
| 13 | 60.001 | 0.24999 | 6.3056 | 34.375 | 0.39251 | 5.3098 | 6.2928 | 6.6853 |
| 14 | 70.001 | 0.29529 | 6.3085 | 30.163 | 0.34426 | 5.3065 | 6.2928 | 6.6371 |
| 15 | 80.001 | 0.33724 | 6.3111 | 23.845 | 0.27204 | 5.2959 | 6.2928 | 6.5648 |
| 16 | 90.002 | 0.37583 | 6.3136 | 43.751 | 0.49893 | 5.377 | 6.2928 | 6.7917 |
| 17 | 100 | 0.42113 | 6.3164 | 42.12 | 0.48012 | 5.3792 | 6.2928 | 6.7729 |
| 18 | 110 | 0.46475 | 6.3192 | 37.636 | 0.42882 | 5.3715 | 6.2928 | 6.7216 |
| 19 | 120 | 0.51005 | 6.3221 | 27.582 | 0.31412 | 5.3459 | 6.2928 | 6.6069 |
| 20 | 130 | 0.55032 | 6.3246 | 48.098 | 0.54756 | 5.4242 | 6.2928 | 6.8404 |
| 21 | 140 | 0.59394 | 6.3274 | 42.052 | 0.47851 | 5.4087 | 6.2928 | 6.7713 |
| 22 | 150 | 0.64092 | 6.3304 | 29.552 | 0.33612 | 5.3737 | 6.2928 | 6.6289 |
| 23 | 160 | 0.67951 | 6.3329 | 51.971 | 0.59087 | 5.4514 | 6.2928 | 6.8837 |
| 24 | 170 | 0.72481 | 6.3357 | 42.935 | 0.48792 | 5.4248 | 6.2928 | 6.7807 |
| 25 | 180 | 0.76507 | 6.3383 | 56.794 | 0.64515 | 5.477 | 6.2928 | 6.938 |
| 26 | 190 | 0.8087 | 6.3411 | 50.612 | 0.57467 | 5.4603 | 6.2928 | 6.8675 |
| 27 | 200 | 0.85567 | 6.3441 | 30.979 | 0.35158 | 5.4031 | 6.2928 | 6.6444 |
| 28 | 210 | 0.89594 | 6.3467 | 55.639 | 0.6312 | 5.4864 | 6.2928 | 6.924 |
| 29 | 220 | 0.94124 | 6.3496 | 38.723 | 0.4391 | 5.4364 | 6.2928 | 6.7319 |
| 30 | 230 | 0.98151 | 6.3522 | 59.376 | 0.67301 | 5.5064 | 6.2928 | 6.9658 |
| 31 | 240 | 1.0268 | 6.3551 | 41.984 | 0.47566 | 5.4553 | 6.2928 | 6.7685 |
| 32 | 270 | 1.1543 | 6.3633 | 62.637 | 0.70873 | 5.5347 | 6.2928 | 7.0015 |
| 33 | 300 | 1.2835 | 6.3716 | 68.751 | 0.77689 | 5.5636 | 6.2928 | 7.0697 |
| 34 | 330 | 1.4161 | 6.3802 | 52.854 | 0.59645 | 5.5253 | 6.2928 | 6.8893 |
| 35 | 360 | 1.5436 | 6.3884 | 72.691 | 0.81926 | 5.5963 | 6.2928 | 7.1121 |
| 36 | 390 | 1.6728 | 6.3968 | 77.515 | 0.87247 | 5.6152 | 6.2928 | 7.1653 |
| 37 | 420 | 1.8053 | 6.4055 | 80.504 | 0.90489 | 5.6297 | 6.2928 | 7.1977 |
| 38 | 450 | 1.9362 | 6.414 | 83.425 | 0.93648 | 5.643 | 6.2928 | 7.2293 |
| 39 | 480 | 2.0654 | 6.4225 | 87.229 | 0.9779 | 5.6547 | 6.2928 | 7.2707 |
| 40 | 510 | 2.1962 | 6.4311 | 90.218 | 1.0101 | 5.6647 | 6.2928 | 7.3029 |
| 41 | 540 | 2.3254 | 6.4396 | 92.936 | 1.0391 | 5.6735 | 6.2928 | 7.3319 |
| 42 | 570 | 2.4563 | 6.4482 | 95.925 | 1.0711 | 5.6819 | 6.2928 | 7.3639 |
| 43 | 600 | 2.5855 | 6.4568 | 98.439 | 1.0977 | 5.6885 | 6.2928 | 7.3905 |
| 44 | 630 | 2.7163 | 6.4654 | 100.27 | 1.1167 | 5.6957 | 6.2928 | 7.4095 |
| 45 | 660 | 2.8489 | 6.4743 | 102.18 | 1.1363 | 5.7013 | 6.2928 | 7.4291 |
| 46 | 690 | 2.9781 | 6.4829 | 104.15 | 1.1567 | 5.7057 | 6.2928 | 7.4495 |
| 47 | 720 | 3.1089 | 6.4916 | 105.84 | 1.1739 | 5.7102 | 6.2928 | 7.4667 |
| 48 | 750 | 3.2381 | 6.5003 | 107.75 | 1.1934 | 5.7141 | 6.2928 | 7.4862 |
| 49 | 780 | 3.369 | 6.5091 | 109.72 | 1.2136 | 5.7169 | 6.2928 | 7.5064 |
| 50 | 810 | 3.4982 | 6.5178 | 111.55 | 1.2323 | 5.7191 | 6.2928 | 7.5251 |
| 51 | 840 | 3.6307 | 6.5268 | 112.37 | 1.2396 | 5.7202 | 6.2928 | 7.5324 |
| 52 | 870 | 3.7616 | 6.5357 | 112.91 | 1.2439 | 5.7213 | 6.2928 | 7.5367 |
| 53 | 900 | 3.8925 | 6.5446 | 114.34 | 1.2579 | 5.7218 | 6.2928 | 7.5507 |
| 54 | 930 | 4.0233 | 6.5535 | 115.56 | 1.2696 | 5.7218 | 6.2928 | 7.5624 |
| 55 | 960 | 4.1525 | 6.5623 | 116.99 | 1.2835 | 5.7213 | 6.2928 | 7.5763 |
| 56 | 990 | 4.2817 | 6.5712 | 118.21 | 1.2952 | 5.7207 | 6.2928 | 7.588 |
| 57 | 1020 | 4.4143 | 6.5803 | 118.96 | 1.3016 | 5.7196 | 6.2928 | 7.5944 |
| 58 | 1050 | 4.5418 | 6.5891 | 120.31 | 1.3147 | 5.7202 | 6.2928 | 7.6075 |
| 59 | 1080 | 4.6726 | 6.5981 | 121.13 | 1.3218 | 5.7202 | 6.2928 | 7.6146 |
| 60 | 1110 | 4.8018 | 6.6071 | 122.56 | 1.3355 | 5.7196 | 6.2928 | 7.6283 |
| 61 | 1140 | 4.931 | 6.6161 | 123.71 | 1.3463 | 5.7174 | 6.2928 | 7.6391 |
| 62 | 1170 | 5.0619 | 6.6252 | 125 | 1.3585 | 5.7146 | 6.2928 | 7.6513 |
| 63 | 1200 | 5.1928 | 6.6343 | 126.09 | 1.3684 | 5.7113 | 6.2928 | 7.6612 |
| 64 | 1230 | 5.322 | 6.6434 | 127.18 | 1.3783 | 5.708 | 6.2928 | 7.6711 |
| 65 | 1260 | 5.4545 | 6.6527 | 128.06 | 1.3859 | 5.7052 | 6.2928 | 7.6787 |
| 66 | 1290 | 5.5837 | 6.6618 | 128.81 | 1.3921 | 5.7019 | 6.2928 | 7.6849 |
| 67 | 1320 | 5.7129 | 6.6709 | 129.89 | 1.4019 | 5.6991 | 6.2928 | 7.6947 |
| 68 | 1350 | 5.8437 | 6.6802 | 130.71 | 1.4088 | 5.6957 | 6.2928 | 7.7016 |
| 69 | 1380 | 5.9746 | 6.6895 | 131.73 | 1.4178 | 5.6924 | 6.2928 | 7.7106 |
| 70 | 1410 | 6.1055 | 6.6988 | 133.15 | 1.4312 | 5.6896 | 6.2928 | 7.724 |
| 71 | 1440 | 6.2363 | 6.7082 | 134.85 | 1.4474 | 5.6869 | 6.2928 | 7.7402 |
| 72 | 1470 | 6.3655 | 6.7174 | 136.14 | 1.4592 | 5.683 | 6.2928 | 7.752 |
| 73 | 1500 | 6.4947 | 6.7267 | 138.38 | 1.4812 | 5.6796 | 6.2928 | 7.774 |
| 74 | 1530 | 6.6239 | 6.736 | 140.02 | 1.4966 | 5.6774 | 6.2928 | 7.7894 |
| 75 | 1560 | 6.7531 | 6.7453 | 140.15 | 1.496 | 5.6735 | 6.2928 | 7.7888 |
| 76 | 1590 | 6.884 | 6.7548 | 140.9 | 1.5018 | 5.6696 | 6.2928 | 7.7946 |
| 77 | 1620 | 7.0132 | 6.7642 | 141.24 | 1.5034 | 5.6669 | 6.2928 | 7.7962 |
| 78 | 1650 | 7.1407 | 6.7735 | 143.21 | 1.5223 | 5.6647 | 6.2928 | 7.8151 |
| 79 | 1680 | 7.2682 | 6.7828 | 142.94 | 1.5173 | 5.6624 | 6.2928 | 7.8101 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1710 | 7.3991 | 6.7924 | 144.57 | 1.5324 | 5.6597 | 6.2928 | 7.8252 |
| 81 | 1740 | 7.5299 | 6.802 | 144.91 | 1.5339 | 5.6585 | 6.2928 | 7.8267 |
| 82 | 1770 | 7.6641 | 6.8119 | 145.45 | 1.5374 | 5.6563 | 6.2928 | 7.8302 |
| 83 | 1800 | 7.7984 | 6.8218 | 144.97 | 1.5301 | 5.6547 | 6.2928 | 7.8229 |
| 84 | 1830 | 7.9292 | 6.8315 | 146.13 | 1.5401 | 5.6524 | 6.2928 | 7.8329 |
| 85 | 1860 | 8.0618 | 6.8414 | 147.01 | 1.5472 | 5.6497 | 6.2928 | 7.84 |
| 86 | 1890 | 8.1927 | 6.8511 | 146.81 | 1.5428 | 5.6463 | 6.2928 | 7.8356 |
| 87 | 1920 | 8.3235 | 6.8609 | 148.1 | 1.5542 | 5.6441 | 6.2928 | 7.847 |
| 88 | 1950 | 8.4527 | 6.8706 | 149.8 | 1.5698 | 5.6408 | 6.2928 | 7.8626 |
| 89 | 1980 | 8.5836 | 6.8804 | 149.39 | 1.5633 | 5.6386 | 6.2928 | 7.8561 |
| 90 | 2010 | 8.7128 | 6.8901 | 150.75 | 1.5753 | 5.6358 | 6.2928 | 7.8681 |
| 91 | 2040 | 8.842 | 6.8999 | 150.48 | 1.5702 | 5.6319 | 6.2928 | 7.863 |
| 92 | 2070 | 8.9695 | 6.9096 | 150.82 | 1.5716 | 5.6291 | 6.2928 | 7.8644 |
| 93 | 2100 | 9.0987 | 6.9194 | 151.63 | 1.5778 | 5.6263 | 6.2928 | 7.8706 |
| 94 | 2130 | 9.2295 | 6.9294 | 153.33 | 1.5932 | 5.6241 | 6.2928 | 7.886 |
| 95 | 2160 | 9.3604 | 6.9394 | 154.76 | 1.6057 | 5.6213 | 6.2928 | 7.8985 |
| 96 | 2190 | 9.4913 | 6.9494 | 156.66 | 1.6231 | 5.6191 | 6.2928 | 7.9159 |
| 97 | 2220 | 9.6238 | 6.9596 | 156.32 | 1.6172 | 5.6169 | 6.2928 | 7.91 |
| 98 | 2250 | 9.7547 | 6.9697 | 155.71 | 1.6085 | 5.6152 | 6.2928 | 7.9013 |
| 99 | 2280 | 9.8872 | 6.9799 | 155.5 | 1.6041 | 5.6119 | 6.2928 | 7.8969 |
| 100 | 2310 | 10.02 | 6.9902 | 155.3 | 1.5996 | 5.6097 | 6.2928 | 7.8924 |
| 101 | 2340 | 10.151 | 7.0004 | 155.71 | 1.6015 | 5.6069 | 6.2928 | 7.8943 |
| 102 | 2370 | 10.285 | 7.0109 | 156.18 | 1.604 | 5.6041 | 6.2928 | 7.8968 |
| 103 | 2400 | 10.417 | 7.0213 | 157.2 | 1.612 | 5.6008 | 6.2928 | 7.9048 |
| 104 | 2430 | 10.548 | 7.0315 | 157.75 | 1.6153 | 5.598 | 6.2928 | 7.9081 |
| 105 | 2460 | 10.681 | 7.042 | 157.75 | 1.6129 | 5.5963 | 6.2928 | 7.9057 |
| 106 | 2490 | 10.81 | 7.0522 | 158.22 | 1.6154 | 5.5925 | 6.2928 | 7.9082 |
| 107 | 2520 | 10.939 | 7.0624 | 158.97 | 1.6207 | 5.5886 | 6.2928 | 7.9135 |
| 108 | 2550 | 11.07 | 7.0728 | 159.78 | 1.6266 | 5.5858 | 6.2928 | 7.9194 |
| 109 | 2580 | 11.199 | 7.0831 | 160.26 | 1.6291 | 5.5825 | 6.2928 | 7.9219 |
| 110 | 2610 | 11.328 | 7.0934 | 161.14 | 1.6356 | 5.5797 | 6.2928 | 7.9284 |
| 111 | 2640 | 11.459 | 7.1039 | 159.85 | 1.6202 | 5.578 | 6.2928 | 7.913 |
| 112 | 2670 | 11.59 | 7.1144 | 160.6 | 1.6253 | 5.5752 | 6.2928 | 7.9181 |
| 113 | 2700 | 11.718 | 7.1247 | 164.95 | 1.6669 | 5.573 | 6.2928 | 7.9597 |
| 114 | 2730 | 11.852 | 7.1355 | 159.92 | 1.6137 | 5.5703 | 6.2928 | 7.9065 |
| 115 | 2760 | 11.983 | 7.1461 | 158.56 | 1.5976 | 5.5669 | 6.2928 | 7.8904 |
| 116 | 2790 | 12.112 | 7.1566 | 159.78 | 1.6075 | 5.5647 | 6.2928 | 7.9003 |
| 117 | 2820 | 12.243 | 7.1673 | 159.92 | 1.6065 | 5.5619 | 6.2928 | 7.8993 |
| 118 | 2850 | 12.375 | 7.1781 | 159.85 | 1.6034 | 5.5603 | 6.2928 | 7.8962 |
| 119 | 2880 | 12.506 | 7.1889 | 160.26 | 1.6051 | 5.558 | 6.2928 | 7.8979 |
| 120 | 2910 | 12.639 | 7.1998 | 160.06 | 1.6006 | 5.5541 | 6.2928 | 7.8934 |
| 121 | 2940 | 12.771 | 7.2107 | 160.4 | 1.6016 | 5.5525 | 6.2928 | 7.8944 |
| 122 | 2970 | 12.904 | 7.2217 | 160.19 | 1.5971 | 5.5497 | 6.2928 | 7.8899 |
| 123 | 3000 | 13.035 | 7.2326 | 160.33 | 1.5961 | 5.5475 | 6.2928 | 7.8889 |
| 124 | 3030 | 13.169 | 7.2438 | 160.74 | 1.5976 | 5.5458 | 6.2928 | 7.8904 |
| 125 | 3060 | 13.298 | 7.2545 | 160.87 | 1.5966 | 5.5442 | 6.2928 | 7.8894 |
| 126 | 3090 | 13.427 | 7.2654 | 160.87 | 1.5942 | 5.543 | 6.2928 | 7.887 |
| 127 | 3120 | 13.56 | 7.2765 | 161.62 | 1.5992 | 5.5403 | 6.2928 | 7.892 |
| 128 | 3150 | 13.689 | 7.2874 | 162.43 | 1.6049 | 5.5397 | 6.2928 | 7.8977 |
| 129 | 3180 | 13.818 | 7.2983 | 162.98 | 1.6078 | 5.538 | 6.2928 | 7.9006 |
| 130 | 3210 | 13.947 | 7.3093 | 162.84 | 1.6041 | 5.5369 | 6.2928 | 7.8969 |
| 131 | 3240 | 14.078 | 7.3204 | 163.39 | 1.607 | 5.5353 | 6.2928 | 7.8998 |
| 132 | 3270 | 14.208 | 7.3314 | 163.93 | 1.6099 | 5.5342 | 6.2928 | 7.9027 |
| 133 | 3300 | 14.338 | 7.3426 | 165.02 | 1.6181 | 5.533 | 6.2928 | 7.9109 |
| 134 | 3330 | 14.468 | 7.3537 | 164.4 | 1.6097 | 5.5319 | 6.2928 | 7.9025 |
| 135 | 3360 | 14.598 | 7.365 | 165.02 | 1.6132 | 5.5314 | 6.2928 | 7.906 |
| 136 | 3390 | 14.731 | 7.3765 | 165.15 | 1.612 | 5.5303 | 6.2928 | 7.9048 |
| 137 | 3420 | 14.864 | 7.3879 | 165.49 | 1.6128 | 5.5292 | 6.2928 | 7.9056 |
| 138 | 3450 | 14.994 | 7.3993 | 165.56 | 1.611 | 5.5275 | 6.2928 | 7.9038 |
| 139 | 3480 | 15.127 | 7.4109 | 165.42 | 1.6072 | 5.5258 | 6.2928 | 7.9 |
| 140 | 3510 | 15.261 | 7.4226 | 165.9 | 1.6092 | 5.5242 | 6.2928 | 7.902 |
| 141 | 3540 | 15.394 | 7.4342 | 166.31 | 1.6107 | 5.523 | 6.2928 | 7.9035 |
| 142 | 3570 | 15.525 | 7.4457 | 167.12 | 1.6161 | 5.5219 | 6.2928 | 7.9089 |
| 143 | 3600 | 15.655 | 7.4573 | 166.99 | 1.6122 | 5.5197 | 6.2928 | 7.905 |
| 144 | 3630 | 15.788 | 7.469 | 167.19 | 1.6117 | 5.5181 | 6.2928 | 7.9045 |
| 145 | 3660 | 15.916 | 7.4804 | 167.6 | 1.6132 | 5.5169 | 6.2928 | 7.906 |
| 146 | 3690 | 16.048 | 7.4922 | 168.55 | 1.6198 | 5.5153 | 6.2928 | 7.9126 |
| 147 | 3695.9 | 16.073 | 7.4944 | 168.96 | 1.6232 | 5.5158 | 6.2928 | 7.916 |

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3 " ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.41 in
Specimen Area: 6.29 in^2
Specimen Volume: 34.03 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.2928 | 6.2928 | 0 | 0.000 | 1.2529 | 1.2529 | 1.000 | 1.2529 | 0 |
| 2 | 0.02 | 6.4343 | 6.2928 | 0.071079 | 0.502 | 1.3233 | 1.1818 | 1.120 | 1.2525 | 0.070757 |
| 3 | 0.04 | 6.5182 | 6.2928 | 0.11883 | 0.527 | 1.3595 | 1.134 | 1.199 | 1.2468 | 0.11272 |
| 4 | 0.06 | 6.5835 | 6.2928 | 0.1566 | 0.539 | 1.3869 | 1.0963 | 1.265 | 1.2416 | 0.14534 |
| 5 | 0.08 | 6.6331 | 6.2928 | 0.18658 | 0.548 | 1.4066 | 1.0663 | 1.319 | 1.2365 | 0.17017 |
| 6 | 0.10 | 6.6781 | 6.2928 | 0.21268 | 0.552 | 1.4255 | 1.0402 | 1.370 | 1.2328 | 0.19267 |
| 7 | 0.12 | 6.5584 | 6.2928 | 0.18325 | 0.690 | 1.3352 | 1.0696 | 1.248 | 1.2024 | 0.13282 |
| 8 | 0.14 | 6.6772 | 6.2928 | 0.23045 | 0.600 | 1.4068 | 1.0224 | 1.376 | 1.2146 | 0.1922 |
| 9 | 0.16 | 6.7268 | 6.2928 | 0.25488 | 0.587 | 1.432 | 0.99798 | 1.435 | 1.215 | 0.217 |
| 10 | 0.19 | 6.6188 | 6.2928 | 0.22767 | 0.698 | 1.3512 | 1.0252 | 1.318 | 1.1882 | 0.16301 |
| 11 | 0.21 | 6.7189 | 6.2928 | 0.2671 | 0.627 | 1.4118 | 0.98576 | 1.432 | 1.1988 | 0.21303 |
| 12 | 0.23 | 6.5364 | 6.2928 | 0.21657 | 0.889 | 1.2799 | 1.0363 | 1.235 | 1.1581 | 0.12181 |
| 13 | 0.25 | 6.6853 | 6.2928 | 0.26988 | 0.688 | 1.3755 | 0.98299 | 1.399 | 1.1792 | 0.19626 |
| 14 | 0.30 | 6.6371 | 6.2928 | 0.26655 | 0.774 | 1.3306 | 0.98632 | 1.349 | 1.1585 | 0.17213 |
| 15 | 0.34 | 6.5648 | 6.2928 | 0.25599 | 0.941 | 1.2689 | 0.99687 | 1.273 | 1.1329 | 0.13602 |
| 16 | 0.38 | 6.7917 | 6.2928 | 0.33707 | 0.676 | 1.4147 | 0.9158 | 1.545 | 1.1653 | 0.24947 |
| 17 | 0.42 | 6.7729 | 6.2928 | 0.33929 | 0.707 | 1.3937 | 0.91357 | 1.526 | 1.1536 | 0.24006 |
| 18 | 0.46 | 6.7216 | 6.2928 | 0.33152 | 0.773 | 1.3502 | 0.92135 | 1.465 | 1.1358 | 0.21441 |
| 19 | 0.51 | 6.6069 | 6.2928 | 0.30597 | 0.974 | 1.261 | 0.94689 | 1.332 | 1.104 | 0.15706 |
| 20 | 0.55 | 6.8404 | 6.2928 | 0.38427 | 0.702 | 1.4161 | 0.86859 | 1.630 | 1.1424 | 0.27378 |
| 21 | 0.59 | 6.7713 | 6.2928 | 0.36872 | 0.771 | 1.3627 | 0.88414 | 1.541 | 1.1234 | 0.23926 |
| 22 | 0.64 | 6.6289 | 6.2928 | 0.33374 | 0.993 | 1.2552 | 0.91913 | 1.366 | 1.0872 | 0.16806 |
| 23 | 0.68 | 6.8837 | 6.2928 | 0.41148 | 0.696 | 1.4323 | 0.84138 | 1.702 | 1.1368 | 0.29543 |
| 24 | 0.72 | 6.7807 | 6.2928 | 0.38483 | 0.789 | 1.356 | 0.86804 | 1.562 | 1.112 | 0.24396 |
| 25 | 0.77 | 6.938 | 6.2928 | 0.43702 | 0.677 | 1.461 | 0.81584 | 1.791 | 1.1384 | 0.32258 |
| 26 | 0.81 | 6.8675 | 6.2928 | 0.42036 | 0.731 | 1.4072 | 0.8325 | 1.690 | 1.1198 | 0.28734 |
| 27 | 0.86 | 6.6444 | 6.2928 | 0.36317 | 1.033 | 1.2413 | 0.8897 | 1.395 | 1.0655 | 0.17579 |
| 28 | 0.90 | 6.924 | 6.2928 | 0.44646 | 0.707 | 1.4376 | 0.8064 | 1.783 | 1.122 | 0.3156 |
| 29 | 0.94 | 6.7319 | 6.2928 | 0.39649 | 0.903 | 1.2955 | 0.85638 | 1.513 | 1.0759 | 0.21955 |
| 30 | 0.98 | 6.9658 | 6.2928 | 0.46646 | 0.693 | 1.4594 | 0.78641 | 1.856 | 1.1229 | 0.3365 |
| 31 | 1.03 | 6.7685 | 6.2928 | 0.41537 | 0.873 | 1.3132 | 0.8375 | 1.568 | 1.0753 | 0.23783 |
| 32 | 1.15 | 7.0015 | 6.2928 | 0.49478 | 0.698 | 1.4668 | 0.75809 | 1.935 | 1.1125 | 0.35436 |
| 33 | 1.28 | 7.0697 | 6.2928 | 0.52365 | 0.674 | 1.5061 | 0.72921 | 2.065 | 1.1177 | 0.38845 |
| 34 | 1.42 | 6.8893 | 6.2928 | 0.48534 | 0.814 | 1.364 | 0.76753 | 1.777 | 1.0658 | 0.29823 |
| 35 | 1.54 | 7.1121 | 6.2928 | 0.55641 | 0.679 | 1.5157 | 0.69645 | 2.176 | 1.1061 | 0.40963 |
| 36 | 1.67 | 7.1653 | 6.2928 | 0.57529 | 0.659 | 1.55 | 0.67757 | 2.288 | 1.1138 | 0.43624 |
| 37 | 1.81 | 7.1977 | 6.2928 | 0.58973 | 0.652 | 1.568 | 0.66313 | 2.365 | 1.1156 | 0.45245 |
| 38 | 1.94 | 7.2293 | 6.2928 | 0.60306 | 0.644 | 1.5863 | 0.6498 | 2.441 | 1.118 | 0.46824 |
| 39 | 2.07 | 7.2707 | 6.2928 | 0.61472 | 0.629 | 1.616 | 0.63814 | 2.532 | 1.1271 | 0.48895 |
| 40 | 2.20 | 7.3029 | 6.2928 | 0.62472 | 0.618 | 1.6382 | 0.62815 | 2.608 | 1.1332 | 0.50503 |
| 41 | 2.33 | 7.3319 | 6.2928 | 0.6336 | 0.610 | 1.6584 | 0.61926 | 2.678 | 1.1388 | 0.51955 |
| 42 | 2.46 | 7.3639 | 6.2928 | 0.64193 | 0.599 | 1.682 | 0.61093 | 2.753 | 1.1465 | 0.53554 |
| 43 | 2.59 | 7.3905 | 6.2928 | 0.64859 | 0.591 | 1.702 | 0.60427 | 2.817 | 1.1531 | 0.54885 |
| 44 | 2.72 | 7.4095 | 6.2928 | 0.65581 | 0.587 | 1.7137 | 0.59705 | 2.870 | 1.1554 | 0.55833 |
| 45 | 2.85 | 7.4291 | 6.2928 | 0.66137 | 0.582 | 1.7278 | 0.5915 | 2.921 | 1.1596 | 0.56814 |
| 46 | 2.98 | 7.4495 | 6.2928 | 0.66581 | 0.576 | 1.7437 | 0.58706 | 2.970 | 1.1654 | 0.57833 |
| 47 | 3.11 | 7.4667 | 6.2928 | 0.67025 | 0.571 | 1.7565 | 0.58261 | 3.015 | 1.1696 | 0.58697 |
| 48 | 3.24 | 7.4862 | 6.2928 | 0.67414 | 0.565 | 1.7722 | 0.57873 | 3.062 | 1.1754 | 0.59672 |
| 49 | 3.37 | 7.5064 | 6.2928 | 0.67692 | 0.558 | 1.7896 | 0.57595 | 3.107 | 1.1828 | 0.60681 |
| 50 | 3.50 | 7.5251 | 6.2928 | 0.67914 | 0.551 | 1.806 | 0.57373 | 3.148 | 1.1899 | 0.61613 |
| 51 | 3.63 | 7.5324 | 6.2928 | 0.68025 | 0.549 | 1.8122 | 0.57262 | 3.165 | 1.1924 | 0.61978 |
| 52 | 3.76 | 7.5367 | 6.2928 | 0.68136 | 0.548 | 1.8154 | 0.57151 | 3.176 | 1.1934 | 0.62193 |
| 53 | 3.89 | 7.5507 | 6.2928 | 0.68191 | 0.542 | 1.8288 | 0.57095 | 3.203 | 1.1999 | 0.62893 |
| 54 | 4.02 | 7.5624 | 6.2928 | 0.68191 | 0.537 | 1.8405 | 0.57095 | 3.224 | 1.2057 | 0.63479 |
| 55 | 4.15 | 7.5763 | 6.2928 | 0.68136 | 0.531 | 1.855 | 0.57151 | 3.246 | 1.2133 | 0.64176 |
| 56 | 4.28 | 7.588 | 6.2928 | 0.6808 | 0.526 | 1.8673 | 0.57206 | 3.264 | 1.2197 | 0.6476 |
| 57 | 4.41 | 7.5944 | 6.2928 | 0.67969 | 0.522 | 1.8748 | 0.57317 | 3.271 | 1.224 | 0.65079 |
| 58 | 4.54 | 7.6075 | 6.2928 | 0.68025 | 0.517 | 1.8873 | 0.57262 | 3.296 | 1.23 | 0.65734 |
| 59 | 4.67 | 7.6146 | 6.2928 | 0.68025 | 0.515 | 1.8944 | 0.57262 | 3.308 | 1.2335 | 0.66089 |
| 60 | 4.80 | 7.6283 | 6.2928 | 0.67969 | 0.509 | 1.9087 | 0.57317 | 3.330 | 1.2409 | 0.66777 |
| 61 | 4.93 | 7.6391 | 6.2928 | 0.67747 | 0.503 | 1.9217 | 0.57539 | 3.340 | 1.2485 | 0.67315 |
| 62 | 5.06 | 7.6513 | 6.2928 | 0.67469 | 0.497 | 1.9366 | 0.57817 | 3.350 | 1.2574 | 0.67923 |
| 63 | 5.19 | 7.6612 | 6.2928 | 0.67136 | 0.491 | 1.9499 | 0.5815 | 3.353 | 1.2657 | 0.6842 |
| 64 | 5.32 | 7.6711 | 6.2928 | 0.66803 | 0.485 | 1.9631 | 0.58483 | 3.357 | 1.274 | 0.68915 |
| 65 | 5.45 | 7.6787 | 6.2928 | 0.66525 | 0.480 | 1.9735 | 0.58761 | 3.359 | 1.2806 | 0.69297 |
| 66 | 5.58 | 7.6849 | 6.2928 | 0.66192 | 0.475 | 1.9831 | 0.59094 | 3.356 | 1.287 | 0.69606 |
| 67 | 5.71 | 7.6947 | 6.2928 | 0.65915 | 0.470 | 1.9957 | 0.59372 | 3.361 | 1.2947 | 0.70097 |
| 68 | 5.84 | 7.7016 | 6.2928 | 0.65581 | 0.466 | 2.0058 | 0.59705 | 3.360 | 1.3014 | 0.70439 |
| 69 | 5.97 | 7.7106 | 6.2928 | 0.65248 | 0.460 | 2.0182 | 0.60038 | 3.361 | 1.3093 | 0.7089 |
| 70 | 6.11 | 7.724 | 6.2928 | 0.64971 | 0.454 | 2.0343 | 0.60316 | 3.373 | 1.3187 | 0.71558 |
| 71 | 6.24 | 7.7402 | 6.2928 | 0.64693 | 0.447 | 2.0533 | 0.60594 | 3.389 | 1.3296 | 0.7237 |
| 72 | 6.37 | 7.752 | 6.2928 | 0.64304 | 0.441 | 2.0691 | 0.60982 | 3.393 | 1.3394 | 0.72962 |
| 73 | 6.49 | 7.774 | 6.2928 | 0.63971 | 0.432 | 2.0944 | 0.61315 | 3.416 | 1.3538 | 0.74061 |
| 74 | 6.62 | 7.7894 | 6.2928 | 0.63749 | 0.426 | 2.112 | 0.61538 | 3.432 | 1.3637 | 0.7483 |
| 75 | 6.75 | 7.7888 | 6.2928 | 0.6336 | 0.424 | 2.1152 | 0.61926 | 3.416 | 1.3673 | 0.74799 |
| 76 | 6.88 | 7.7946 | 6.2928 | 0.62971 | 0.419 | 2.125 | 0.62315 | 3.410 | 1.3741 | 0.75092 |
| 77 | 7.01 | 7.7962 | 6.2928 | 0.62694 | 0.417 | 2.1293 | 0.62593 | 3.402 | 1.3776 | 0.75169 |
| 78 | 7.14 | 7.8151 | 6.2928 | 0.62472 | 0.410 | 2.1504 | 0.62815 | 3.423 | 1.3893 | 0.76113 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 7.27 | 7.8101 | 6.2928 | 0.6225 | 0.410 | 2.1476 | 0.63037 | 3.407 | 1.389 | 0.75864 |
| 80 | 7.40 | 7.8252 | 6.2928 | 0.61972 | 0.404 | 2.1656 | 0.63315 | 3.420 | 1.3994 | 0.76621 |
| 81 | 7.53 | 7.8267 | 6.2928 | 0.61861 | 0.403 | 2.1681 | 0.63426 | 3.418 | 1.4012 | 0.76693 |
| 82 | 7.66 | 7.8302 | 6.2928 | 0.61639 | 0.401 | 2.1738 | 0.63648 | 3.415 | 1.4052 | 0.76868 |
| 83 | 7.80 | 7.8229 | 6.2928 | 0.61472 | 0.402 | 2.1683 | 0.63814 | 3.398 | 1.4032 | 0.76506 |
| 84 | 7.93 | 7.8329 | 6.2928 | 0.6125 | 0.398 | 2.1805 | 0.64036 | 3.405 | 1.4104 | 0.77006 |
| 85 | 8.06 | 7.84 | 6.2928 | 0.60972 | 0.394 | 2.1903 | 0.64314 | 3.406 | 1.4167 | 0.7736 |
| 86 | 8.19 | 7.8356 | 6.2928 | 0.60639 | 0.393 | 2.1893 | 0.64647 | 3.387 | 1.4179 | 0.77142 |
| 87 | 8.32 | 7.847 | 6.2928 | 0.60417 | 0.389 | 2.2029 | 0.64869 | 3.396 | 1.4258 | 0.7771 |
| 88 | 8.45 | 7.8626 | 6.2928 | 0.60084 | 0.383 | 2.2218 | 0.65203 | 3.408 | 1.4369 | 0.7849 |
| 89 | 8.58 | 7.8561 | 6.2928 | 0.59862 | 0.383 | 2.2175 | 0.65425 | 3.389 | 1.4359 | 0.78165 |
| 90 | 8.71 | 7.8681 | 6.2928 | 0.59584 | 0.378 | 2.2323 | 0.65702 | 3.398 | 1.4447 | 0.78764 |
| 91 | 8.84 | 7.863 | 6.2928 | 0.59195 | 0.377 | 2.2311 | 0.66091 | 3.376 | 1.446 | 0.78511 |
| 92 | 8.97 | 7.8644 | 6.2928 | 0.58918 | 0.375 | 2.2352 | 0.66369 | 3.368 | 1.4495 | 0.78578 |
| 93 | 9.10 | 7.8706 | 6.2928 | 0.5864 | 0.372 | 2.2443 | 0.66646 | 3.367 | 1.4554 | 0.78891 |
| 94 | 9.23 | 7.886 | 6.2928 | 0.58418 | 0.367 | 2.2619 | 0.66869 | 3.383 | 1.4653 | 0.79659 |
| 95 | 9.36 | 7.8985 | 6.2928 | 0.5814 | 0.362 | 2.2772 | 0.67146 | 3.391 | 1.4743 | 0.80285 |
| 96 | 9.49 | 7.9159 | 6.2928 | 0.57918 | 0.357 | 2.2968 | 0.67368 | 3.409 | 1.4852 | 0.81154 |
| 97 | 9.62 | 7.91 | 6.2928 | 0.57696 | 0.357 | 2.2931 | 0.6759 | 3.393 | 1.4845 | 0.8086 |
| 98 | 9.75 | 7.9013 | 6.2928 | 0.57529 | 0.358 | 2.2861 | 0.67757 | 3.374 | 1.4818 | 0.80427 |
| 99 | 9.89 | 7.8969 | 6.2928 | 0.57196 | 0.357 | 2.285 | 0.6809 | 3.356 | 1.4829 | 0.80204 |
| 100 | 10.02 | 7.8924 | 6.2928 | 0.56974 | 0.356 | 2.2827 | 0.68312 | 3.342 | 1.4829 | 0.79981 |
| 101 | 10.15 | 7.8943 | 6.2928 | 0.56696 | 0.354 | 2.2874 | 0.6859 | 3.335 | 1.4866 | 0.80074 |
| 102 | 10.28 | 7.8968 | 6.2928 | 0.56419 | 0.352 | 2.2926 | 0.68868 | 3.329 | 1.4907 | 0.80198 |
| 103 | 10.42 | 7.9048 | 6.2928 | 0.56086 | 0.348 | 2.3041 | 0.69201 | 3.330 | 1.498 | 0.80602 |
| 104 | 10.55 | 7.9081 | 6.2928 | 0.55808 | 0.346 | 2.31 | 0.69478 | 3.325 | 1.5024 | 0.80763 |
| 105 | 10.68 | 7.9057 | 6.2928 | 0.55641 | 0.345 | 2.3093 | 0.69645 | 3.316 | 1.5029 | 0.80643 |
| 106 | 10.81 | 7.9082 | 6.2928 | 0.55253 | 0.342 | 2.3157 | 0.70034 | 3.307 | 1.508 | 0.80769 |
| 107 | 10.94 | 7.9135 | 6.2928 | 0.54864 | 0.339 | 2.3249 | 0.70422 | 3.301 | 1.5146 | 0.81033 |
| 108 | 11.07 | 7.9194 | 6.2928 | 0.54586 | 0.336 | 2.3336 | 0.707 | 3.301 | 1.5203 | 0.81329 |
| 109 | 11.20 | 7.9219 | 6.2928 | 0.54253 | 0.333 | 2.3394 | 0.71033 | 3.293 | 1.5249 | 0.81453 |
| 110 | 11.33 | 7.9284 | 6.2928 | 0.53976 | 0.330 | 2.3488 | 0.71311 | 3.294 | 1.5309 | 0.81782 |
| 111 | 11.46 | 7.913 | 6.2928 | 0.53809 | 0.332 | 2.3349 | 0.71478 | 3.267 | 1.5249 | 0.81008 |
| 112 | 11.59 | 7.9181 | 6.2928 | 0.53531 | 0.329 | 2.3429 | 0.71755 | 3.265 | 1.5302 | 0.81266 |
| 113 | 11.72 | 7.9597 | 6.2928 | 0.53309 | 0.320 | 2.3867 | 0.71977 | 3.316 | 1.5532 | 0.83346 |
| 114 | 11.85 | 7.9065 | 6.2928 | 0.53031 | 0.329 | 2.3362 | 0.72255 | 3.233 | 1.5294 | 0.80683 |
| 115 | 11.98 | 7.8904 | 6.2928 | 0.52698 | 0.330 | 2.3235 | 0.72588 | 3.201 | 1.5247 | 0.79878 |
| 116 | 12.11 | 7.9003 | 6.2928 | 0.52476 | 0.326 | 2.3356 | 0.7281 | 3.208 | 1.5319 | 0.80376 |
| 117 | 12.24 | 7.8993 | 6.2928 | 0.52199 | 0.325 | 2.3374 | 0.73088 | 3.198 | 1.5341 | 0.80325 |
| 118 | 12.38 | 7.8962 | 6.2928 | 0.52032 | 0.325 | 2.3359 | 0.73255 | 3.189 | 1.5342 | 0.8017 |
| 119 | 12.51 | 7.8979 | 6.2928 | 0.5181 | 0.323 | 2.3398 | 0.73477 | 3.184 | 1.5373 | 0.80254 |
| 120 | 12.64 | 7.8934 | 6.2928 | 0.51421 | 0.321 | 2.3393 | 0.73865 | 3.167 | 1.539 | 0.8003 |
| 121 | 12.77 | 7.8944 | 6.2928 | 0.51255 | 0.320 | 2.3419 | 0.74032 | 3.163 | 1.5411 | 0.80079 |
| 122 | 12.90 | 7.8899 | 6.2928 | 0.50977 | 0.319 | 2.3402 | 0.7431 | 3.149 | 1.5416 | 0.79855 |
| 123 | 13.03 | 7.8889 | 6.2928 | 0.50755 | 0.318 | 2.3414 | 0.74532 | 3.141 | 1.5433 | 0.79803 |
| 124 | 13.17 | 7.8904 | 6.2928 | 0.50588 | 0.317 | 2.3446 | 0.74698 | 3.139 | 1.5458 | 0.79882 |
| 125 | 13.30 | 7.8894 | 6.2928 | 0.50422 | 0.316 | 2.3453 | 0.74865 | 3.133 | 1.547 | 0.79831 |
| 126 | 13.43 | 7.887 | 6.2928 | 0.50311 | 0.316 | 2.344 | 0.74976 | 3.126 | 1.5469 | 0.79712 |
| 127 | 13.56 | 7.892 | 6.2928 | 0.50033 | 0.313 | 2.3517 | 0.75254 | 3.125 | 1.5521 | 0.7996 |
| 128 | 13.69 | 7.8977 | 6.2928 | 0.49977 | 0.311 | 2.3579 | 0.75309 | 3.131 | 1.5555 | 0.80243 |
| 129 | 13.82 | 7.9006 | 6.2928 | 0.49811 | 0.310 | 2.3626 | 0.75476 | 3.130 | 1.5587 | 0.80391 |
| 130 | 13.95 | 7.8969 | 6.2928 | 0.497 | 0.310 | 2.3599 | 0.75587 | 3.122 | 1.5579 | 0.80203 |
| 131 | 14.08 | 7.8998 | 6.2928 | 0.49533 | 0.308 | 2.3645 | 0.75753 | 3.121 | 1.561 | 0.80349 |
| 132 | 14.21 | 7.9027 | 6.2928 | 0.49422 | 0.307 | 2.3685 | 0.75864 | 3.122 | 1.5636 | 0.80495 |
| 133 | 14.34 | 7.9109 | 6.2928 | 0.49311 | 0.305 | 2.3779 | 0.75975 | 3.130 | 1.5688 | 0.80905 |
| 134 | 14.47 | 7.9025 | 6.2928 | 0.492 | 0.306 | 2.3705 | 0.76087 | 3.116 | 1.5657 | 0.80484 |
| 135 | 14.60 | 7.906 | 6.2928 | 0.49144 | 0.305 | 2.3746 | 0.76142 | 3.119 | 1.568 | 0.80659 |
| 136 | 14.73 | 7.9048 | 6.2928 | 0.49033 | 0.304 | 2.3745 | 0.76253 | 3.114 | 1.5685 | 0.806 |
| 137 | 14.86 | 7.9056 | 6.2928 | 0.48922 | 0.303 | 2.3765 | 0.76364 | 3.112 | 1.57 | 0.80641 |
| 138 | 14.99 | 7.9038 | 6.2928 | 0.48756 | 0.303 | 2.3763 | 0.76531 | 3.105 | 1.5708 | 0.8055 |
| 139 | 15.13 | 7.9 | 6.2928 | 0.48589 | 0.302 | 2.3741 | 0.76697 | 3.095 | 1.5706 | 0.80358 |
| 140 | 15.26 | 7.902 | 6.2928 | 0.48422 | 0.301 | 2.3779 | 0.76864 | 3.094 | 1.5733 | 0.80462 |
| 141 | 15.39 | 7.9035 | 6.2928 | 0.48311 | 0.300 | 2.3804 | 0.76975 | 3.092 | 1.5751 | 0.80533 |
| 142 | 15.52 | 7.9089 | 6.2928 | 0.482 | 0.298 | 2.3869 | 0.77086 | 3.096 | 1.5789 | 0.80803 |
| 143 | 15.66 | 7.905 | 6.2928 | 0.47978 | 0.298 | 2.3853 | 0.77308 | 3.085 | 1.5792 | 0.80612 |
| 144 | 15.79 | 7.9045 | 6.2928 | 0.47812 | 0.297 | 2.3864 | 0.77475 | 3.080 | 1.5806 | 0.80584 |
| 145 | 15.92 | 7.906 | 6.2928 | 0.47701 | 0.296 | 2.389 | 0.77586 | 3.079 | 1.5824 | 0.80658 |
| 146 | 16.05 | 7.9126 | 6.2928 | 0.47534 | 0.293 | 2.3973 | 0.77752 | 3.083 | 1.5874 | 0.80988 |
| 147 | 16.07 | 7.916 | 6.2928 | 0.4759 | 0.293 | 2.4002 | 0.77697 | 3.089 | 1.5886 | 0.81159 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.93 in
Specimen Area: 5.37 in^2
Specimen Volume: 31.88 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5.3738 | 0 | 0 | 5.042 | 6.84 | 6.84 |
| 2 | 5 | 0.017296 | 5.3747 | 9.9129 | 0.13279 | 5.1121 | 6.84 | 6.9728 |
| 3 | 10 | 0.036033 | 5.3757 | 12.588 | 0.16859 | 5.1464 | 6.84 | 7.0086 |
| 4 | 15 | 0.054771 | 5.3767 | 13.427 | 0.1798 | 5.167 | 6.84 | 7.0198 |
| 5 | 20 | 0.073508 | 5.3778 | 13.847 | 0.18538 | 5.1822 | 6.84 | 7.0254 |
| 6 | 25 | 0.092245 | 5.3788 | 14.319 | 0.19167 | 5.1958 | 6.84 | 7.0317 |
| 7 | 30.001 | 0.11242 | 5.3799 | 14.843 | 0.19865 | 5.2083 | 6.84 | 7.0386 |
| 8 | 35.001 | 0.13116 | 5.3809 | 15.945 | 0.21335 | 5.2214 | 6.84 | 7.0533 |
| 9 | 40.001 | 0.15134 | 5.3819 | 17.046 | 0.22804 | 5.2344 | 6.84 | 7.068 |
| 10 | 45.001 | 0.17152 | 5.383 | 18.515 | 0.24764 | 5.2485 | 6.84 | 7.0876 |
| 11 | 50.001 | 0.19026 | 5.384 | 19.931 | 0.26653 | 5.2632 | 6.84 | 7.1065 |
| 12 | 55.001 | 0.20899 | 5.3851 | 21.189 | 0.28331 | 5.2768 | 6.84 | 7.1233 |
| 13 | 60.001 | 0.22773 | 5.3861 | 22.553 | 0.30149 | 5.2898 | 6.84 | 7.1415 |
| 14 | 70.001 | 0.26521 | 5.3881 | 29.739 | 0.39739 | 5.3404 | 6.84 | 7.2374 |
| 15 | 80.001 | 0.30124 | 5.39 | 35.088 | 0.46871 | 5.3887 | 6.84 | 7.3087 |
| 16 | 90.002 | 0.34015 | 5.3921 | 39.127 | 0.52245 | 5.4322 | 6.84 | 7.3625 |
| 17 | 100 | 0.37907 | 5.3943 | 42.746 | 0.57055 | 5.4703 | 6.84 | 7.4106 |
| 18 | 110 | 0.41799 | 5.3964 | 45.788 | 0.61092 | 5.5056 | 6.84 | 7.4509 |
| 19 | 120 | 0.45546 | 5.3984 | 48.463 | 0.64637 | 5.5376 | 6.84 | 7.4864 |
| 20 | 130 | 0.49582 | 5.4006 | 51.138 | 0.68177 | 5.5664 | 6.84 | 7.5218 |
| 21 | 140 | 0.53473 | 5.4027 | 53.498 | 0.71295 | 5.5925 | 6.84 | 7.553 |
| 22 | 150 | 0.57365 | 5.4048 | 55.439 | 0.73853 | 5.6175 | 6.84 | 7.5785 |
| 23 | 160 | 0.61401 | 5.407 | 57.274 | 0.76267 | 5.6393 | 6.84 | 7.6027 |
| 24 | 170 | 0.65292 | 5.4091 | 58.9 | 0.78401 | 5.6594 | 6.84 | 7.624 |
| 25 | 180 | 0.69184 | 5.4112 | 60.474 | 0.80464 | 5.6789 | 6.84 | 7.6446 |
| 26 | 190 | 0.7322 | 5.4134 | 61.837 | 0.82245 | 5.6974 | 6.84 | 7.6625 |
| 27 | 200 | 0.77111 | 5.4156 | 63.306 | 0.84166 | 5.7132 | 6.84 | 7.6817 |
| 28 | 210 | 0.81147 | 5.4178 | 63.935 | 0.84968 | 5.7284 | 6.84 | 7.6897 |
| 29 | 220 | 0.85039 | 5.4199 | 65.824 | 0.87443 | 5.7431 | 6.84 | 7.7144 |
| 30 | 230 | 0.8893 | 5.422 | 67.082 | 0.8908 | 5.7566 | 6.84 | 7.7308 |
| 31 | 240 | 0.92966 | 5.4242 | 68.131 | 0.90436 | 5.7697 | 6.84 | 7.7444 |
| 32 | 270 | 1.0493 | 5.4308 | 71.121 | 0.9429 | 5.8034 | 6.84 | 7.7829 |
| 33 | 300 | 1.1689 | 5.4374 | 73.639 | 0.9751 | 5.8306 | 6.84 | 7.8151 |
| 34 | 330 | 1.2871 | 5.4439 | 75.999 | 1.0052 | 5.8545 | 6.84 | 7.8452 |
| 35 | 360 | 1.4053 | 5.4504 | 77.939 | 1.0296 | 5.8746 | 6.84 | 7.8696 |
| 36 | 390 | 1.5235 | 5.4569 | 79.775 | 1.0526 | 5.8925 | 6.84 | 7.8926 |
| 37 | 420 | 1.6417 | 5.4635 | 81.611 | 1.0755 | 5.9083 | 6.84 | 7.9155 |
| 38 | 450 | 1.7599 | 5.4701 | 83.184 | 1.0949 | 5.9219 | 6.84 | 7.9349 |
| 39 | 480 | 1.8781 | 5.4767 | 84.653 | 1.1129 | 5.9333 | 6.84 | 7.9529 |
| 40 | 510 | 1.9977 | 5.4833 | 86.174 | 1.1315 | 5.9441 | 6.84 | 7.9715 |
| 41 | 540 | 2.1159 | 5.49 | 87.538 | 1.148 | 5.9534 | 6.84 | 7.988 |
| 42 | 570 | 2.2326 | 5.4965 | 88.849 | 1.1638 | 5.9615 | 6.84 | 8.0038 |
| 43 | 600 | 2.3494 | 5.5031 | 90.265 | 1.181 | 5.9675 | 6.84 | 8.021 |
| 44 | 630 | 2.4704 | 5.5099 | 91.838 | 1.2001 | 5.974 | 6.84 | 8.0401 |
| 45 | 660 | 2.5872 | 5.5165 | 93.097 | 1.2151 | 5.9805 | 6.84 | 8.0551 |
| 46 | 690 | 2.7068 | 5.5233 | 94.146 | 1.2273 | 5.9843 | 6.84 | 8.0673 |
| 47 | 720 | 2.8236 | 5.5299 | 95.667 | 1.2456 | 5.9876 | 6.84 | 8.0856 |
| 48 | 750 | 2.9418 | 5.5367 | 96.821 | 1.2591 | 5.992 | 6.84 | 8.0991 |
| 49 | 780 | 3.0599 | 5.5434 | 97.818 | 1.2705 | 5.9952 | 6.84 | 8.1105 |
| 50 | 810 | 3.1781 | 5.5502 | 99.129 | 1.2859 | 5.9979 | 6.84 | 8.1259 |
| 51 | 840 | 3.2934 | 5.5568 | 99.968 | 1.2953 | 6.0001 | 6.84 | 8.1353 |
| 52 | 870 | 3.4102 | 5.5635 | 101.02 | 1.3073 | 6.0034 | 6.84 | 8.1473 |
| 53 | 900 | 3.5284 | 5.5703 | 101.86 | 1.3166 | 6.0045 | 6.84 | 8.1566 |
| 54 | 930 | 3.6451 | 5.5771 | 102.96 | 1.3292 | 6.0061 | 6.84 | 8.1692 |
| 55 | 960 | 3.7633 | 5.5839 | 104.01 | 1.3411 | 6.0072 | 6.84 | 8.1811 |
| 56 | 990 | 3.883 | 5.5909 | 104.95 | 1.3516 | 6.0083 | 6.84 | 8.1916 |
| 57 | 1020 | 3.9997 | 5.5977 | 105.95 | 1.3627 | 6.0093 | 6.84 | 8.2027 |
| 58 | 1050 | 4.1179 | 5.6046 | 106.89 | 1.3732 | 6.011 | 6.84 | 8.2132 |
| 59 | 1080 | 4.2346 | 5.6114 | 107.99 | 1.3857 | 6.011 | 6.84 | 8.2257 |
| 60 | 1110 | 4.3514 | 5.6183 | 108.83 | 1.3947 | 6.0126 | 6.84 | 8.2347 |
| 61 | 1140 | 4.4681 | 5.6251 | 109.46 | 1.4011 | 6.0131 | 6.84 | 8.2411 |
| 62 | 1170 | 4.5849 | 5.632 | 110.25 | 1.4094 | 6.0148 | 6.84 | 8.2494 |
| 63 | 1200 | 4.7045 | 5.6391 | 111.14 | 1.419 | 6.0142 | 6.84 | 8.259 |
| 64 | 1230 | 4.8213 | 5.646 | 112.03 | 1.4287 | 6.0126 | 6.84 | 8.2687 |
| 65 | 1260 | 4.9438 | 5.6533 | 112.98 | 1.4388 | 6.0131 | 6.84 | 8.2788 |
| 66 | 1290 | 5.0576 | 5.6601 | 113.81 | 1.4478 | 6.0115 | 6.84 | 8.2878 |
| 67 | 1320 | 5.1744 | 5.667 | 114.97 | 1.4607 | 6.0104 | 6.84 | 8.3007 |
| 68 | 1350 | 5.294 | 5.6742 | 115.81 | 1.4695 | 6.0093 | 6.84 | 8.3095 |
| 69 | 1380 | 5.4093 | 5.6811 | 116.8 | 1.4803 | 6.0088 | 6.84 | 8.3203 |
| 70 | 1410 | 5.5261 | 5.6881 | 117.91 | 1.4924 | 6.0077 | 6.84 | 8.3324 |
| 71 | 1440 | 5.6443 | 5.6953 | 118.95 | 1.5038 | 6.005 | 6.84 | 8.3438 |
| 72 | 1470 | 5.7596 | 5.7022 | 120.06 | 1.5159 | 6.0028 | 6.84 | 8.3559 |
| 73 | 1500 | 5.8763 | 5.7093 | 120.95 | 1.5253 | 6.0023 | 6.84 | 8.3653 |
| 74 | 1530 | 5.9945 | 5.7165 | 121.94 | 1.5359 | 6.0012 | 6.84 | 8.3759 |
| 75 | 1560 | 6.1141 | 5.7238 | 122.84 | 1.5452 | 5.999 | 6.84 | 8.3852 |
| 76 | 1590 | 6.2309 | 5.7309 | 123.94 | 1.5571 | 5.9941 | 6.84 | 8.3971 |
| 77 | 1620 | 6.3491 | 5.7381 | 124.93 | 1.5676 | 5.9914 | 6.84 | 8.4076 |
| 78 | 1650 | 6.4673 | 5.7454 | 125.83 | 1.5768 | 5.9892 | 6.84 | 8.4168 |
| 79 | 1680 | 6.5854 | 5.7526 | 126.87 | 1.588 | 5.9882 | 6.84 | 8.428 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1710 | 6.7036 | 5.7599 | 128.13 | 1.6017 | 5.9849 | 6.84 | 8.4417 |
| 81 | 1740 | 6.8204 | 5.7671 | 128.92 | 1.6095 | 5.9816 | 6.84 | 8.4495 |
| 82 | 1770 | 6.9386 | 5.7745 | 130.02 | 1.6212 | 5.9784 | 6.84 | 8.4612 |
| 83 | 1800 | 7.0582 | 5.7819 | 131.33 | 1.6354 | 5.9746 | 6.84 | 8.4754 |
| 84 | 1830 | 7.1793 | 5.7894 | 132.43 | 1.647 | 5.9713 | 6.84 | 8.487 |
| 85 | 1860 | 7.2946 | 5.7966 | 133.48 | 1.658 | 5.9686 | 6.84 | 8.498 |
| 86 | 1890 | 7.4099 | 5.8039 | 134.58 | 1.6696 | 5.9659 | 6.84 | 8.5096 |
| 87 | 1920 | 7.5252 | 5.8111 | 135.27 | 1.676 | 5.9621 | 6.84 | 8.516 |
| 88 | 1950 | 7.6405 | 5.8184 | 136.05 | 1.6836 | 5.9593 | 6.84 | 8.5236 |
| 89 | 1980 | 7.7558 | 5.8256 | 136.84 | 1.6912 | 5.9566 | 6.84 | 8.5312 |
| 90 | 2010 | 7.8726 | 5.833 | 138.05 | 1.704 | 5.9528 | 6.84 | 8.544 |
| 91 | 2040 | 7.9893 | 5.8404 | 139.25 | 1.7167 | 5.949 | 6.84 | 8.5567 |
| 92 | 2070 | 8.1075 | 5.8479 | 140.14 | 1.7255 | 5.9458 | 6.84 | 8.5655 |
| 93 | 2100 | 8.2228 | 5.8553 | 140.98 | 1.7336 | 5.942 | 6.84 | 8.5736 |
| 94 | 2130 | 8.3396 | 5.8627 | 141.87 | 1.7424 | 5.9387 | 6.84 | 8.5824 |
| 95 | 2160 | 8.4577 | 5.8703 | 143.03 | 1.7543 | 5.9338 | 6.84 | 8.5943 |
| 96 | 2190 | 8.5745 | 5.8778 | 144.08 | 1.7649 | 5.93 | 6.84 | 8.6049 |
| 97 | 2220 | 8.6956 | 5.8856 | 145.44 | 1.7792 | 5.9267 | 6.84 | 8.6192 |
| 98 | 2250 | 8.8123 | 5.8931 | 146.81 | 1.7936 | 5.9229 | 6.84 | 8.6336 |
| 99 | 2280 | 8.9305 | 5.9008 | 147.7 | 1.8022 | 5.9191 | 6.84 | 8.6422 |
| 100 | 2310 | 9.0516 | 5.9086 | 148.17 | 1.8055 | 5.9153 | 6.84 | 8.6455 |
| 101 | 2340 | 9.1683 | 5.9162 | 149.11 | 1.8147 | 5.911 | 6.84 | 8.6547 |
| 102 | 2370 | 9.2865 | 5.9239 | 149.79 | 1.8206 | 5.9066 | 6.84 | 8.6606 |
| 103 | 2400 | 9.4033 | 5.9316 | 150.42 | 1.8259 | 5.9028 | 6.84 | 8.6659 |
| 104 | 2430 | 9.5214 | 5.9393 | 151.42 | 1.8356 | 5.899 | 6.84 | 8.6756 |
| 105 | 2460 | 9.6382 | 5.947 | 152.78 | 1.8498 | 5.8958 | 6.84 | 8.6898 |
| 106 | 2490 | 9.7549 | 5.9547 | 153.62 | 1.8575 | 5.892 | 6.84 | 8.6975 |
| 107 | 2520 | 9.8731 | 5.9625 | 154.36 | 1.8639 | 5.8871 | 6.84 | 8.7039 |
| 108 | 2550 | 9.9884 | 5.9701 | 155.56 | 1.8761 | 5.8827 | 6.84 | 8.7161 |
| 109 | 2580 | 10.107 | 5.978 | 156.77 | 1.8882 | 5.8778 | 6.84 | 8.7282 |
| 110 | 2610 | 10.222 | 5.9857 | 158.08 | 1.9015 | 5.8729 | 6.84 | 8.7415 |
| 111 | 2640 | 10.343 | 5.9937 | 158.71 | 1.9065 | 5.8686 | 6.84 | 8.7465 |
| 112 | 2670 | 10.46 | 6.0015 | 159.76 | 1.9166 | 5.8653 | 6.84 | 8.7566 |
| 113 | 2700 | 10.578 | 6.0095 | 160.28 | 1.9204 | 5.8604 | 6.84 | 8.7604 |
| 114 | 2730 | 10.695 | 6.0173 | 161.49 | 1.9323 | 5.8556 | 6.84 | 8.7723 |
| 115 | 2760 | 10.813 | 6.0253 | 162.17 | 1.9379 | 5.8512 | 6.84 | 8.7779 |
| 116 | 2790 | 10.931 | 6.0333 | 163.01 | 1.9453 | 5.8469 | 6.84 | 8.7853 |
| 117 | 2820 | 11.049 | 6.0413 | 163.9 | 1.9534 | 5.8425 | 6.84 | 8.7934 |
| 118 | 2850 | 11.167 | 6.0494 | 164.74 | 1.9608 | 5.8392 | 6.84 | 8.8008 |
| 119 | 2880 | 11.284 | 6.0573 | 165.58 | 1.9682 | 5.8349 | 6.84 | 8.8082 |
| 120 | 2910 | 11.404 | 6.0655 | 166.37 | 1.9749 | 5.8289 | 6.84 | 8.8149 |
| 121 | 2940 | 11.519 | 6.0734 | 167.47 | 1.9854 | 5.8235 | 6.84 | 8.8254 |
| 122 | 2970 | 11.637 | 6.0815 | 168.57 | 1.9957 | 5.8197 | 6.84 | 8.8357 |
| 123 | 3000 | 11.754 | 6.0896 | 169.46 | 2.0036 | 5.8159 | 6.84 | 8.8436 |
| 124 | 3030 | 11.872 | 6.0977 | 170.2 | 2.0096 | 5.8115 | 6.84 | 8.8496 |
| 125 | 3060 | 11.992 | 6.106 | 171.14 | 2.018 | 5.8072 | 6.84 | 8.858 |
| 126 | 3090 | 12.107 | 6.114 | 171.88 | 2.024 | 5.8018 | 6.84 | 8.864 |
| 127 | 3120 | 12.224 | 6.1222 | 172.56 | 2.0294 | 5.7963 | 6.84 | 8.8694 |
| 128 | 3150 | 12.344 | 6.1305 | 173.66 | 2.0395 | 5.792 | 6.84 | 8.8795 |
| 129 | 3180 | 12.46 | 6.1387 | 174.13 | 2.0424 | 5.7865 | 6.84 | 8.8824 |
| 130 | 3210 | 12.577 | 6.1469 | 175.23 | 2.0525 | 5.7827 | 6.84 | 8.8925 |
| 131 | 3240 | 12.694 | 6.1551 | 176.28 | 2.0621 | 5.7778 | 6.84 | 8.9021 |
| 132 | 3270 | 12.813 | 6.1636 | 177.17 | 2.0697 | 5.7729 | 6.84 | 8.9097 |
| 133 | 3300 | 12.932 | 6.1719 | 177.8 | 2.0742 | 5.7681 | 6.84 | 8.9142 |
| 134 | 3330 | 13.05 | 6.1803 | 178.69 | 2.0818 | 5.7632 | 6.84 | 8.9218 |
| 135 | 3360 | 13.172 | 6.189 | 179.59 | 2.0892 | 5.7583 | 6.84 | 8.9292 |
| 136 | 3390 | 13.288 | 6.1973 | 180.27 | 2.0944 | 5.7528 | 6.84 | 8.9344 |
| 137 | 3420 | 13.412 | 6.2061 | 180.84 | 2.098 | 5.7474 | 6.84 | 8.938 |
| 138 | 3450 | 13.527 | 6.2144 | 181.89 | 2.1074 | 5.7414 | 6.84 | 8.9474 |
| 139 | 3480 | 13.644 | 6.2228 | 182.68 | 2.1137 | 5.7371 | 6.84 | 8.9537 |
| 140 | 3510 | 13.763 | 6.2315 | 183.52 | 2.1204 | 5.7316 | 6.84 | 8.9604 |
| 141 | 3540 | 13.88 | 6.2399 | 184.36 | 2.1272 | 5.7273 | 6.84 | 8.9672 |
| 142 | 3570 | 13.998 | 6.2485 | 185.56 | 2.1382 | 5.723 | 6.84 | 8.9782 |
| 143 | 3600 | 14.118 | 6.2572 | 186.14 | 2.1419 | 5.7175 | 6.84 | 8.9819 |
| 144 | 3630 | 14.237 | 6.2659 | 186.93 | 2.1479 | 5.7121 | 6.84 | 8.9879 |
| 145 | 3660 | 14.348 | 6.274 | 188.03 | 2.1578 | 5.7072 | 6.84 | 8.9978 |
| 146 | 3690 | 14.465 | 6.2826 | 188.82 | 2.1639 | 5.7018 | 6.84 | 9.0039 |
| 147 | 3720 | 14.581 | 6.2911 | 189.76 | 2.1718 | 5.6963 | 6.84 | 9.0118 |
| 148 | 3750 | 14.702 | 6.3 | 190.55 | 2.1777 | 5.6925 | 6.84 | 9.0177 |
| 149 | 3780 | 14.814 | 6.3083 | 191.39 | 2.1844 | 5.6871 | 6.84 | 9.0244 |
| 150 | 3810 | 14.934 | 6.3172 | 192.12 | 2.1897 | 5.6817 | 6.84 | 9.0297 |
| 151 | 3840 | 15.046 | 6.3255 | 192.49 | 2.191 | 5.6768 | 6.84 | 9.031 |
| 152 | 3870 | 15.164 | 6.3344 | 193.12 | 2.1951 | 5.6719 | 6.84 | 9.0351 |
| 153 | 3900 | 15.281 | 6.3431 | 193.75 | 2.1992 | 5.667 | 6.84 | 9.0392 |
| 154 | 3930 | 15.402 | 6.3522 | 194.27 | 2.202 | 5.6637 | 6.84 | 9.042 |
| 155 | 3934.9 | 15.419 | 6.3535 | 194.17 | 2.2004 | 5.6626 | 6.84 | 9.0404 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.93 in
Specimen Area: 5.37 in^2
Specimen Volume: 31.88 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

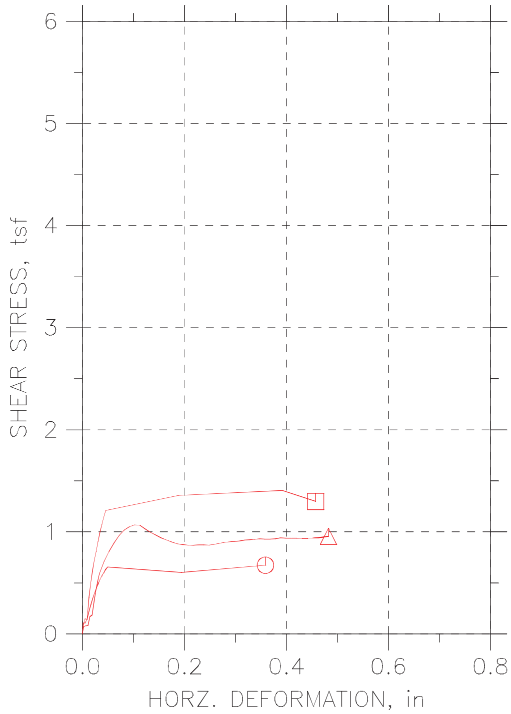
Measured Specific Gravity: 2.66

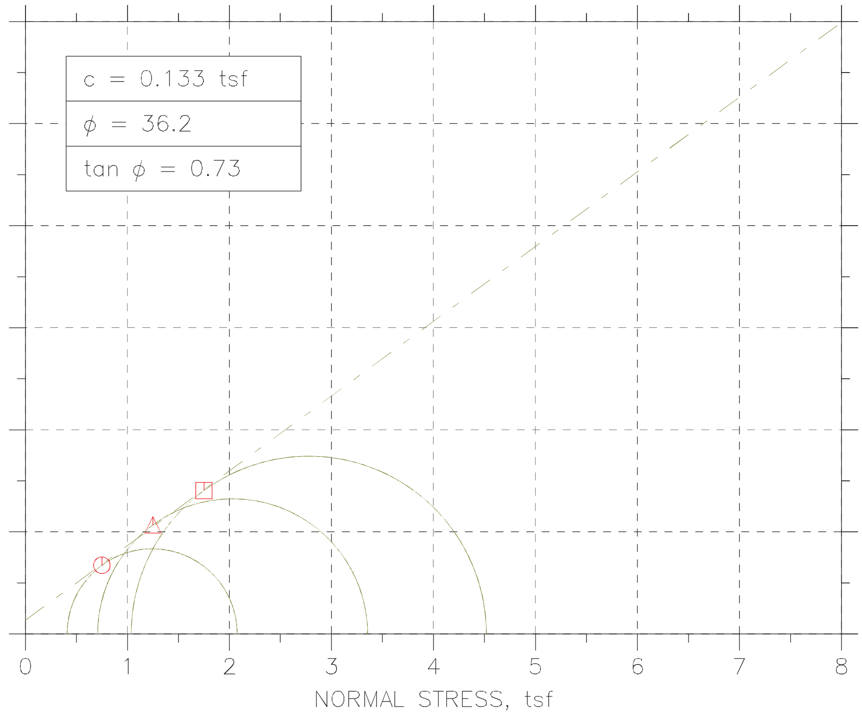
| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.84 | 6.84 | 0 | 0.000 | 1.798 | 1.798 | 1.000 | 1.798 | 0 |
| 2 | 0.02 | 6.9728 | 6.84 | 0.070104 | 0.528 | 1.8607 | 1.7279 | 1.077 | 1.7943 | 0.066397 |
| 3 | 0.04 | 7.0086 | 6.84 | 0.10434 | 0.619 | 1.8622 | 1.6936 | 1.100 | 1.7779 | 0.084297 |
| 4 | 0.05 | 7.0198 | 6.84 | 0.12499 | 0.695 | 1.8528 | 1.673 | 1.107 | 1.7629 | 0.0899 |
| 5 | 0.07 | 7.0254 | 6.84 | 0.14021 | 0.756 | 1.8432 | 1.6578 | 1.112 | 1.7505 | 0.092692 |
| 6 | 0.09 | 7.0317 | 6.84 | 0.15379 | 0.802 | 1.8359 | 1.6442 | 1.117 | 1.74 | 0.095834 |
| 7 | 0.11 | 7.0386 | 6.84 | 0.16629 | 0.837 | 1.8303 | 1.6317 | 1.122 | 1.731 | 0.099325 |
| 8 | 0.13 | 7.0533 | 6.84 | 0.17933 | 0.841 | 1.832 | 1.6186 | 1.132 | 1.7253 | 0.10667 |
| 9 | 0.15 | 7.068 | 6.84 | 0.19238 | 0.844 | 1.8336 | 1.6056 | 1.142 | 1.7196 | 0.11402 |
| 10 | 0.17 | 7.0876 | 6.84 | 0.20651 | 0.834 | 1.8391 | 1.5915 | 1.156 | 1.7153 | 0.12382 |
| 11 | 0.19 | 7.1065 | 6.84 | 0.22118 | 0.830 | 1.8433 | 1.5768 | 1.169 | 1.7101 | 0.13326 |
| 12 | 0.21 | 7.1233 | 6.84 | 0.23477 | 0.829 | 1.8465 | 1.5632 | 1.181 | 1.7049 | 0.14165 |
| 13 | 0.23 | 7.1415 | 6.84 | 0.24781 | 0.822 | 1.8517 | 1.5502 | 1.194 | 1.7009 | 0.15074 |
| 14 | 0.27 | 7.2374 | 6.84 | 0.29835 | 0.751 | 1.897 | 1.4996 | 1.265 | 1.6983 | 0.1987 |
| 15 | 0.30 | 7.3087 | 6.84 | 0.34671 | 0.740 | 1.92 | 1.4513 | 1.323 | 1.6856 | 0.23436 |
| 16 | 0.34 | 7.3625 | 6.84 | 0.39019 | 0.747 | 1.9302 | 1.4078 | 1.371 | 1.669 | 0.26123 |
| 17 | 0.38 | 7.4106 | 6.84 | 0.42823 | 0.751 | 1.9403 | 1.3697 | 1.417 | 1.655 | 0.28528 |
| 18 | 0.42 | 7.4509 | 6.84 | 0.46355 | 0.759 | 1.9453 | 1.3344 | 1.458 | 1.6399 | 0.30546 |
| 19 | 0.46 | 7.4864 | 6.84 | 0.49562 | 0.767 | 1.9487 | 1.3024 | 1.496 | 1.6255 | 0.32318 |
| 20 | 0.50 | 7.5218 | 6.84 | 0.52442 | 0.769 | 1.9553 | 1.2736 | 1.535 | 1.6144 | 0.34088 |
| 21 | 0.53 | 7.553 | 6.84 | 0.5505 | 0.772 | 1.9604 | 1.2475 | 1.572 | 1.6039 | 0.35648 |
| 22 | 0.57 | 7.5785 | 6.84 | 0.5755 | 0.779 | 1.961 | 1.2225 | 1.604 | 1.5917 | 0.36926 |
| 23 | 0.61 | 7.6027 | 6.84 | 0.59724 | 0.783 | 1.9634 | 1.2007 | 1.635 | 1.5821 | 0.38133 |
| 24 | 0.65 | 7.624 | 6.84 | 0.61735 | 0.787 | 1.9646 | 1.1806 | 1.664 | 1.5726 | 0.39201 |
| 25 | 0.69 | 7.6446 | 6.84 | 0.63691 | 0.792 | 1.9657 | 1.1611 | 1.693 | 1.5634 | 0.40232 |
| 26 | 0.73 | 7.6625 | 6.84 | 0.65539 | 0.797 | 1.965 | 1.1426 | 1.720 | 1.5538 | 0.41123 |
| 27 | 0.77 | 7.6817 | 6.84 | 0.67115 | 0.797 | 1.9685 | 1.1268 | 1.747 | 1.5477 | 0.42083 |
| 28 | 0.81 | 7.6897 | 6.84 | 0.68636 | 0.808 | 1.9613 | 1.1116 | 1.764 | 1.5365 | 0.42484 |
| 29 | 0.85 | 7.7144 | 6.84 | 0.70104 | 0.802 | 1.9714 | 1.0969 | 1.797 | 1.5342 | 0.43721 |
| 30 | 0.89 | 7.7308 | 6.84 | 0.71462 | 0.802 | 1.9742 | 1.0834 | 1.822 | 1.5288 | 0.4454 |
| 31 | 0.93 | 7.7444 | 6.84 | 0.72766 | 0.805 | 1.9747 | 1.0703 | 1.845 | 1.5225 | 0.45218 |
| 32 | 1.05 | 7.7829 | 6.84 | 0.76136 | 0.807 | 1.9795 | 1.0366 | 1.910 | 1.5081 | 0.47145 |
| 33 | 1.17 | 7.8151 | 6.84 | 0.78853 | 0.809 | 1.9845 | 1.0094 | 1.966 | 1.497 | 0.48755 |
| 34 | 1.29 | 7.8452 | 6.84 | 0.81244 | 0.808 | 1.9907 | 0.98553 | 2.020 | 1.4881 | 0.50258 |
| 35 | 1.41 | 7.8696 | 6.84 | 0.83255 | 0.809 | 1.995 | 0.96543 | 2.066 | 1.4802 | 0.51479 |
| 36 | 1.52 | 7.8926 | 6.84 | 0.85048 | 0.808 | 2.0001 | 0.94749 | 2.111 | 1.4738 | 0.52628 |
| 37 | 1.64 | 7.9155 | 6.84 | 0.86624 | 0.805 | 2.0072 | 0.93173 | 2.154 | 1.4695 | 0.53775 |
| 38 | 1.76 | 7.9349 | 6.84 | 0.87983 | 0.804 | 2.0131 | 0.91815 | 2.193 | 1.4656 | 0.54746 |
| 39 | 1.88 | 7.9529 | 6.84 | 0.89124 | 0.801 | 2.0196 | 0.90674 | 2.227 | 1.4632 | 0.55645 |
| 40 | 2.00 | 7.9715 | 6.84 | 0.90211 | 0.797 | 2.0274 | 0.89587 | 2.263 | 1.4616 | 0.56576 |
| 41 | 2.12 | 7.988 | 6.84 | 0.91135 | 0.794 | 2.0347 | 0.88663 | 2.295 | 1.4606 | 0.57402 |
| 42 | 2.23 | 8.0038 | 6.84 | 0.9195 | 0.790 | 2.0423 | 0.87848 | 2.325 | 1.4604 | 0.58192 |
| 43 | 2.35 | 8.021 | 6.84 | 0.92548 | 0.784 | 2.0535 | 0.8725 | 2.354 | 1.463 | 0.59049 |
| 44 | 2.47 | 8.0401 | 6.84 | 0.932 | 0.777 | 2.0661 | 0.86598 | 2.386 | 1.466 | 0.60004 |
| 45 | 2.59 | 8.0551 | 6.84 | 0.93852 | 0.772 | 2.0745 | 0.85946 | 2.414 | 1.467 | 0.60754 |
| 46 | 2.71 | 8.0673 | 6.84 | 0.94232 | 0.768 | 2.0829 | 0.85565 | 2.434 | 1.4693 | 0.61363 |
| 47 | 2.82 | 8.0856 | 6.84 | 0.94558 | 0.759 | 2.098 | 0.85239 | 2.461 | 1.4752 | 0.62279 |
| 48 | 2.94 | 8.0991 | 6.84 | 0.94993 | 0.754 | 2.1071 | 0.84804 | 2.485 | 1.4776 | 0.62954 |
| 49 | 3.06 | 8.1105 | 6.84 | 0.95319 | 0.750 | 2.1153 | 0.84478 | 2.504 | 1.48 | 0.63524 |
| 50 | 3.18 | 8.1259 | 6.84 | 0.95591 | 0.743 | 2.128 | 0.84207 | 2.527 | 1.485 | 0.64297 |
| 51 | 3.29 | 8.1353 | 6.84 | 0.95808 | 0.740 | 2.1352 | 0.83989 | 2.542 | 1.4875 | 0.64765 |
| 52 | 3.41 | 8.1473 | 6.84 | 0.96134 | 0.735 | 2.1439 | 0.83663 | 2.563 | 1.4903 | 0.65365 |
| 53 | 3.53 | 8.1566 | 6.84 | 0.96243 | 0.731 | 2.1521 | 0.83555 | 2.576 | 1.4938 | 0.65828 |
| 54 | 3.65 | 8.1692 | 6.84 | 0.96406 | 0.725 | 2.1631 | 0.83392 | 2.594 | 1.4985 | 0.66459 |
| 55 | 3.76 | 8.1811 | 6.84 | 0.96515 | 0.720 | 2.1739 | 0.83283 | 2.610 | 1.5034 | 0.67054 |
| 56 | 3.88 | 8.1916 | 6.84 | 0.96623 | 0.715 | 2.1833 | 0.83174 | 2.625 | 1.5075 | 0.67578 |
| 57 | 4.00 | 8.2027 | 6.84 | 0.96732 | 0.710 | 2.1934 | 0.83065 | 2.641 | 1.512 | 0.68137 |
| 58 | 4.12 | 8.2132 | 6.84 | 0.96895 | 0.706 | 2.2022 | 0.82902 | 2.656 | 1.5156 | 0.68659 |
| 59 | 4.23 | 8.2257 | 6.84 | 0.96895 | 0.699 | 2.2147 | 0.82902 | 2.671 | 1.5218 | 0.69283 |
| 60 | 4.35 | 8.2347 | 6.84 | 0.97058 | 0.696 | 2.2221 | 0.82739 | 2.686 | 1.5248 | 0.69736 |
| 61 | 4.47 | 8.2411 | 6.84 | 0.97112 | 0.693 | 2.2279 | 0.82685 | 2.694 | 1.5274 | 0.70053 |
| 62 | 4.58 | 8.2494 | 6.84 | 0.97276 | 0.690 | 2.2346 | 0.82522 | 2.708 | 1.5299 | 0.70471 |
| 63 | 4.70 | 8.259 | 6.84 | 0.97221 | 0.685 | 2.2448 | 0.82576 | 2.718 | 1.5353 | 0.70952 |
| 64 | 4.82 | 8.2687 | 6.84 | 0.97058 | 0.679 | 2.2561 | 0.82739 | 2.727 | 1.5417 | 0.71433 |
| 65 | 4.94 | 8.2788 | 6.84 | 0.97112 | 0.675 | 2.2657 | 0.82685 | 2.740 | 1.5463 | 0.71942 |
| 66 | 5.06 | 8.2878 | 6.84 | 0.96949 | 0.670 | 2.2763 | 0.82848 | 2.748 | 1.5524 | 0.7239 |
| 67 | 5.17 | 8.3007 | 6.84 | 0.96841 | 0.663 | 2.2902 | 0.82957 | 2.761 | 1.5599 | 0.73034 |
| 68 | 5.29 | 8.3095 | 6.84 | 0.96732 | 0.658 | 2.3001 | 0.83065 | 2.769 | 1.5654 | 0.73474 |
| 69 | 5.41 | 8.3203 | 6.84 | 0.96678 | 0.653 | 2.3115 | 0.8312 | 2.781 | 1.5714 | 0.74016 |
| 70 | 5.53 | 8.3324 | 6.84 | 0.96569 | 0.647 | 2.3247 | 0.83228 | 2.793 | 1.5785 | 0.74622 |
| 71 | 5.64 | 8.3438 | 6.84 | 0.96297 | 0.640 | 2.3388 | 0.835 | 2.801 | 1.5869 | 0.75192 |
| 72 | 5.76 | 8.3559 | 6.84 | 0.9608 | 0.634 | 2.3531 | 0.83718 | 2.811 | 1.5951 | 0.75795 |
| 73 | 5.88 | 8.3653 | 6.84 | 0.96026 | 0.630 | 2.363 | 0.83772 | 2.821 | 1.6004 | 0.76264 |
| 74 | 5.99 | 8.3759 | 6.84 | 0.95917 | 0.624 | 2.3747 | 0.83881 | 2.831 | 1.6068 | 0.76795 |
| 75 | 6.11 | 8.3852 | 6.84 | 0.957 | 0.619 | 2.3861 | 0.84098 | 2.837 | 1.6136 | 0.77258 |
| 76 | 6.23 | 8.3971 | 6.84 | 0.9521 | 0.611 | 2.403 | 0.84587 | 2.841 | 1.6244 | 0.77854 |
| 77 | 6.35 | 8.4076 | 6.84 | 0.94939 | 0.606 | 2.4162 | 0.84859 | 2.847 | 1.6324 | 0.78381 |
| 78 | 6.47 | 8.4168 | 6.84 | 0.94721 | 0.601 | 2.4276 | 0.85076 | 2.853 | 1.6392 | 0.78841 |

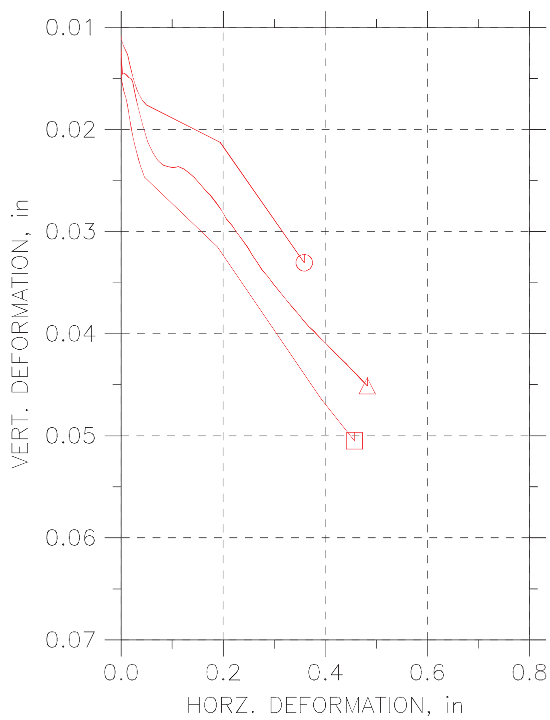
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 6.59 | 8.428 | 6.84 | 0.94613 | 0.596 | 2.4398 | 0.85185 | 2.864 | 1.6458 | 0.79398 |
| 80 | 6.70 | 8.4417 | 6.84 | 0.94287 | 0.589 | 2.4568 | 0.85511 | 2.873 | 1.656 | 0.80084 |
| 81 | 6.82 | 8.4495 | 6.84 | 0.93961 | 0.584 | 2.4679 | 0.85837 | 2.875 | 1.6631 | 0.80475 |
| 82 | 6.94 | 8.4612 | 6.84 | 0.93634 | 0.578 | 2.4828 | 0.86163 | 2.882 | 1.6722 | 0.8106 |
| 83 | 7.06 | 8.4754 | 6.84 | 0.93254 | 0.570 | 2.5009 | 0.86543 | 2.890 | 1.6832 | 0.81772 |
| 84 | 7.18 | 8.487 | 6.84 | 0.92928 | 0.564 | 2.5157 | 0.8687 | 2.896 | 1.6922 | 0.8235 |
| 85 | 7.29 | 8.498 | 6.84 | 0.92656 | 0.559 | 2.5294 | 0.87141 | 2.903 | 1.7004 | 0.82899 |
| 86 | 7.41 | 8.5096 | 6.84 | 0.92385 | 0.553 | 2.5437 | 0.87413 | 2.910 | 1.7089 | 0.8348 |
| 87 | 7.53 | 8.516 | 6.84 | 0.92004 | 0.549 | 2.5539 | 0.87793 | 2.909 | 1.7159 | 0.83798 |
| 88 | 7.64 | 8.5236 | 6.84 | 0.91732 | 0.545 | 2.5643 | 0.88065 | 2.912 | 1.7225 | 0.8418 |
| 89 | 7.76 | 8.5312 | 6.84 | 0.91461 | 0.541 | 2.5746 | 0.88337 | 2.915 | 1.729 | 0.84561 |
| 90 | 7.87 | 8.544 | 6.84 | 0.9108 | 0.535 | 2.5911 | 0.88717 | 2.921 | 1.7392 | 0.85199 |
| 91 | 7.99 | 8.5567 | 6.84 | 0.907 | 0.528 | 2.6077 | 0.89098 | 2.927 | 1.7493 | 0.85834 |
| 92 | 8.11 | 8.5655 | 6.84 | 0.90374 | 0.524 | 2.6197 | 0.89424 | 2.930 | 1.757 | 0.86273 |
| 93 | 8.22 | 8.5736 | 6.84 | 0.89993 | 0.519 | 2.6317 | 0.89804 | 2.930 | 1.7648 | 0.86681 |
| 94 | 8.34 | 8.5824 | 6.84 | 0.89667 | 0.515 | 2.6437 | 0.9013 | 2.933 | 1.7725 | 0.87118 |
| 95 | 8.46 | 8.5943 | 6.84 | 0.89178 | 0.508 | 2.6605 | 0.90619 | 2.936 | 1.7833 | 0.87713 |
| 96 | 8.57 | 8.6049 | 6.84 | 0.88798 | 0.503 | 2.6749 | 0.91 | 2.939 | 1.7924 | 0.88244 |
| 97 | 8.70 | 8.6192 | 6.84 | 0.88472 | 0.497 | 2.6925 | 0.91326 | 2.948 | 1.8029 | 0.88961 |
| 98 | 8.81 | 8.6336 | 6.84 | 0.88091 | 0.491 | 2.7107 | 0.91706 | 2.956 | 1.8139 | 0.8968 |
| 99 | 8.93 | 8.6422 | 6.84 | 0.87711 | 0.487 | 2.723 | 0.92087 | 2.957 | 1.8219 | 0.90108 |
| 100 | 9.05 | 8.6455 | 6.84 | 0.87331 | 0.484 | 2.7302 | 0.92467 | 2.953 | 1.8274 | 0.90276 |
| 101 | 9.17 | 8.6547 | 6.84 | 0.86896 | 0.479 | 2.7437 | 0.92902 | 2.953 | 1.8364 | 0.90735 |
| 102 | 9.29 | 8.6606 | 6.84 | 0.86461 | 0.475 | 2.754 | 0.93336 | 2.951 | 1.8437 | 0.91031 |
| 103 | 9.40 | 8.6659 | 6.84 | 0.86081 | 0.471 | 2.7631 | 0.93717 | 2.948 | 1.8501 | 0.91296 |
| 104 | 9.52 | 8.6756 | 6.84 | 0.857 | 0.467 | 2.7766 | 0.94097 | 2.951 | 1.8588 | 0.91781 |
| 105 | 9.64 | 8.6898 | 6.84 | 0.85374 | 0.462 | 2.794 | 0.94423 | 2.959 | 1.8691 | 0.92488 |
| 106 | 9.75 | 8.6975 | 6.84 | 0.84994 | 0.458 | 2.8055 | 0.94804 | 2.959 | 1.8768 | 0.92876 |
| 107 | 9.87 | 8.7039 | 6.84 | 0.84505 | 0.453 | 2.8169 | 0.95293 | 2.956 | 1.8849 | 0.93197 |
| 108 | 9.99 | 8.7161 | 6.84 | 0.8407 | 0.448 | 2.8334 | 0.95728 | 2.960 | 1.8953 | 0.93806 |
| 109 | 10.11 | 8.7282 | 6.84 | 0.83581 | 0.443 | 2.8503 | 0.96217 | 2.962 | 1.9063 | 0.94409 |
| 110 | 10.22 | 8.7415 | 6.84 | 0.83092 | 0.437 | 2.8686 | 0.96706 | 2.966 | 1.9178 | 0.95076 |
| 111 | 10.34 | 8.7465 | 6.84 | 0.82657 | 0.434 | 2.8779 | 0.97141 | 2.963 | 1.9247 | 0.95326 |
| 112 | 10.46 | 8.7566 | 6.84 | 0.82331 | 0.430 | 2.8913 | 0.97467 | 2.966 | 1.933 | 0.95831 |
| 113 | 10.58 | 8.7604 | 6.84 | 0.81842 | 0.426 | 2.8999 | 0.97956 | 2.960 | 1.9397 | 0.96019 |
| 114 | 10.69 | 8.7723 | 6.84 | 0.81353 | 0.421 | 2.9168 | 0.98445 | 2.963 | 1.9506 | 0.96615 |
| 115 | 10.81 | 8.7779 | 6.84 | 0.80918 | 0.418 | 2.9267 | 0.9888 | 2.960 | 1.9577 | 0.96895 |
| 116 | 10.93 | 8.7853 | 6.84 | 0.80483 | 0.414 | 2.9385 | 0.99314 | 2.959 | 1.9658 | 0.97267 |
| 117 | 11.05 | 8.7934 | 6.84 | 0.80049 | 0.410 | 2.9509 | 0.99749 | 2.958 | 1.9742 | 0.97669 |
| 118 | 11.17 | 8.8008 | 6.84 | 0.79722 | 0.407 | 2.9615 | 1.0008 | 2.959 | 1.9811 | 0.98039 |
| 119 | 11.28 | 8.8082 | 6.84 | 0.79288 | 0.403 | 2.9733 | 1.0051 | 2.958 | 1.9892 | 0.98409 |
| 120 | 11.40 | 8.8149 | 6.84 | 0.7869 | 0.398 | 2.9859 | 1.0111 | 2.953 | 1.9985 | 0.98743 |
| 121 | 11.52 | 8.8254 | 6.84 | 0.78146 | 0.394 | 3.0019 | 1.0165 | 2.953 | 2.0092 | 0.99268 |
| 122 | 11.64 | 8.8357 | 6.84 | 0.77766 | 0.390 | 3.0161 | 1.0203 | 2.956 | 2.0182 | 0.99787 |
| 123 | 11.75 | 8.8436 | 6.84 | 0.77386 | 0.386 | 3.0278 | 1.0241 | 2.956 | 2.0259 | 1.0018 |
| 124 | 11.87 | 8.8496 | 6.84 | 0.76951 | 0.383 | 3.0381 | 1.0285 | 2.954 | 2.0333 | 1.0048 |
| 125 | 11.99 | 8.858 | 6.84 | 0.76516 | 0.379 | 3.0508 | 1.0328 | 2.954 | 2.0418 | 1.009 |
| 126 | 12.11 | 8.864 | 6.84 | 0.75973 | 0.375 | 3.0623 | 1.0382 | 2.949 | 2.0503 | 1.012 |
| 127 | 12.22 | 8.8694 | 6.84 | 0.75429 | 0.372 | 3.0731 | 1.0437 | 2.944 | 2.0584 | 1.0147 |
| 128 | 12.34 | 8.8795 | 6.84 | 0.74995 | 0.368 | 3.0876 | 1.048 | 2.946 | 2.0678 | 1.0198 |
| 129 | 12.46 | 8.8824 | 6.84 | 0.74451 | 0.365 | 3.0958 | 1.0535 | 2.939 | 2.0746 | 1.0212 |
| 130 | 12.58 | 8.8925 | 6.84 | 0.74071 | 0.361 | 3.1098 | 1.0573 | 2.941 | 2.0835 | 1.0263 |
| 131 | 12.69 | 8.9021 | 6.84 | 0.73582 | 0.357 | 3.1242 | 1.0622 | 2.941 | 2.0932 | 1.031 |
| 132 | 12.81 | 8.9097 | 6.84 | 0.73093 | 0.353 | 3.1367 | 1.0671 | 2.940 | 2.1019 | 1.0348 |
| 133 | 12.93 | 8.9142 | 6.84 | 0.72603 | 0.350 | 3.1461 | 1.0719 | 2.935 | 2.109 | 1.0371 |
| 134 | 13.05 | 8.9218 | 6.84 | 0.72114 | 0.346 | 3.1586 | 1.0768 | 2.933 | 2.1177 | 1.0409 |
| 135 | 13.17 | 8.9292 | 6.84 | 0.71625 | 0.343 | 3.1709 | 1.0817 | 2.931 | 2.1263 | 1.0446 |
| 136 | 13.29 | 8.9344 | 6.84 | 0.71082 | 0.339 | 3.1815 | 1.0872 | 2.926 | 2.1343 | 1.0472 |
| 137 | 13.41 | 8.938 | 6.84 | 0.70538 | 0.336 | 3.1906 | 1.0926 | 2.920 | 2.1416 | 1.049 |
| 138 | 13.53 | 8.9474 | 6.84 | 0.69941 | 0.332 | 3.206 | 1.0986 | 2.918 | 2.1523 | 1.0537 |
| 139 | 13.64 | 8.9537 | 6.84 | 0.69506 | 0.329 | 3.2166 | 1.1029 | 2.916 | 2.1598 | 1.0568 |
| 140 | 13.76 | 8.9604 | 6.84 | 0.68962 | 0.325 | 3.2288 | 1.1084 | 2.913 | 2.1686 | 1.0602 |
| 141 | 13.88 | 8.9672 | 6.84 | 0.68528 | 0.322 | 3.2399 | 1.1127 | 2.912 | 2.1763 | 1.0636 |
| 142 | 14.00 | 8.9782 | 6.84 | 0.68093 | 0.318 | 3.2553 | 1.117 | 2.914 | 2.1862 | 1.0691 |
| 143 | 14.12 | 8.9819 | 6.84 | 0.67549 | 0.315 | 3.2644 | 1.1225 | 2.908 | 2.1934 | 1.0709 |
| 144 | 14.24 | 8.9879 | 6.84 | 0.67006 | 0.312 | 3.2759 | 1.1279 | 2.904 | 2.2019 | 1.074 |
| 145 | 14.35 | 8.9978 | 6.84 | 0.66517 | 0.308 | 3.2906 | 1.1328 | 2.905 | 2.2117 | 1.0789 |
| 146 | 14.47 | 9.0039 | 6.84 | 0.65973 | 0.305 | 3.3021 | 1.1382 | 2.901 | 2.2202 | 1.0819 |
| 147 | 14.58 | 9.0118 | 6.84 | 0.6543 | 0.301 | 3.3154 | 1.1437 | 2.899 | 2.2296 | 1.0859 |
| 148 | 14.70 | 9.0177 | 6.84 | 0.6505 | 0.299 | 3.3252 | 1.1475 | 2.898 | 2.2363 | 1.0888 |
| 149 | 14.81 | 9.0244 | 6.84 | 0.64506 | 0.295 | 3.3373 | 1.1529 | 2.895 | 2.2451 | 1.0922 |
| 150 | 14.93 | 9.0297 | 6.84 | 0.63963 | 0.292 | 3.348 | 1.1583 | 2.890 | 2.2532 | 1.0948 |
| 151 | 15.05 | 9.031 | 6.84 | 0.63474 | 0.290 | 3.3542 | 1.1632 | 2.884 | 2.2587 | 1.0955 |
| 152 | 15.16 | 9.0351 | 6.84 | 0.62985 | 0.287 | 3.3632 | 1.1681 | 2.879 | 2.2657 | 1.0975 |
| 153 | 15.28 | 9.0392 | 6.84 | 0.62495 | 0.284 | 3.3722 | 1.173 | 2.875 | 2.2726 | 1.0996 |
| 154 | 15.40 | 9.042 | 6.84 | 0.62169 | 0.282 | 3.3783 | 1.1763 | 2.872 | 2.2773 | 1.101 |
| 155 | 15.42 | 9.0404 | 6.84 | 0.62061 | 0.282 | 3.3777 | 1.1774 | 2.869 | 2.2776 | 1.1002 |

# DIRECT SHEAR TEST REPORT

AECOM




| | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|
| | Test No. | .75 TSF | 1.25 TSF | 1.75 TSF | |
| | Sample No. | S-16-18 | S-16-18 | S-16-18 | |
| | Shape | Circular | Circular | Circular | |
| Initial | Dimension, in | 2.3504 | 2.3504 | 2.3504 | |
| Initial | Area, in^2 | 4.3388 | 4.3388 | 4.3388 | |
| Initial | Height, in | 1 | 1 | 1 | |
| Initial | Water Content, % | 16.12 | 16.62 | 16.15 | |
| Initial | Dry Density, pcf | 117.9 | 117.1 | 117.9 | |
| Initial | Saturation, % | 99.55 | 100.36 | 99.77 | |
| Initial | Void Ratio | 0.44047 | 0.45053 | 0.44026 | |
| | Consol. Height, in | 0.98989 | 0.9897 | 0.98947 | |
| | Consol. Void Ratio | 0.42591 | 0.43558 | 0.4251 | |
| Final | Water Content, % | 14.02 | 14.02 | 12.51 | |
| Final | Dry Density, pcf | 121.9 | 122.6 | 124.2 | |
| Final | Saturation, % | 97.07 | 99.04 | 92.56 | |
| Final | Void Ratio | 0.39288 | 0.38509 | 0.36752 | |
| | Normal Stress, tsf | 0.75 | 1.25 | 1.75 | |
| | Max. Shear Stress, tsf | 0.67243 | 1.0674 | 1.4045 | |
| | Ult. Shear Stress, tsf | 0.67243 | 0.95657 | 1.2984 | |
| | Time to Failure, min | 180.15 | 62.996 | 198 | |
| | Disp. Rate, in/min | 0.001417 | 0.001417 | 0.001417 | |
| | Estimated Specific Gravity | 2.72 | 2.72 | 2.72 | |
| | Liquid Limit | --- | --- | --- | |
| | Plastic Limit | --- | --- | --- | |
| | Plasticity Index | --- | --- | --- | |

| |
|---|
| Project: COLETO CREEK FACILITY |
| Location: IPR-GDF SUEZ |
| Project No.: 60225561 |
| Boring No.: B-1-1 |
| Sample Type: TRIMMED |
| Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE |
| Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC |

Thu, 22-DEC-2011 13:30:56

# DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: .75 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.75 | 0.01082 | 0 | 0 | 0 |
| 2 | 2.00 | 0.75 | 0.01127 | 0.06009 | 0.001129 | 0.001129 |
| 3 | 4.00 | 0.75 | 0.01182 | 0.1469 | 0.004796 | 0.004796 |
| 4 | 6.00 | 0.75 | 0.01225 | 0.143 | 0.008888 | 0.008888 |
| 5 | 8.00 | 0.75 | 0.01266 | 0.2189 | 0.0127 | 0.0127 |
| 6 | 10.00 | 0.75 | 0.0135 | 0.2873 | 0.01651 | 0.01651 |
| 7 | 12.00 | 0.75 | 0.01429 | 0.3483 | 0.02031 | 0.02031 |
| 8 | 14.00 | 0.75 | 0.01498 | 0.4009 | 0.02384 | 0.02384 |
| 9 | 16.00 | 0.75 | 0.01557 | 0.4496 | 0.02751 | 0.02751 |
| 10 | 18.00 | 0.75 | 0.01607 | 0.4908 | 0.03104 | 0.03104 |
| 11 | 20.00 | 0.75 | 0.01648 | 0.5329 | 0.03456 | 0.03456 |
| 12 | 22.00 | 0.75 | 0.01683 | 0.5689 | 0.03809 | 0.03809 |
| 13 | 24.00 | 0.75 | 0.01715 | 0.6005 | 0.0419 | 0.0419 |
| 14 | 26.00 | 0.75 | 0.01735 | 0.6294 | 0.04543 | 0.04543 |
| 15 | 28.00 | 0.75 | 0.01757 | 0.6558 | 0.04938 | 0.04938 |
| 16 | 98.00 | 0.75 | 0.02125 | 0.6014 | 0.1943 | 0.1943 |
| 17 | 180.15 | 0.75 | 0.03304 | 0.6724 | 0.3589 | 0.3589 |

DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: 1.25 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.25 | 0.01189 | 0 | 0 | 0 |
| 2 | 12.00 | 1.25 | 0.01458 | 0.07233 | 0.002821 | 0.002821 |
| 3 | 14.00 | 1.25 | 0.01451 | 0.07971 | 0.006913 | 0.006913 |
| 4 | 16.00 | 1.25 | 0.01467 | 0.08127 | 0.011 | 0.011 |
| 5 | 18.00 | 1.25 | 0.01488 | 0.1684 | 0.01481 | 0.01481 |
| 6 | 20.00 | 1.25 | 0.01499 | 0.1843 | 0.0189 | 0.0189 |
| 7 | 22.00 | 1.25 | 0.0153 | 0.313 | 0.02271 | 0.02271 |
| 8 | 24.00 | 1.25 | 0.01616 | 0.413 | 0.0261 | 0.0261 |
| 9 | 26.00 | 1.25 | 0.01703 | 0.5094 | 0.02963 | 0.02963 |
| 10 | 28.00 | 1.25 | 0.01777 | 0.5879 | 0.03315 | 0.03315 |
| 11 | 33.00 | 1.25 | 0.01959 | 0.7097 | 0.04246 | 0.04246 |
| 12 | 38.00 | 1.25 | 0.02117 | 0.8061 | 0.05206 | 0.05206 |
| 13 | 43.00 | 1.25 | 0.02223 | 0.8912 | 0.06193 | 0.06193 |
| 14 | 48.00 | 1.25 | 0.02302 | 0.9647 | 0.07209 | 0.07209 |
| 15 | 53.00 | 1.25 | 0.02348 | 1.018 | 0.08196 | 0.08196 |
| 16 | 58.00 | 1.25 | 0.02364 | 1.05 | 0.09198 | 0.09198 |
| 17 | 63.00 | 1.25 | 0.02373 | 1.067 | 0.1021 | 0.1021 |
| 18 | 68.00 | 1.25 | 0.02364 | 1.064 | 0.1126 | 0.1126 |
| 19 | 73.00 | 1.25 | 0.02385 | 1.029 | 0.123 | 0.123 |
| 20 | 78.00 | 1.25 | 0.02424 | 0.9962 | 0.1333 | 0.1333 |
| 21 | 83.00 | 1.25 | 0.0247 | 0.969 | 0.1436 | 0.1436 |
| 22 | 88.00 | 1.25 | 0.02532 | 0.941 | 0.1542 | 0.1542 |
| 23 | 93.00 | 1.25 | 0.02591 | 0.9196 | 0.1648 | 0.1648 |
| 24 | 98.00 | 1.25 | 0.02646 | 0.9006 | 0.1754 | 0.1754 |
| 25 | 103.00 | 1.25 | 0.02715 | 0.8831 | 0.1859 | 0.1859 |
| 26 | 108.00 | 1.25 | 0.02788 | 0.8749 | 0.1964 | 0.1964 |
| 27 | 113.00 | 1.25 | 0.02879 | 0.8695 | 0.2068 | 0.2068 |
| 28 | 118.00 | 1.25 | 0.02939 | 0.8679 | 0.2174 | 0.2174 |
| 29 | 123.00 | 1.25 | 0.03015 | 0.871 | 0.2277 | 0.2277 |
| 30 | 128.00 | 1.25 | 0.03082 | 0.8718 | 0.2378 | 0.2378 |
| 31 | 133.00 | 1.25 | 0.03154 | 0.8706 | 0.248 | 0.248 |
| 32 | 138.00 | 1.25 | 0.03235 | 0.8772 | 0.2577 | 0.2577 |
| 33 | 143.00 | 1.25 | 0.03304 | 0.8858 | 0.2673 | 0.2673 |
| 34 | 148.00 | 1.25 | 0.0338 | 0.8955 | 0.2769 | 0.2769 |
| 35 | 153.00 | 1.25 | 0.03439 | 0.9017 | 0.2872 | 0.2872 |
| 36 | 158.00 | 1.25 | 0.03505 | 0.9064 | 0.2972 | 0.2972 |
| 37 | 163.00 | 1.25 | 0.03568 | 0.9091 | 0.3074 | 0.3074 |
| 38 | 168.00 | 1.25 | 0.0363 | 0.9185 | 0.3176 | 0.3176 |
| 39 | 173.00 | 1.25 | 0.03691 | 0.922 | 0.3276 | 0.3276 |
| 40 | 178.00 | 1.25 | 0.03753 | 0.9262 | 0.3377 | 0.3377 |
| 41 | 183.00 | 1.25 | 0.03808 | 0.9321 | 0.3476 | 0.3476 |
| 42 | 188.00 | 1.25 | 0.03874 | 0.9282 | 0.3578 | 0.3578 |
| 43 | 193.00 | 1.25 | 0.0393 | 0.929 | 0.3678 | 0.3678 |
| 44 | 198.00 | 1.25 | 0.03976 | 0.9309 | 0.3779 | 0.3779 |
| 45 | 203.00 | 1.25 | 0.04033 | 0.941 | 0.3884 | 0.3884 |
| 46 | 208.00 | 1.25 | 0.04084 | 0.9383 | 0.399 | 0.399 |
| 47 | 213.00 | 1.25 | 0.04139 | 0.9371 | 0.4095 | 0.4095 |
| 48 | 218.00 | 1.25 | 0.04193 | 0.9379 | 0.42 | 0.42 |
| 49 | 223.00 | 1.25 | 0.04244 | 0.9356 | 0.4307 | 0.4307 |
| 50 | 228.00 | 1.25 | 0.04296 | 0.936 | 0.4413 | 0.4413 |
| 51 | 233.00 | 1.25 | 0.04351 | 0.9391 | 0.4517 | 0.4517 |
| 52 | 238.00 | 1.25 | 0.04403 | 0.9406 | 0.462 | 0.462 |
| 53 | 243.00 | 1.25 | 0.04459 | 0.9476 | 0.4723 | 0.4723 |
| 54 | 248.00 | 1.25 | 0.04511 | 0.9566 | 0.4823 | 0.4823 |

DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: 1.75 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

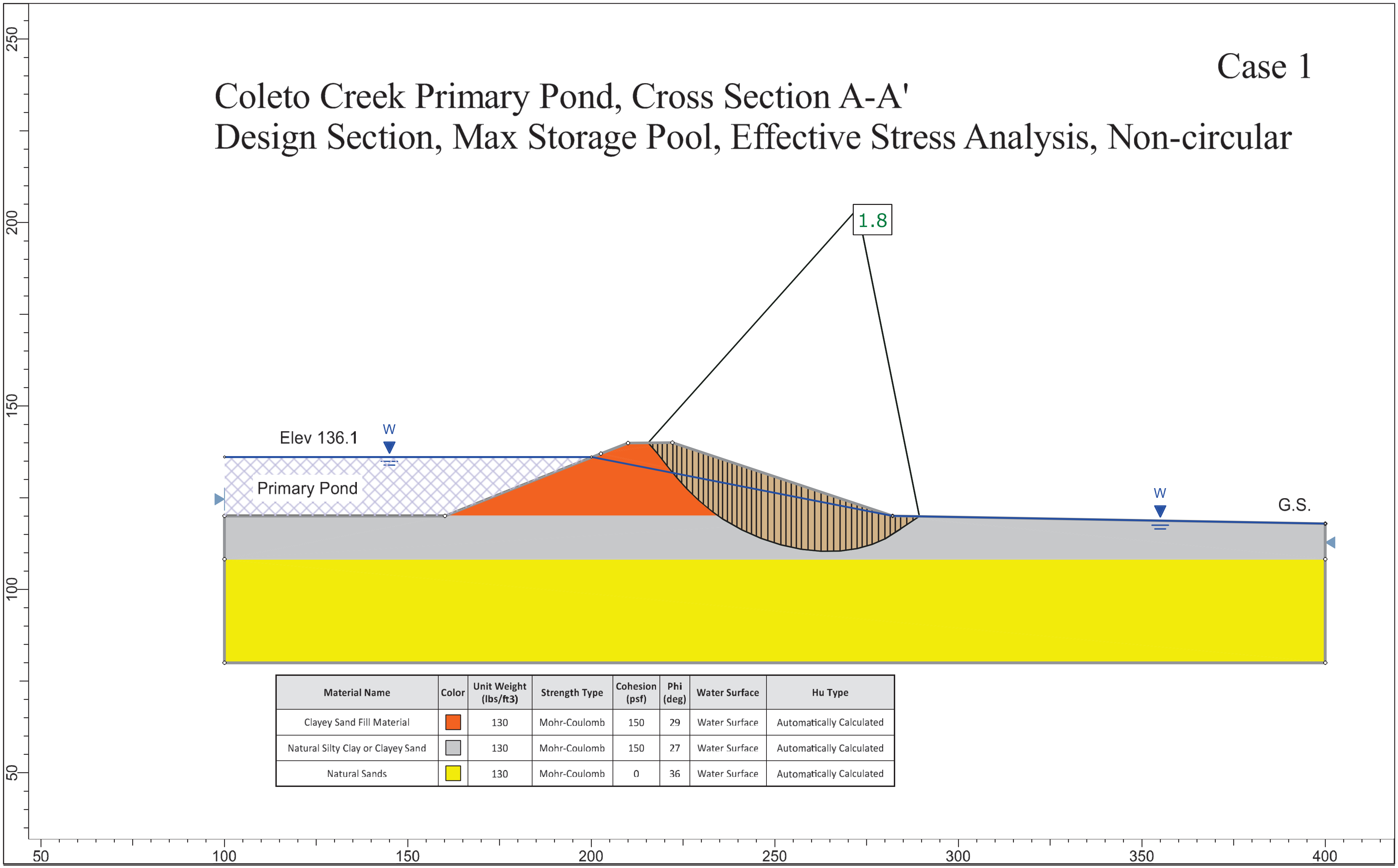
Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.75 | 0.01256 | 0 | 0 | 0 |
| 2 | 4.00 | 1.75 | 0.01529 | 0.1083 | 0.001552 | 0.001552 |
| 3 | 6.00 | 1.75 | 0.0162 | 0.107 | 0.00522 | 0.00522 |
| 4 | 8.00 | 1.75 | 0.01687 | 0.1474 | 0.009311 | 0.009311 |
| 5 | 10.00 | 1.75 | 0.01767 | 0.3553 | 0.0127 | 0.0127 |
| 6 | 12.00 | 1.75 | 0.01877 | 0.497 | 0.01622 | 0.01622 |
| 7 | 14.00 | 1.75 | 0.01979 | 0.615 | 0.01961 | 0.01961 |
| 8 | 16.00 | 1.75 | 0.0207 | 0.7159 | 0.02328 | 0.02328 |
| 9 | 18.00 | 1.75 | 0.02152 | 0.8062 | 0.02694 | 0.02694 |
| 10 | 20.00 | 1.75 | 0.02223 | 0.904 | 0.03061 | 0.03061 |
| 11 | 22.00 | 1.75 | 0.02289 | 0.9887 | 0.03414 | 0.03414 |
| 12 | 24.00 | 1.75 | 0.02361 | 1.072 | 0.03809 | 0.03809 |
| 13 | 26.00 | 1.75 | 0.02409 | 1.144 | 0.0419 | 0.0419 |
| 14 | 28.00 | 1.75 | 0.02466 | 1.209 | 0.04585 | 0.04585 |
| 15 | 98.00 | 1.75 | 0.0315 | 1.356 | 0.1888 | 0.1888 |
| 16 | 198.00 | 1.75 | 0.04639 | 1.405 | 0.392 | 0.392 |
| 17 | 243.36 | 1.75 | 0.0505 | 1.298 | 0.4572 | 0.4572 |

# APPENDIX C:  SLIDE 7.0 STABILITY ANALYSIS MODELS

Case 1

Coleto Creek Primary Pond, Cross Section A-A'
Design Section, Max Storage Pool, Effective Stress Analysis, Non-circular



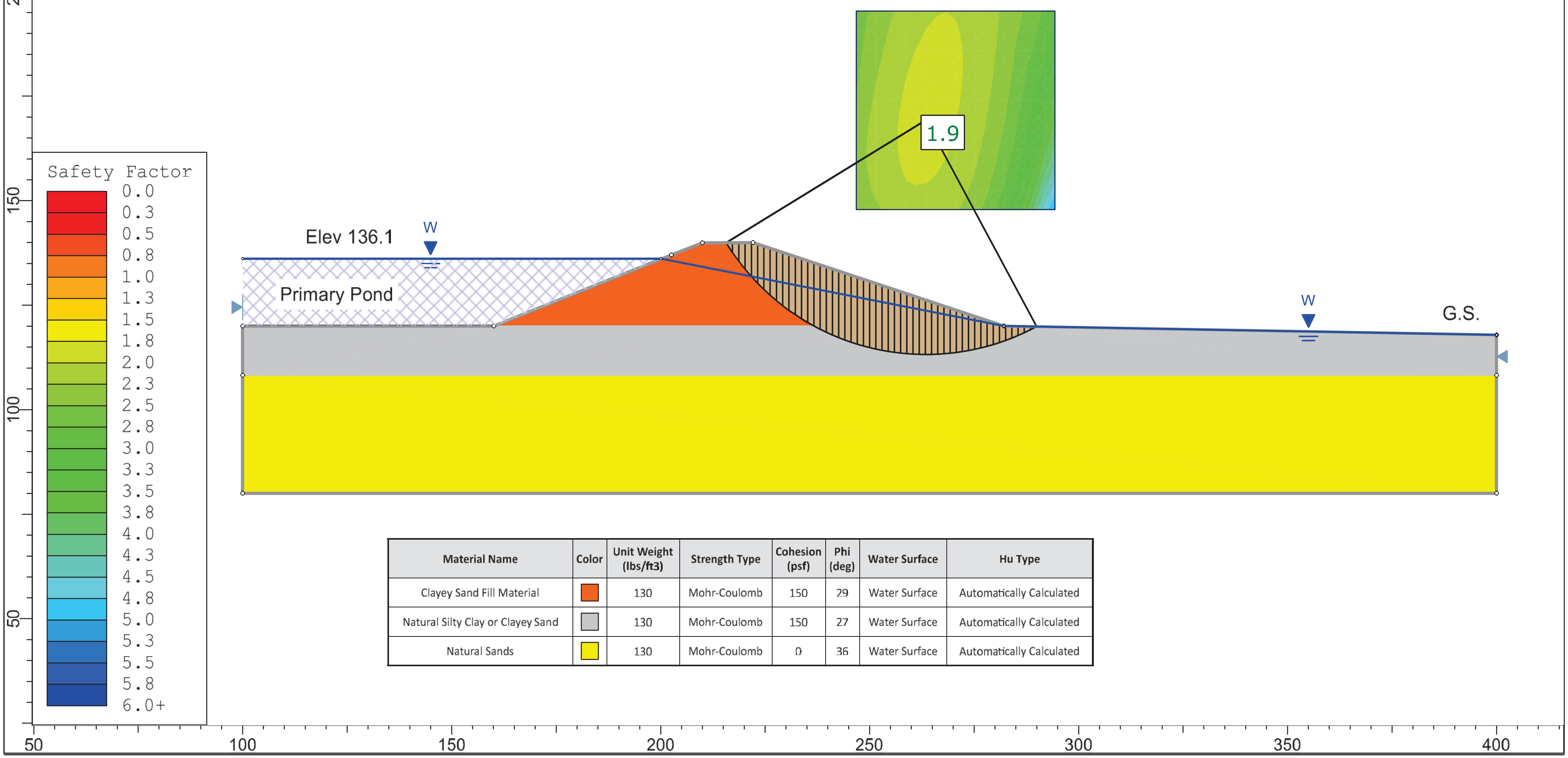

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 1_A-A_design_maxstor_eff_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 2

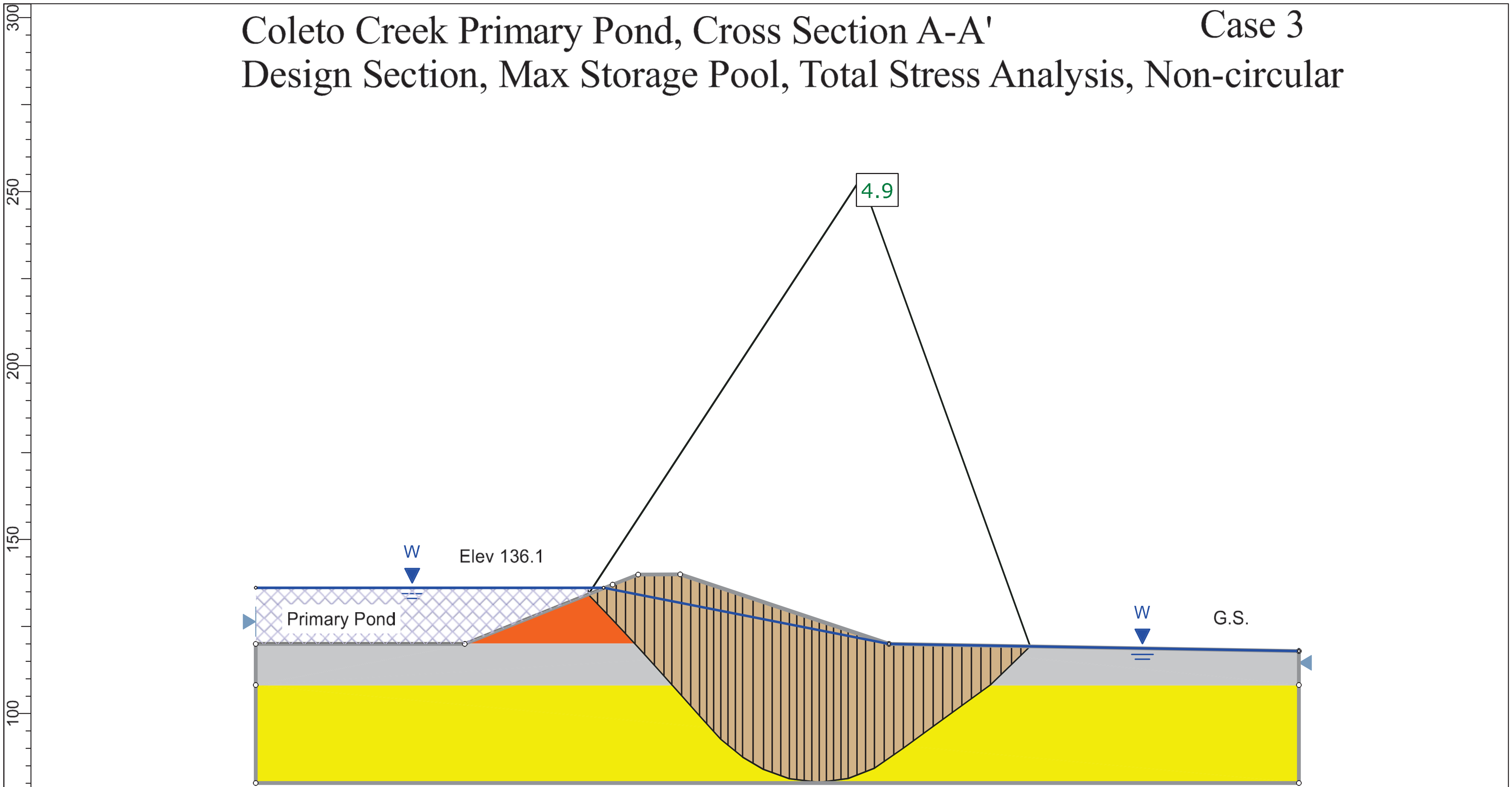
# Coleto Creek Primary Pond, Cross Section A-A'
## Design Section, Max Storage Pool, Effective Stress Analysis, Circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto Creek Primary Pond, Cross Section A-A' Case 3

Design Section, Max Storage Pool, Total Stress Analysis, Non-circular



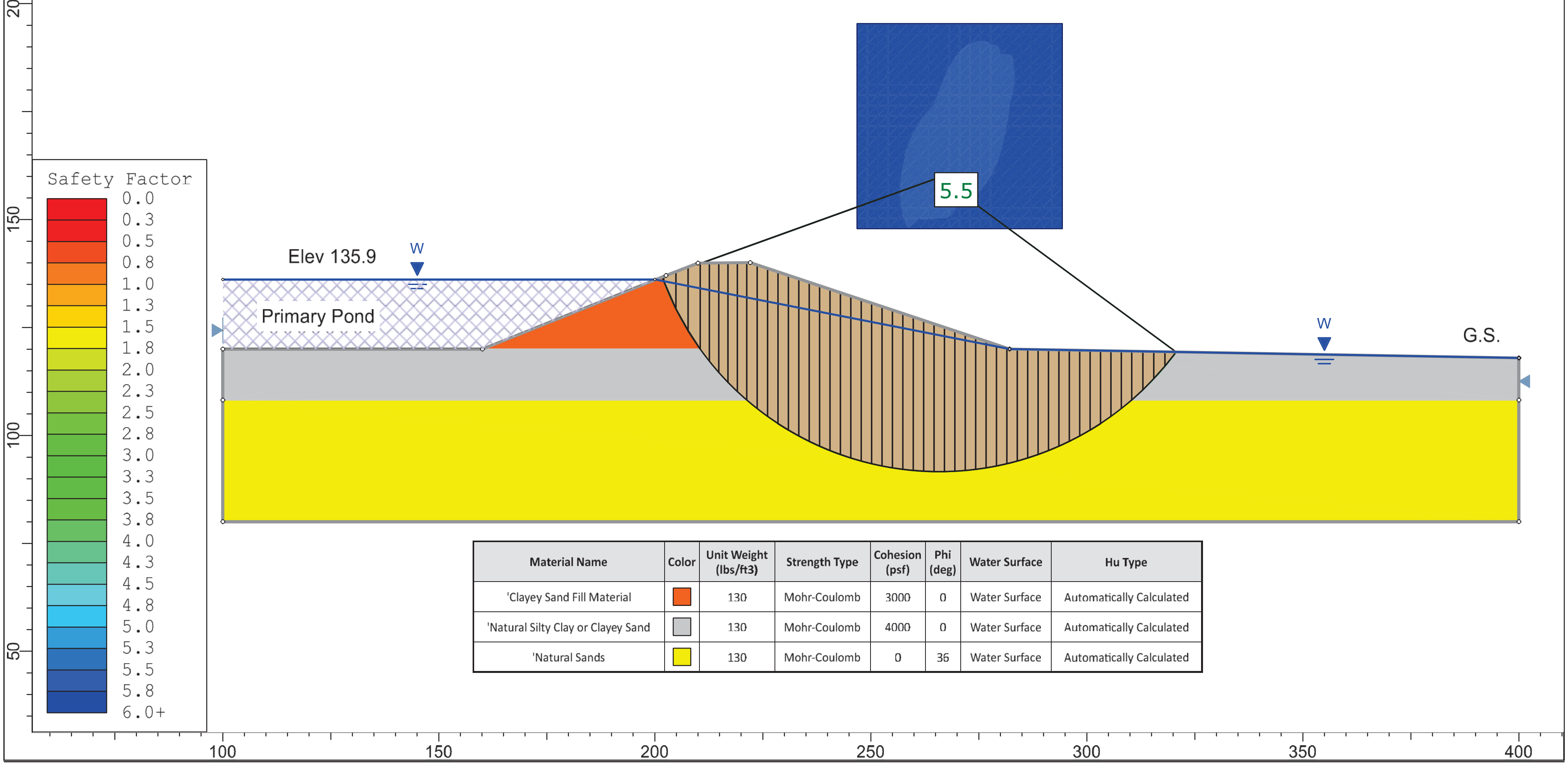

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 3_A-A_design_maxstor_tot_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 4

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Total Stress Analysis, Circular



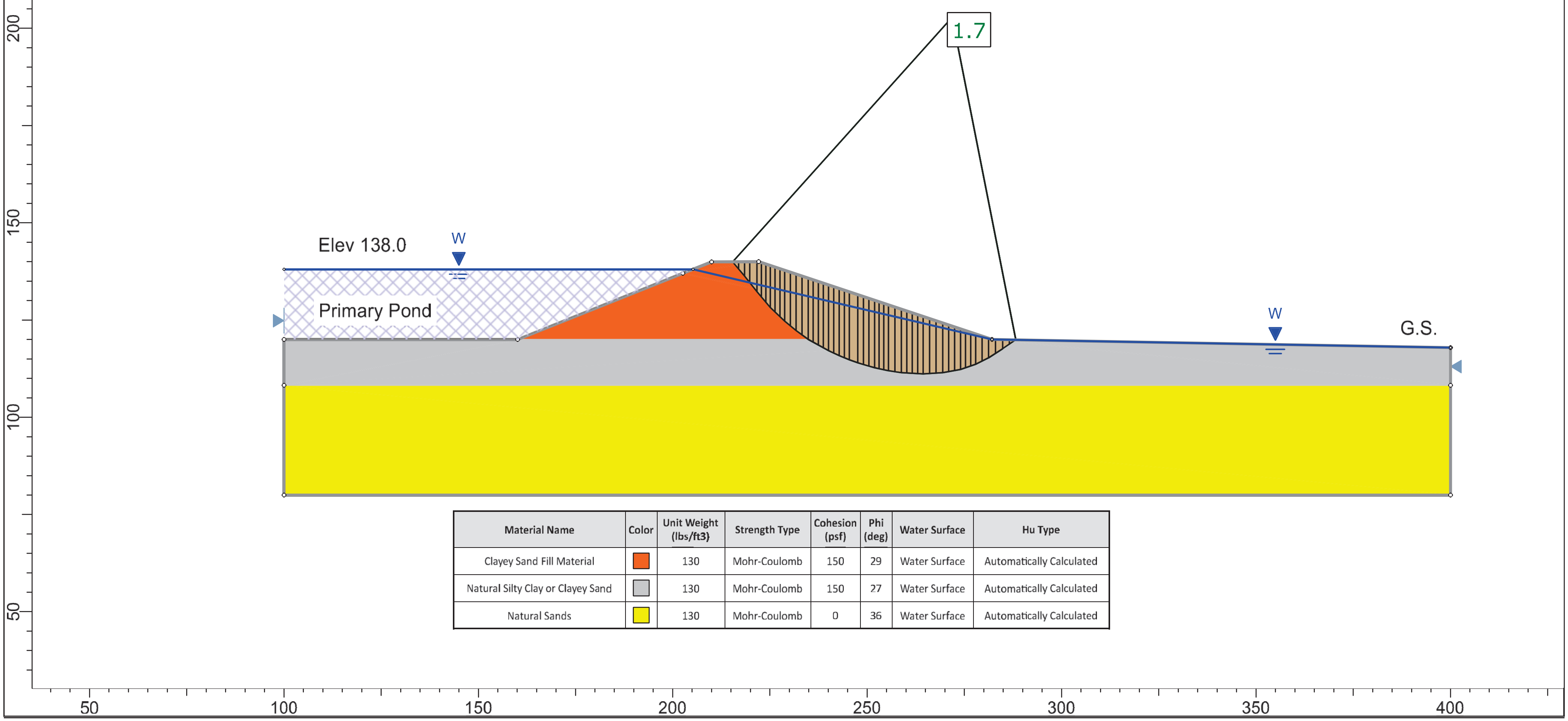

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 4_A-A_design_maxstor_tot_cir.slmd

Bullock, Bennett & Associates, LLC

Case 5

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Surcharge Pool, Effective Stress Analysis, Non-circular



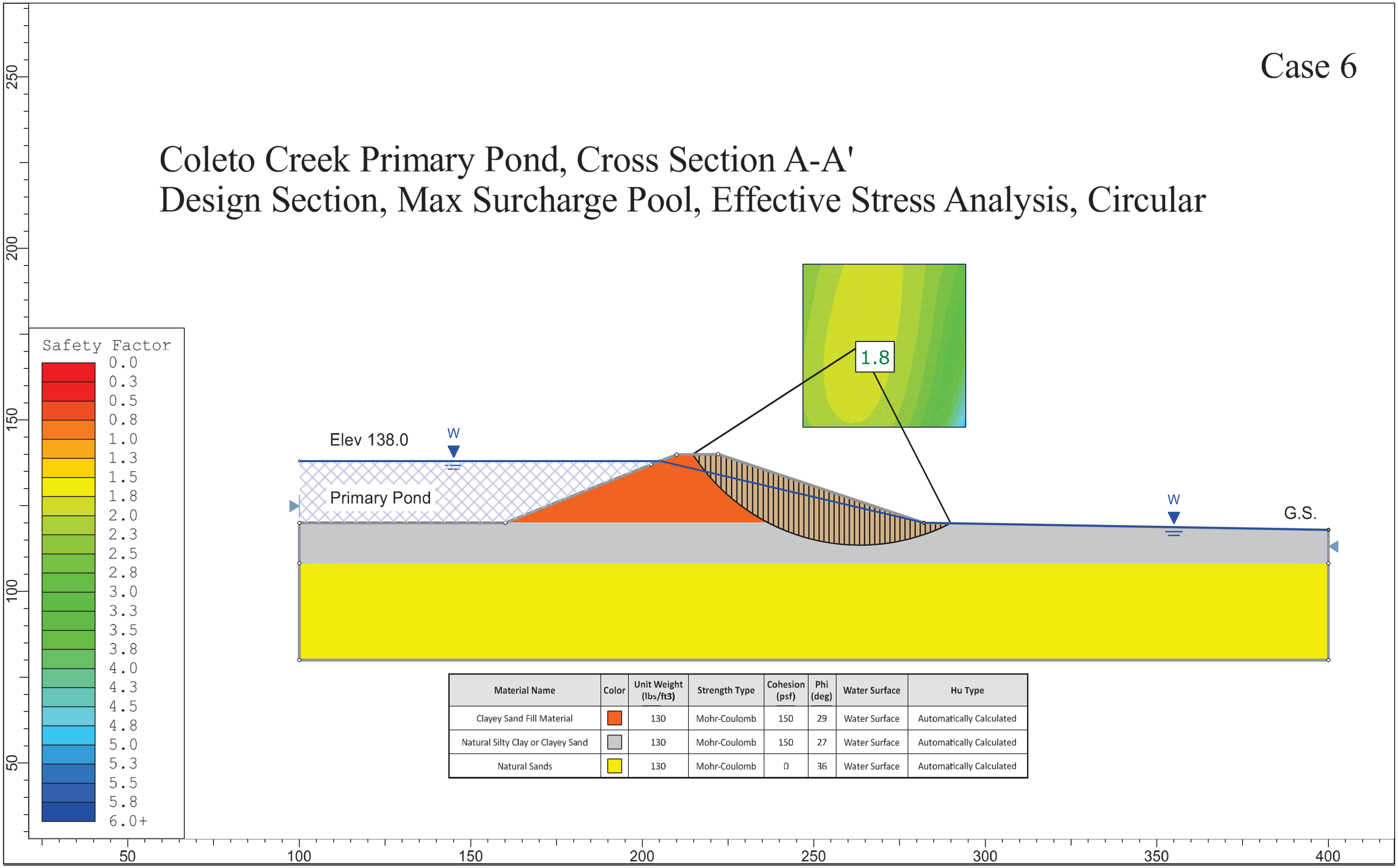

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 5_A-A_design_maxsur_eff_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 6

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Surcharge Pool, Effective Stress Analysis, Circular

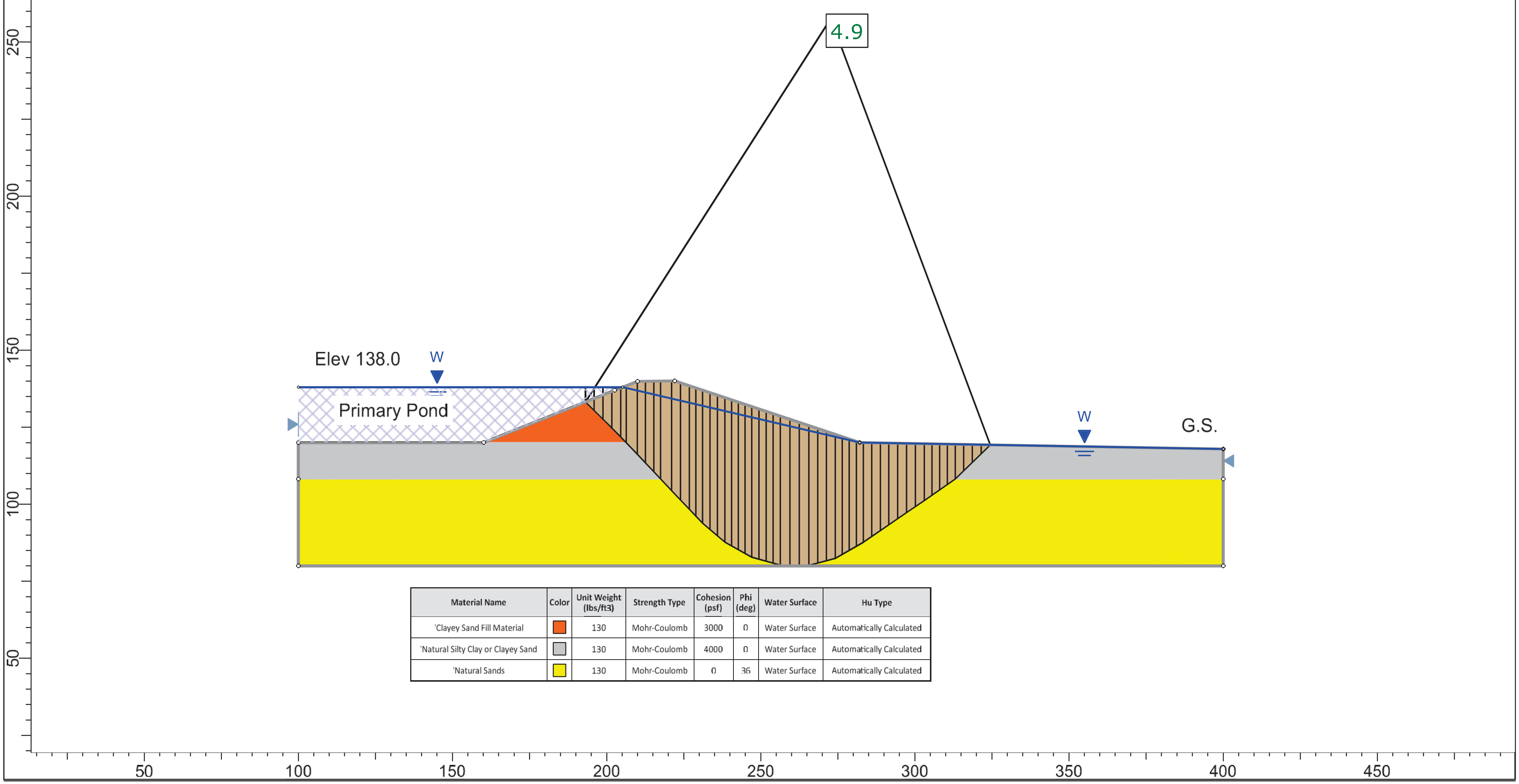



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 6_A-A_design_maxsur_eff_cir.slmd

Bullock, Bennett & Associates, LLC

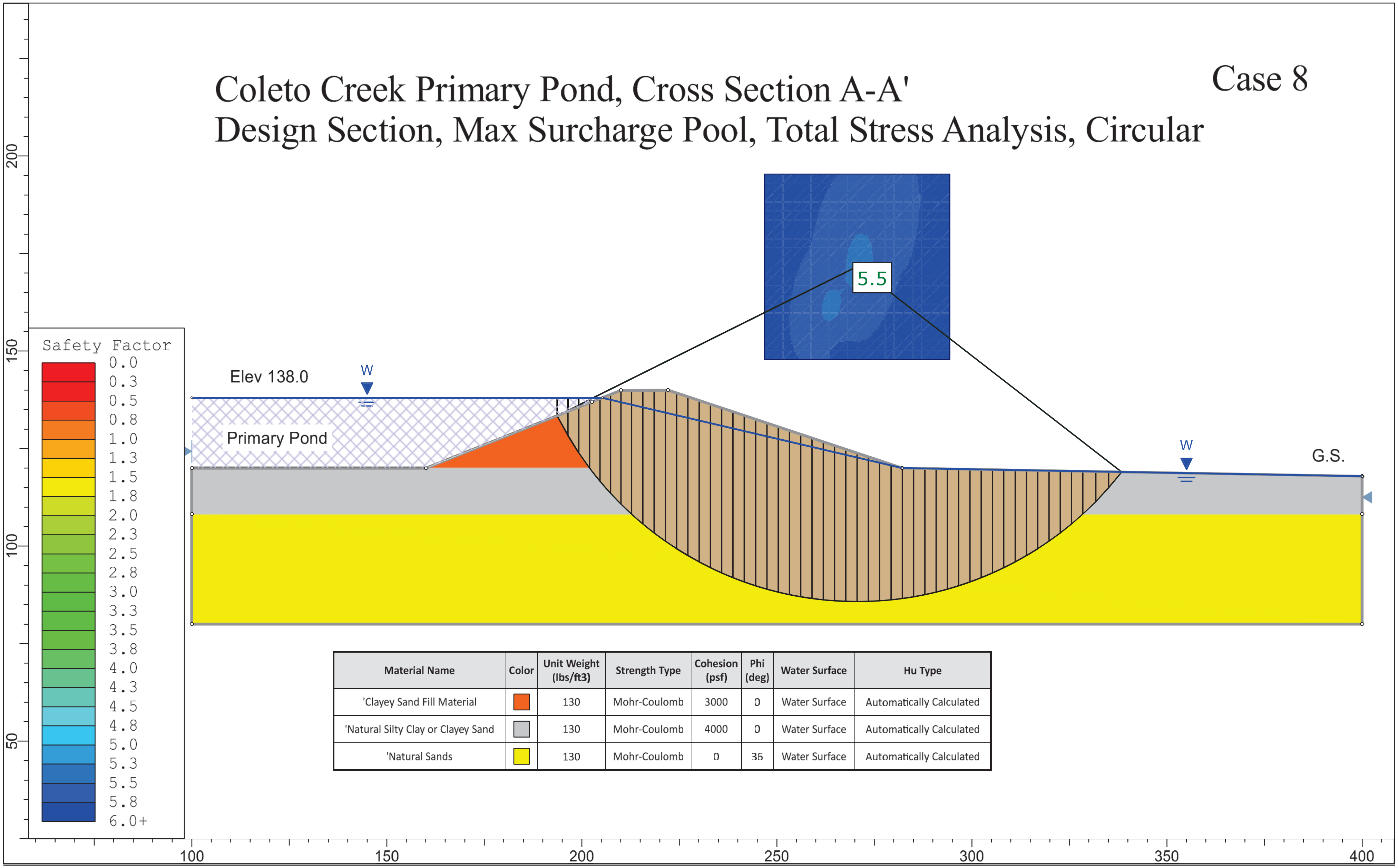
# Coleto Creek Primary Pond, Cross Section A-A' Case 7
## Design Section, Max Surcharge Pool, Total Stress Analysis, Non-circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Case 8

# Coleto Creek Primary Pond, Cross Section A-A'
## Design Section, Max Surcharge Pool, Total Stress Analysis, Circular



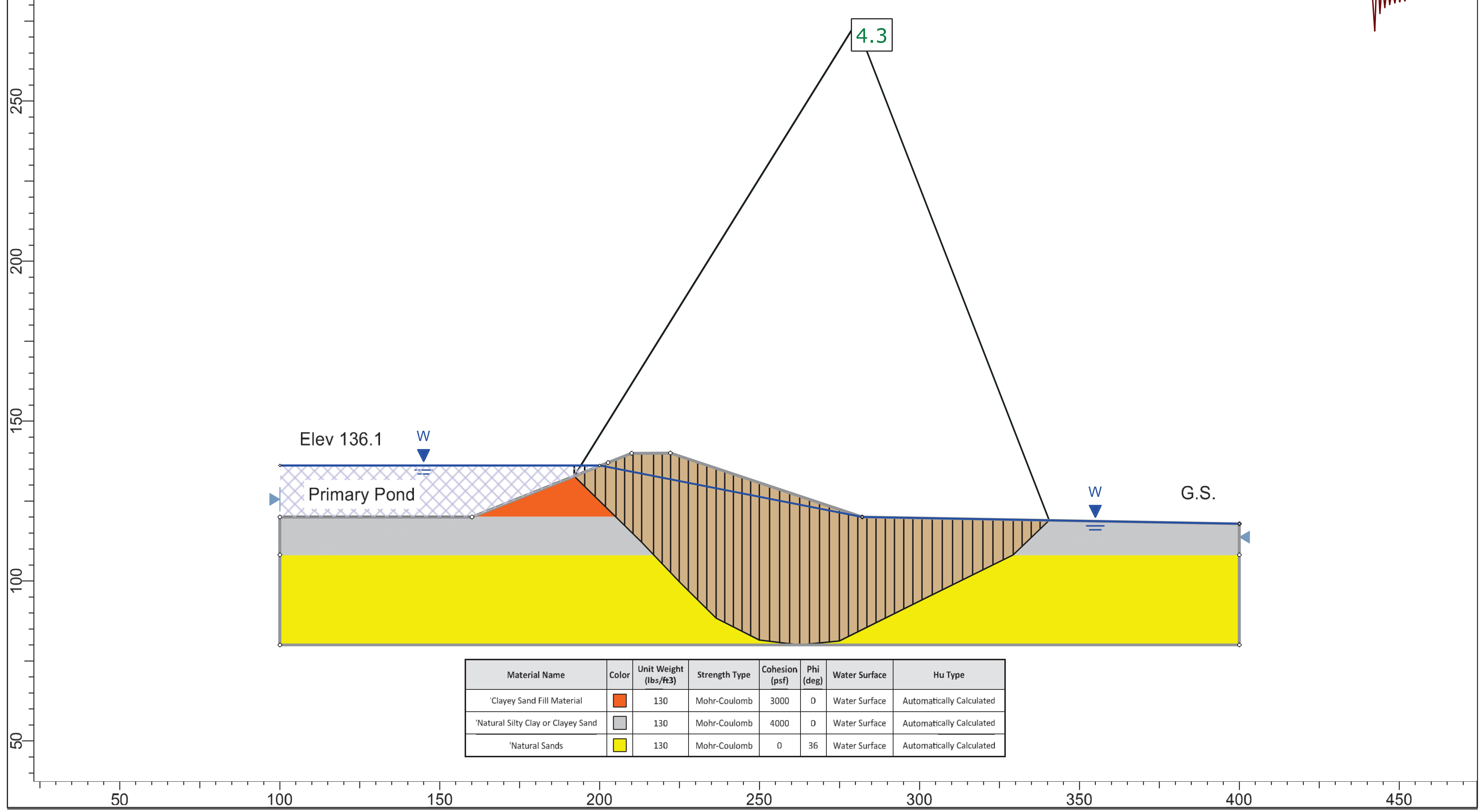

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 8_A-A_design_maxsur_tot_cir.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Seismic, Total Stress Analysis, Non-circular

Case 9



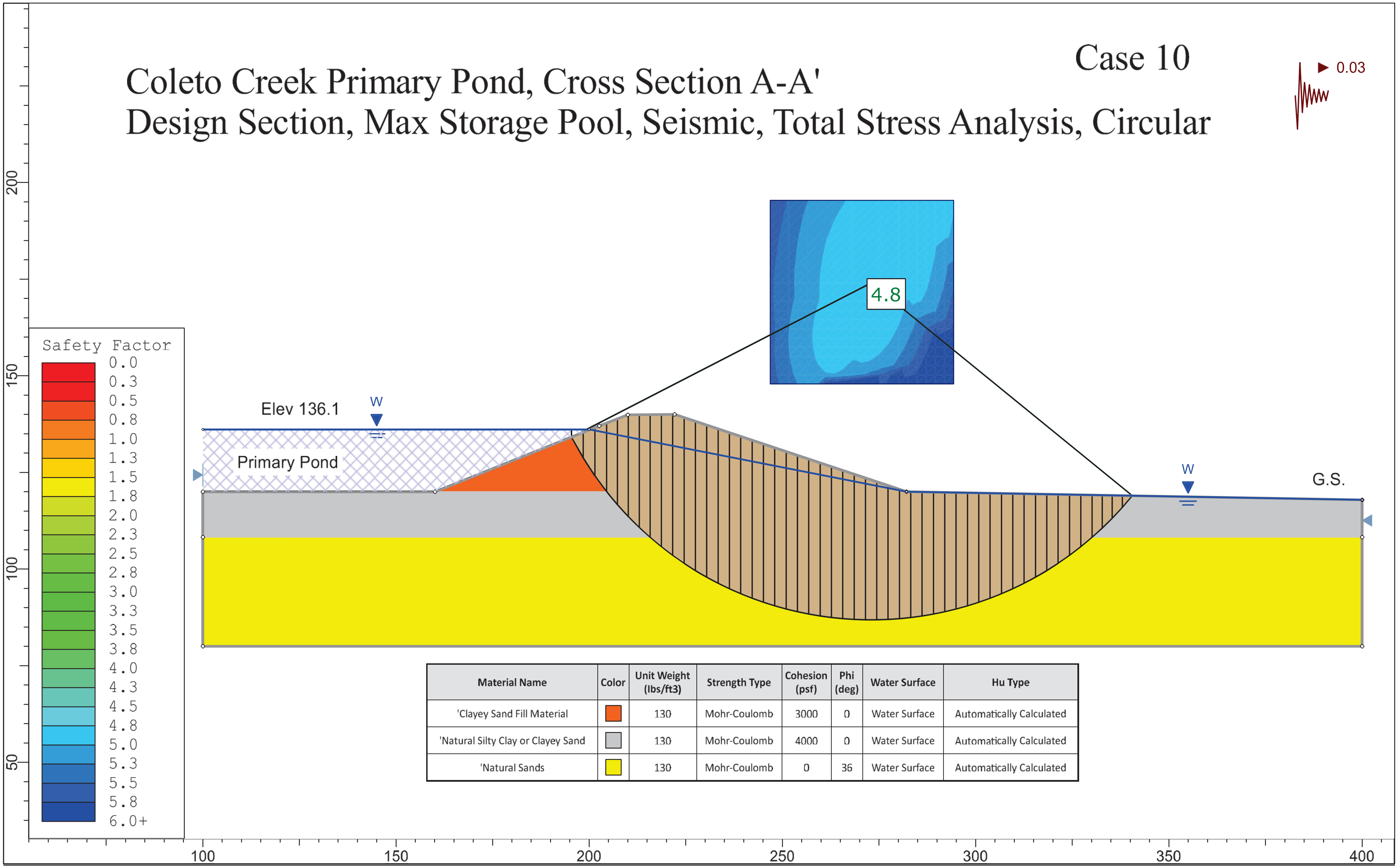

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 9_A-A_design_maxstor_seis_tot_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 10

# Coleto Creek Primary Pond, Cross Section A-A'
## Design Section, Max Storage Pool, Seismic, Total Stress Analysis, Circular



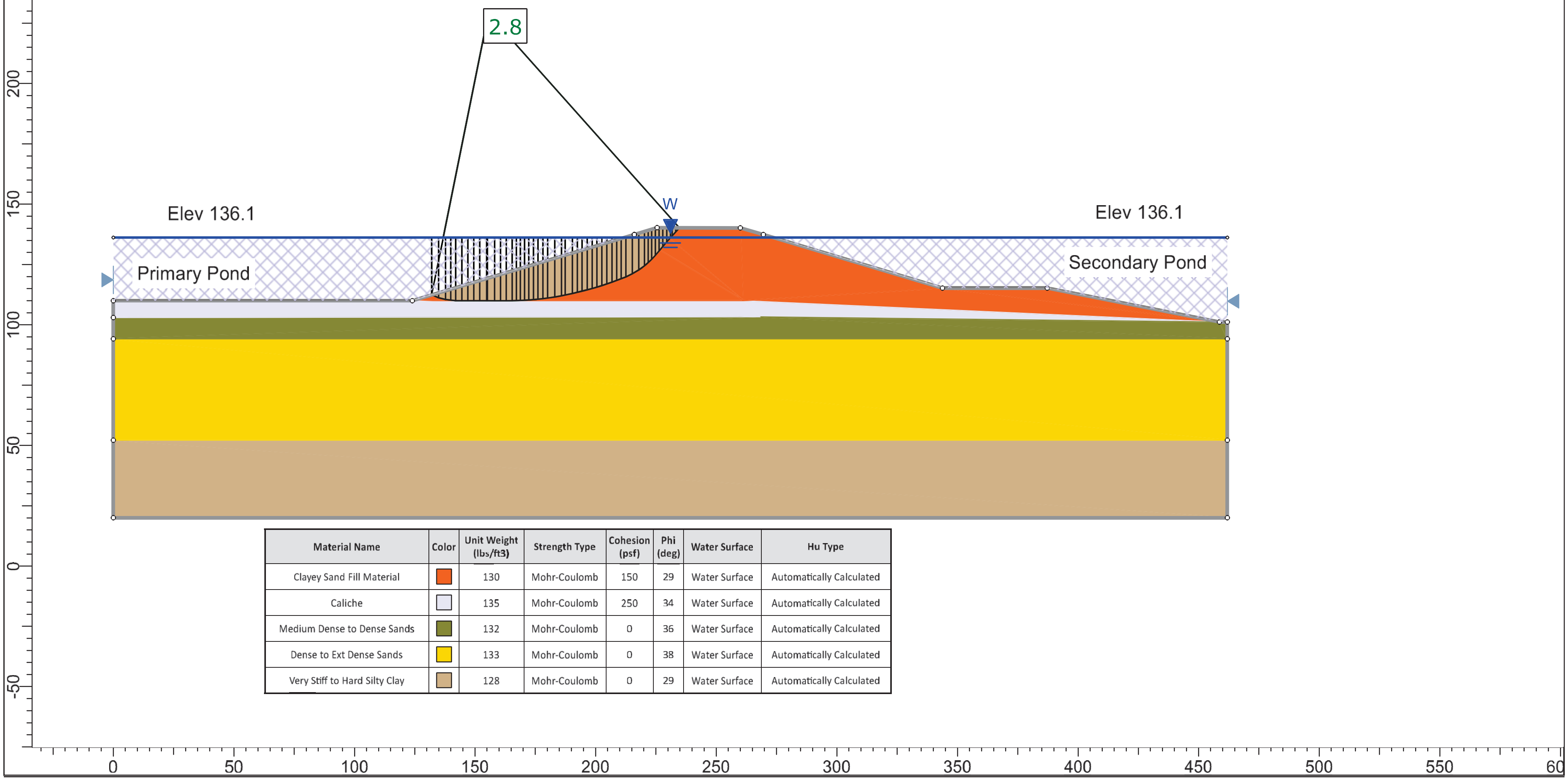

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 10_A-A_design_maxstor_seis_tot_cir.slmd

Bullock, Bennett & Associates, LLC

Case 11

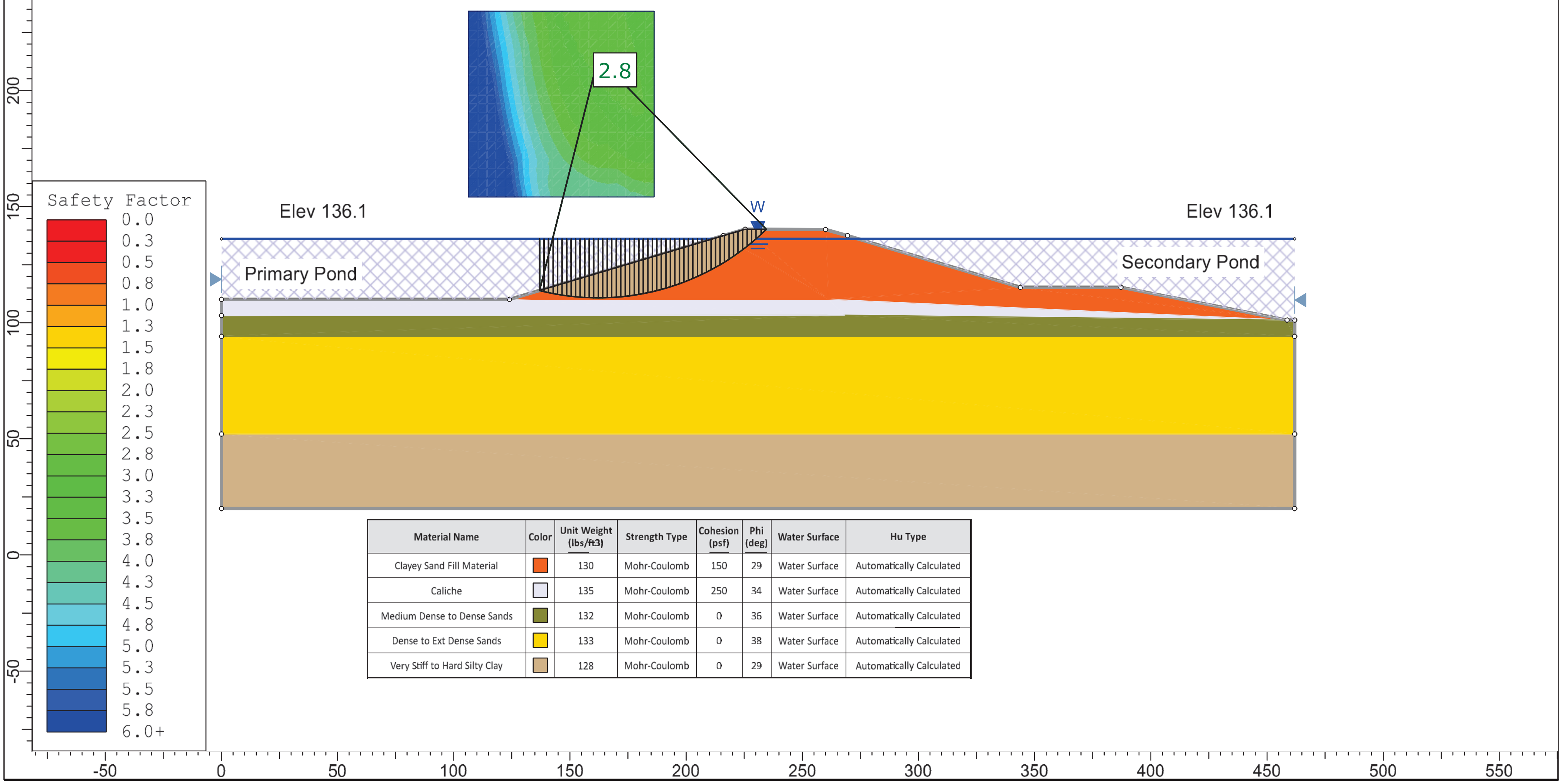
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Effective Stress Analysis, Non-circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 34 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 0 | 29 | Water Surface | Automatically Calculated |

Case 12

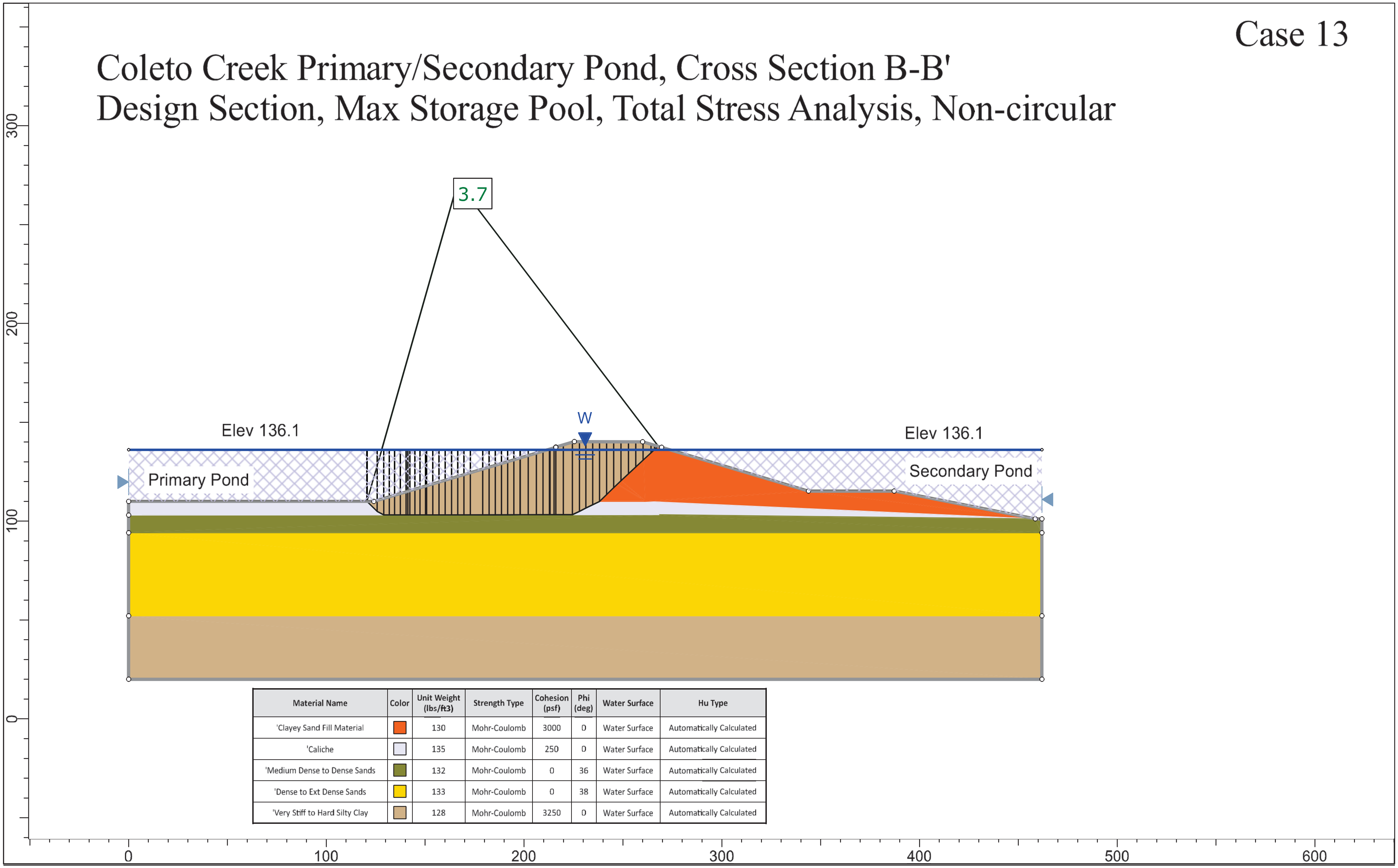
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Effective Stress Analysis, Circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 34 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 0 | 29 | Water Surface | Automatically Calculated |

Case 13

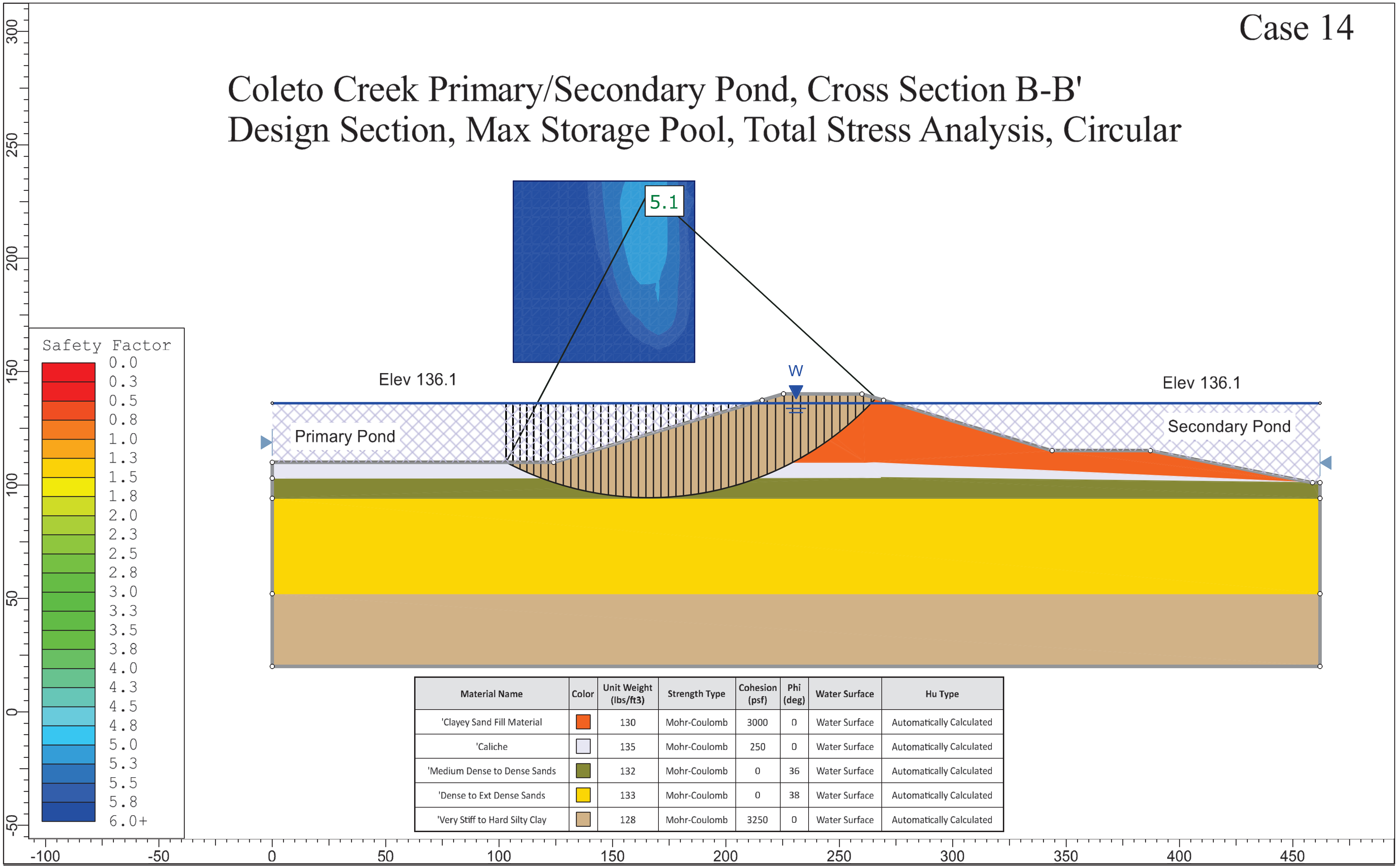
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Non-circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Case 14

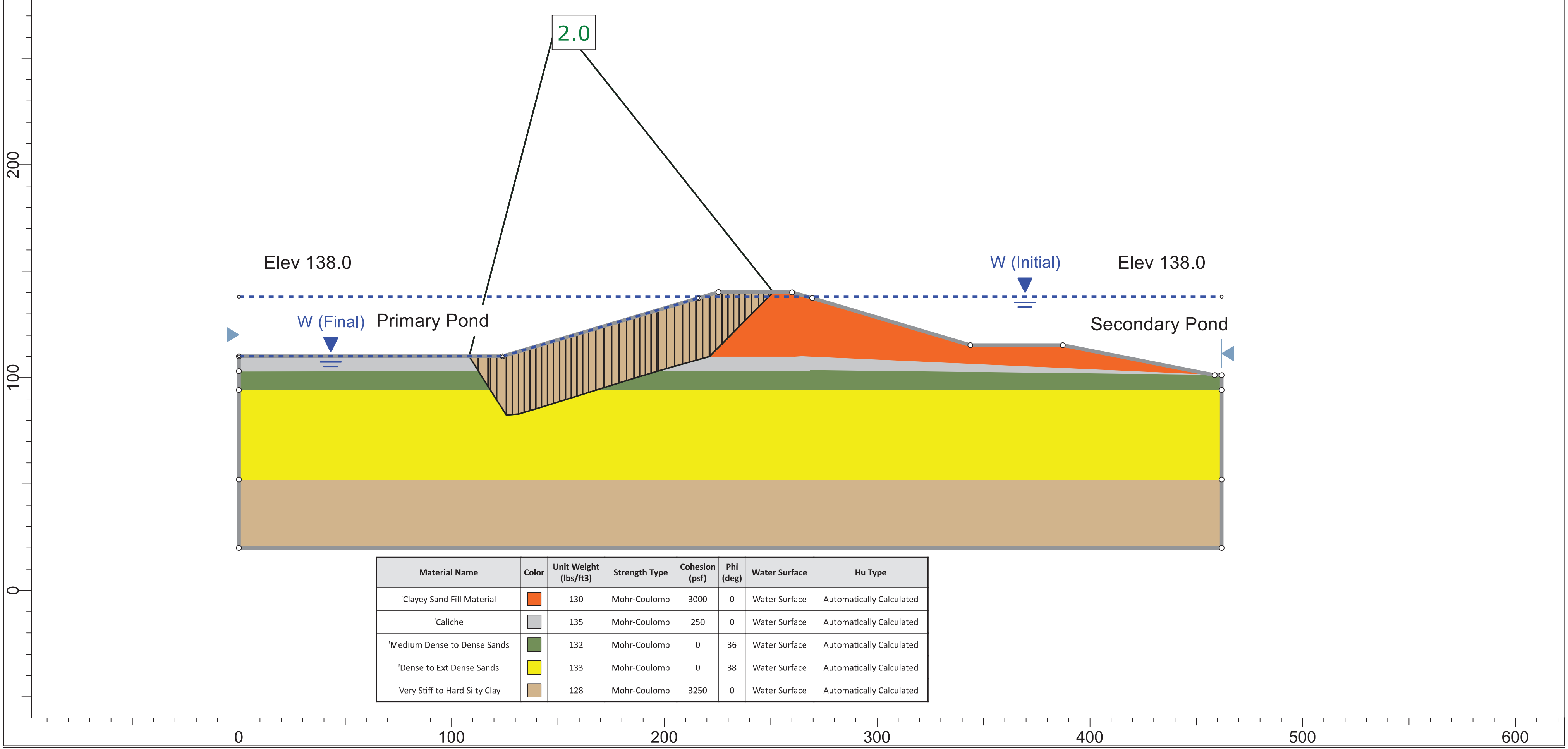
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Case 15

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Surcharge Pool, Rapid DD, Total Stress Analysis, Non-circular



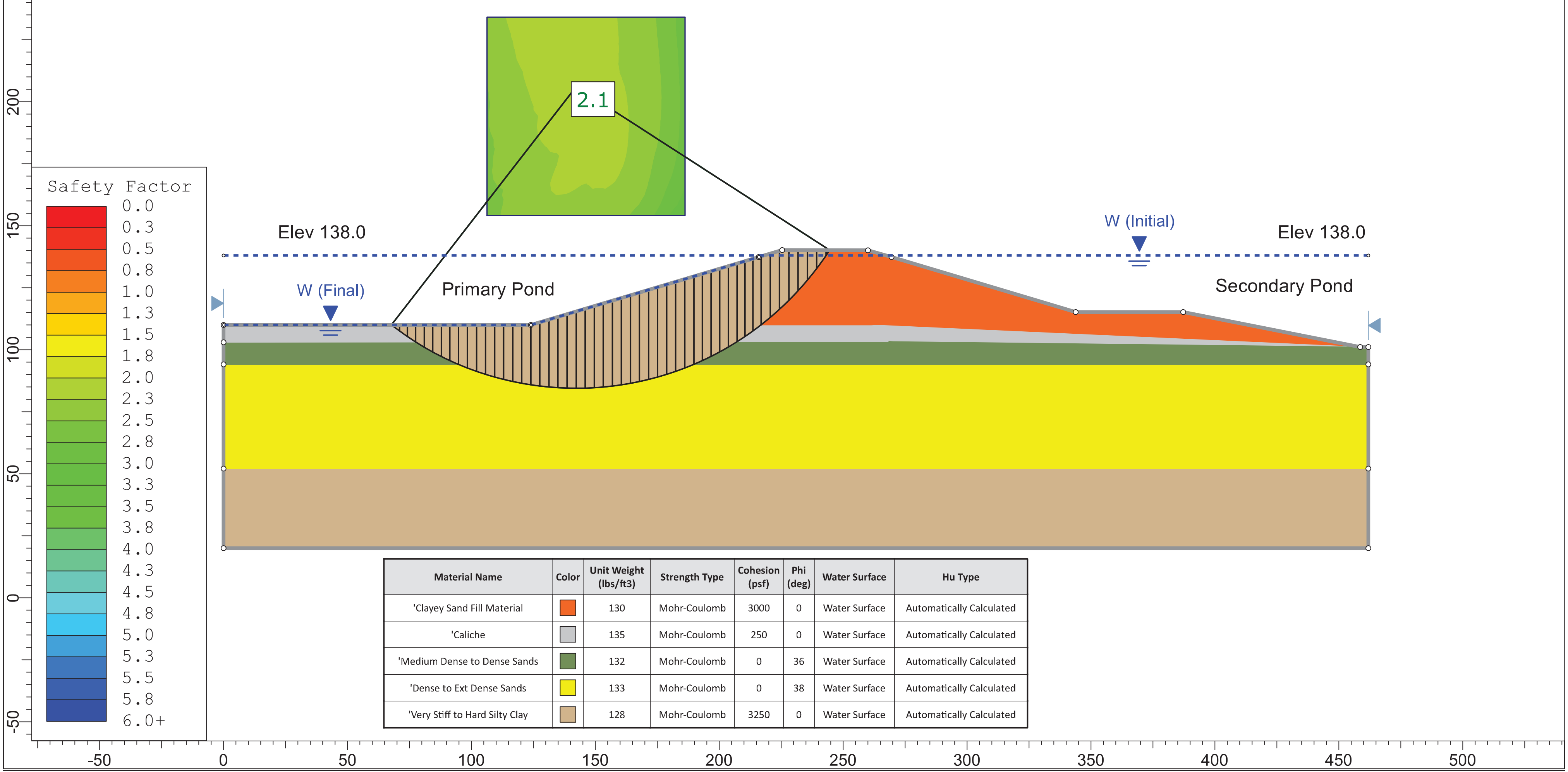

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 15_B-B Model_Maxsur_Rapid DD_total_noncirc.slmd

Bullock, Bennett & Associates, LLC

Case 16

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Surcharge Pool, Rapid DD, Total Stress Analysis, Circular



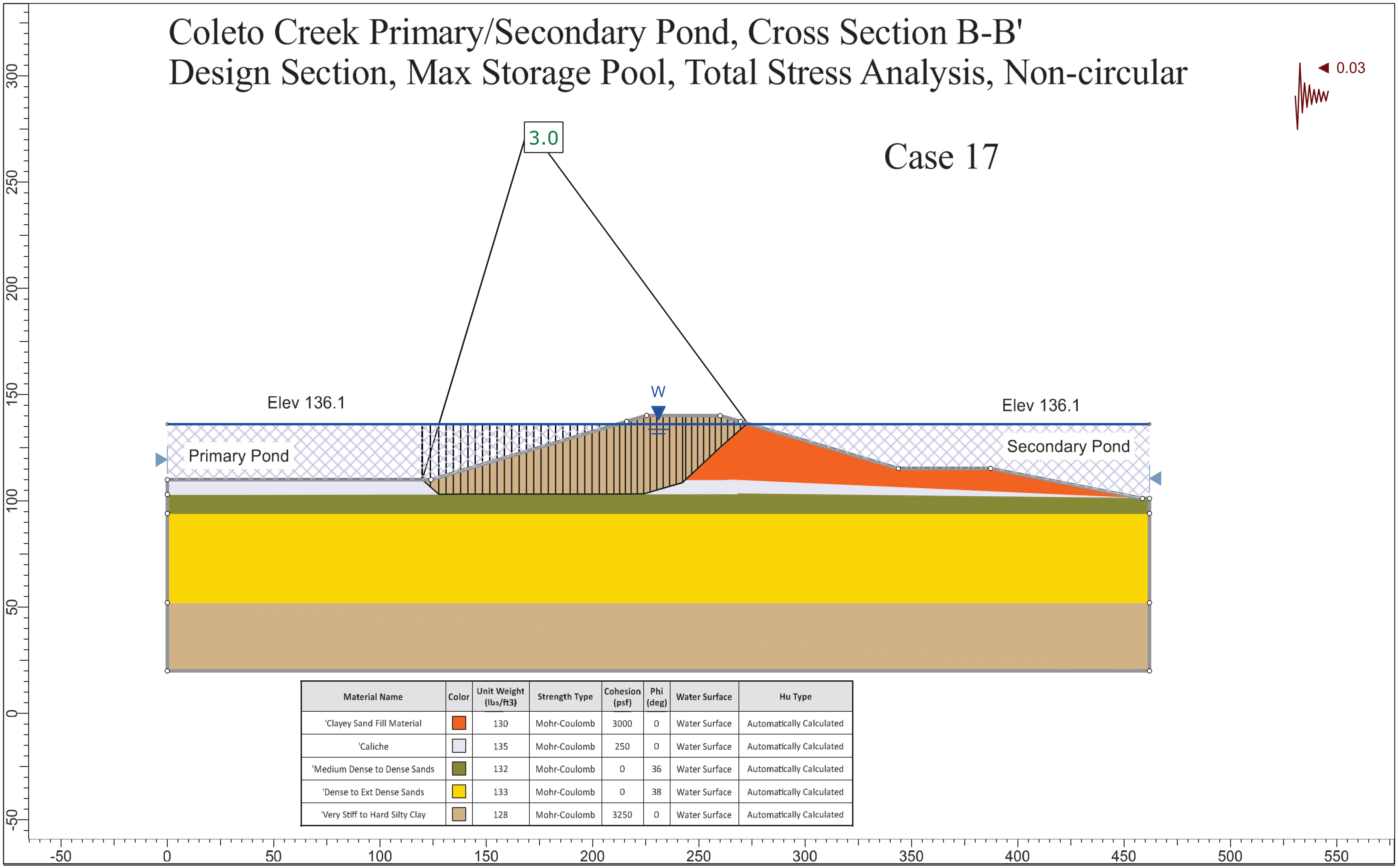

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 16_B-B Model_Maxsur_Rapid DD_total_circ.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Non-circular

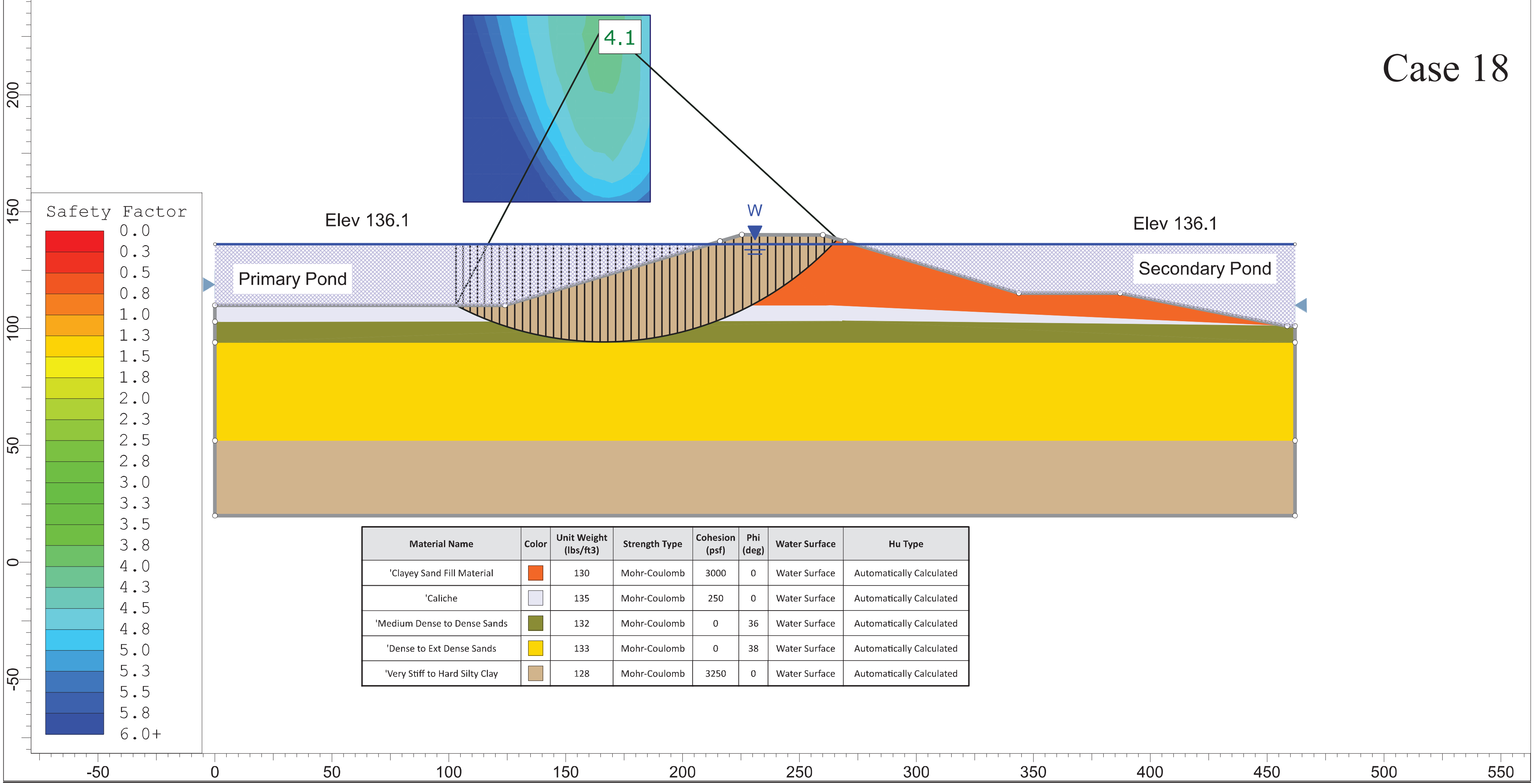
## Case 17




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Circular

Case 18




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 18_B-B Design_maxstor_total__seismic_circ.slmd

Bullock, Bennett & Associates, LLC

# APPENDIX D:  LIQUEFACTION ASSESSMENT CALCULATIONS

**APPENDIX D**
**LIQUEFACTION FACTOR OF SAFETY**
**ASSESSMENT METHODOLOGY**
**Coleto Creek Power Station**

Sources: Coduto, Donald P., Geotechnical Engineering Principles and Practices. Prentice-Hall.

Rauch, Alan F., May 1997. EPOLLS: *An Empiracle Method for Predicting Surface Displacements Due to Liquefaction-Induced Lateral Spreading in Earthquakes.* Dissertation Submitted to Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for degree of Doctor of Philosophy in Civil Engineering.

United States Environmental Protection Agency (USEPA), April 1995. RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities. Office of Research and Development. Washington, DC. EPA/600/R-95/051

Methodology: Standard Penetration Test (SPT)

*Step 1: Compute the standardized value of number of blow counts per foot normalized for overburden stress at the depth of the test*

$$(N_1)_{60} = NSPT \cdot C_N \cdot CE \cdot CB \cdot CS \cdot C_R$$

where:
$(N_1)_{60}$ = Measured blowcount normalized for overburden stress at the depth of the test
$C_N$ = Correction factor to normalize the measured blowcount to an equivalent value under one atmosphere of effective overburden stress

$$C_N = \sqrt{\frac{Pa}{\sigma'_{vo}}} \leq 2.0$$

where:
Pa = one atmosphere of pressure (101.325kPa) in the same units as $\sigma'_{vo}$
$\sigma'_{vo}$ = vertical efffective stress at depth of $N_{SPT}$

$C_E$ =Correction factor of the measured SPT blowcount for level of energy delivered by the SPT hammer, 1.0 for safety hammer type with rope and pulley hammer release
$C_B$ = Correction factor for borehole diameters outside the recommended range of 2.5 to 4.5 inch, 1.0 for borehole inside range
$C_S$ = Correction factor for SPT samplers used without a sample liner, 1.0 for standard sampler
$C_R$ = Correction factor for loss of energy through reflection in short lengths of drill rod:

where:
For $z < 3$ m; $C_R = 0.75$
For $3 < z < 9$ m; $C_R = (15+z)/24$
For $z > 9$ m; $C_R = 1.0$
where: z = length of drill rod in meters (approximately equal to depth of $N_{SPT}$)

Step 2: Compute a clean-sand equivalent value of $(N_1)_{60}$

$$(N_1)_{60} - cs = (N_1)_{60} + \Delta(N_1)$$

where:

$\Delta(N_1)_{60}$ = correction factor computed as follows:

For FC < 5%, $\Delta(N_1)_{60}$ = 0.0

For 5 < FC < 35%, $\Delta(N_1)_{60}$ = 7*(FC - 5)/30

For FC > 35%, $\Delta(N_1)_{60}$ = 7.0

where:

FC = Fines content (percent finer than 0.075 mm)

Note: Where data was available, those FC were used. Otherwise, representative values from the USGS standard soil classification were used for the soil type observed during drilling.

*Step 3: Compute the cyclic resistance ratio for a standardized magnitude 7.5 earthquake (CRR $_{M7.5}$)*

$$100 \cdot CRR_{M7.5} = \frac{95}{34 - (N_1)_{60} - cs} + \frac{(N_1)_{60} - cs}{1.3} - \frac{1}{2}$$

Note: A value of $(N_1)_{60}$-cs > 30 indicates an unliquefiable soil with an infinite CRR. Designated as UL in the calculation tables.

*Step 4: Adjust the standardized cyclic resistance ratio for the worst-case magnitude of earthquake for the area*

$$CRR = CRRM_{7.5} \cdot MSF \cdot K\sigma \cdot K\alpha$$

where:

MSF = magnitude scaling factor computed as follows:

For $M_w < 7.0$; MSF = $10^{3.00} * M_w^{-3.46}$

where:

$M_w$ = estimated worst-case magnitude eartquake, 6.1 taken from Figure 3.3 Seismic Source Zones in the Contiguous United States (USGS, 1982) and Table 3.1 Parameters for Seismic Source Zones (USGS, 2982) (USEPA, 1995)

Note: Two additional correction factors are potentially applicable for liquefiable soil deposits subject to significant overburden with a stress factor greater than 1 tsf (2000 psf) ($K\sigma$) or static shear stresses such as significant slopes ($K\alpha$). $K\sigma$ values were interpolated using Figure 5.7 Curves for Estimation of Correction Factor (Harder 1988, and Hynes 1988, as Quoted in Marcuson, et.al., 1990) (USEPA, 1998). No $K\alpha$ factor was applied due to the relatively flat ground surface in the area.

*Step 5: Estimate the average cyclic shear stress (CSR)*

$$CSR = 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_{vo}}{\sigma'_{vo}} \cdot rd$$

where:

$a_{max}/g$ = peak horizonal acceleration that would occur at the ground surface in the absence of excess pore pressures or liquefaction, 0.03 g taken from the 2014 United States Geological Survey National Seismic Hazard Maps found at http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014pga2pct.pdf).

$\sigma_{vo}$ = total vertical overburden stress

g = acceleration due to gravity, 9.81 $m/s^2$

$r_d$ = stress reduction factor calculated as follows for depths up to 30 m:

$$r_d = 1.0 + 1.6*10^{-6}(z^4 - 42z^3 + 105z^2 - 4200z)$$

Step 6: Calculate the Factor of Safety against liquefaction ($FS_{liq}$)

$$FS_{liq} = \frac{CRR}{CSR}$$

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-1-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 12 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 50' bgs<br>3", 50' to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | Kσ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0.61 | Unsaturated | 40 | SC | 250 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 60.0 | 35 | 7.0 | 67.0 | UL | 1.92 | NA | UL | 0.03 | 250 | 1.00 | UL | UL |
| 2 | 4 | 1.22 | Unsaturated | 13 | SC | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 19.5 | 35 | 7.0 | 26.5 | 0.33 | 1.92 | NA | 0.62 | 0.03 | 500 | 0.99 | 0.019 | 32 |
| 3 | 6 | 1.83 | Unsaturated | 14 | SC | 750 | 1.68 | 1.0 | 1.00 | 1.0 | 0.75 | 17.6 | 35 | 7.0 | 24.6 | 0.29 | 1.92 | NA | 0.55 | 0.03 | 750 | 0.99 | 0.019 | 28 |
| 4 | 8 | 2.44 | Unsaturated | 15 | SC | 1000 | 1.45 | 1.0 | 1.00 | 1.0 | 0.75 | 16.4 | 90.6 | 7.0 | 23.4 | 0.26 | 1.92 | NA | 0.51 | 0.03 | 1000 | 0.98 | 0.019 | 26 |
| 7 | 14 | 4.27 | Saturated | 10 | SC | 1635.4 | 1.14 | 1.0 | 1.00 | 1.0 | 0.80 | 9.1 | 35 | 7.0 | 16.1 | 0.17 | 1.92 | NA | 0.33 | 0.03 | 1760 | 0.97 | 0.020 | 16 |
| 8 | 16 | 4.88 | Saturated | 13 | SC | 1770.8 | 1.09 | 1.0 | 1.00 | 1.0 | 0.83 | 11.8 | 35 | 7.0 | 18.8 | 0.20 | 1.92 | NA | 0.39 | 0.03 | 2020 | 0.96 | 0.021 | 18 |
| 9 | 18 | 5.49 | Saturated | 9 | SC | 1906.2 | 1.05 | 1.0 | 1.00 | 1.0 | 0.85 | 8.1 | 35 | 7.0 | 15.1 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 2280 | 0.96 | 0.022 | 14 |
| 10 | 20 | 6.10 | Saturated | 15 | SC | 2041.6 | 1.02 | 1.0 | 1.00 | 1.0 | 0.88 | 13.4 | 39.5 | 7.0 | 20.4 | 0.22 | 1.92 | 0.93 | 0.40 | 0.03 | 2540 | 0.95 | 0.023 | 17 |
| 12 | 24 | 7.32 | Saturated | 13 | SC | 2312.4 | 0.96 | 1.0 | 1.00 | 1.0 | 0.93 | 11.6 | 35 | 7.0 | 18.6 | 0.20 | 1.92 | 0.92 | 0.35 | 0.03 | 3060 | 0.94 | 0.024 | 15 |
| 13 | 26 | 7.92 | Saturated | 21 | SC | 2447.8 | 0.93 | 1.0 | 1.00 | 1.0 | 0.96 | 18.7 | 35 | 7.0 | 25.7 | 0.31 | 1.92 | 0.92 | 0.54 | 0.03 | 3320 | 0.93 | 0.025 | 22 |
| 14 | 28 | 8.53 | Saturated | 15 | SC | 2583.2 | 0.91 | 1.0 | 1.00 | 1.0 | 0.98 | 13.3 | 35 | 7.0 | 20.3 | 0.22 | 1.92 | 0.91 | 0.39 | 0.03 | 3580 | 0.92 | 0.025 | 16 |
| 15 | 30 | 9.14 | Saturated | 28 | SC | 2718.6 | 0.88 | 1.0 | 1.00 | 1.0 | 1.0 | 24.7 | 35 | 7.0 | 31.7 | UL | 1.92 | 0.91 | UL | 0.03 | 3840 | 0.91 | UL | UL |
| 16 | 32 | 9.75 | Saturated | 12 | SC | 2854 | 0.86 | 1.0 | 1.00 | 1.0 | 1.0 | 10.3 | 35 | 7.0 | 17.3 | 0.19 | 1.92 | 0.90 | 0.32 | 0.03 | 4100 | 0.90 | 0.025 | 13 |
| 18 | 34.7 | 10.58 | Saturated | 6 | SM | 3036.79 | 0.83 | 1.0 | 1.00 | 1.0 | 1.0 | 5.0 | 15 | 2.3 | 7.3 | 0.09 | 1.92 | 0.90 | 0.15 | 0.03 | 4451 | 0.89 | 0.025 | 6 |
| 18A | 36 | 10.97 | Saturated | 15 | SM | 3124.8 | 0.82 | 1.0 | 1.00 | 1.0 | 1.0 | 12.3 | 15 | 2.3 | 14.7 | 0.16 | 1.92 | 0.90 | 0.27 | 0.03 | 4620 | 0.88 | 0.025 | 11 |
| 19 | 36.7 | 11.19 | Saturated | 24 | SP | 3172.19 | 0.82 | 1.0 | 1.00 | 1.0 | 1.0 | 19.6 | 1 | 0.0 | 19.6 | 0.21 | 1.92 | 0.89 | 0.36 | 0.03 | 4711 | 0.88 | 0.025 | 14 |
| 19A | 38 | 11.58 | Saturated | 26 | SP | 3260.2 | 0.81 | 1.0 | 1.00 | 1.0 | 1.0 | 20.9 | 1 | 0.0 | 20.9 | 0.23 | 1.92 | 0.89 | 0.39 | 0.03 | 4880 | 0.87 | 0.025 | 15 |
| 20 | 40 | 12.19 | Saturated | 39 | SP | 3395.6 | 0.79 | 1.0 | 1.00 | 1.0 | 1.0 | 30.8 | 1 | 0.0 | 30.8 | UL | 1.92 | 0.89 | UL | 0.03 | 5140 | 0.86 | UL | UL |
| 21 | 42 | 12.80 | Saturated | 27 | SP | 3531 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 20.9 | 1 | 0.0 | 20.9 | 0.23 | 1.92 | 0.88 | 0.39 | 0.03 | 5400 | 0.84 | 0.025 | 15 |
| 22 | 44 | 13.41 | Saturated | 35 | SM | 3666.4 | 0.76 | 1.0 | 1.00 | 1.0 | 1.0 | 26.6 | 15 | 2.3 | 28.9 | 0.40 | 1.92 | 0.88 | 0.68 | 0.03 | 5660 | 0.83 | UL | UL |
| 23 | 46 | 14.02 | Saturated | 34 | SP | 3801.8 | 0.75 | 1.0 | 1.00 | 1.0 | 1.0 | 25.4 | 1 | 0.0 | 25.4 | 0.30 | 1.92 | 0.87 | 0.50 | 0.03 | 5920 | 0.82 | UL | UL |
| 24 | 48 | 14.63 | Saturated | 66 | SP | 3937.2 | 0.73 | 1.0 | 1.00 | 1.0 | 1.0 | 48.4 | 1 | 0.0 | 48.4 | UL | 1.92 | 0.87 | UL | 0.03 | 6180 | 0.80 | UL | UL |
| 25 | 50 | 15.24 | Saturated | 56 | SP | 4072.6 | 0.72 | 1.0 | 1.00 | 1.0 | 1.0 | 40.4 | 1 | 0.0 | 40.4 | UL | 1.92 | 0.86 | UL | 0.03 | 6440 | 0.79 | UL | UL |
| 26 | 52 | 15.85 | Saturated | 50 | SP | 4208 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 35.5 | 1 | 0.0 | 35.5 | UL | 1.92 | 0.86 | UL | 0.03 | 6700 | 0.77 | UL | UL |
| 27 | 57 | 17.37 | Saturated | 50 | SP | 4546.5 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 34.1 | 1 | 0.0 | 34.1 | UL | 1.92 | 0.85 | UL | 0.03 | 7350 | 0.73 | UL | UL |
| 28 | 62 | 18.90 | Saturated | 66 | SP | 4885 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 43.4 | 1 | 0.0 | 43.4 | UL | 1.92 | 0.84 | UL | 0.03 | 8000 | 0.68 | UL | UL |
| 29 | 67 | 20.42 | Saturated | 50 | SC | 5223.5 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 31.8 | 35 | 7.0 | 38.8 | UL | 1.92 | 0.83 | UL | 0.03 | 8650 | 0.64 | UL | UL |
| 30 | 72 | 21.95 | Saturated | 92 | SC | 5562 | 0.62 | 1.0 | 1.00 | 1.0 | 1.0 | 56.7 | 35 | 7.0 | 63.7 | UL | 1.92 | 0.81 | UL | 0.03 | 9300 | 0.59 | UL | UL |
| 31 | 75 | 22.86 | Saturated | 50 | SC | 5765.1 | 0.61 | 1.0 | 1.00 | 1.0 | 1.0 | 30.3 | 35 | 7.0 | 37.3 | UL | 1.92 | 0.81 | UL | 0.03 | 9690 | 0.57 | UL | UL |
| 32 | 81 | 24.69 | Saturated | 50 | SP | 6171.3 | 0.59 | 1.0 | 1.00 | 1.0 | 1.0 | 29.3 | 1 | 0.0 | 29.3 | UL | 1.92 | 0.79 | UL | 0.03 | 10470 | 0.52 | UL | UL |
| 33 | 86 | 26.21 | Saturated | 50 | SM | 6509.8 | 0.57 | 1.0 | 1.00 | 1.0 | 1.0 | 28.5 | 15 | 2.3 | 30.8 | UL | 1.92 | 0.78 | UL | 0.03 | 11120 | 0.48 | UL | UL |
| 34 | 91 | 27.74 | Saturated | 50 | CL | 6848.3 | 0.56 | 1.0 | 1.00 | 1.0 | 1.0 | 27.8 | 77.9 | 7.0 | 34.8 | UL | 1.92 | 0.77 | UL | 0.03 | 11770 | 0.46 | UL | UL |
| 35 | 96 | 29.26 | Saturated | 50 | CL | 7186.8 | 0.54 | 1.0 | 1.00 | 1.0 | 1.0 | 27.1 | 90 | 7.0 | 34.1 | UL | 1.92 | 0.76 | UL | 0.03 | 12420 | 0.44 | UL | UL |
| 36 | 100 | 30.48 | Saturated | 50 | SC | 7457.6 | 0.53 | 1.0 | 1.00 | 1.0 | 1.0 | 26.6 | 35 | 7.0 | 33.6 | UL | 1.92 | 0.75 | UL | 0.03 | 12940 | 0.43 | UL | UL |
| 37 | 107 | 32.61 | Saturated | 93 | CH | 7931.5 | 0.52 | 1.0 | 1.00 | 1.0 | 1.0 | 48.0 | 90 | 7.0 | 55.0 | UL | 1.92 | 0.74 | UL | 0.03 | 13850 | 0.44 | UL | UL |
| 38 | 112 | 34.14 | Saturated | 51 | CH | 9516 | 0.47 | 1.0 | 1.00 | 1.0 | 1.0 | 24.1 | 90 | 7.0 | 31.1 | UL | 1.92 | 0.68 | UL | 0.03 | 14500 | 0.47 | UL | UL |
| 39 | 117 | 35.66 | Saturated | 38 | CH | 9854.5 | 0.46 | 1.0 | 1.00 | 1.0 | 1.0 | 17.6 | 90 | 7.0 | 24.6 | 0.29 | 1.92 | 0.67 | 0.37 | 0.03 | 15150 | 0.51 | 0.015 | 24 |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-2-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 32 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 50' bgs<br>3", 50' to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0.61 | Unsaturated | 17 | SC | 250 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 35 | 7.0 | 32.5 | UL | 1.92 | NA | UL | 0.03 | 250 | 1.00 | UL | UL |
| 2 | 4 | 1.22 | Unsaturated | 21 | SC | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 31.5 | 35 | 7.0 | 38.5 | UL | 1.92 | NA | UL | 0.03 | 500 | 0.99 | UL | UL |
| 3 | 6 | 1.83 | Unsaturated | 15 | SC | 750 | 1.68 | 1.0 | 1.00 | 1.0 | 0.75 | 18.9 | 35 | 7.0 | 25.9 | 0.31 | 1.92 | NA | 0.60 | 0.03 | 750 | 0.99 | 0.019 | 31 |
| 4 | 8 | 2.44 | Unsaturated | 13 | SC | 1000 | 1.45 | 1.0 | 1.00 | 1.0 | 0.75 | 14.2 | 35 | 7.0 | 21.2 | 0.23 | 1.92 | NA | 0.45 | 0.03 | 1000 | 0.98 | 0.019 | 23 |
| 5 | 10 | 3.05 | Unsaturated | 15 | SC | 1250 | 1.30 | 1.0 | 1.00 | 1.0 | 0.75 | 14.6 | 37.3 | 7.0 | 21.6 | 0.24 | 1.92 | NA | 0.46 | 0.03 | 1250 | 0.98 | 0.019 | 24 |
| 7 | 14 | 4.27 | Unsaturated | 12 | SC | 1750 | 1.10 | 1.0 | 1.00 | 1.0 | 0.80 | 10.6 | 35 | 7.0 | 17.6 | 0.19 | 1.92 | NA | 0.36 | 0.03 | 1750 | 0.97 | 0.019 | 19 |
| 8 | 16 | 4.88 | Unsaturated | 21 | SC | 2000 | 1.03 | 1.0 | 1.00 | 1.0 | 0.83 | 17.9 | 35 | 7.0 | 24.9 | 0.29 | 1.92 | NA | 0.56 | 0.03 | 2000 | 0.96 | 0.019 | 30 |
| 9 | 18 | 5.49 | Unsaturated | 9 | SC | 2250 | 0.97 | 1.0 | 1.00 | 1.0 | 0.85 | 7.4 | 42.3 | 7.0 | 14.4 | 0.15 | 1.92 | NA | 0.30 | 0.03 | 2250 | 0.96 | 0.019 | 16 |
| 11 | 22 | 6.71 | Unsaturated | 14 | SC | 2750 | 0.88 | 1.0 | 1.00 | 1.0 | 0.90 | 11.1 | 35 | 7.0 | 18.1 | 0.19 | 1.92 | 0.91 | 0.34 | 0.03 | 2750 | 0.95 | 0.018 | 18 |
| 12 | 24 | 7.32 | Unsaturated | 17 | SC | 3000 | 0.84 | 1.0 | 1.00 | 1.0 | 0.93 | 13.3 | 35 | 7.0 | 20.3 | 0.22 | 1.92 | 0.90 | 0.38 | 0.03 | 3000 | 0.94 | 0.018 | 21 |
| 13 | 26 | 7.92 | Unsaturated | 18 | SC | 3250 | 0.81 | 1.0 | 1.00 | 1.0 | 0.96 | 13.9 | 35.2 | 7.0 | 20.9 | 0.23 | 1.92 | 0.89 | 0.39 | 0.03 | 3250 | 0.93 | 0.018 | 22 |
| 15 | 30 | 9.14 | Unsaturated | 16 | SC | 3750 | 0.75 | 1.0 | 1.00 | 1.0 | 1.0 | 12.0 | 35 | 7.0 | 19.0 | 0.20 | 1.92 | 0.88 | 0.34 | 0.03 | 3750 | 0.91 | 0.018 | 19 |
| 16 | 32 | 9.75 | Saturated | 22 | SC | 4000 | 0.73 | 1.0 | 1.00 | 1.0 | 1.0 | 16.0 | 38.4 | 7.0 | 23.0 | 0.26 | 1.92 | 0.87 | 0.43 | 0.03 | 4000 | 0.90 | 0.018 | 24 |
| 18 | 36 | 10.97 | Saturated | 15 | SC | 4270.8 | 0.70 | 1.0 | 1.00 | 1.0 | 1.0 | 10.6 | 35 | 7.0 | 17.6 | 0.19 | 1.92 | 0.86 | 0.31 | 0.03 | 4520 | 0.88 | 0.018 | 17 |
| 19 | 38 | 11.58 | Saturated | 8 | SC | 4406.2 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 5.5 | 35 | 7.0 | 12.5 | 0.14 | 1.92 | 0.85 | 0.22 | 0.03 | 4780 | 0.87 | 0.018 | 12 |
| 20 | 40 | 12.19 | Saturated | 16 | SC | 4541.6 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 10.9 | 35 | 7.0 | 17.9 | 0.19 | 1.92 | 0.85 | 0.31 | 0.03 | 5040 | 0.86 | 0.019 | 17 |
| 21A | 42 | 12.80 | Saturated | 14 | SP | 4677 | 0.67 | 1.0 | 1.00 | 1.0 | 1.0 | 9.4 | 1 | 0.0 | 9.4 | 0.11 | 1.92 | 0.84 | 0.17 | 0.03 | 5300 | 0.84 | 0.019 | 9 |
| 22 | 44 | 13.41 | Saturated | 27 | SP | 4812.4 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 17.9 | 1 | 0.0 | 17.9 | 0.19 | 1.92 | 0.84 | 0.31 | 0.03 | 5560 | 0.83 | 0.019 | 17 |
| 23 | 46 | 14.02 | Saturated | 25 | SP | 4947.8 | 0.65 | 1.0 | 1.00 | 1.0 | 1.0 | 5.0 | 1 | 0.0 | 5.0 | 0.07 | 1.92 | 0.84 | 0.11 | 0.03 | 5820 | 0.82 | 0.019 | 6 |
| 24 | 48 | 14.63 | Saturated | 37 | SP | 5083.2 | 0.65 | 1.0 | 1.00 | 1.0 | 1.0 | 23.9 | 1 | 0.0 | 23.9 | 0.27 | 1.92 | 0.83 | 0.43 | 0.03 | 6080 | 0.80 | 0.019 | 23 |
| 25 | 50 | 15.24 | Saturated | 35 | SP | 5218.6 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 22.3 | 1 | 0.0 | 22.3 | 0.25 | 1.92 | 0.83 | 0.39 | 0.03 | 6340 | 0.79 | 0.019 | 21 |
| 26 | 52 | 15.85 | Saturated | 33 | SM | 5354 | 0.63 | 1.0 | 1.00 | 1.0 | 1.0 | 20.7 | 35 | 7.0 | 27.7 | 0.36 | 1.92 | 0.82 | 0.57 | 0.03 | 6600 | 0.77 | 0.018 | 31 |
| 27 | 56 | 17.07 | Saturated | 39 | SC | 5624.8 | 0.61 | 1.0 | 1.00 | 1.0 | 1.0 | 23.9 | 45.7 | 7.0 | 30.9 | UL | 1.92 | 0.81 | UL | 0.03 | 7120 | 0.74 | UL | UL |
| 28 | 61 | 18.59 | Saturated | 43 | SC | 5963.3 | 0.60 | 1.0 | 1.00 | 1.0 | 1.0 | 25.6 | 35 | 7.0 | 32.6 | UL | 1.92 | 0.80 | UL | 0.03 | 7770 | 0.69 | UL | UL |
| 29 | 66 | 20.12 | Saturated | 40 | SP-SM | 6301.8 | 0.58 | 1.0 | 1.00 | 1.0 | 1.0 | 23.2 | 10 | 1.2 | 24.3 | 0.28 | 1.92 | 0.79 | 0.43 | 0.03 | 8420 | 0.65 | 0.017 | 25 |
| 30 | 71 | 21.64 | Saturated | 39 | SP | 6640.3 | 0.56 | 1.0 | 1.00 | 1.0 | 1.0 | 22.0 | 1 | 0.0 | 22.0 | 0.24 | 1.92 | 0.78 | 0.36 | 0.03 | 9070 | 0.60 | 0.016 | 23 |
| 31 | 76 | 23.16 | Saturated | 50 | SM | 6978.8 | 0.55 | 1.0 | 1.00 | 1.0 | 1.0 | 27.5 | 35 | 7.0 | 34.5 | UL | 1.92 | 0.77 | UL | 0.03 | 9720 | 0.56 | UL | UL |
| 32 | 81 | 24.69 | Saturated | 60 | CL-ML-S | 7317.3 | 0.54 | 1.0 | 1.00 | 1.0 | 1.0 | 32.3 | 50 | 0.0 | 32.3 | UL | 1.92 | 0.76 | UL | 0.03 | 10370 | 0.52 | UL | UL |
| 33 | 86 | 26.21 | Saturated | 34 | CH | 7655.8 | 0.53 | 1.0 | 1.00 | 1.0 | 1.0 | 17.9 | 92.4 | 7.0 | 24.9 | 0.29 | 1.92 | 0.74 | 0.41 | 0.03 | 11020 | 0.48 | 0.014 | 31 |
| 34 | 91 | 27.74 | Saturated | 41 | CH | 7994.3 | 0.51 | 1.0 | 1.00 | 1.0 | 1.0 | 21.1 | 90 | 7.0 | 28.1 | 0.37 | 1.92 | 0.73 | 0.52 | 0.03 | 11670 | 0.46 | 0.013 | 40 |
| 36 | 101 | 30.78 | Saturated | 50 | SC | 8671.3 | 0.49 | 1.0 | 1.00 | 1.0 | 1.0 | 24.7 | 35 | 7.0 | 31.7 | UL | 1.92 | 0.71 | UL | 0.03 | 12970 | 0.43 | UL | UL |
| 37 | 107 | 32.61 | Saturated | 70 | CH | 9077.5 | 0.48 | 1.0 | 1.00 | 1.0 | 1.0 | 33.8 | 90 | 7.0 | 40.8 | UL | 1.92 | 0.70 | UL | 0.03 | 13750 | 0.44 | UL | UL |
| 38 | 111 | 33.83 | Saturated | 68 | CH | 9348.3 | 0.48 | 1.0 | 1.00 | 1.0 | 1.0 | 32.4 | 90 | 7.0 | 39.4 | UL | 1.92 | 0.69 | UL | 0.03 | 14270 | 0.46 | UL | UL |
| 39 | 116 | 35.36 | Saturated | 58 | CH | 9686.8 | 0.47 | 1.0 | 1.00 | 1.0 | 1.0 | 27.1 | 90 | 7.0 | 34.1 | UL | 1.92 | 0.68 | UL | 0.03 | 14920 | 0.50 | UL | UL |
| 40 | 119 | 36.27 | Saturated | 77 | CH | 9889.9 | 0.46 | 1.0 | 1.00 | 1.0 | 1.0 | 35.6 | 90 | 7.0 | 42.6 | UL | 1.92 | 0.67 | UL | 0.03 | 15310 | 0.54 | UL | UL |

Source: AECOM, 2012.  (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-2-2[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 3.5 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | Kσ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 5 | OL | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 7.5 | 50 | 7.0 | 14.5 | 0.16 | 1.92 | NA | 0.30 | 0.03 | 125 | 1.00 | 0.019 | UL |
| 2 | 3 | 0.91 | Unsaturated | 16 | OL | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 24.0 | 50 | 7.0 | 31.0 | 0.55 | 1.92 | NA | 1.05 | 0.03 | 375 | 0.99 | 0.019 | UL |
| 3 | 5 | 1.52 | Saturated | 15 | SC | 510.4 | 2.04 | 1.0 | 1.00 | 1.0 | 0.75 | 22.9 | 35 | 7.0 | 29.9 | 0.46 | 1.92 | NA | 0.88 | 0.03 | 635 | 0.99 | 0.024 | 37 |
| 4 | 7 | 2.13 | Saturated | 16 | SP | 645.8 | 1.81 | 1.0 | 1.00 | 1.0 | 0.75 | 21.7 | 1 | 0.0 | 21.7 | 0.24 | 1.92 | NA | 0.46 | 0.03 | 895 | 0.99 | 0.027 | 17 |
| 5 | 9 | 2.74 | Saturated | 15 | SP | 781.2 | 1.65 | 1.0 | 1.00 | 1.0 | 0.75 | 18.5 | 1 | 0.0 | 18.5 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1155 | 0.98 | 0.028 | 13 |
| 6 | 10 | 3.05 | Saturated | 18 | SP | 848.9 | 1.58 | 1.0 | 1.00 | 1.0 | 0.75 | 21.3 | 1 | 0.0 | 21.3 | 0.23 | 1.92 | NA | 0.45 | 0.03 | 1285 | 0.98 | 0.029 | 16 |
| 6A | 11 | 3.35 | Saturated | 15 | SP | 916.6 | 1.52 | 1.0 | 1.00 | 1.0 | 0.75 | 17.1 | 1 | 0.0 | 17.1 | 0.18 | 1.92 | NA | 0.35 | 0.03 | 1415 | 0.98 | 0.029 | 12 |
| 7 | 14 | 4.27 | Saturated | 26 | ML | 1119.7 | 1.37 | 1.0 | 1.00 | 1.0 | 0.80 | 28.6 | 50 | 7.0 | 35.6 | UL | 1.92 | NA | UL | 0.03 | 1805 | 0.97 | UL | UL |
| 7A | 15 | 4.57 | Saturated | 32 | CL | 1187.4 | 1.34 | 1.0 | 1.00 | 1.0 | 0.75 | 32.0 | 50 | 7.0 | 39.0 | UL | 1.92 | NA | UL | 0.03 | 1935 | 0.97 | UL | UL |
| 8 | 20 | 6.10 | Saturated | 21 | ML | 1525.9 | 1.18 | 1.0 | 1.00 | 1.0 | 0.88 | 21.8 | 50 | 7.0 | 28.8 | 0.40 | 1.92 | NA | 0.76 | 0.03 | 2585 | 0.95 | 0.031 | 24 |
| 9 | 25 | 7.62 | Saturated | 35 | SP | 1864.4 | 1.07 | 1.0 | 1.00 | 1.0 | 0.94 | 35.1 | 1 | 0.0 | 35.1 | UL | 1.92 | NA | UL | 0.03 | 3235 | 0.93 | UL | UL |
| 10 | 31 | 9.45 | Saturated | 41 | SP | 2270.6 | 0.97 | 1.0 | 1.00 | 1.0 | 1.02 | 40.4 | 1 | 0.0 | 40.4 | UL | 1.92 | 0.92 | UL | 0.03 | 4015 | 0.91 | UL | UL |
| 11 | 35 | 10.67 | Saturated | 45 | SC | 2541.4 | 0.91 | 1.0 | 1.00 | 1.0 | 1.07 | 43.9 | 35 | 7.0 | 50.9 | UL | 1.92 | 0.92 | UL | 0.03 | 4535 | 0.89 | UL | UL |
| 12 | 39 | 11.89 | Saturated | 50 | SC | 2812.2 | 0.87 | 1.0 | 1.00 | 1.0 | 1.12 | 48.6 | 35 | 7.0 | 55.6 | UL | 1.92 | 0.91 | UL | 0.03 | 5055 | 0.86 | UL | UL |
| 13 | 45 | 13.72 | Saturated | 42 | SP | 3218.4 | 0.81 | 1.0 | 1.00 | 1.0 | 1.20 | 40.9 | 1 | 0.0 | 40.9 | UL | 1.92 | 0.89 | UL | 0.03 | 5835 | 0.82 | UL | UL |
| 14 | 50 | 15.24 | Saturated | 26 | CL | 3556.9 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 20.1 | 50 | 7.0 | 27.1 | 0.34 | 1.92 | 0.88 | 0.57 | 0.03 | 6485 | 0.79 | 0.028 | 21 |
| 15 | 54 | 16.46 | Saturated | 56 | SP | 3827.7 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 41.6 | 1 | 0.0 | 41.6 | UL | 1.92 | 0.87 | UL | 0.03 | 7005 | 0.75 | UL | UL |
| 15A | 55 | 16.76 | Saturated | 120 | SP | 3895.4 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 88.4 | 1 | 0.0 | 88.4 | UL | 1.92 | 0.87 | UL | 0.03 | 7135 | 0.74 | UL | UL |
| 16 | 59 | 17.98 | Saturated | 83 | CL | 4166.2 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 59.2 | 50 | 7.0 | 66.2 | UL | 1.92 | 0.86 | UL | 0.03 | 7655 | 0.71 | UL | UL |
| 17 | 65 | 19.81 | Saturated | 50 | SM | 4572.4 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 34.0 | 35 | 7.0 | 41.0 | UL | 1.92 | 0.85 | UL | 0.03 | 8435 | 0.66 | UL | UL |
| 18 | 70 | 21.34 | Saturated | 56 | CH | 4910.9 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 36.8 | 90 | 7.0 | 43.8 | UL | 1.92 | 0.84 | UL | 0.03 | 9085 | 0.61 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-3-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 28 | ft (Only saturated strata was found between 28.0 and 28.5 ft bgs) |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 30'<br>3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 19 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 28.5 | 35 | 7.0 | 35.5 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 17 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 35 | 7.0 | 32.5 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 26 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 35.9 | 35 | 7.0 | 42.9 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 26 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 30.3 | 35 | 7.0 | 37.3 | UL | 1.92 | NA | UL | 0.03 | 875 | 0.99 | UL | UL |
| 5 | 9 | 2.74 | Unsaturated | 9 | SC | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 9.3 | 35 | 7.0 | 16.3 | 0.17 | 1.92 | NA | 0.33 | 0.03 | 1125 | 0.98 | 0.019 | 17 |
| 6 | 11 | 3.35 | Unsaturated | 15 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.75 | 14.0 | 35 | 7.0 | 21.0 | 0.23 | 1.92 | NA | 0.44 | 0.03 | 1375 | 0.98 | 0.019 | 23 |
| 7 | 13 | 3.96 | Unsaturated | 12 | SC | 1625 | 1.14 | 1.0 | 1.00 | 1.0 | 0.79 | 10.8 | 35 | 7.0 | 17.8 | 0.19 | 1.92 | NA | 0.37 | 0.03 | 1625 | 0.97 | 0.019 | 19 |
| 8 | 15 | 4.57 | Unsaturated | 11 | SC | 1875 | 1.06 | 1.0 | 1.00 | 1.0 | 0.75 | 8.8 | 35 | 7.0 | 15.8 | 0.17 | 1.92 | NA | 0.32 | 0.03 | 1875 | 0.97 | 0.019 | 17 |
| 8A | 16 | 4.88 | Unsaturated | 24 | SC | 2000 | 1.03 | 1.0 | 1.00 | 1.0 | 0.83 | 20.5 | 40 | 7.0 | 27.5 | 0.35 | 1.92 | NA | 0.68 | 0.03 | 2000 | 0.96 | 0.019 | 36 |
| 11 | 21 | 6.40 | Unsaturated | 18 | SC | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.89 | 14.4 | 34.8 | 7.0 | 21.4 | 0.23 | 1.92 | 0.91 | 0.41 | 0.03 | 2625 | 0.95 | 0.019 | 22 |
| 12 | 23 | 7.01 | Unsaturated | 21 | CL | 2875 | 0.86 | 1.0 | 1.00 | 1.0 | 0.92 | 16.6 | 50 | 7.0 | 23.6 | 0.27 | 1.92 | 0.90 | 0.46 | 0.03 | 2875 | 0.94 | 0.018 | 25 |
| 14 | 27 | 8.23 | Unsaturated | 19 | SC | 3375 | 0.79 | 1.0 | 1.00 | 1.0 | 1.0 | 15.0 | 35 | 7.0 | 22.0 | 0.24 | 1.92 | 0.89 | 0.42 | 0.03 | 3375 | 0.93 | 0.018 | 23 |
| 15 | 28.5 | 8.69 | Saturated | 16 | SC | 3533.85 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 12.4 | 35 | 7.0 | 19.4 | 0.21 | 1.92 | 0.88 | 0.35 | 0.03 | 3565 | 0.92 | 0.018 | 20 |
| 15A | 29 | 8.84 | Unsaturated | 20 | SM | 3627.5 | 0.76 | 1.0 | 1.00 | 1.0 | 1.0 | 15.3 | 35 | 7.0 | 22.3 | 0.25 | 1.92 | 0.88 | 0.42 | 0.03 | 3627.5 | 0.92 | 0.018 | 23 |
| 16 | 31 | 9.45 | Unsaturated | 17 | SM | 3877.5 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 12.6 | 35 | 7.0 | 19.6 | 0.21 | 1.92 | 0.87 | 0.35 | 0.03 | 3877.5 | 0.91 | 0.018 | 20 |
| 17 | 36 | 10.97 | Unsaturated | 65 | SM | 4502.5 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 44.6 | 35 | 7.0 | 51.6 | UL | 1.92 | 0.85 | UL | 0.03 | 4502.5 | 0.88 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-3-2[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 14 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 12 | SM | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 18.0 | 35 | 7.0 | 25.0 | 0.29 | 1.92 | NA | 0.56 | 0.03 | 125 | 1.00 | 0.019 | 29 |
| 2 | 3 | 0.91 | Unsaturated | 14 | CL | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 21.0 | 50 | 7.0 | 28.0 | 0.37 | 1.92 | NA | 0.71 | 0.03 | 375 | 0.99 | 0.019 | 36 |
| 2A | 4 | 1.22 | Unsaturated | 18 | CL | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 27.0 | 50 | 7.0 | 34.0 | UL | 1.92 | NA | UL | 0.03 | 500 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 18 | CL | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 24.8 | 50 | 7.0 | 31.8 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 18 | CL | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 21.0 | 50 | 7.0 | 28.0 | 0.37 | 1.92 | NA | 0.71 | 0.03 | 875 | 0.99 | 0.019 | 37 |
| 5 | 9 | 2.74 | Unsaturated | 19 | CL | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 19.5 | 50 | 7.0 | 26.5 | 0.33 | 1.92 | NA | 0.63 | 0.03 | 1125 | 0.98 | 0.019 | 33 |
| 6 | 11 | 3.35 | Unsaturated | 47 | SM | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 44.3 | 35 | 7.0 | 51.3 | UL | 1.92 | NA | UL | 0.03 | 1375 | 0.98 | UL | UL |
| 7 | 15 | 4.57 | Saturated | 23 | SP | 1817.7 | 1.08 | 1.0 | 1.00 | 1.0 | 0.82 | 20.3 | 1 | 0.0 | 20.3 | 0.22 | 1.92 | NA | 0.42 | 0.03 | 1880 | 0.97 | 0.020 | 22 |
| 8 | 20 | 6.10 | Saturated | 42 | SM | 2156.2 | 0.99 | 1.0 | 1.00 | 1.0 | 0.75 | 31.2 | 35 | 7.0 | 38.2 | UL | 1.92 | NA | UL | 0.03 | 2530 | 0.95 | UL | UL |
| 9 | 24 | 7.32 | Saturated | 50 | SP | 2427 | 0.93 | 1.0 | 1.00 | 1.0 | 0.93 | 43.4 | 1 | 0.0 | 43.4 | UL | 1.92 | 0.92 | UL | 0.03 | 3050 | 0.94 | UL | UL |
| 10 | 29 | 8.84 | Saturated | 52 | SP | 2765.5 | 0.87 | 1.0 | 1.00 | 1.0 | 0.99 | 45.0 | 1 | 0.0 | 45.0 | UL | 1.92 | 0.91 | UL | 0.03 | 3700 | 0.92 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-4-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 35.6 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 17 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 12.8 | 1.8 | 27.3 | 0.35 | 1.92 | NA | 0.67 | 0.03 | 125 | 1.00 | 0.019 | 34 |
| 2 | 3 | 0.91 | Unsaturated | 12 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 18.0 | 12.8 | 1.8 | 19.8 | 0.21 | 1.92 | NA | 0.41 | 0.03 | 375 | 0.99 | 0.019 | 21 |
| 3 | 5 | 1.52 | Unsaturated | 12 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 16.6 | 12.8 | 1.8 | 18.4 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 625 | 0.99 | 0.019 | 20 |
| 6 | 11 | 3.35 | Unsaturated | 14 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 13.2 | 12.8 | 1.8 | 15.0 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 1375 | 0.98 | 0.019 | 16 |
| 8 | 14 | 4.27 | Unsaturated | 21 | SC | 1750 | 1.10 | 1.0 | 1.00 | 1.0 | 0.80 | 18.5 | 12.8 | 1.8 | 20.3 | 0.22 | 1.92 | NA | 0.42 | 0.03 | 1750 | 0.97 | 0.019 | 22 |
| 9 | 17 | 5.18 | Unsaturated | 20 | SC | 2125 | 1.00 | 1.0 | 1.00 | 1.0 | 0.84 | 16.8 | 12.8 | 1.8 | 18.6 | 0.20 | 1.92 | 0.93 | 0.38 | 0.03 | 2125 | 0.96 | 0.019 | 20 |
| 10 | 19 | 5.79 | Unsaturated | 29 | SC | 2375 | 0.94 | 1.0 | 1.00 | 1.0 | 0.87 | 23.8 | 12.8 | 1.8 | 25.6 | 0.31 | 1.92 | 0.92 | 0.59 | 0.03 | 2375 | 0.96 | 0.019 | 31 |
| 11 | 20 | 6.10 | Unsaturated | 16 | CL | 2500 | 0.92 | 1.0 | 1.00 | 1.0 | 0.88 | 13.0 | 50 | 7.0 | 20.0 | 0.22 | 1.92 | 0.92 | 0.41 | 0.03 | 2500 | 0.95 | 0.019 | 22 |
| 11A | 21 | 6.40 | Unsaturated | 23 | CL | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.89 | 18.4 | 50 | 7.0 | 25.4 | 0.30 | 1.92 | 0.91 | 0.58 | 0.03 | 2625 | 0.95 | 0.019 | 31 |
| 12 | 22 | 6.71 | Unsaturated | 24 | CL | 2750 | 0.88 | 1.0 | 1.00 | 1.0 | 0.90 | 18.9 | 50 | 7.0 | 25.9 | 0.31 | 1.92 | 0.91 | 0.60 | 0.03 | 2750 | 0.95 | 0.018 | 33 |
| 12A | 23 | 7.01 | Unsaturated | 22 | CL | 2875 | 0.86 | 1.0 | 1.00 | 1.0 | 0.92 | 17.4 | 50 | 7.0 | 24.4 | 0.28 | 1.92 | 0.90 | 0.54 | 0.03 | 2875 | 0.94 | 0.018 | 29 |
| 14 | 27 | 8.23 | Unsaturated | 25 | SC | 3375 | 0.79 | 1.0 | 1.00 | 1.0 | 0.97 | 19.2 | 35 | 7.0 | 26.2 | 0.32 | 1.92 | 0.89 | 0.61 | 0.03 | 3375 | 0.93 | 0.018 | 34 |
| 15 | 29 | 8.84 | Unsaturated | 23 | SC | 3625 | 0.76 | 1.0 | 1.00 | 1.0 | 0.99 | 17.4 | 35 | 7.0 | 24.4 | 0.28 | 1.92 | 0.88 | 0.54 | 0.03 | 3625 | 0.92 | 0.018 | 30 |
| 16 | 31 | 9.45 | Unsaturated | 26 | SM | 3875 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 19.2 | 35 | 7.0 | 26.2 | 0.32 | 1.92 | 0.87 | 0.61 | 0.03 | 3875 | 0.91 | 0.018 | 35 |
| 17 | 34 | 10.36 | Unsaturated | 22 | CL | 4242 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 15.5 | 50 | 7.0 | 22.5 | 0.25 | 1.92 | 0.86 | 0.48 | 0.03 | 4242 | 0.89 | 0.017 | 28 |
| 17A | 36 | 10.97 | Saturated | 28 | SP | 4477.08 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 19.3 | 1 | 0.0 | 19.3 | 0.21 | 1.92 | 0.85 | 0.40 | 0.03 | 4502 | 0.88 | 0.017 | 23 |
| 18 | 41 | 12.50 | Saturated | 35 | SP | 4815.58 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 23.2 | 1 | 0.0 | 23.2 | 0.26 | 1.92 | 0.84 | 0.50 | 0.03 | 5152 | 0.85 | 0.018 | 28 |
| 19 | 46 | 14.02 | Saturated | 35 | SP | 5154.08 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 22.4 | 1 | 0.0 | 22.4 | 0.25 | 1.92 | 0.83 | 0.48 | 0.03 | 5802 | 0.82 | 0.018 | 27 |
| 20 | 51 | 15.54 | Unsaturated | 60 | SP | 6427 | 0.57 | 1.0 | 1.00 | 1.0 | 1.0 | 34.4 | 1 | 0.0 | 34.4 | UL | 1.92 | 0.79 | UL | 0.03 | 6427 | 0.78 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-4-2[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 14 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | Kσ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 23 | SM | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 34.5 | 35 | 7.0 | 41.5 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 33 | SM | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 49.5 | 35 | 7.0 | 56.5 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 28 | OL | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 38.6 | 50 | 7.0 | 45.6 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 22 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 25.7 | 35 | 7.0 | 32.7 | UL | 1.92 | NA | UL | 0.03 | 875 | 0.99 | UL | UL |
| 6 | 11 | 3.35 | Unsaturated | 12 | SM | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 11.3 | 35 | 7.0 | 18.3 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1375 | 0.98 | 0.019 | 20 |
| 7 | 15 | 4.57 | Saturated | 13 | SP | 1817.7 | 1.08 | 1.0 | 1.00 | 1.0 | 0.82 | 11.5 | 1 | 0.0 | 11.5 | 0.13 | 1.92 | NA | 0.24 | 0.03 | 1880 | 0.97 | 0.020 | 12 |
| 8 | 20 | 6.10 | Saturated | 16 | SP | 2156.2 | 0.99 | 1.0 | 1.00 | 1.0 | 0.75 | 11.9 | 1 | 0.0 | 11.9 | 0.13 | 1.92 | 0.93 | 0.25 | 0.03 | 2530 | 0.95 | 0.022 | 11 |
| 9 | 25 | 7.62 | Saturated | 29 | SP | 2494.7 | 0.92 | 1.0 | 1.00 | 1.0 | 0.94 | 25.1 | 1 | 0.0 | 25.1 | 0.29 | 1.92 | 0.92 | 0.57 | 0.03 | 3180 | 0.93 | 0.023 | 24 |
| 10 | 29 | 8.84 | Saturated | 12 | SM | 2765.5 | 0.87 | 1.0 | 1.00 | 1.0 | 0.99 | 10.4 | 35 | 7.0 | 17.4 | 0.19 | 1.92 | 0.91 | 0.36 | 0.03 | 3700 | 0.92 | 0.024 | 15 |
| 10A | 29.5 | 8.99 | Saturated | 43 | SP | 2799.35 | 0.87 | 1.0 | 1.00 | 1.0 | 1.00 | 37.4 | 1 | 0.0 | 37.4 | UL | 1.92 | 0.91 | UL | 0.03 | 3765 | 0.91 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-5-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 32 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 34 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 51.0 | 35 | 7.0 | 58.0 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 26 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 39.0 | 35 | 7.0 | 46.0 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 23 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 31.7 | 35 | 7.0 | 38.7 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 17 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 19.8 | 35 | 7.0 | 26.8 | 0.33 | 1.92 | NA | 0.64 | 0.03 | 875 | 0.99 | 0.019 | 33 |
| 5 | 9 | 2.74 | Unsaturated | 11 | SC | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 11.3 | 35 | 7.0 | 18.3 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1125 | 0.98 | 0.019 | 20 |
| 6 | 11 | 3.35 | Unsaturated | 17 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.75 | 15.8 | 35 | 7.0 | 22.8 | 0.26 | 1.92 | NA | 0.49 | 0.03 | 1375 | 0.98 | 0.019 | 26 |
| 7 | 12 | 3.66 | Unsaturated | 12 | SC | 1500 | 1.19 | 1.0 | 1.00 | 1.0 | 0.75 | 10.7 | 35 | 7.0 | 17.7 | 0.19 | 1.92 | NA | 0.36 | 0.03 | 1500 | 0.97 | 0.019 | 19 |
| 7A | 13 | 3.96 | Unsaturated | 18 | SC | 1625 | 1.14 | 1.0 | 1.00 | 1.0 | 0.75 | 15.4 | 35 | 7.0 | 22.4 | 0.25 | 1.92 | NA | 0.48 | 0.03 | 1625 | 0.97 | 0.019 | 25 |
| 8 | 15 | 4.57 | Unsaturated | 10 | SC | 1875 | 1.06 | 1.0 | 1.00 | 1.0 | 0.75 | 8.0 | 35 | 7.0 | 15.0 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 1875 | 0.97 | 0.019 | 16 |
| 9 | 17 | 5.18 | Unsaturated | 15 | SC | 2125 | 1.00 | 1.0 | 1.00 | 1.0 | 0.75 | 11.2 | 35 | 7.0 | 18.2 | 0.20 | 1.92 | 0.93 | 0.37 | 0.03 | 2125 | 0.96 | 0.019 | 20 |
| 10 | 19 | 5.79 | Unsaturated | 32 | SC | 2375 | 0.94 | 1.0 | 1.00 | 1.0 | 0.75 | 22.7 | 35 | 7.0 | 29.7 | 0.44 | 1.92 | 0.92 | 0.85 | 0.03 | 2375 | 0.96 | 0.019 | 45 |
| 11 | 20 | 6.10 | Unsaturated | 20 | SC | 2500 | 0.92 | 1.0 | 1.00 | 1.0 | 0.75 | 13.8 | 35 | 7.0 | 20.8 | 0.23 | 1.92 | 0.92 | 0.44 | 0.03 | 2500 | 0.95 | 0.019 | 23 |
| 11A | 21 | 6.40 | Unsaturated | 28 | CL | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.75 | 18.9 | 83.9 | 7.0 | 25.9 | 0.31 | 1.92 | 0.91 | 0.60 | 0.03 | 2625 | 0.95 | 0.019 | 32 |
| 16 | 31 | 9.45 | Unsaturated | 35 | CL | 3875 | 0.74 | 1.0 | 1.00 | 1.0 | 0.75 | 19.4 | 50 | 7.0 | 26.4 | 0.32 | 1.92 | 0.87 | 0.62 | 0.03 | 3875 | 0.91 | 0.018 | 35 |
| 17 | 33 | 10.06 | Saturated | 33 | SM | 4067.7 | 0.72 | 1.0 | 1.00 | 1.0 | 0.75 | 17.9 | 35 | 7.0 | 24.9 | 0.29 | 1.92 | 0.86 | 0.56 | 0.03 | 4130 | 0.90 | 0.018 | 31 |
| 18 | 36 | 10.97 | Saturated | 80 | SP | 4270.8 | 0.70 | 1.0 | 1.00 | 1.0 | 0.75 | 42.2 | 1 | 0.0 | 42.2 | UL | 1.92 | 0.86 | UL | 0.03 | 4520 | 0.88 | UL | UL |
| 19 | 41 | 12.50 | Saturated | 77 | SP | 4609.3 | 0.68 | 1.0 | 1.00 | 1.0 | 0.75 | 39.1 | 1 | 0.0 | 39.1 | UL | 1.92 | 0.85 | UL | 0.03 | 5170 | 0.85 | UL | UL |
| 20 | 46 | 14.02 | Saturated | 42 | SM | 4947.8 | 0.65 | 1.0 | 1.00 | 1.0 | 0.75 | 20.6 | 35 | 7.0 | 27.6 | 0.36 | 1.92 | 0.84 | 0.68 | 0.03 | 5820 | 0.82 | 0.019 | 36 |
| 21 | 50 | 15.24 | Saturated | 50 | SM | 5218.6 | 0.64 | 1.0 | 1.00 | 1.0 | 0.75 | 23.9 | 35 | 7.0 | 30.9 | UL | 1.92 | 0.83 | UL | 0.03 | 6340 | 0.79 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

# APPENDIX E:  GUADALUPE-BLANCO RIVER AUTHORITY LAKE AREA-CAPACITY CURVES

ATTACHMENT 3-1

TABLE 1

COLETO CREEK RESERVOIR
AREAS AND CAPACITIES
INITIAL CONDITIONS*

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AREA IN ACRES | | | | | |
| 50 | | | | | | | | | 0 | 9 |
| 60 | 18 | 26 | 34 | 42 | 50 | 60 | 80 | 100 | 120 | 145 |
| 70 | 170 | 200 | 239 | 277 | 314 | 351 | 397 | 442 | 495 | 547 |
| 80 | 599 | 679 | 758 | 835 | 910 | 984 | 1087 | 1189 | 1299 | 1408 |
| 90 | 1504 | 1650 | 1796 | 1940 | 2084 | 2230 | 2369 | 2514 | 2652 | 2787 |
| 100 | 2918 | 3077 | 3255 | 3461 | 3698 | 3954 | 4207 | 4458 | 4706 | 4949 |
| 110 | 5190 | 5531 | 5910 | 6324 | 6763 | 7234 | 7734 | 8229 | 8725 | 9223 |
| 120 | 9723 | | | | | | | | | |
| | | | | | CAPACITY IN ACRE-FEET | | | | | |
| 50 | | | | | | | | | 0 | 4 |
| 60 | 18 | 40 | 70 | 108 | 154 | 209 | 279 | 369 | 479 | 611 |
| 70 | 769 | 954 | 1174 | 1432 | 1727 | 2060 | 2434 | 2853 | 3322 | 3843 |
| 80 | 4416 | 5055 | 5774 | 6570 | 7442 | 8389 | 9425 | 10,563 | 11,807 | 13,160 |
| 90 | 14,617 | 16,194 | 17,917 | 19,786 | 21,798 | 23,955 | 26,254 | 28,695 | 31,277 | 33,996 |
| 100 | 36,849 | 39,846 | 43,012 | 46,370 | 49,949 | 53,744 | 57,855 | 62,187 | 66,769 | 71,597 |
| 110 | 76,667 | 82,027 | 87,747 | 93,863 | 100,406 | 107,409 | 114,807 | 122,878 | 131,354 | 140,328 |
| 120 | 149,800 | | | | | | | | | |

*Areas and capacities of impoundments behind Dike Nos. 1 and 2 are not included in this tabulation.

ATTACHMENT 3-2

TABLE 2

COLETO CREEK PROJECT
AREAS AND CAPACITIES
SULPHUR CREEK BEHIND DIKE NO. 1
INCLUDING FLUME NO. 1

**AREA IN ACRES**

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | | | | | | | 0 | 1 | 2 |
| 80 | 3 | 5 | 7 | 10 | 14 | 18 | 22 | 26 | 31 | 36 |
| 90 | 49 | 56 | 64 | 73 | 82 | 90 | 101 | 113 | 126 | 138 |
| 100 | 151 | 164 | 178 | 193 | 207 | 223 | 240 | 259 | 279 | 303 |
| 110 | 329 | 358 | 388 | 419 | 455 | 499 | 540 | 590 | 641 | 699 |
| 120 | 770 | | | | | | | | | |

**CAPACITY IN ACRE-FEET**

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | | | | | | | | 0 | 2 |
| 80 | 4 | 8 | 14 | 23 | 35 | 51 | 71 | 95 | 123 | 157 |
| 90 | 199 | 251 | 311 | 379 | 456 | 542 | 638 | 745 | 865 | 997 |
| 100 | 1141 | 1299 | 1470 | 1656 | 1856 | 2071 | 2303 | 2553 | 2822 | 3113 |
| 110 | 3429 | 3773 | 4146 | 4550 | 4987 | 5464 | 5984 | 6549 | 7165 | 7835 |
| 120 | 8570 | | | | | | | | | |

ATTACHMENT 3-3

TABLE 3

COLETO CREEK PROJECT
AREAS AND CAPACITIES
TURKEY CREEK BEHIND DIKE NO. 2
INCLUDING FLUME NO. 2

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AREA IN ACRES | | | | | |
| 70 | | 0 | 1 | 3 | 6 | 9 | 13 | 18 | 24 | 31 |
| 80 | 38 | 46 | 55 | 65 | 76 | 88 | 101 | 115 | 130 | 146 |
| 90 | 167 | 184 | 200 | 217 | 234 | 250 | 270 | 293 | 322 | 355 |
| 100 | 391 | 429 | 467 | 506 | 545 | 583 | 623 | 663 | 705 | 748 |
| 110 | 791 | 831 | 882 | 947 | 1032 | 1118 | 1206 | 1291 | 1374 | 1458 |
| 120 | 1537 | | | | | | | | | |
| | | | | | CAPACITY IN ACRE-FEET | | | | | |
| 70 | | 0 | 0 | 2 | 7 | 14 | 25 | 41 | 62 | 89 |
| 80 | 124 | 166 | 216 | 276 | 347 | 429 | 523 | 631 | 754 | 892 |
| 90 | 1048 | 1224 | 1416 | 1624 | 1850 | 2092 | 2352 | 2634 | 2942 | 3281 |
| 100 | 3654 | 4064 | 4512 | 4998 | 5524 | 6089 | 6691 | 7334 | 8018 | 8744 |
| 110 | 9513 | 10,324 | 11,181 | 12,096 | 13,086 | 14,161 | 15,323 | 16,572 | 17,905 | 19,321 |
| 120 | 20,819 | | | | | | | | | |

# ATTACHMENT 8 – CLOSURE PLAN

## SITE INFORMATION

| | | | |
|---|---|---|---|
| Site Name / Address | Coleto Creek Power Station, 45 FM 2987 Fannin, Goliad County, TX | | |
| Owner Name / Address | Coleto Creek Power, LP 1500 Eastport Plaza Drive Collinsville, IL 62234 | | |
| CCR Unit | Primary Ash Pond | Final Cover Type | Soil/Synthetic Liner System |
| Reason for Initiating Closure | Known final receipt of waste/Final removal of beneficial reuse materials | Closure Method | Close In-Place |

## CLOSURE PLAN DESCRIPTION

| | |
|---|---|
| (b)(1)(i) – Narrative description of how the CCR unit will be closed in accordance with this section. | The Primary Ash Pond will be closed such that contained CCR solids will remain in-place. In accordance with §257.102(b)(3), this written closure plan will be amended to provide additional details after the final engineering design for the grading and cover system is completed. This closure plan reflects the best information available to date, and the plan may be amended in the future. |
| (b)(1)(iii) – If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system and methods and procedures used to install the final cover. | First, the Primary Ash Pond will be dewatered with the resulting water to be discharged through existing TPDES Outfall No. 003. CCR solids will be graded and leveled, then covered with a final cover system as described below. Existing perimeter dikes will remain intact and the final cover system will tie into these dikes. The cover system will consist of the following elements, listed in order from contact with the CCR to the top: 1) subgrade leveling fill (as needed); 2) 1 foot thick soil liner with a permeability not to exceed the permeability of $1 \times 10^{-5}$ cm/sec; 3) Synthetic Liner System consisting of: Geosynthetic Clay Liner (GCL), Textured (both sides) 40 Mil Linear-Low Density Polyethylene Flexible Membrane Liner (LLDPE-FML), Double Sided (geotextile fabric on both sides) Geonet Drainage Layer; and 4) 24-inch Protective/Vegetative Soil Layer. The top of the final cover system will be vegetated to minimize erosion. The final cover will be sloped to promote drainage and storm water runoff. |

| (b)(1)(iii) – How the final cover system will achieve the performance standards in §257.102(d). | |
|---|---|
| (d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere. | The permeability of the final cover will be equal to or less than the permeability of the bottom liner or a permeability no greater than $1 \times 10^{-5}$ cm/sec, whichever is less, and will be graded to prevent ponding and promote drainage. |
| (d)(1)(ii) – Preclude the probability of future impoundment of water, sediment, or slurry. | The final cover will be sloped across the unit as needed to preclude the probability of future impoundment of water, sediment, or slurry. |
| (d)(1)(iii) – Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period. | The top of the vegetated final cover system will be sloped and the outsides of the perimeter dikes will be vegetated as necessary to minimize the potential for erosion. The cap system will be designed by a Qualified Professional Engineer in a manner to prevent sloughing or movement of the final cover system and geotechnical testing and evaluation will be performed as needed during and after construction to confirm that engineering slope stability standards have been achieved. |
| (d)(1)(iv) – Minimize the need for further maintenance of the CCR unit. | The vegetative cover will be regularly mowed and maintained to minimize the potential for erosion or other structural issues that would cause more extensive and long-term maintenance issues. The storm water control system will be regularly inspected for proper operation. |
| (d)(1)(v) – Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices. | Construction would occur in a phased approach as sections of the impoundment are prepared, enabling expedited capping of portions of the CCR impoundment. |
| (d)(2)(i) – Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue. | The unit will be dewatered sufficiently to remove the free liquids to provide a stable base for the construction of the final cover system. |
| (d)(2)(ii) – Remaining wastes must be stabilized sufficiently to support the final cover system. | Dewatering and regrading of existing in-place CCR will sufficiently stabilize the waste such that the final cover will be supported. |
| (d)(3) – A final cover system must be installed to minimize infiltration and erosion, and at minimum, meets the requirements of (d)(3)(i). | The final cover system will be constructed as described above in accordance with (d)(3)(i) and will minimize infiltration and erosion. |
| (d)(3)(i) – The design of the final cover system must be included in the written closure plan. | When the final design of the final cover system is completed, the written closure plan will be amended to include the detailed final design. |
| (d)(3)(i)(A) – The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ cm/sec, whichever is less. | The permeability of the final cover will be equal to or less than the permeability of the existing bottom liner or no greater than $1x10^{-5}$ cm/sec, whichever is less. This will be verified during construction per the construction quality assurance plan to be developed in conjunction with the detailed amended closure plan. |
| (d)(3)(i)(B) – The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer than contains a minimum of 18 inches of earthen material. | Infiltration of liquids through the closed CCR unit will be minimized by the placement of a 24-inch thick protective/vegetated soil layer over the Geonet drainage layer. |
| (d)(3)(i)(C) – The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth. | The final cover will include a minimum 24-inch protective/vegetated soil layer that is capable of sustaining native plant growth. The vegetative cover will be regularly maintained to prevent erosion. |
| (d)(3)(i)(D) – The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence. | The final cover system will be designed to account for expected settlement and subsidence. |

## INVENTORY AND AREA ESTIMATES

| | |
|---|---|
| (b)(1)(iv) – Estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit | Approx. 10 million cubic yards |
| (b)(1)(v) – Estimate of the largest area of the CCR unit ever requiring a final cover | Approx. 190 acres |

## CLOSURE SCHEDULE

(b)(1)(vi) – Schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including major milestones ...and the estimated timeframes to complete each step or phase of CCR unit closure.

Note: At the time of this Written Closure Plan, there are no immediate plans to close the Primary Ash Pond. The Primary Ash Pond is currently actively managing CCR wastes generated during operation of the coal-fired power plant. CCR waste is also actively removed from the Primary Ash Pond for off-site beneficial use. This practice is expected to continue after the pond no longer accepts CCR solids. The milestones presented in this plan, therefore, provide an overview of major tasks associated with final closure of the Primary Ash Pond and a schedule relative to the timeframes specified in the rule. This Closure Plan will be amended with more specific information once closure activities have been initiated.

| | |
|---|---|
| (b)(2) - Initial Written Closure Plan Placed in Permanent Record | By October 17, 2016 |

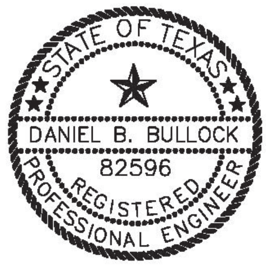
| | |
|---|---|
| (e)(1)(ii) – The owner or operator must commence closure of the CCR unit no later than 30 days after the date on which the CCR unit…: Removed the known final volume of CCR from the CCR unit for the purpose of beneficial use of CCR. | Closure activities will commence 30 days after known final receipt of CCR waste and removal of the last known quantity of CCR from the Primary Ash Pond for the purpose of beneficial reuse, which for the purposes of this plan is assumed to be the year 2045. Closure activities will consist of the following components which will be implemented between 2045 and 2050:<br>1) §257.102(g) Preparation of Notice of Intent to close a CCR Unit<br>2) Agency coordination<br>3) Mobilization<br>4) Reroute plant process water pipes and dewater and stabilize CCR<br>5) Grading of CCR material to final design grades<br>6) Installation of cap system<br>7) §257.102(h) Preparation of Notification of Closure of a CCR Unit<br>8) §257.102(h)(i) Deed Notation |
| f(2)(ii) – …the owner or operator must complete closure of the CCR unit: For existing and new CCR surface impoundments and any lateral expansion of a CCR surface impoundment, within five years of commencing closure activities pursuant to…paragraph (e)(2) of this section. | Final closure of the Primary Ash Pond will occur within 5 years of commencing closure activities. |

**Certification by qualified professional engineer appended to this plan.**

**Certification Statement 40 *CFR* § 257.102 (b)(4) – Written Closure Plan for a CCR Surface Impoundment or Landfill**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the written closure plan, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.102.



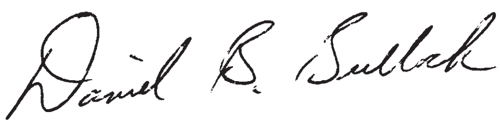

1/24/2018

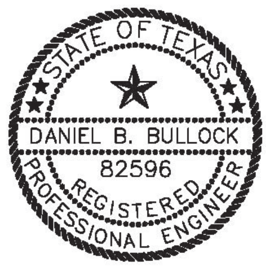
Daniel Bullock, P.E. (TX 82596)
Bullock, Bennett & Associates, LLC
Firm Registrations: Engineering F-8542, Geoscience 50127

**Certification Statement 40 *CFR* § 257.102 (d)(3)(iii) – Design of the Final Cover System for a CCR Surface Impoundment or Landfill**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the conceptual-level design of the final cover system as included in the written closure plan, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.102.






1/24/2018

Daniel Bullock, P.E. (TX 82596)
Bullock, Bennett & Associates, LLC
Firm Registrations: Engineering F-8542, Geoscience 50127

RAMBOLL

ENVIRONMENT
& HEALTH



# ADDENDUM NO. 1
# COLETO CREEK EXISTING CCR SURFACE IMPOUNDMENT CLOSURE PLAN

This Addendum No. 1 to the Closure Plan for Existing Coal Combustion Residuals (CCR) Impoundment for the Coleto Creek Primary Ash Pond at the Coleto Creek Power Station, Revision 1 - January 24, 2018 has been prepared to meet the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R. Section 257.103(f)(2)(v)(D)) as a component of the demonstration that the Coleto Creek Primary Ash Pond qualifies for a site-specific alternative deadline to initiate closure due to permanent cessation of a coal-fired boiler by a certain date.

The Coleto Creek Primary Ash Pond will begin construction of closure by April 17, 2025 and cease receipt and placement of CCR and non-CCR wastestreams by no later than September 17, 2027 as indicated in the Coleto Creek Power Plant Alternative Closure Demonstration dated November 30, 2020. Closure will be completed by October 17, 2028 within the 5-year timeframe included in the Closure Schedule identified in the Coleto Creek Existing CCR Surface Impoundment Closure Plan in accordance with 40 C.F.R. § 257.102(f)(1)(ii).

All other aspects of the Closure Plan remain unchanged.

# CERTIFICATION

I, Maureen T. Warren, a Qualified Professional Engineer in good standing in the State of Texas, certify that the information in this addendum is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.


Maureen T. Warren
Qualified Professional Engineer
117550
Texas
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: November 30, 2020

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**Fannin, Texas**

# COAL COMBUSTION RESIDUALS
# PRIMARY ASH POND
# PERIODIC HAZARD POTENTIAL
# CLASSIFICATION ASSESSMENT
# 5-Year Periodic Update

## COLETO CREEK POWER PLANT
## FANNIN, TEXAS

October 11, 2021


**Bullock, Bennett & Associates, LLC**
**Engineering and Geoscience**
**Registrations: Engineering F-8542, Geoscience 50127**
**www.bbaengineering.com**

**Certification Statement 40 C.F.R. § 257.73(a) and 30 T.A.C. § 352.731- Hazard Potential Classification Assessment**

**CCR Unit: Coleto Creek Power, LLC; Coleto Creek Power Plant; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Hazard Potential Classification Assessment, dated October 11, 2021, meets the requirements of 40 C.F.R. § 257.73(a) and 30 T.A.C. § 352.731.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock, P.E. (TX 82596)

10-11-2021

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## 1.0 INTRODUCTION

Coleto Creek Power Plant is located at 45 FM 2987 just outside the city of Fannin in Goliad County, Texas. The power plant consists of one coal-fired boiler. Bottom ash and fly ash, or coal combustion residuals (CCR), generated in the boiler are either shipped off-site for beneficial re-use or managed in an on-site CCR surface impoundment (Coleto Creek Primary Ash Pond). Figures 1 and 2 provide site location maps showing the Primary Ash Pond configuration.

In April 2015, the Environmental Protection Agency (EPA) promulgated rules (40 C.F.R. Part 257, Subpart D) to address potential risks associated with operating CCR surface impoundments at coal-fired power plants. The State of Texas subsequently codified 30 T.A.C. Chapter 352, which incorporated 40 C.F.R. §257 by reference, to address CCR management in surface impoundments and landfills. This report has been prepared to specifically address the requirements for periodic Hazard Potential Classification Assessments to be performed every 5 years as identified in 40 C.F.R. § 257.73(a)(2) and 30 T.A.C. § 352.731.

## 2.0 PERIODIC HAZARD POTENTIAL CLASSIFICATION ASSESSMENT

According to 30 T.A.C. § 352.731 and 40 C.F.R. § 257.73(a)(2) by reference, the owner and operator of a CCR surface impoundment must assign a hazard potential classification to each operating unit. For the purposes of the CCR rule, hazard potential classification means "the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances." The impoundment must be classified as high hazard, significant hazard, or low hazard. Each hazard potential classification is defined as follows under § 257.53:

1) *High hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

2) *Low hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

3) *Significant hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

In 2010 the United States Environmental Protection Agency (USEPA) contracted CDM to perform a site assessment of the Primary Ash Pond at the Coleto Creek Power Plant. As part of the assessment, CDM assigned the pond with a Low Hazard classification (CDM, 2011).

Subsequent to the CDM report findings, AECOM was contracted by the plant to perform geotechnical studies to further evaluate the structural stability of the CCR surface impoundments. AECOM implemented a subsurface investigation and performed a geotechnical stability evaluation, a liquefaction assessment, and hydraulic analysis. AECOM also performed an independent hazard assessment of the Primary Ash Pond and Secondary Pond. The results of that assessment supported the initial CDM classification of Low Hazard. The initial Potential Hazard Class assessment performed in 2016 in accordance with the federal CCR rules also concluded that the Primary Ash Pond is a Low Hazard surface impoundment (BBA, 2018).

## 2.1 Dam Breach Analysis

The Coleto Creek Primary Ash Pond is the only CCR-regulated surface impoundment at the Coleto Creek Power Plant and is therefore subject to the Hazard Potential Classification Assessment under the CCR rules. Because the Primary Ash Pond is hydraulically connected to, and is separated by a dike system from, the Secondary Pond, it is necessary to include the Secondary Pond when evaluating potential failure scenarios as noted below. Although the Secondary Pond is not a CCR-regulated unit, it is subject to operational and safety standards established by the Texas Commission on Environmental Quality (TCEQ) in its Dam Safety rules (30 T.A.C. Part 1 Chapter 299).

Bullock, Bennett & Associates (BBA) performed a dam breach analysis of the Primary Ash Pond and Secondary Pond to support the loss of life, and environmental and economic impact analyses. The Primary Ash Pond and Secondary Pond combined have a maximum storage capacity of approximately 4,000 acre-ft and a maximum dike height for the Secondary Pond of approximately 39 feet above adjacent lake level of 101 feet MSL. Construction was completed in 1978 and the effective water storage capacity in the Primary Ash Pond has diminished with the placement of CCR over time. According to topography and bathymetric survey data collected in August 2021, the water storage capacity in the Primary Ash Pond has been reduced to approximately 1,390 acre-ft at the maximum dike crest height while the water capacity of the Secondary Pond is estimated at 200 acre-ft.

The Primary Ash Pond and Secondary Pond are located next to the Coleto Creek Reservoir which was constructed to serve as a cooling pond for the Power Plant. The reservoir is divided into a “hot” side and a “cool” side. The ponds are located immediately adjacent to the hot side of the lake. The hot side of the lake is created from Sulphur Creek behind Dike No. 1 (Dike No. 1 Lake) which is connected to Turkey Creek behind Dike No. 2 (Dike No. 2 Lake) by a secondary flume. Water from these lakes then flows into Main Lake which is the cool side. Decant water from the Secondary Pond can be combined with other plant water then routed through TCEQ-approved Outfall 003 to the hot side of the lake. Cool water is pumped into the Power Plant from the Main Lake.

GBRA provided area-capacity tables for the Coleto Creek Reservoir and Dike Lake Nos. 1 and 2. These tables are presented as attachments in Appendix A. Dike No. 1 Lake consists of approximately 164 acres at the normal operating elevation of 101 feet MSL. Dike No. 2 Lake is approximately 429 acres at the normal operating elevation of 101 feet MSL. The two Dike Lakes are separated from Coleto Creek Reservoir by splitter dikes with an approximate elevation of 102 feet MSL (GBRA, 2016). Coleto Creek Reservoir covers an area of approximately 2,652 acres at a normal operating elevation of 98 feet MSL (GBRA, 2016). Coleto Creek Power, LLC reportedly controls the lake up to an elevation of 104 feet MSL. An area map showing the relative locations of the Primary Ash Pond, Secondary Pond, Dike Lakes, and Coleto Creek Reservoir is presented as Figure 1.

For the purposes of this evaluation, a conservatively worst-case dam breach scenario was developed assuming that the breach was due to overtopping of the surface impoundment dikes and that the breach occurs in the shared Primary Ash Pond and Secondary Pond dike and subsequently in the Secondary Pond dike adjacent to Coleto Creek Reservoir, releasing the entire water contents of both ponds. This scenario allows for the greatest quantity of pond decant water to be released.

An evaluation of potential water and residual solids flow paths was performed to support the loss of life, environmental, and economic evaluations. Surface elevation cross-sections assembled from Google Earth™ profiles of the areas adjacent to the pond dikes were reviewed to estimate the potential flow path of the released water and solids. As shown in Figure 1, the wet side of the ponds are bound by the Evaporation Pond followed by Dike No. 1 Lake on the north-northwest, Dike No. 1 Lake on the northeast corner, and the primary plant discharge flume on the east. The surface elevation of the terrain that bounds the east side of the discharge flume appears to extend to approximately elevation 132 feet. The flume channel, therefore, appears to be located within a larger basin bounded to the west by the Primary Ash Pond and Secondary Pond dikes (approximate elevation 140 feet) and to the east by land mass (approximate elevation 132 feet). The distance between the dike on the west side of the basin and land mass high points on the east side appears to be approximately 300 feet. The flume channel and basin would route flow from an east-side breach of the dike to the hot side of the lake. Released water and solids, therefore, would initially flow to the hot side of the lake regardless of the location of the breach. From there, water levels would increase one foot (the amount of available freeboard behind Dike No. 1 and Dike No. 2 lakes) then flow into the Main Lake. Eventually all water would be released into the Main Lake.

Using the tables provided by GBRA, a one-foot increase in the Main Lake elevation requires an additional approximately 2,720 acre-feet of water. The estimated maximum volume of discharge from the Primary Ash Pond and Secondary Pond is approximately 1,590 acre-feet of water, resulting in a water surface elevation change on the reservoir of approximately seven inches. A seven-inch change in water surface elevation is considered to be nominal and would not result in the loss of major infrastructure elements or disrupt lifeline facilities.

## 2.2 Loss of Life Evaluation

The Primary Ash Pond and Secondary Pond are located apart from the active industrial areas of the Power Plant. Two fly-ash silos are located adjacent to the southwest border of the Primary Ash Pond and loading of trucks for off-site transport and beneficial reuse of the fly ash regularly occurs at this location. These silos and truck loading operations are adjacent to the southwest limits of the Primary Ash Pond, which is filled with dry and compact CCRs, and any catastrophic failure of the impoundment in this area is unlikely. If a failure were to occur, it would probably be located on the "wet" side of the pond, including the northern or eastern dikes for both the Primary Ash Pond and Secondary Pond (see Figure 1). There are no regular or active plant operations that occur downstream of those areas where personnel would be expected to be present in the event of a catastrophic failure of the dike. There are no residences or other off-site manned operations immediately downstream of the ponds. As noted in Section 2.1 the Dike 1, Dike 2, and Main Lakes would absorb the released water and raise reservoir levels a nominal amount (less than a foot). Loss of life in the event of a catastrophic failure of the surface impoundment dike system, therefore, is considered to be improbable.

## 2.3 Economic and/or Environmental Loss Evaluation

Additional consideration was given to the impacts of the water quality from a large volume discharge from Primary Ash Pond and Secondary Pond into the Coleto Creek Reservoir. Using the volume ratio of pond water (approximately 1,590 acre-feet) that could potentially be discharged into the Coleto Creek Reservoir to the existing volume of water in the reservoir (approx. 31,280 acre-feet at elevation 98 feet msl), the impacts to the water quality are minimal (31,280 acre-feet/1,590 acre-feet = ~20 dilution factor of analytes in the Primary Ash Pond water). Discharge of Secondary Pond water is currently allowed to the Coleto Creek Reservoir under Permit No. WQ002159000 (TCEQ, 2010).

Currently, the coal combustion by-products are sluiced into the Primary Ash Pond. The assumed ratio of solids-to-water is approximated at 20%-to-80%. The solids settle out of solution and the water decants to the surface. As the solids settle out of solution, they consolidate. Additionally, based on field observations the ash "sets up" similar to cement, becoming very hard and massive. The expected flow of any unconsolidated solids from the Primary Ash Pond is believed to be minimal.

For the sake of conservatism, it is assumed that a volume of ash equivalent to six months of production (assuming no recycling) is disposed in the Primary Ash Pond that may not be consolidated and may flow should a breach occur. Under these assumptions, there is potential for approximately 45,000 cubic yards (approximately 28 acre-feet) of ash flow. The ash volume would be in solution with the decant water, displacing an equal volume of the decant water. This ash would be expected to be contained within the hot side of the lake. Impacts would therefore be primarily limited to the owner's property.

### 2.4 Hazard Potential Classification

Based on a review of previous studies, analytical data, ash production/recycling volumes, available impoundment capacities, available lake capacities, observed current conditions at the site, assumptions, and other factors, the Coleto Creek Primary Ash Pond is classified as a Low Hazard Potential impoundment.

## 3.0 REFERENCES

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CDM. (March 2011). *Assessment of Dam Safety of Coal Combustion Surface Impoundments Coleto LP, LLC Coleto Creek Power, LP.*

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# FIGURES


N

APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

Daniel B. Bullock
10-11-2021

**Coleto Creek Power, LLC**

Figure 1

SITE LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL103.dwg


N

APPROXIMATE SCALE: 1" = 1000'

0 500 1000 2000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

Daniel B. Bullock
10-11-2021

**Coleto Creek Power, LLC**

Figure 2

PRIMARY ASH POND LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:22pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL104.dwg

# APPENDIX A

## Guadalupe-Blanco River Authority Lake Area-Capacity Summaries

TABLE 1

COLETO CREEK RESERVOIR
AREAS AND CAPACITIES
INITIAL CONDITIONS*

AREA IN ACRES

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | | | | | | | | | 0 | 9 |
| 60 | 18 | 26 | 34 | 42 | 50 | 60 | 80 | 100 | 120 | 145 |
| 70 | 170 | 200 | 239 | 277 | 314 | 351 | 397 | 442 | 495 | 547 |
| 80 | 599 | 679 | 758 | 835 | 910 | 984 | 1087 | 1189 | 1299 | 1408 |
| 90 | 1504 | 1650 | 1796 | 1940 | 2084 | 2230 | 2369 | 2514 | 2652 | 2787 |
| 100 | 2918 | 3077 | 3255 | 3461 | 3698 | 3954 | 4207 | 4458 | 4706 | 4949 |
| 110 | 5190 | 5531 | 5910 | 6324 | 6763 | 7234 | 7734 | 8229 | 8725 | 9223 |
| 120 | 9723 | | | | | | | | | |

CAPACITY IN ACRE-FEET

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | | | | | | | | | 0 | 4 |
| 60 | 18 | 40 | 70 | 108 | 154 | 209 | 279 | 369 | 479 | 611 |
| 70 | 769 | 954 | 1174 | 1432 | 1727 | 2060 | 2434 | 2853 | 3322 | 3843 |
| 80 | 4416 | 5055 | 5774 | 6570 | 7442 | 8389 | 9425 | 10,563 | 11,807 | 13,160 |
| 90 | 14,617 | 16,194 | 17,917 | 19,786 | 21,798 | 23,955 | 26,254 | 28,695 | 31,277 | 33,996 |
| 100 | 36,849 | 39,846 | 43,012 | 46,370 | 49,949 | 53,744 | 57,855 | 62,187 | 66,769 | 71,597 |
| 110 | 76,667 | 82,027 | 87,747 | 93,863 | 100,406 | 107,409 | 114,807 | 122,878 | 131,354 | 140,328 |
| 120 | 149,800 | | | | | | | | | |

*Areas and capacities of impoundments behind Dike Nos. 1 and 2 are not included in this tabulation.

TABLE 2

COLETO CREEK PROJECT
AREAS AND CAPACITIES
SULPHUR CREEK BEHIND DIKE NO. 1
INCLUDING FLUME NO. 1

AREA IN ACRES

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | | | | | | | 0 | 1 | 2 |
| 80 | 3 | 5 | 7 | 10 | 14 | 18 | 22 | 26 | 31 | 36 |
| 90 | 49 | 56 | 64 | 73 | 82 | 90 | 101 | 113 | 126 | 138 |
| 100 | 151 | 164 | 178 | 193 | 207 | 223 | 240 | 259 | 279 | 303 |
| 110 | 329 | 358 | 388 | 419 | 455 | 499 | 540 | 590 | 641 | 699 |
| 120 | 770 | | | | | | | | | |

CAPACITY IN ACRE-FEET

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | | | | | | | | 0 | 2 |
| 80 | 4 | 8 | 14 | 23 | 35 | 51 | 71 | 95 | 123 | 157 |
| 90 | 199 | 251 | 311 | 379 | 456 | 542 | 638 | 745 | 865 | 997 |
| 100 | 1141 | 1299 | 1470 | 1656 | 1856 | 2071 | 2303 | 2553 | 2822 | 3113 |
| 110 | 3429 | 3773 | 4146 | 4550 | 4987 | 5464 | 5984 | 6549 | 7165 | 7835 |
| 120 | 8570 | | | | | | | | | |

TABLE 3

COLETO CREEK PROJECT
AREAS AND CAPACITIES
TURKEY CREEK BEHIND DIKE NO. 2
INCLUDING FLUME NO. 2

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| AREA IN ACRES | | | | | | | | | | |
| 70 | | 0 | 1 | 3 | 6 | 9 | 13 | 18 | 24 | 31 |
| 80 | 38 | 46 | 55 | 65 | 76 | 88 | 101 | 115 | 130 | 146 |
| 90 | 167 | 184 | 200 | 217 | 234 | 250 | 270 | 293 | 322 | 355 |
| 100 | 391 | 429 | 467 | 506 | 545 | 583 | 623 | 663 | 705 | 748 |
| 110 | 791 | 831 | 882 | 947 | 1032 | 1118 | 1206 | 1291 | 1374 | 1458 |
| 120 | 1537 | | | | | | | | | |
| CAPACITY IN ACRE-FEET | | | | | | | | | | |
| 70 | | 0 | 0 | 2 | 7 | 14 | 25 | 41 | 62 | 89 |
| 80 | 124 | 166 | 216 | 276 | 347 | 429 | 523 | 631 | 754 | 892 |
| 90 | 1048 | 1224 | 1416 | 1624 | 1850 | 2092 | 2352 | 2634 | 2942 | 3281 |
| 100 | 3654 | 4064 | 4512 | 4998 | 5524 | 6089 | 6691 | 7334 | 8018 | 8744 |
| 110 | 9513 | 10,324 | 11,181 | 12,096 | 13,086 | 14,161 | 15,323 | 16,572 | 17,905 | 19,321 |
| 120 | 20,819 | | | | | | | | | |

**COLETO CREEK POWER, LLC**
**Fannin, Texas**

# COAL COMBUSTION RESIDUALS
# COLETO CREEK PRIMARY ASH POND
# INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
# 5-Year Periodic Update

## COLETO CREEK POWER PLANT
## FANNIN, TEXAS

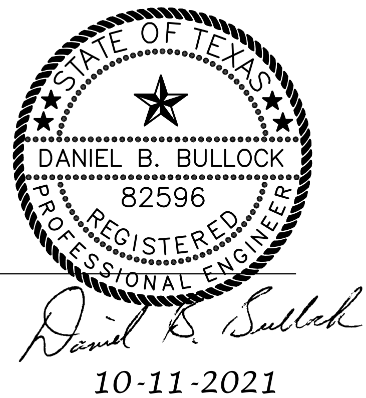
October 11, 2021

**Bullock, Bennett & Associates, LLC**
**Engineering and Geoscience**
**Registrations: Engineering F-8542, Geoscience 50127**
**www.bbaengineering.com**

**Certification Statement 40 C.F.R. § 257.82 and 30 T.A.C. § 352.821—Inflow Design Flood Control System Plan for a CCR Surface Impoundment**

**CCR Unit: Coleto Creek Power, LLC; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this plan has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Inflow Design Flood Control System Plan, dated October 11, 2021, meets the requirements of 40 C.F.R. § 257.82 and 30 T.A.C. § 352.821.




Daniel B. Bullock, P.E. (TX 82596)

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## 1.0 SITE SUMMARY

Coleto Creek Power, LLC operates the Coleto Creek Power Plant located at 45 FM 2987 near the city of Fannin in Goliad County, Texas (Figure 1). One boiler is operated at the facility to generate electricity for distribution to the area power grid. The boiler uses coal as the primary fuel and fuel oil as a backup fuel. There are two streams of coal combustion residuals (CCR) generated at this plant. Bottom ash is collected from the boiler, combined with water, and transferred in slurry form for disposal in the facility's surface impoundment (Primary Ash Pond). Fly ash is collected from the boiler exhaust and transported pneumatically to two storage silos. From there, the fly ash is loaded into enclosed dry haul hoppers for off-site beneficial use by a third party. Fly ash not meeting required beneficial reuse specifications is combined with water and pumped to the Coleto Creek Primary Ash Pond for disposal. Bottom ash in the Primary Ash Pond is routinely recovered for beneficial reuse via excavation, screening, and placement in covered dump trucks for transport off site.

The CCR slurry is pumped directly to the 190-acre Primary Ash Pond where the majority of solids settle out of the carrier water. The treated water can then flow into a 10-acre Secondary Pond. The facility's Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0002159000 allows for the discharge of up to 0.64 million gallons per day (gpd) of water from the Secondary Pond to the adjacent Coleto Creek Reservoir. Because the Primary Ash Pond and Secondary Pond are hydraulically connected (a levee failure of the Secondary Pond and the associated rapid dewatering could impact the stability of the Primary Ash Pond), both ponds are considered in this assessment even though the Secondary Pond is not regulated under the CCR Rule.

Pursuant to Rule 30 T.A.C. § 352.821 (and by reference, 40 C.F.R. § 257.82(a)), "the owner or operator of an existing or new CCR surface impoundment…must design, construct, operate, and maintain an inflow design flood control system." 40 C.F.R. § 257.82(c) requires the owner or operator of existing CCR surface impoundments to "…prepare initial and periodic inflow design flood control system plans for the CCR unit." This *5-Year Periodic Inflow Design Flood Control System Plan* has been prepared to meet the requirements of the rule. This plan should be amended at any time that CCR management operations substantially change. In addition, this plan will be updated every five years in accordance with § 257.82(c)(4). A copy of this Plan will be maintained in the facility's operating record and publicly accessible internet site.

## 2.0 HYDRAULIC ANALYSIS

According to §257.82(a)(1) and (2), the inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood as defined by the CCR rule. In addition, the inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood. As noted in the *Coleto Creek Power Station 5 Year Hazard Classification Assessment, 2021* (BBA, 2021), the Primary Ash Pond is classified as having a Low Hazard Potential. The inflow design flood, therefore, is defined in § 257.82(a)(3)(iii) as the 24-hour, 100-year flood.

The Coleto Creek Primary Ash Pond and Secondary Pond are currently operated as a relatively closed system. The ponds are surrounded by dikes that range from approximately four (4) to 39 ft above grade for the Primary Ash Pond and up to 56 ft for the Secondary Pond (Sargent & Lundy Engineers, 1978). The only sources of storm water accumulation, therefore, are the rain that falls within the surface impoundment boundary and incidental runoff from the dike crest. No other facility storm water is reportedly pumped into the ponds. Water from the ponds can be siphoned from the Secondary Pond at a maximum rate of approximately 0.64 million gpd and discharged to the adjacent "hot side" of the Coleto Creek Reservoir. Water levels in the pond are currently maintained below approximate elevation 136 ft NAVD88.

Bullock, Bennett and Associates, LLC (BBA) contracted T. Baker Smith (TBS) (formerly Naismith Marine Services) to complete a land and bathymetric site survey in August 2021 for the purpose of evaluating current conditions at the ponds and to obtain approximate as-built dike cross sections in areas of interest. Figure 2 provides the results of the August 2021 survey. Based on the 2021 survey the crest height generally appears to be constructed to elevation 140 ft NAVD88; however, areas were identified to be as low as approximate elevation 139.74 ft. This lower elevation is used to evaluate available capacity in the ponds.

The staff gauge elevation was measured during a site topography and bathymetry survey conducted in 2016. The survey found that the staff gauge mark of 140.0 corresponds to an elevation of approximately 140.4 ft NAVD88.

Because no significant inflow of outside storm water occurs and no conventional spillway is present, the surface impoundment must be operated so that it can contain the entirety of the design storm as well as the inflow of water/CCR from normal plant operations that occurs during the same period. The Primary Ash Pond is currently partially full of CCR, and water storage capacity remains primarily in the north portion of the pond, between approximate elevations 106 ft and 139.74 ft NAVD88 (the lowest dike crest elevation recorded in the recent survey). The estimated available capacity of the Primary Ash Pond and Secondary Pond based on 2021 survey data is 2,238,600 cy (breach elevation 139.74 ft) and 324,700 cy (breach elevation 139.68), respectively.

Maximum precipitation values for a 100-year, 24-hour storm were evaluated from various data sources. The most applicable and appropriate value was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Precipitation Frequency Data Server (retrieved October 1st, 2021 from https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx). The total rainfall for the 100-year design storm is listed as 13.20 inches in a 24-hour period. This rainfall amount was applied to the entire impoundment as a National Resources Conservation Service (NRCS) type III storm event.

The hydraulic model for the impoundment was developed using the Hydrologic Engineering Center River Analysis System (HEC-RAS), version 6.0. This version of HEC-RAS provided the ability to model the storm water flow and infiltration characteristics using a 2-dimensional (2D), gridded geometry. The geometry grid was applied over the entire impoundment terrain, including perimeter conveyance channels, Primary and Secondary ponds, and the perimeter dike roads. The 2D model captured storm water flow direction, depth, and velocity, incorporating specific terrain features and elevations, and the timing of flow interactions across the impoundment surface.

The 2D model included soil and land cover data that were used to account for storm water infiltration into the impoundment. Soil data was obtained from the Gridded Soil Survey Geographic Database, provided by the NRCS (retrieved September 7th, 2021 from https://datagateway.nrcs.usda.gov/GDGOrder.aspx). Land cover data was obtained from the National Land Cover Database 2019 (retrieved September 8th, 2021 from https://www.mrlc.gov). The soil and land cover data were combined to develop NRCS curve number values that accounted for the hydrologic infiltration characteristics of the impoundment.

For the purposes of this evaluation, it was assumed that no water was discharged to Coleto Creek Reservoir during the design storm event. Based on the wind and wave run-up estimates (Section 3.0), 1.7 ft of freeboard is required above the containment elevation of the design storm event. Therefore, since the low point of the perimeter dike is approximately elevation 139.7 ft, containment of the design storm event should be within or below elevation 138.0 ft (maximum surcharge pool elevation). The results of the HEC-RAS 2D model showed that with a Primary Ash Pond starting elevation of 136.1 ft (maximum storage pool), the pooled water surface reached a maximum elevation of 137.3 feet. The primary ash pond is, therefore, capable of containing the design storm event. The secondary pond reached a maximum depth elevation of 137.1 feet, also containing the design storm event. The HEC-RAS 2D model demonstrated the impoundment is capable of containing the entire 100 year, 24-hour design storm event.

## 3.0 WIND AND WAVE RUN-UP ANALYSIS

Wind and wave run-up effects were estimated using guidance contained in the document *Freeboard Criteria and Guidelines for Computing Freeboard Allowances for Storage Dams* (USBR, 1981). Equation 3 of USBR was used to calculate wave run-up as follows:

$$R_s = \frac{H_s}{0.4 + (H_s/L)^{0.5} \cot \Theta}$$

where:
$R_s$ = wave run-up
$H_s$ = significant wave height, 1.8 ft
L = deep water wavelength, 27.08 ft
$\Theta$ = angle of upstream face of the dam with the horizon, 18 deg

$H_s$ was calculated using Figure 9 in the USBR guidelines. Figure 9 determines significant wave height from the effective fetch (Fe) and the design wave velocity. Effective fetch is estimated to be ½ of wave fetch (F). F was determined to be the longest over water tangent normal to the dam and was measured at 3,818 ft (.72 mi) which leaves Fe at 1,909 ft (0.36 miles). Design wind velocity was determined from Figure 3 of the USBR guidelines, Fastest Mile of Record-Summer. This measurement was used because it yielded the highest velocity and therefore the most conservative measurement. Wind velocity was determined to be 63 mph. After applying the wind velocity ratio (wind over water) from Table 2 of 1.08 for a Fe of 0.5 miles (rounded up), the design wind velocity was determined to be 68 mph.

L was calculated using the Equation 2, $L = 5.12T^2$, with T being wave period. T was found with Figure 10 of USBR to be 2.3 seconds. When applied to the equation, L is determined to be 27.08 ft. $\Theta$ is 18 degrees as the dam has a side slope of approximately 3 horizontal to 1 vertical.

When all variables are applied to equation 3 of the USBR guidelines, the wave run-up is calculated to be 1.5 ft.

The wind setup in feet is calculated using Equation 4 of the USBR guidelines as follows:

$$S = \frac{U^2F}{1400D}$$

where:
U = design wind velocity over water in miles per hour, 68 mph
F = wind fetch in miles, 0.72 miles
D = average water depth along the central radial in feet, conservatively estimated to equal 10 ft

The wind setup is calculated to equal 0.2 ft.

The required freeboard is the wave run-up plus the wind setup. The total required freeboard, therefore, is 1.7 ft.

# 4.0 SUMMARY

The Coleto Creek Primary Ash Pond is considered an existing CCR surface impoundment that is regulated under 30 T.A.C. Chapter 352 which incorporates, by reference, Federal CCR rules codified in 40 C.F.R. Part 257 Subpart D. Section 257.82(c) requires that existing CCR surface impoundment prepare a written *Inflow Design Flood Control System Plan* to ensure that the surface impoundment is operated such that inflows to and from the impoundment from a design storm are adequately controlled. Because the Primary Ash Pond has a Low Hazard classification, the design storm is the 100-year, 24-hour rain event.

Using the estimated rainfall accumulation associated with the design storm event, wind and wave run-up estimates, and maximum storage pool elevation of 136.1 ft NAVD88 (staff gauge elevation of 135.7 ft), HEC-RAS hydrologic modeling indicates that the Primary Ash Pond would provide containment for the design storm and allow 1.7 ft of additional freeboard for wave action. The East and West channels located within the dry side of the pond should be maintained to allow the cumulative flow of ash sluice water and peak rainwater flow from the design 100-year storm into the "wet" side of the Primary Ash Pond.

# 5.0 REFERENCES

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USBR. (1981). *Freeboard Criteria and Guidelines for Computing Feeboard Allowances for Storage Dams, ACER Technical Memorandum No. 2.* Assistant Commissioner-Engineering and Research, U.S. Department of the Interior, Bureau of Reclamation.

# FIGURES


N

APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

Daniel B. Bullock
10-11-2021

**Coleto Creek Power, LLC**

Figure 1

SITE LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL103.dwg


**SOURCES:**

AERIAL PHOTO PROVIDED BY TBS, MAXAR TECHNOLOGIES, TEXAS GENERAL LAND OFFICE, PHOTO TAKEN 2021.

TOPOGRAPHIC MAP WAS PROVIDED BY: T. BAKER SMITH (TBS), 412 S. VAN AVE., HOUMA, LA 70363, (985) 868-1050, SEPTEMBER 2021. DATUM: TEXAS SOUTH CENTRAL ZONE, US FEET. DATUM: NAD83.

VERTICAL DATUM: NAVD88
REFERENCE MONUMENT "SCHROEDER"
N: 13,484,797.62
E: 2,539,540.98
ELEV:175.0' NAVD88

REFERENCE MONUMENT "NMS SET 1"
(SET ALUMINUM DISK)
N: 13,450,038.01
E: 2,543,208.41
ELEV:135.7' NAVD88

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER
10-11-2021

**Coleto Creek Power, LLC**

Figure 2

SITE TOPOGRAPHY MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:25pm, Plotted by: Admin
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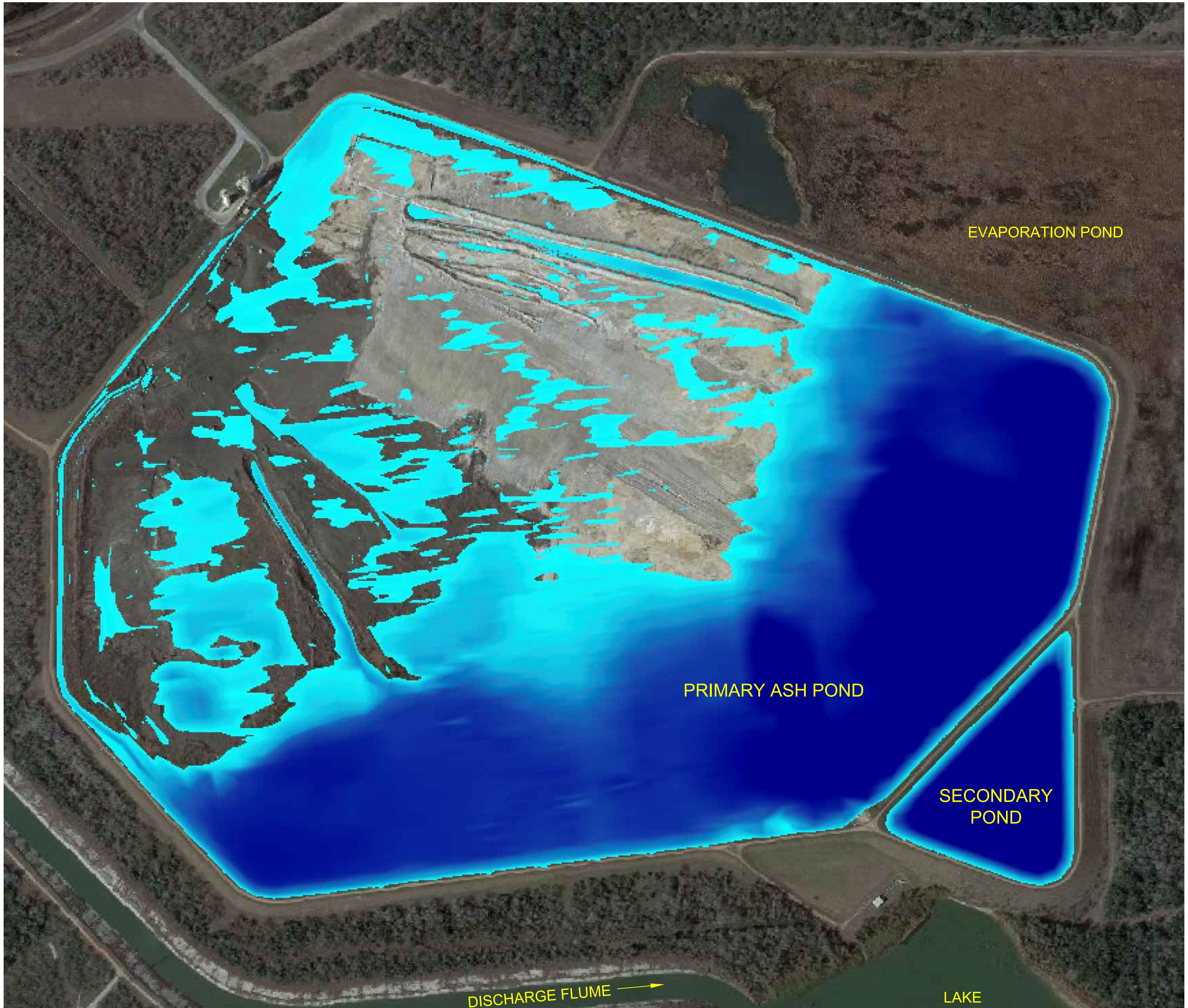



N

APPROXIMATE SCALE IN FEET

0 200 400 800

NOTES:

MAXIMUM STORAGE POOL ELEVATION OF 136.1 FT NAVD88. MAXIMUM SURCHARGE POOL ELEVATION OF 137.3 FT NAVD88 IN PRIMARY ASH POND.

ROADWAY WATER IS INDICATIVE OF POOLED STORMWATER, NOT OVERTOPPING.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

10-11-2021

**Coleto Creek Power, LLC**

Figure 3

# HEC-RAS MODELING RESULTS

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL105.dwg

# APPENDIX A

# HEC-RAS MODEL INPUTS

**HEC-RAS MODEL INPUTS**
**Coleto Creek Primary Ash Pond**
**Inflow Design Flood**

**Primary Ash Pond Water Surface Elevations**

| | |
|---|---|
| Starting Water Surface Elevation | 136.1 feet |
| Maximum Ponding Water Surface Elevation | 137.3 feet |

**Secondary Pond Water Surface Elevations**

| | |
|---|---|
| Starting Water Surface Elevation | 136.1 feet |
| Maximum Ponding Water Surface Elevation | 137.0 feet |

**Manning's n Coefficients**

| Land Cover Classification | Manning's n |
|---|---|
| Brush-weed-grass mix | 0.05 |
| Open Water | 0.04 |
| Developed, Open Space | 0.04 |
| Developed, Low Intensity | 0.1 |
| Developed, Medium Intensity | 0.12 |
| Developed, High Intensity | 0.15 |
| Barren Land Rock/Sand/Clay | 0.025 |
| Mixed Forest | 0.16 |
| Grassland/Herbaceous | 0.035 |
| Woody Wetlands | 0.12 |
| Channel 2 | 0.025 |
| Channel 1 | 0.025 |
| Central Brush Bare Mix | 0.037 |
| West Channel Vegetation | 0.037 |

**HEC-RAS MODEL INPUTS**
**Coleto Creek Primary Ash Pond**
**Inflow Design Flood**

**NRCS Curve Numbers**

| Land Cover: Soil Type | CN Value |
|---|---|
| Brush-weed-grass mix : NoData | 77 |
| Brush-weed-grass mix : D | 77 |
| Brush-weed-grass mix : C/D | 74 |
| Brush-weed-grass mix : C | 70 |
| Brush-weed-grass mix : Ash Material | 35 |
| Open Water : NoData | 100 |
| Open Water : D | 100 |
| Open Water : C/D | 100 |
| Open Water : C | 100 |
| Open Water : Ash Material | 100 |
| Developed, Open Space : NoData | 84 |
| Developed, Open Space : D | 84 |
| Developed, Open Space : C/D | 82 |
| Developed, Open Space : C | 79 |
| Developed, Open Space : Ash Material | 49 |
| Developed, Low Intensity : NoData | 82 |
| Developed, Low Intensity : D | 82 |
| Developed, Low Intensity : C/D | 80 |
| Developed, Low Intensity : C | 77 |
| Developed, Low Intensity : Ash Material | 46 |
| Developed, Medium Intensity : NoData | 84 |
| Developed, Medium Intensity : D | 84 |
| Developed, Medium Intensity : C/D | 82 |
| Developed, Medium Intensity : C | 79 |
| Developed, Medium Intensity : Ash Material | 51 |
| Developed, High Intensity : NoData | 95 |
| Developed, High Intensity : D | 95 |
| Developed, High Intensity : C/D | 95 |
| Developed, High Intensity : C | 94 |
| Developed, High Intensity : Ash Material | 89 |
| Barren Land Rock/Sand/Clay : NoData | 94 |
| Barren Land Rock/Sand/Clay : D | 94 |
| Barren Land Rock/Sand/Clay : C/D | 93 |
| Barren Land Rock/Sand/Clay : C | 91 |
| Barren Land Rock/Sand/Clay : Ash Material | 77 |
| Mixed Forest : NoData | 79 |
| Mixed Forest : D | 79 |
| Mixed Forest : C/D | 76 |

**HEC-RAS MODEL INPUTS**
**Coleto Creek Primary Ash Pond**
**Inflow Design Flood**

**NRCS Curve Numbers (cont'd)**

| | |
|---|---|
| Mixed Forest : C | 73 |
| Mixed Forest : Ash Material | 36 |
| Grassland/Herbaceous : NoData | 77 |
| Grassland/Herbaceous : D | 77 |
| Grassland/Herbaceous : C/D | 74 |
| Grassland/Herbaceous : C | 70 |
| Grassland/Herbaceous : Ash Material | 35 |
| Woody Wetlands : NoData | 86 |
| Woody Wetlands : D | 86 |
| Woody Wetlands : C/D | 86 |
| Woody Wetlands : C | 86 |
| Woody Wetlands : Ash Material | 86 |
| Channel 2 : NoData | 94 |
| Channel 2 : D | 94 |
| Channel 2 : C/D | 93 |
| Channel 2 : C | 91 |
| Channel 2 : Ash Material | 77 |
| Channel 1 : NoData | 94 |
| Channel 1 : D | 94 |
| Channel 1 : C/D | 93 |
| Channel 1 : C | 91 |
| Channel 1 : Ash Material | 77 |
| Central Brush Bare Mix : NoData | 86 |
| Central Brush Bare Mix : D | 86 |
| Central Brush Bare Mix : C/D | 85 |
| Central Brush Bare Mix : C | 80 |
| Central Brush Bare Mix : Ash Material | 56 |
| West Channel Vegetation : NoData | 86 |
| West Channel Vegetation : D | 86 |
| West Channel Vegetation : C/D | 85 |
| West Channel Vegetation : C | 80 |
| West Channel Vegetation : Ash Material | 56 |

# Coal Combustion Residuals Surface Impoundment History of Construction and Initial Hazard Potential Assessment, Structural Integrity Assessment, and Safety Factor Assessment (Rev. 1)

## Coleto Creek Power Station

**Fannin, Texas**

**January 24, 2018**
**(Original Version: October 13, 2016)**

*Prepared for:*

**Coleto Creek Power, LP**
Coleto Creek Power Station
Fannin, Texas

*Prepared by:*


**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Registrations: Engineering F-8542, Geoscience 50127

165 N. Lampasas Street
Bertram, Texas 78605
(512) 355-9198


BBA Project No. 17266

**Certification Statement 40 *CFR* § 257.73(c) - Structural Integrity Criteria for Existing CCR Surface Impoundments, History of Construction**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the History of Construction, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(c).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

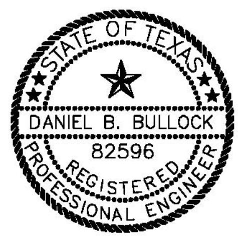
1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

**Certification Statement 40 *CFR* § 257.73(a) - Structural Integrity Criteria for Existing CCR Surface Impoundments, Potential Hazard Classification Assessment**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Potential Hazard Classification Assessment, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(a).




1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

**Certification Statement 40 *CFR* § 257.73(d) - Structural Integrity Criteria for Existing CCR Surface Impoundments, Initial Structural Stability Assessment**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Initial Structural Stability Assessment, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(d).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

**Certification Statement 40 *CFR* § 257.73(e) - Structural Integrity Criteria for Existing CCR Surface Impoundments, Initial Safety Factor Assessment**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Initial Safety Factor Assessment, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.73(e).

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

1/24/2018

Daniel B. Bullock, P.E. (TX 82596)

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## 1.0 INTRODUCTION

Coleto Creek Power Station is located at 45 FM 2987 just outside the city of Fannin in Goliad County, Texas. The power station consists of one coal-fired boiler. Bottom ash and fly ash, or coal combustion residuals (CCR), generated in the boiler are either shipped off-site for beneficial re-use or managed in an on-site CCR surface impoundment (Coleto Creek Primary Ash Pond). Figures 1-1A and 1-1B provide site location maps showing the Primary Ash Pond configuration.

In April 2015, the Environmental Protection Agency (EPA) enacted rules codified in 40 *CFR* Part 257 to address potential risks associated with operating CCR surface impoundments at coal-fired power plants. This report has been prepared to specifically address the requirements identified in §257.73 *Structural Integrity Criteria for Existing CCR Surface Impoundments*[1]. Section 2.0 of the report provides the History of Construction (§257.73(c)(1)(i – xii)). Section 3.0 contains the Initial Potential Hazard Classification Assessment (§257.73(a)(2)), Section 4.0 provides the Initial Structural Stability Assessment (§257.73(d)(1)), and Section 5.0 includes the Initial Safety Factor Assessment (§257.73(e)(1).

[1]This revised History of Construction and Initial Hazard Potential Assessment, Structural Integrity Assessment, and Safety Factor Assessment replaces the initial version of this report dated October 13, 2016.

## 2.0 HISTORY OF CONSTRUCTION

The following History of Construction has been prepared in accordance with the requirements defined in §257.73 (c)(1)(i – xii).

### 2.1 Owner and Operator of CCR Unit

The Coleto Creek Power Station is owned and operated by Coleto Creek Power, LP. The address is as follows:

Coleto Creek Power Station
45 FM 2987
PO Box 8
Fannin, Texas 77960
Primary Ash Pond SWR No. 31911, Unit No. 001

### 2.2 CCR Unit Location

The Coleto Creek Power Station and associated CCR surface impoundment (Primary Ash Pond) is located just outside the city of Fannin in Goliad County, Texas on approximately 8,000 total acres. The Primary Ash Pond is approximately 190 acres in surface area with a reported storage capacity of 2,700 acre-feet (S&L, December 1978). The Primary Ash Pond is located adjacent to the facility's Evaporation Pond and Secondary Pond. Figure 2-1 (U.S.G.S. Area Map) shows the CCR surface impoundment on the most recent US Geological Survey (USGS) 7½ minute quadrangle topographic map.

### 2.3 Primary Ash Pond Statement of Purpose

The Coleto Creek Primary Ash Pond was constructed between 1976 and 1977 during the Power Station site development. The pond was designed and constructed to accommodate wastes from two coal-fired boilers (S&L, December 1978). However, only one boiler has been constructed and operated at the facility.

Bottom ash is collected from the boiler, combined with water, and transferred in slurry form for disposal in the facility's surface impoundment. Fly ash is collected from the boiler exhaust using a baghouse. The fly ash is transported pneumatically to two storage silos. From there, the fly ash is loaded into enclosed dry haul hoppers for off-site beneficial reuse. Fly ash not meeting required beneficial reuse specifications is combined with water and pumped to the facility's Primary Ash Pond for disposal. CCR solids settle out of the conveyance water in the Primary Ash Pond and the treated water overflows stoplogs within an outlet (weir box) structure then flows through a 30" diameter pipe to the smaller Secondary Pond as needed to control water levels. Water from the Secondary Pond can be recirculated to the ash sluice system or discharged in accordance with the facility's TPDES permit. The Secondary Pond has never received more than deminimis quantities of CCR; therefore, it is not subject to the CCR Rule.

Other plant wastes may also reportedly be sluiced into the Coleto Creek Primary Ash Pond including aqueous lab waste, boiler chemical cleaning rinseate, air preheater cleaning rinseate, air preheater cleaning residue, basin solids, de-ionizer regenerate wastewater, heat exchanger cleaning rinseate, waste de-ionizer resin beads, waste molybdate contaminated cooling water, waste filter media, boiler blowdown, demineralizer effluent, storm water, low volume waste, and effluent water/wastewater from plant processes (S&L, 1981).

## 2.4 Watershed Description

Coleto Creek Power Station is located in the lower half of the Coleto Creek Watershed (Figure 2-2) which is maintained by the Guadalupe-Blanco River Authority (GBRA). Coleto Creek is approximately 27 miles long, beginning in DeWitt County and travels through Goliad and Victoria Counties before its confluence with the Guadalupe River (GBRA, 2013). Approximately 558 square miles drain into the Coleto Creek Watershed. Typical land uses in the watershed include farming, ranching, oil and gas production and more recently, in-situ uranium mining. The only urbanized area in the watershed is the small city of Yorktown located upstream of the Power Station in DeWitt County.

Coleto Creek Reservoir Dam was constructed in the late 1970s to create the approximate 3,100 surface acre Coleto Creek Reservoir which serves as a cooling pond for the Coleto Creek Power Station. The Power Station discharges approximately 360,000 gallons per minute of water to the reservoir (GBRA, 2013). Perdido Creek, Turkey Creek, and Sulphur Creek also feed into the reservoir. Although the reservoir is managed by the GBRA, it is reportedly wholly owned by Coleto Creek Power, LP up to an elevation of 104 feet MSL.

## 2.5 Primary Ash Pond Foundation and Abutment Material Description

The Coleto Creek Primary Ash Pond was designed and constructed under the guidance of Sargent & Lundy Engineers (S&L). As part of the design process, S&L advanced 63 soil borings and installed eight monitoring wells in the immediate vicinity of the pond. Based on the information collected, the pond is constructed within a surface deposit of cohesive soils consisting of mostly clayey sand and silty clay with varying amounts of caliche. The soils are classified as CH, CL, and SC soils using the Unified Soil Classification System. These soils range in thickness from 4 to 20 feet, and average 9 feet beneath the Primary Ash Pond and Secondary Pond (average thickness data for the Primary Ash Pond only is not provided in the report) (S&L, December 1978). Figure 2-3 provides the Thickness Contour Map for In-Situ Cohesive Soils in the vicinity of the Primary Ash Pond. The impoundment dikes are continuous and do not include a conventional spillway, thus there are no abutments with other structures.

## 2.6 Primary Ash Pond Construction Summary

As noted in Section 2.3, the Coleto Creek Primary Ash Pond was constructed between 1976 and 1977 during overall site development. Construction was performed by H. B. Zachary Construction with full-time on-site inspection by S&L. Field testing of site soils and construction materials was performed by Trinity Testing Laboratory, Inc. In general, the Primary Ash Pond dikes have a total interior circumference of approximately 10,975 feet and a height ranging from approximately 4 feet up to 39 feet. The maximum reported storage volume is 2,700 acre-feet in the Primary Ash Pond (S&L, December 1978).

As further described below, a topographic and bathymetric survey was conducted for the Primary Ash Pond in July 2016. Results of that survey were combined with assumptions regarding the original base elevation of the pond (limited as-built base elevation data is available) to generate area-capacity estimates for use in subsequent assessments presented in this report. The area-capacity estimates generated using 2016 data indicate that the top of dike capacity is approximately 3,700 acre-ft, or nearly 1,000 acre-ft more than originally reported by S&L. The originally reported 2,700 acre-ft corresponds to an approximate elevation of 135 feet in the 2016 assessment, which is also the operating level identified in the S&L report. For the purposes of this report, the larger capacity is used where appropriate.

In-situ cohesive soils were used as the Primary Ash Pond lining and the geotechnical characteristics of those soils are documented in the S&L construction summary report dated December, 1978. Laboratory geotechnical testing was performed on representative samples collected post-construction from the borings advanced in the in-situ liner soils. The median laboratory permeability was reported as $3.8x10^{-8}$ cm/sec. The average plasticity index, liquid limit, and fines content were listed as 23%, 42%, and 40%, respectively. S&L concluded that the soil liner as constructed overall either met or exceeded requirements for a 3-foot thick compacted clay liner of $1x10^{-7}$ cm/sec permeability in accordance with Texas Department of Water Resources technical guidelines for the design and construction of waste water ponds that were in place at the time of construction (S&L, December 1978).

Primary Ash Pond dikes were constructed using controlled and compacted cohesive fill excavated from borrow areas around the Plant site (S&L, December 1978). As noted previously, site soils generally consist of clayey sand and silty clay, with various amounts of caliche. The dikes were constructed with side slopes ranging from 2.5 and/or 3.0 horizontal to 1.0 vertical. This side slope was specified in accordance with the Bureau of Reclamation Design of Small Dams, 1974, for small homogenous dams constructed with cohesive fill on a stable foundation. Side slopes were reportedly seeded.

Dike fill was specified to be placed and compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698. Four hundred and twenty field density tests conducted specifically on Primary Ash Pond dike materials during construction reported densities ranging from a minimum of 92 percent up to 110 percent, with an average of 98 percent.

The exterior dikes for the Primary Ash Pond were constructed approximately 4 to 39 feet above the existing grade. The crest of the dike is reportedly 15 feet wide and includes a gravel perimeter access road. Typical cross-sections depicting the Primary Ash Pond construction configuration are provided on Figure 2-5.

The Primary Ash Pond and Secondary Pond are separated by a dike that has side slopes of approximately 3.0 horizontal to 1.0 vertical and a height of approximately 40 feet above natural grade. This dike also has a crest that is approximately 15 feet wide and contains a gravel road (see Figure 2-5). An outlet structure intersects the divider dike to allow the overflow of water from the Primary Ash Pond to the Secondary Pond. The structure inlet is located in the Primary Ash Pond and consists of a 7-feet wide by 9.5-feet long concrete structure configured with stoplogs supported by a 12-feet wide by 14.5 feet long foundation. The inlet structure is accessed by a walkway extending from the shared Primary Ash Pond and Secondary Pond dike into the Primary Ash Pond. The concrete inlet structure is intersected by a 30-inch diameter corrugated metal pipe (CMP) with 7-feet by 7-feet steel seepage collars at 28 feet on center. The CMP has an inlet elevation of El. 106 and an outlet elevation of El. 105 (CDM, March 2011).

Bottom ash and boiler slag are sluiced along the south embankment into the Primary Ash Pond via one 12-inch-diameter high density polyethylene (HDPE) pipe and one 12-inch-diameter carbon steel pipe (CSP). The ash slurry is sluiced onto a screen processor to separate fine and coarse material. Demineralizer effluent is sluiced into the Primary Ash Pond along the southeast embankment through an 8-inch-diameter HDPE pipe.

A boiler area sump in the plant collects other liquid waste and sluices it through a 20-inch diameter Class 200 polyvinyl chloride (PVC) pipe along the Primary Ash Pond west embankment adjacent to the groin with the evaporation pond. A valve in the pipeline also allows the boiler area sump water to be discharged directly into the evaporation pond. Flow to the Primary Ash Pond from the boiler area sump is regulated depending on water levels and weather conditions. The pipeline can also be used as a clean water decanting pipe.

In 2012, Coleto Creek Power, LP contracted AECOM Technical Services, Inc. (AECOM) to prepare a hydraulic and geotechnical stability analysis of the Primary Ash Pond (AECOM, March 2012). Under that study, AECOM conducted field and laboratory testing to evaluate the current geotechnical stability of the Primary Ash Pond dike system. According to the report, AECOM found that “the ash pond has adequate factor of safety under the steady-state, normal operating, maximum operating, rapid drawdown, and seismic conditions modeled.”

## 2.7 Primary Ash Pond Drawings

Figures 2-4 and 2-5A, -B, and -C provide dimensional drawings of the Primary Ash Pond as required in §257.73(c)(1)(vii).

## 2.8 Primary Ash Pond Instrumentation

The Coleto Creek Primary Ash Pond water levels are observed on a daily basis during site inspections using the pond staff gauge located on the inlet structure. The staff gauge has a maximum reading of +140 feet which approximately corresponds to the top of the dike embankment. Based on an on-site topographic survey conducted by Naismith Marine Services of Corpus Christi, Texas (Naismith) in July 2016, the elevation 140 reading on the staff gauge corresponds to approximate elevation 140.4 feet NAVD88. Furthermore, the plant datum (referred to as MSL) was surveyed and determined by Naismith to be equal to NAVD88. Water levels are normally maintained at an elevation of El. 136 feet (NAVD88) or lower. There is no other instrumentation used to monitor the Primary Ash Pond.

## 2.9 Primary Ash Pond Area-Capacity Curves

Figure 2-6 provides the area-capacity curves for the Primary Ash Pond.

## 2.10 Primary Ash Pond Spillway and Diversion Design Features

The Primary Ash Pond was not constructed with a conventional spillway. Water from the Primary Ash Pond is primarily lost through evaporation. Excess water that needs to be removed to maintain proper freeboard distances can either be discharged through the Secondary Pond and subsequently through Outfall 003 in accordance with the plant's TPDES permit or recirculated back to the plant for re-use.

Pond water levels are maintained to accommodate safe plant operations and are primarily dependent on plant water and ash loading rates as no storm water runoff from the surrounding area (other than run-off from the dike crest) enters the pond. Water levels are monitored daily and the amount discharged to the outfall or recirculated to the plant can be adjusted to accommodate for expected rain events or drought conditions. The Primary Ash Pond is currently operated with more than four feet of freeboard to allow removal of bottom ash and fly ash for off-site beneficial reuse.

### 2.11 Primary Ash Pond Surveillance, Maintenance, and Repair Provisions

Formal and informal inspections of the pond are conducted by qualified facility personnel for the purpose of ensuring proper and safe operation in accordance with the provisions defined in §257.83(a). Weekly inspections include observation of the static pond water level, vegetation control, and structural integrity evaluations of dike embankments and any noted issues are addressed as necessary. In addition to the weekly observational inspections performed by site personnel, formal inspections of the pond conditions are conducted by an independent consulting firm annually in accordance with §257.83(b).

### 2.12 Primary Ash Pond Structural Stability History

There is no record or knowledge of structural instability of the Primary Ash Pond. The pond dikes have been maintained to minimize the potential for structural failure.

## 3.0 INITIAL POTENTIAL HAZARD CLASS ASSESSMENT

According to 40 *CFR* §257.73(a)(2), the owner and operator of a CCR surface impoundment must assign a hazard potential classification to each operating unit. For the purposes of the rule, hazard potential classification means "the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances." The impoundment must be classified as high hazard, significant hazard, or low hazard. Each hazard potential classification is defined as follows (§257.53):

1) *High hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

2) *Low hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

3) *Significant hazard potential CCR surface impoundment* means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

In 2010 the United States Environmental Protection Agency (USEPA) contracted CDM to perform a site assessment of the Primary Ash Pond at the Coleto Creek Power Station. As part of the assessment, CDM assigned the pond with a Low Hazard classification (CDM, 2011).

Subsequent to the CDM report findings, Coleto Creek Power, LP contracted AECOM to perform geotechnical studies to further evaluate the structural stability of the CCR surface impoundments. AECOM implemented a subsurface investigation and performed a geotechnical stability evaluation, a liquefaction assessment, and hydraulic analysis. AECOM also performed an independent hazard assessment of the Primary Ash Pond and Secondary Pond. The results of that assessment supported the initial CDM classification of Low Hazard.

### 3.1 Dam Breach Analysis

The Coleto Creek Primary Ash Pond is the only CCR-regulated surface impoundment at the Coleto Creek Power Station and is therefore subject to the Hazard Classification Assessment under the CCR rules. Because the Primary Ash Pond is hydraulically connected to, and is separated by a dike system from, the Secondary Pond, it is necessary to include the Secondary Pond when evaluating potential failure scenarios as noted below. Although the Secondary Pond is not a CCR-regulated unit, it is subject to operational and safety standards established by the Texas Commission on Environmental Quality (TCEQ) in its Dam Safety rules (30 TAC Part 1 Chapter 299).

Bullock, Bennett & Associates (BBA) performed a simplified dam breach analysis of the Primary Ash Pond and Secondary Pond to support the loss of life, and environmental and economic impact analyses. The Primary Ash Pond and Secondary Pond combined, as indicated by the most recent survey conducted in July 2016, have a maximum storage capacity of approximately 4,000 acre-ft and a maximum levee height for the Secondary Pond of approximately 39 feet above adjacent lake level of 101 feet MSL. Construction was completed in 1978 and the effective fluid storage capacity in the Primary Ash Pond has diminished with the placement of CCR over time. According to topography and bathymetric survey data collected in July 2016, the fluid capacity in the Primary Ash Pond has been reduced to approximately 1,720 acre-ft at the maximum dike crest height.

The Primary Ash Pond and Secondary Pond are located next to the Coleto Creek Reservoir which was constructed to serve as a cooling pond for the Power Station. The reservoir is divided into a “hot” side and a “cool” side. The ponds are located immediately adjacent to the hot side of the lake. The hot side of the lake is created from Sulphur Creek behind Dike No. 1 (Dike No. 1 Lake) which is connected to Turkey Creek behind Dike No. 2 (Dike No. 2 Lake) by a secondary flume. Water from these lakes then flows into Main Lake which is the cool side. Decant water from the Secondary Pond can be combined with other plant water then routed through TCEQ-approved Outfall 003 to the hot side of the lake. Cool water is pumped into the Power Station from the Main Lake.

GBRA provided area-capacity tables for the Coleto Creek Reservoir and Dike Lake Nos. 1 and 2. These tables are presented as Attachments 3-1, 3-2, and 3-3 in Appendix E. Dike No. 1

Lake consists of approximately 164 acres at the normal operating elevation of 101 feet MSL. Dike No. 2 Lake is approximately 429 acres at the normal operating elevation of 101 feet MSL. The two Dike Lakes are separated from Coleto Creek Reservoir by splitter dikes with an approximate elevation of 102 feet MSL (GBRA, 2016). Coleto Creek Reservoir covers an area of approximately 2,652 acres at a normal operating elevation of 98 feet MSL (GBRA, 2016). Coleto Creek Power, LP reportedly controls the lake up to an elevation of 104 feet MSL. An area map showing the relative locations of the Primary Ash Pond, Secondary Pond, Dike Lakes, and Coleto Creek Reservoir is presented in the attachments as Figure 1-1.

For the purposes of this evaluation, a conservatively worst-case dam breach scenario was developed assuming that the breach was due to overtopping of the surface impoundment levees and that the breach occurs in the shared Primary Ash Pond and Secondary Pond dike and subsequently in the Secondary Pond dike adjacent to Coleto Creek Reservoir, releasing the entire water contents of both ponds. This scenario allows for the greatest quantity of pond decant water to be released.

An evaluation of potential water and residual solids flow paths was performed to support the loss of life, environmental, and economic evaluations. Surface elevation cross-sections assembled from Google Earth™ profiles of the areas adjacent to the pond dikes were reviewed to estimate the potential flow path of the released water and solids. As shown in Figure 1-1A, the wet side of the ponds are bound by the Evaporation Pond followed by Dike No. 1 lake on the north-northwest, Dike No. 1 lake on the northeast corner, and the primary plant discharge flume on the east. The surface elevation of the terrain that bounds the east side of the discharge flume appears to extend to approximately elevation 132 feet. The flume channel, therefore, appears to be located within a larger basin bounded to the west by the Primary Ash Pond and Secondary Pond dikes (approximate elevation 140 feet) and to the east by land mass (approximate elevation 132 feet). The distance between the dike on the west side of the basin and land mass high points on the east side appears to be approximately 300 feet. The flume channel and basin would route flow from an east-side breach of the dike to the hot side of the lake. Released water and solids, therefore, would initially flow to the hot side of the lake regardless of the location of the breach. From there, water levels would increase one foot (the amount of available freeboard behind Dike No. 1 and Dike No. 2 lakes) then flow into the Main lake. Eventually all water would be released into the Main lake.

Using the tables provided by GBRA, a one-foot increase in the Main Lake elevation requires an additional approximately 2,720 acre-feet of water. The estimated maximum volume of discharge from the Primary Ash Pond and Secondary Pond is approximately 1,720 acre-feet of water, resulting in a water surface elevation change on the reservoir of approximately eight inches. An eight-inch change in water surface elevation is considered to be nominal and would not result in the loss of major infrastructure elements or disrupt lifeline facilities.

### 3.2 Loss of Life Evaluation

The Primary Ash Pond and Secondary Pond are located apart from the active industrial areas of the Power Station. Two fly-ash silos are located adjacent to the western border of the Primary Ash Pond and loading of trucks for off-site transport and beneficial reuse of the fly ash regularly occurs at this location. These silos and truck loading operations are adjacent to the southwest half of the Primary Ash Pond which is filled with dry and compact CCRs, and any catastrophic failure of the impoundment in this area is highly unlikely. If a failure were to occur, it would probably be located on the "wet" side of the pond, including the northern or eastern dikes for both the Primary Ash Pond and Secondary Pond (see Figure 1-1). There are no regular or active plant operations that occur downstream of those areas where personnel would be expected to be present in the event of a catastrophic failure of the dike. There are no residences or other off-site manned operations immediately downstream of the ponds. As noted in Section 3.1 the Dike 1, Dike 2, and Main Lakes would absorb the released water and raise reservoir levels a nominal amount (less than a foot). Loss of life in the event of a catastrophic failure of the surface impoundment dike system, therefore, is considered to be improbable.

### 3.3 Economic and/or Environmental Loss Evaluation

Additional consideration was given to the impacts of the water quality from a large volume discharge from Primary Ash Pond and Secondary Pond into the Coleto Creek Reservoir. Using the volume ratio of pond water (approximately 1,720 acre-feet) that could potentially be discharged into the Coleto Creek Reservoir to the existing volume of water in the reservoir (approx. 31,280 acre-feet at elevation 98 feet msl), the impacts to the water quality are minimal (31,280 acre-feet/1,720 acre-feet = ~18 dilution factor of analytes in the Primary Ash Pond water). Discharge of Secondary Pond water is currently allowed to the Coleto Creek Reservoir under Permit No. WQ002159000 (TCEQ, 2010).

Currently, the coal combustion by-products are sluiced into the Primary Ash Pond. The assumed ratio of solids-to-water is approximated at 20%-to-80%. The solids settle out of solution and the water decants to the surface. As the solids settle out of solution, they consolidate. Additionally, based on field observations the ash “sets up” similar to cement, becoming very hard and massive. The expected flow of any unconsolidated solids from the Primary Ash Pond is believed to be minimal.

Additionally, approximately 90% of the approximate 90,000 cubic yards of ash produced annually is currently being sold and recycled rather than disposed in the Primary Ash Pond (Coleto Creek Power, 2015). However, for the sake of conservatism, it is assumed that a volume of ash equivalent to six months of production (assuming no recycling) is disposed in the Primary Ash Pond and may not be consolidated, and may flow should a breach occur. Under these assumptions, there is potential for approximately 45,000 cubic yards (approximately 28 acre-feet) of ash flow. The ash volume would be in solution with the decant water, displacing an equal volume of the decant water. This ash would be expected to be contained within the hot side of the lake. Impacts would therefore be primarily limited to the owner’s property.

### 3.4 Hazard Potential Classification

Based on a review of previous studies, analytical data, ash production/recycling volumes, available impoundment capacities, available lake capacities, observed current conditions at the site, assumptions, and other factors, the Coleto Creek Primary Ash Pond is classified as a Low Hazard Potential impoundment.

## 4.0 INITIAL STRUCTURAL STABILITY ASSESSMENT

According to §257.73(d), the owner or operator of the CCR surface impoundment "must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein."

*Stable foundations and abutments.* As noted in Section 2.5, the Primary Ash Pond was constructed on a foundation of in-place cohesive soils whose geotechnical characteristics either met or exceeded Texas Department of Water Resources technical guidelines for the design and construction of waste water ponds that were in force at the time of construction (S&L, December 1978). The dikes are continuous, with no constructed abutments. A review of the geotechnical data collected at the time of construction confirms that the foundation for the pond should continue to be stable over its operational life.

*Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.* The Primary Ash Pond dikes were constructed with 2.5 to 3 horizontal to 1 vertical side slope. Outer slopes were seeded for slope protection but interior dike surfaces were not. Vegetation does naturally occur on these surfaces thus assisting in the control of erosion. The interior dike sections in areas impounding water are armored with rock riprap. The dikes are regularly inspected in accordance with §257.83(a) and (b) and repaired as necessary to maintain their integrity. An engineering site inspection was performed in December 2016 in accordance with the requirements defined in §257.83(b) which included an evaluation of the surface impoundment dikes. No additional slope protection was deemed to be necessary at that time. (BBA, 2018).

*Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.* The dike system was engineered by S&L and constructed in approximately 1978. As discussed in Section 2.6 – Ash Pond Construction Summary, dike fill material was placed in controlled, mechanically compacted lifts, averaging approximately 98% maximum dry density as determined by ASTM D698. Full time field inspection was performed during construction, with approximately 420 field density tests performed on the dikes.

*Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection.* The slopes of the dikes and surrounding areas are vegetated as required. The slopes are reportedly mowed as necessary to comply with height of grass requirements.

*A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of the section of the rule*. As is common with surface impoundments of this type, the Primary Ash Pond was not constructed with a spillway. The results of the hydraulic analysis completed in support of the Inflow Design Flood Control System evaluation (BBA, January 2018) showed that the Primary Ash Pond, as configured without a spillway and when operated at a maximum storage operating elevation of 136.1 feet NAVD88, has sufficient capacity to manage the design flood. The design flood is designated by rule for a Low Hazard Potential surface impoundment (see Section 3.0) to equal the 100-year rainfall event. It is therefore not necessary for the surface impoundment to have a spillway.

*Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.* The weir system and pipe penetrations were visually inspected by a professional engineer in December of 2016 (BBA, 2018). There were no observations of conditions that would negatively impact operation of the structures. The inspection was limited to visual observations during a site visit, and did not include, for instance, use of a remote video camera in the outlet structure pipe for inspection of internal conditions.

*For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body*. The dike that separates the Primary Ash Pond from the Secondary Pond was evaluated for stability in the event of rapid drawdown of the Secondary Pond, as further discussed in Section 5.0 Initial Safety Factor Assessments. As noted in the Initial Safety Factor Assessment, the modeled slope stability results indicate this divider dike exceeds the required safety factors under the max surcharge pool/rapid drawdown scenario.

No structural stability deficiencies were identified in this initial Structural Stability Assessment that would require corrective measures.

## 5.0 INITIAL SAFETY FACTOR ASSESSMENTS

§257.63(e) requires that owners of existing and newly constructed CCR surface impoundments conduct initial and periodic safety factor assessments. The purpose of the safety factor assessment is to document that the as-constructed CCR surface impoundment configuration either meets or exceeds regulatory safety factor criteria under long-term, maximum storage pool loading conditions, and maximum surcharge pool loading conditions. In addition, the liquefaction and seismic factor of safety must be estimated.

The rule requires that the safety factor evaluation be performed across the critical cross section of the impoundment dikes. For the purposes of this initial assessment, previous data collected as part of historical site assessments as noted in Section 4.0 were evaluated to determine whether it represented the critical cross section of the pond dikes that would be most susceptible to failure. The critical cross sections for the Primary Ash Pond, as shown in Figure 2-5A, are in the areas of the pond that still contain water, are generally representative of the tallest sections of dikes and contain representative side slopes, and are where the highest potential impacts would be expected were a dike breach to occur.

Geotechnical sampling and analysis of as-constructed dike materials has been conducted during three different events. The first was performed by S&L during and after construction of the pond in 1978. Subsequent studies were performed in 1981 by Underground Resource Management, Inc. (URM) (URM, July 29, 1981) and in 2012 by AECOM Technical Services, Inc. (AECOM, March 2012).

BBA reviewed the previous site geotechnical investigation data gathered by S&L, URM and AECOM used in previously conducted stability analyses of the dikes and the data appears sufficient to provide a reliable estimation of current conditions, therefore no further geotechnical testing was required for the current analysis. Coleto Creek Power provided all previous investigation data to BBA for use in evaluation and preparation of an updated structural stability analysis. The most recent stability analysis, conducted by AECOM in 2012, summarizes previous evaluations by others. A brief summary of previous geotechnical investigations is provided below.

S&L completed approximately 80 soil borings to document the subsurface soils in and around the Primary Ash Pond. All of the borings were reportedly completed prior to construction of the ponds, in support of the pond design. Following commissioning of Unit 1 and filling of the ponds to normal operating levels, seepage was observed west and adjacent to the Recirculating Pump House. URM was contracted to investigate the seeps and their potential impact to dike stability. URM completed a geotechnical investigation of the pond dikes near the seep location, and assessment of both the dike embankment stability and groundwater quality indicated no detrimental effects due to the seep at that time and that, based on site geotechnical investigations, laboratory data analysis, and slope stability modeling of the dike, short and long-term stability of the embankments in the study area were considered satisfactory (URM, July 29, 1981).

AECOM, upon reviewing previous geotechnical investigations from S&L and URM, completed a supplemental geotechnical investigation program to evaluate stability of the dike system in 2012. While their review of previous data found the data to be acceptable for use in evaluation of dike stability of the ponds, they also identified critical areas of interest within the dike system for further evaluation, and implemented a geotechnical investigation of these critical areas (cross sections A and B as shown in Figure 2-5A of the attachments). BBA agrees that these locations are the critical areas to evaluate for stability, given cross section A is near a location of historically observed seepage at the outside toe of the Primary Ash Pond dike and cross section B is located along the splitter dike that separates the Primary Ash Pond and Secondary Pond. It should be noted that due to recent reduction in water surface operational levels at the Primary Ash Pond, the historically observed seepage in the area of cross section A has recently been observed to be dry.

AECOM field data gathering included construction of 8 geotechnical borings extending from depths ranging from 29.5 to 121.5 feet below ground surface (bgs). Five borings were completed from the top of the dikes and three borings were located along the exterior toe of dike. Laboratory testing included water content, dry unit weight, calibrated penetrometer, grain-size distribution, triaxial shear testing and direct shear testing. AECOM contracted with Subsurface Exploration Services, LLC of Green Bay, Wisconsin to complete the field work, and AECOM field staff observed the exploration work, assisted with collection of soil samples, and completed field boring logs. Laboratory testing was conducted by AECOM geotechnical laboratory technicians. AECOM geotechnical laboratories are reportedly certified by multiple state and federal agencies to complete geotechnical testing in accordance with American Society for Testing and Materials (ASTM), United States Army Corp of Engineers (USACE), and State Department of Transportation approved methods and standards (AECOM, 2012).

BBA reviewed the data available from the S&L, URM, and the supplemental data gathered by AECOM including geotechnical data, cross sections, and methodology used by AECOM for modeling slope stability. The data and methods are suitable for evaluation of slope stability of the critical cross section locations. The geotechnical investigation data from the AECOM study, including soil bore logs and geotechnical laboratory data is included in Appendices A and B, respectively, of this report.

BBA contracted Naismith to complete an existing conditions topographic survey of these critical cross section areas, as well as topography of the entire perimeter dike system and bathymetry of the pond interiors. Using the 2016 existing conditions survey data, and geotechnical data obtained from the previous studies (including similar lithology as indicated in the AECOM study for the critical cross sections), BBA graphically reconstructed the cross section locations A and B for completion of further analysis. Upon review of all data and methodologies used by AECOM in analysis of the critical cross section locations of the dike systems, BBA completed a similar analysis. BBA compared the 2016 as-built topographic survey cross sections at cross section locations A and B to the design sections. Based on this review it appeared the as-built sections generally were slightly overbuilt when compared to the design sections, and contained slightly gentler slopes. Based on comparison of design versus as-built sections at each location it was determined that the design sections were likely worse case than the as-built sections in regards to analysis for slope stability, therefore only the design sections were evaluated.

Based on review of the AECOM bore logs and geotechnical laboratory test data, BBA generally agrees with the lithology and soil engineering strength properties used in the AECOM stability analysis. However, BBA's evaluation of field data and laboratory indices testing did result in minor changes in assumed soil properties – the reduction of the effective shear strength of caliche from 36 degrees to 34 degrees for cross section B and the increase in unit weight from 120 pounds per cubic foot (pcf) to 130 pcf. BBA evaluated stability with both sets of data and observed that these changes do not alter the overall safety factor for these sections, however, the revised data set appear more appropriate based on review of field and indices test data and are therefore reported. Review of the data indicates that generally the AECOM engineering strength properties used in their analysis were conservative and representative of the field and laboratory data gathered.

Similar to the AECOM stability evaluation, BBA evaluated the dikes using two sets of time-dependent strength parameters, effective stress and total stress. Effective stress analysis was used to model drained, long-term, steady-state loading conditions where excess pore pressures have had time to dissipate. This would be the normal steady state operating conditions (maximum storage pool) of the pond. Total stress analysis was used to model undrained, short-term loading conditions such as maximum surcharge pool, rapid drawdown, and seismic events, where excess pore water pressure could develop in fine grained silts clays and not have had time to dissipate. The rapid drawdown case is representative of the conditions that would occur immediately after a significant flood event, or if the Secondary Pond was rapidly drained.

The seismic conditions analyze the effect an earthquake would have on the stability of the dike. BBA selected a maximum probable earthquake for the Coleto Creek Power Station based on the 2014 United States Geological Survey National Seismic Hazard Maps found at (http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014pga2pct.pdf). The maximum probable earthquake has a peak ground acceleration of 0.03 g with a 2 percent Probability of Exceedance in 50 years.

Table 5-1 summarizes the effective and total stress soil strength parameters used for each soil layer in the analysis:

**TABLE 5-1**
Soil Strength Parameters used in Geotechnical Stability Analysis
(color shading as shown in cross sections)

**Cross Section A-A'**

| Soil Description | Unit Weight (pcf) | Effective Stress Strength Parameters | | Total Stress Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Ø' | c (psf) | Ø |
| Clayey Sand Fill Material (SC) | 130 | 150 | 29 | 3,000 | 0 |
| Natural Silty Clay or Clayey Sand (CL, SC, CL-Caliche) | 130 | 150 | 27 | 4,000 | 0 |
| Natural Sands (SM, SP, SC) | 130 | 0 | 36 | 0 | 36 |

**Cross Section B-B'**

| Soil Description | Unit Weight (pcf) | Effective Stress Strength Parameters | | Total Stress Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Ø' | c (psf) | Ø |
| Clayey Sand Fill Material (SC) | 130 | 150 | 29 | 3,000 | 0 |
| Caliche (SC) | 135 | 250 | 34 | 250 | 0 |
| Medium Dense to Dense Sands (SP) | 132 | 0 | 36 | 0 | 36 |
| Dense to Extremely Dense Sands (SP, SC, SM, SP-SM) | 133 | 0 | 38 | 0 | 38 |
| Very Stiff to Hard Silty Clay (CL, CL-ML, CH) | 128 | 0 | 29 | 3,250 | 0 |

Based on field observations, the ash located within the Primary Ash Pond tends to set up, much like cement, into a hard, blocky mass of material. However, as was assumed in the AECOM evaluation, for conservative modeling purposes the interior material was considered to be water, with no structural strength that would add a stabilizing force.

Four model conditions were evaluated at each cross section location, as deemed applicable, including: maximum storage pool (the highest normal operating level) and maximum surcharge pool (level reached during inundation from design storm) conditions, rapid drawdown, and the seismic condition. The normal operating water level, based on the Hydrologic and Hydraulic Capacity Requirements evaluation completed by BBA (BBA, January 2018) is 136.1 (NAVD88).

The water level projected in event of a design storm (the 100 year, 24-hour storm) is 138.0 (NAVD88). The lowest top of dike elevation observed in the 2016 survey was 139.7 (NAVD88).

Cross section A, located in the observed historical seep location near the southeast corner of the Primary Ash Pond, was assumed to have a water table elevation at the ground surface along the exterior toe of slope, as observed in the field and as documented in the AECOM stability analysis as well as the BBA inspection conducted in December 2016. Cross section B, located along the separator dike between the Primary Ash Pond and Secondary Pond, was modeled with the maximum storage and maximum surcharge pool elevations. Cross section B was also evaluated for the rapid draw down (RDD) condition. It is conservatively assumed the phreatic surface at cross section A exits the exterior dike surface at approximately 1/3 the height of the dike (although the only field observations of wet soil occurred at the toe of slope, where the seep locations are located). The phreatic surface for cross section B is at the same elevation as the assumed pond water levels.

Dikes should be designed with appropriate safety factors. Required safety factors per §257.73(e)(1)(i) through (e)(1)(iv) for critical embankment sections are as follows:

**Table 5-2**
Required Factors of Safety

| Condition | Required Factor of Safety |
|---|---|
| Long-Term, Maximum Storage Pool Loading Static Factor of Safety | 1.50 |
| Maximum Surcharge Pool Loading Static Factor of Safety | 1.40 |
| Seismic Factor of Safety | 1.00 |
| Liquefaction Factor of Safety | 1.20 |

BBA used the 2D limit equilibrium computer program SLIDE 7.0 by Rocscience to complete the slope stability analysis for the critical cross sections. A combination of the Simplified Bishop and the Morgenstern-Price method of slices, for both circular and block-type failures, was used to analyze the stability of the slopes. Eighteen stability cases were evaluated for the critical cross sections as summarized in Table 5-3, and the lowest factor of safety generated for each case is reported:

**Table 5-3**
Slope Stability Analysis Summary

| Cross Section | Conditions | Effective Stress Analysis Safety Factor | | Total Stress Analysis Safety Factor | |
|---|---|---|---|---|---|
| | | Block | Circular | Block | Circular |
| A-A’ | Max Storage Pool/Static | 1.8 (1) | 1.9 (2) | 4.9 (3) | 5.5 (4) |
| A-A’ | Max Surcharge Pool/Static | 1.7 (5) | 1.8 (6) | 4.9 (7) | 5.5 (8) |
| A-A’ | Max Storage Pool /Seismic | NA | NA | 4.3 (9) | 4.8 (10) |
| B-B’ | Max Storage Pool /Static | 2.8 (11) | 2.8 (12) | 3.7 (13) | 5.1 (14) |
| B-B’ | Max Surcharge Pool, Rapid Drawdown | NA | NA | 2.0 (15) | 2.1 (16) |
| B-B’ | Max Storage Pool/Seismic | NA | NA | 3.0 (17) | 4.1 (18) |

Note: (#) = Case Number (referenced on model output data in Appendix C).

Cross sections, bore logs, laboratory data, and SLIDE 7.0 stability model output data are included in Figure 2-5A and Appendices A, B, & C, respectively of this report.

As shown in Table 5-3, eighteen stability cases were modeled and all cases meet or exceed required factors of safety.

### 5.1 Liquefaction Assessment

BBA utilized the liquefaction assessment process outlined in the U.S. EPA guidance document titled RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, April 1995, published by the Office of Research and Development and other relevant source documents to perform this liquefaction factor of safety evaluation. As identified in those documents, the liquefaction assessment process begins by screening the subject site for its liquefaction potential using the following criteria.

- Geologic age and origin. If a soil layer is a fluvial, lacustrine or aeolian deposit of Holocene age, a greater potential for liquefaction exists than for till, residual deposits, or older deposits.

- Fines content and plasticity index. Liquefaction potential in a soil layer increases with decreasing fines content and plasticity of the soil. Cohesionless soils having less than 15 percent (by weight) of particles smaller than 0.005 mm, a liquid limit less than 35

percent, and an in situ water content greater than 0.9 times the liquid limit may be susceptible to liquefaction.

- Saturation. Although low water content soils have been reported to liquefy, at least 80 to 85 percent saturation is generally deemed to be a necessary condition for soil liquefaction.

- Depth below ground surface. If a soil layer is within 50 feet of the ground surface, it is more likely to liquefy than deeper layers.

- Soil Penetration Resistance. Soil layers with a normalized SPT blowcount [$(N_1)_{60}$] less than 22 have been known to liquefy. Other sources suggest an SPT value of [$(N_1)_{60}$] less than 30 as the threshold to use for suspecting liquefaction potential.

If three or more of the above criteria indicate that liquefaction is not likely, the potential for liquefaction is considered to be negligible. Otherwise, further evaluation of the liquefaction potential at a facility is required. The soils at the Coleto Creek Power facility generally meet at least three of the specified screening criteria and their liquefaction potential is unlikely. However, there are exceptions such as certain layers that are described in the soil borings logs as SP, or sandy soils, which would by definition have a low fines content. In addition, some liquid limits are below 35 percent. Therefore, further evaluation of the soil data has been completed, and factors of safety against liquefaction calculated for each critical layer, as further described below.

A review of existing data regarding site conditions, soil stratigraphy, soil properties, and potential critical layers as well as the methods used to develop that data indicate that the findings presented in the AECOM report (AECOM, 2012) are sufficient for use in this assessment. As noted in previous sections of this report, AECOM drilled eight borings through critical areas of the site to depths ranging from approximately 30 to 120 feet bgs. Standard penetrometer (SPT) blows per foot, plastic limit, water content, and liquid limit data were collected at two to five foot intervals. In addition, samples were collected and sent to an off-site laboratory for analyses of general geotechnical properties. Copies of the boring logs and laboratory data used in this assessment are provided in Appendices A and B.

When available, site specific information such as SPT blow count and percent fines content (soils passing the #200 sieve) was used in the evaluation of liquefaction potential. For strata with no site specific data, conservative estimates were used based on industry accepted references and engineering judgement. For example, earthquake potential maps and tables presented in the

USEPA guidance document were used to estimate the worst-case earthquake magnitude and associated maximum ground acceleration. USGS references for low to mid-ranges of fines content for the reported soil types were used when no laboratory data existed.

A complete discussion of the methodology used and the calculation spreadsheets for each strata identified in the eight boring logs are presented in Appendix D. The findings of the liquefaction assessment indicate that the factor of safety is well above the 1.2 required. This finding is expected given the generally high fines content of most soil strata, the low water content, and low ground acceleration that would be observed in the unlikely event that an earthquake was to occur in this area.

## 5.2 Initial Safety Factor Assessment Summary

In accordance with §257.73, Structural Integrity Criteria for Existing CCR Surface Impoundments, the critical cross sections of the Primary Ash Pond at the Coleto Creek facility have been evaluated for slope stability under appropriate loading conditions, including steady-state seepage, maximum surcharge pool, rapid drawdown, and seismic. In addition, a liquefaction assessment has been completed. Based on review of historic studies, geotechnical data that has been previously gathered, and on stability analysis evaluation, the Primary Ash Pond has an adequate factor of safety for all evaluated loading conditions.

## 6.0 REFERENCES

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FIGURES


N

APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 5-2011.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

12-28-2017

**Coleto Creek Power, LP**

Figure 1-1A

SITE LOCATION MAP

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:38:.m, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL115.dwg


N

APPROXIMATE SCALE: 1" = 1000'

0 500 1000 2000

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

12-28-201

SOURCE: AERIAL PHOTO PROVIDED BY T.N.R.I.S., NAD83 UTM ZONE 14N, DATE: OCT 2014-AUG 2015.

**Coleto Creek Power, LP**

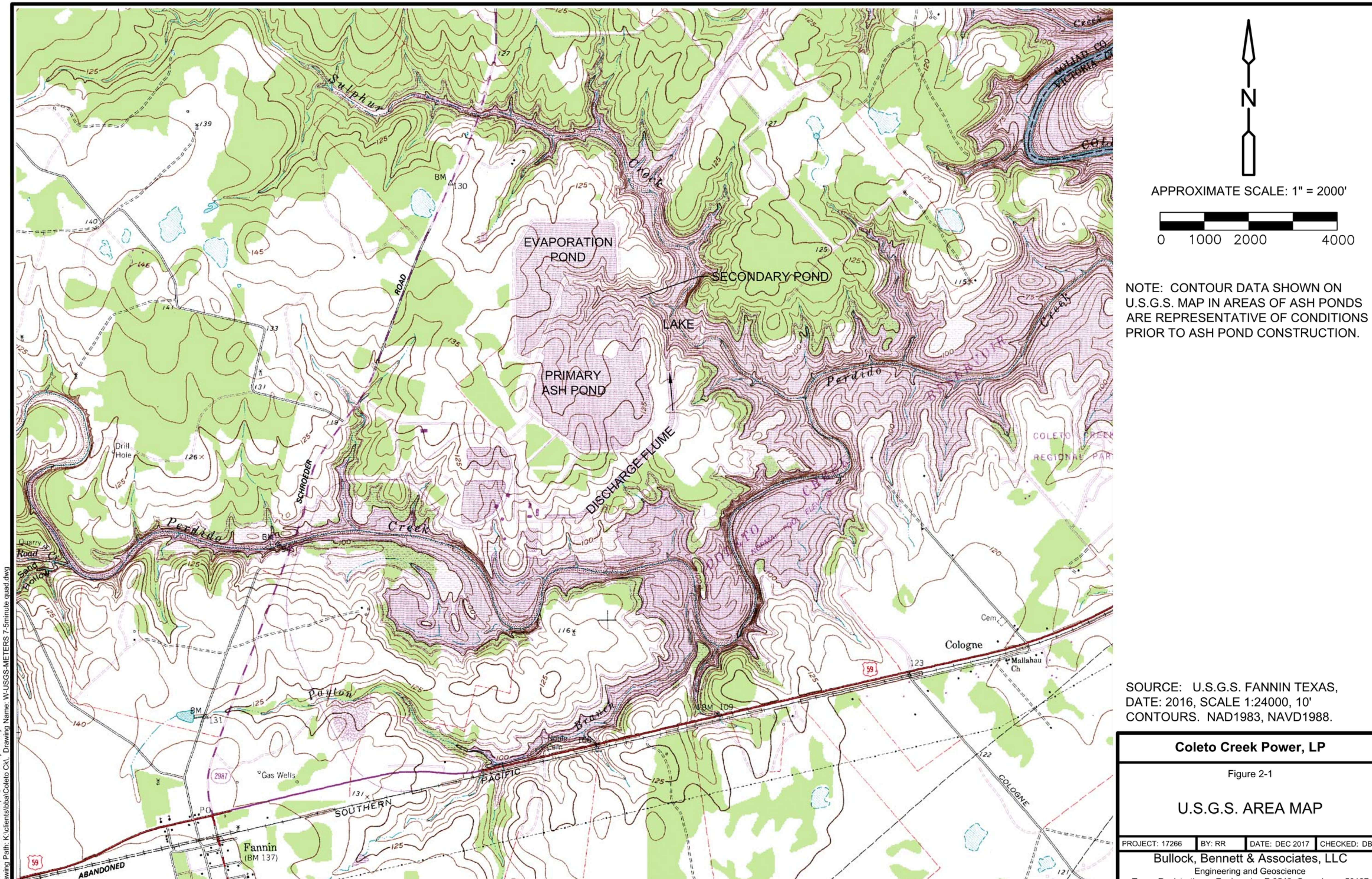
Figure 1-1B

## SITE LOCATION MAP

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:40□m, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL114.dwg




NOTE: CONTOUR DATA SHOWN ON U.S.G.S. MAP IN AREAS OF ASH PONDS ARE REPRESENTATIVE OF CONDITIONS PRIOR TO ASH POND CONSTRUCTION.

SOURCE: U.S.G.S. FANNIN TEXAS, DATE: 2016, SCALE 1:24000, 10' CONTOURS. NAD1983, NAVD1988.

**Coleto Creek Power, LP**

Figure 2-1

U.S.G.S. AREA MAP

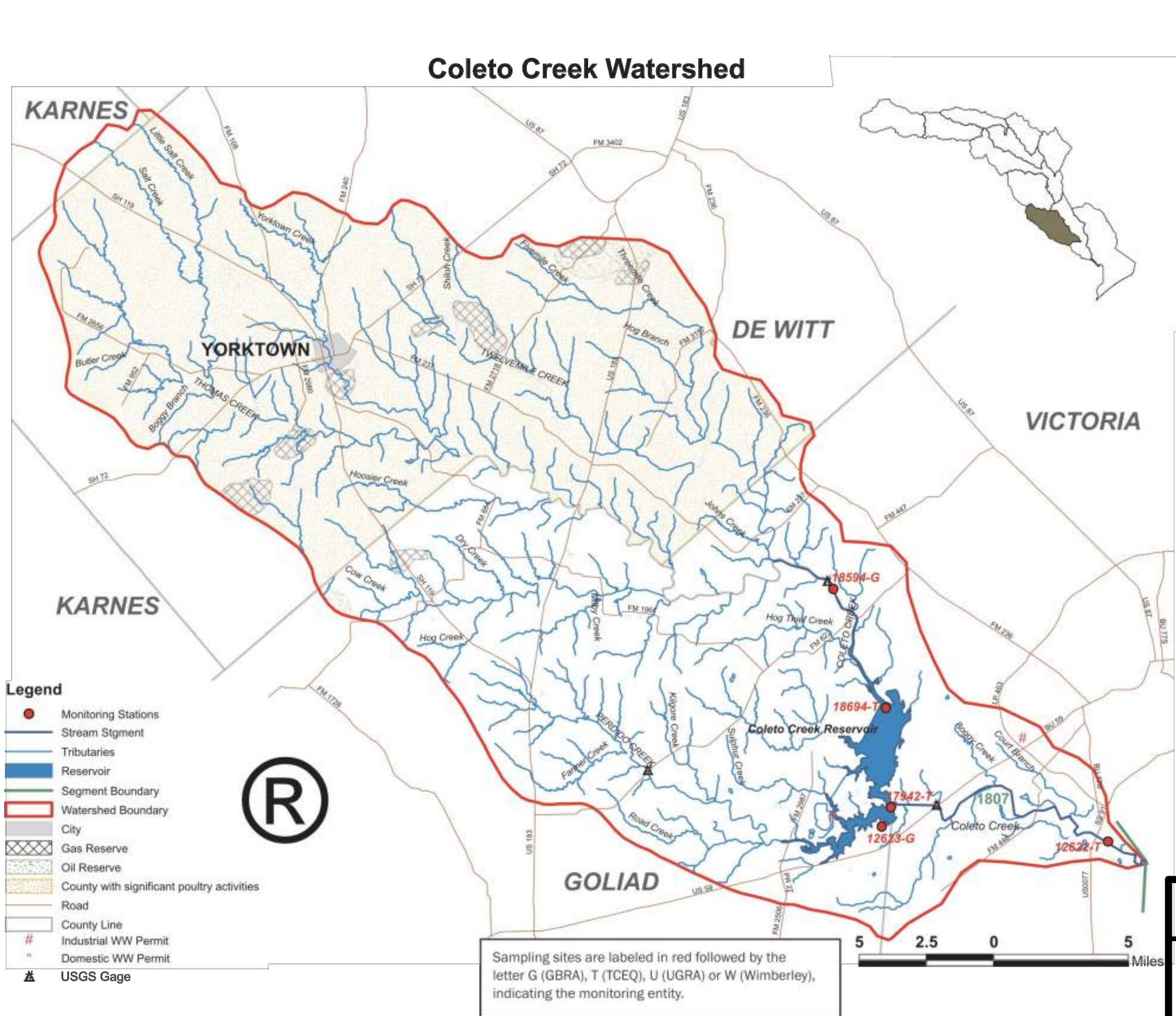
| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 4:09pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: W-USGS-METERS 7-5minute quad.dwg

Plot Date: 12/28/17 - 4:11 m, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL106.dwg





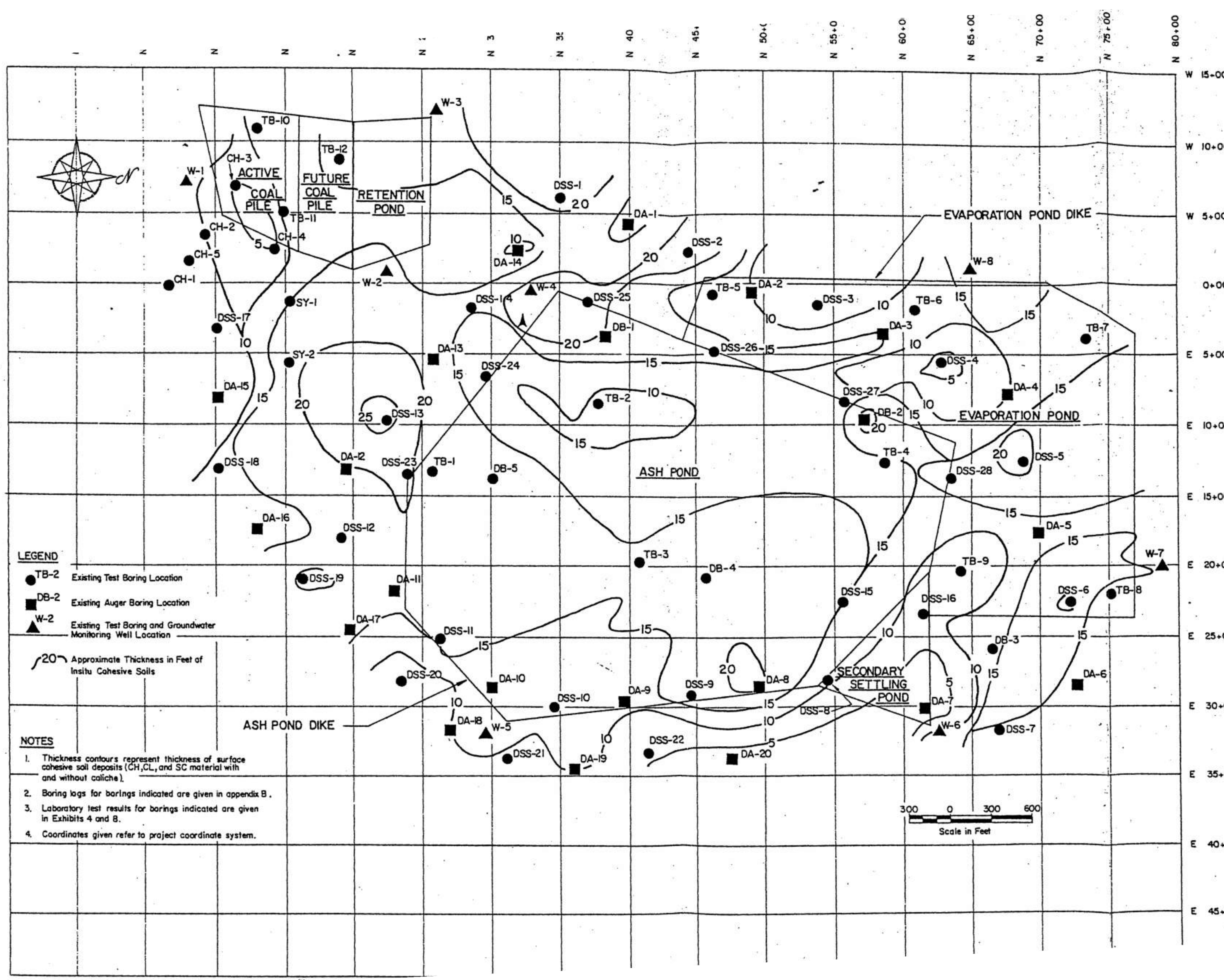

**Coleto Creek Power, LP**

Figure 2-2

COLETO CREEK WATERSHED

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127




SOURCE: MAP PROVIDED BY SARGENT AND LUNDY ENGINEERS, CHICAGO, IL.

**Coleto Creek Power, LP**

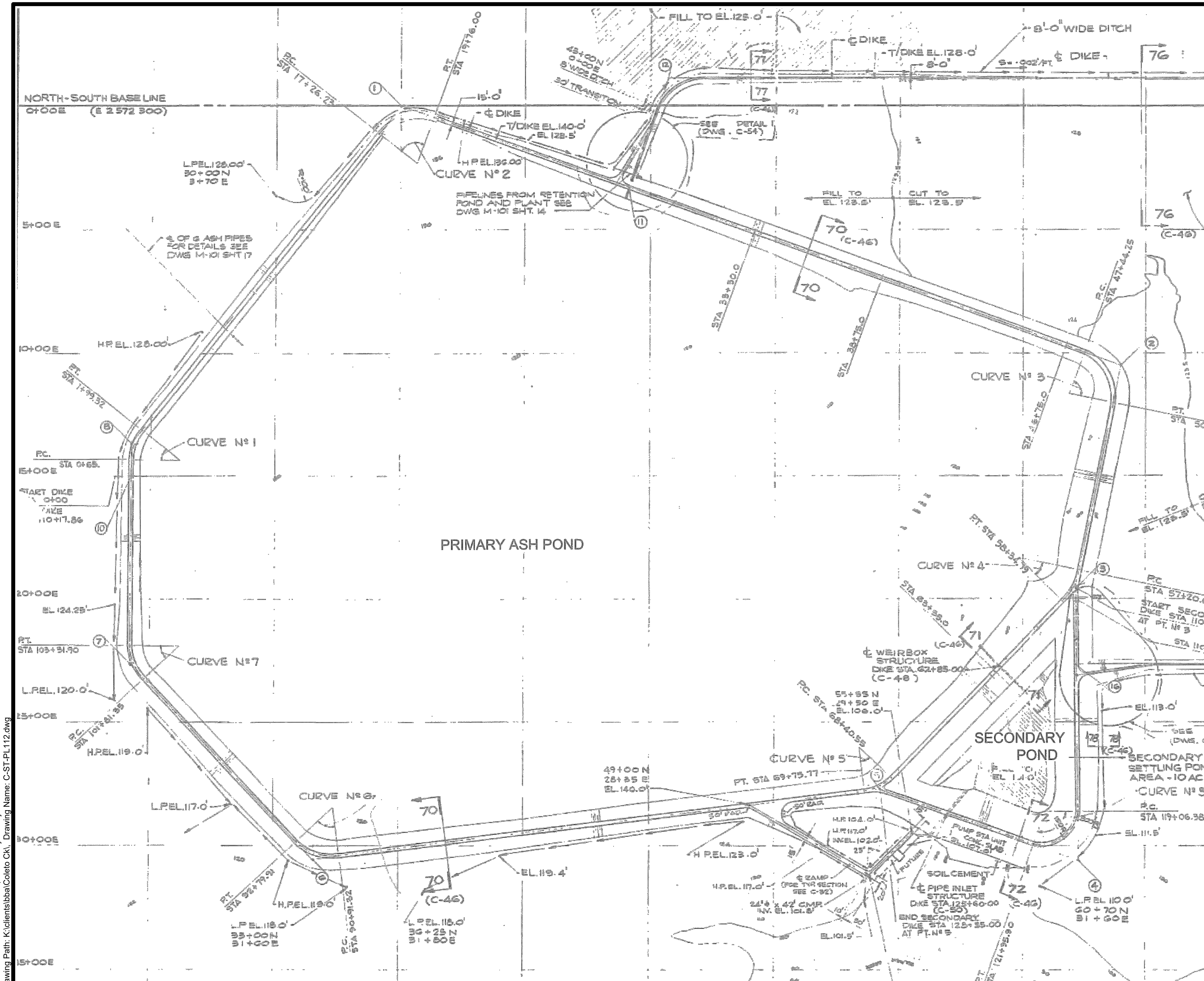
Figure 2-3

THICKNESS MAP OF IN-SITU COHESIVE SOILS

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 4:12 :m, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL108.dwg




APPROXIMATE SCALE: 1" = 400'

0 200 400 800

NOTE:

THE MAX STORAGE POOL FOR THE PRIMARY ASH POND IS 135.9 (NAVD88)

SOURCE:

BACKGROUND DRAWING PROVIDED BY SARGENT & LUNDY, APRIL 1978.

**Coleto Creek Power, LP**

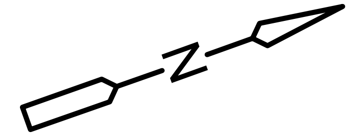
Figure 2-4

SURFACE IMPOUNDMENT CONFIGURATION

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

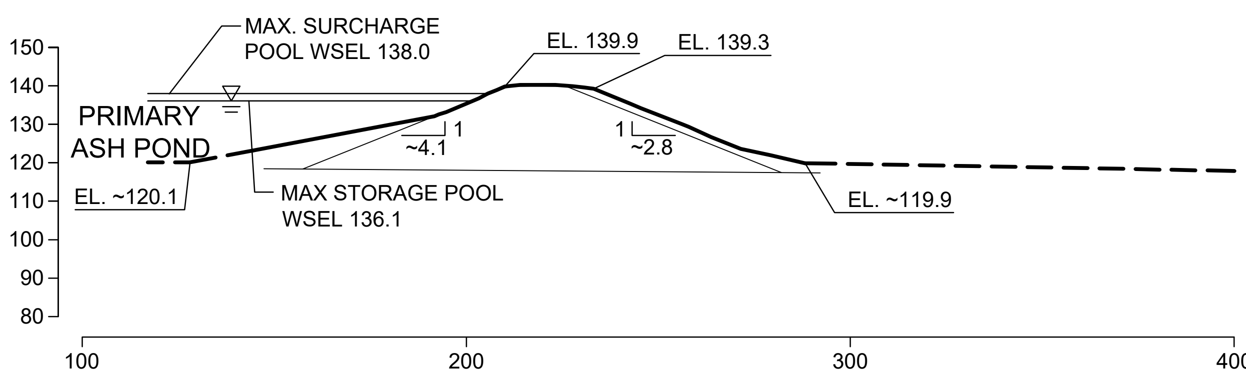
Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 4:14pm, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL112.dwg



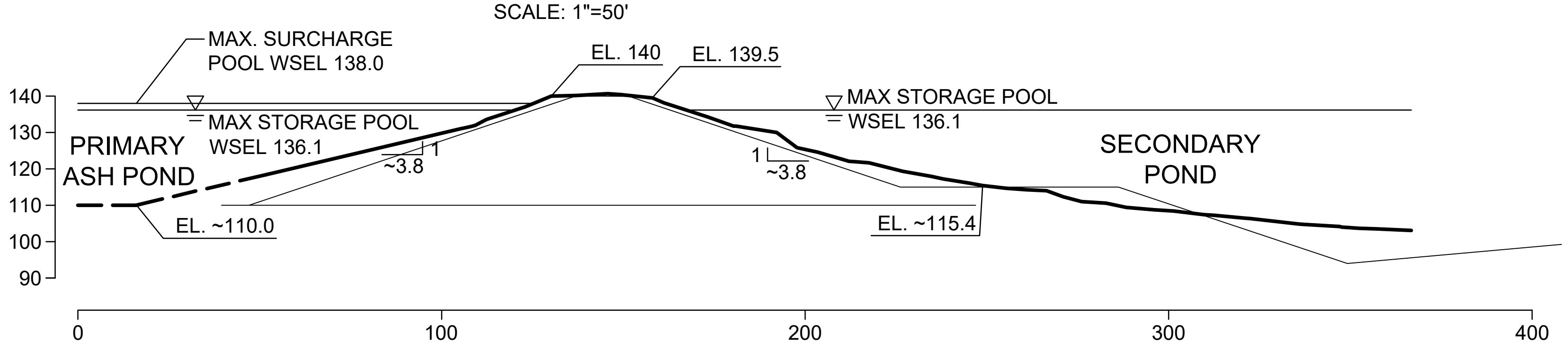

APPROXIMATE SCALE: 1" = 800'

0 400 800 1600



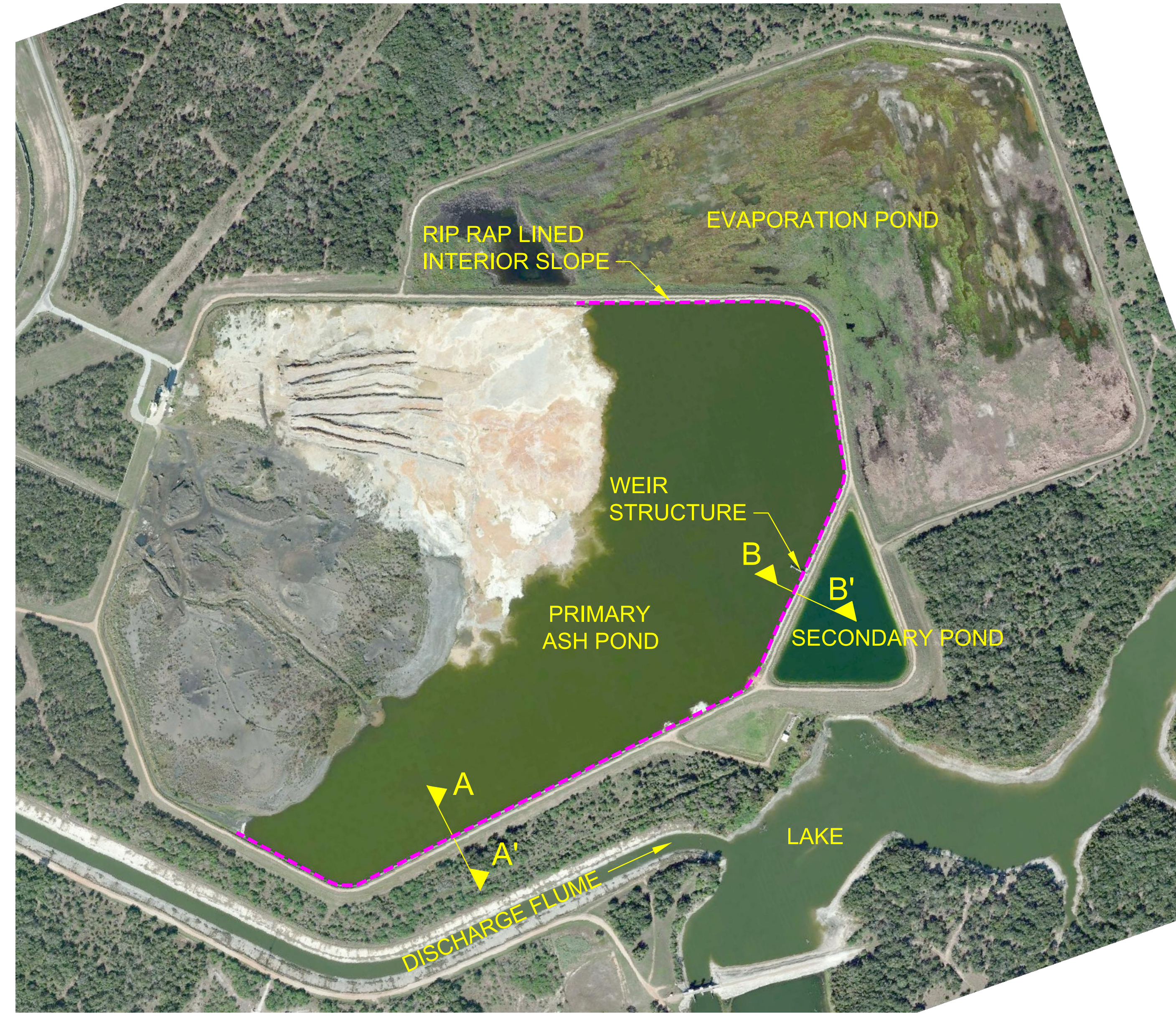

## SECTION A-A'

SCALE: 1"=50'




## SECTION B-B'

SCALE: 1"=50'

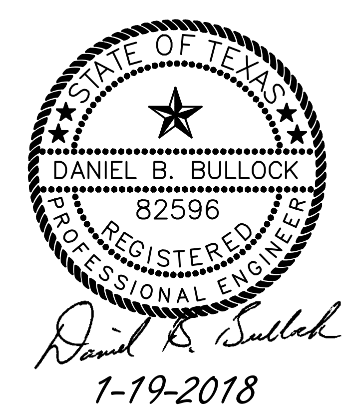



## PARTIAL PLAN

SOURCES:

ON-GROUND TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY NAISMITH MARINE SERVICES ON JULY 2016. HORIZONTAL DATUM: NAD83, TEXAS CENTRAL SOUTH ZONE, US FEET. VERTICAL DATUM: NAVD88.

AERIAL PHOTO PROVIDED BY IMAGEPATCH.COM EARTHSTAR GEOGRAPHICS, DATE: MAY-OCT 2011.




**Coleto Creek Power, LP**

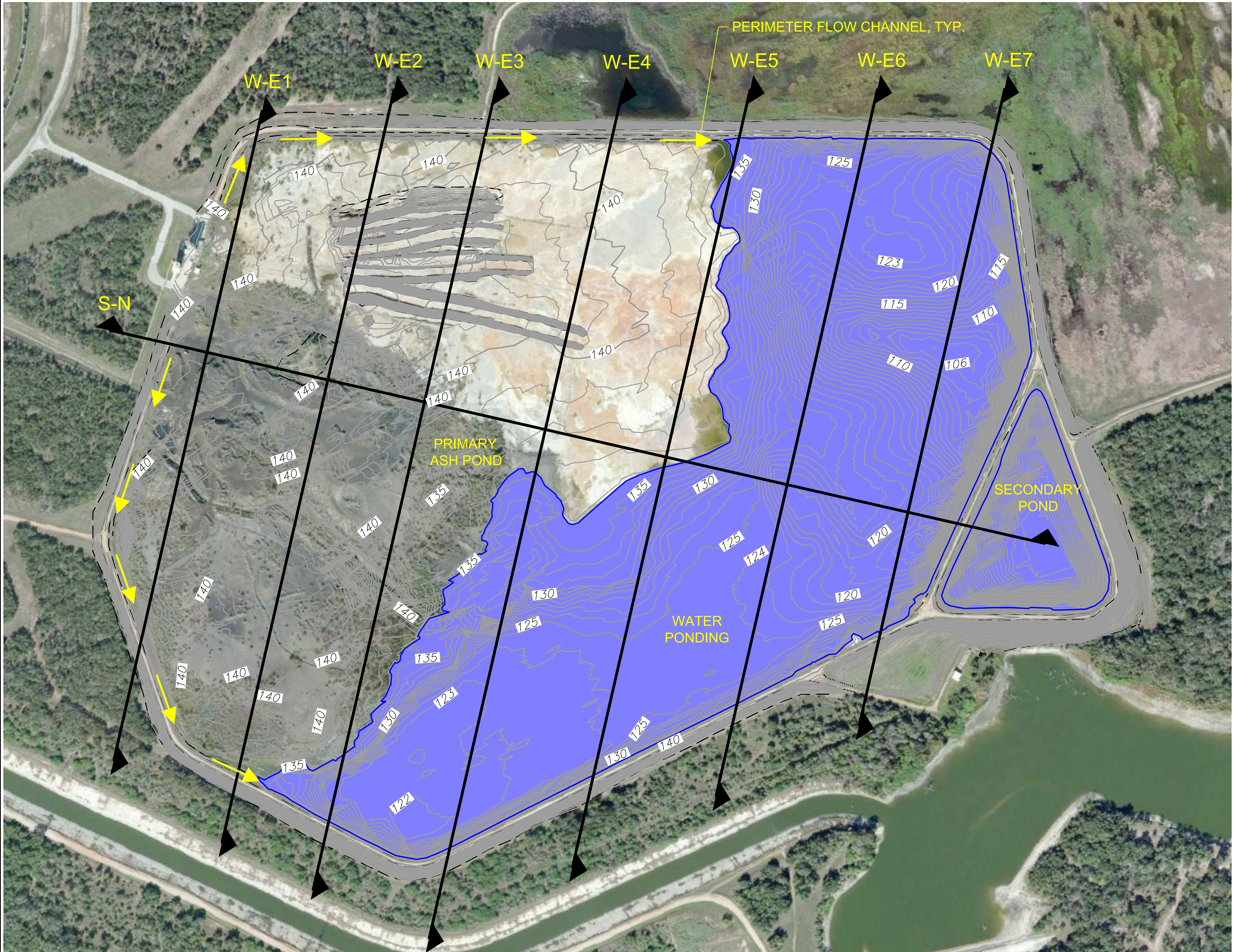
Figure 2-5A

ASH POND PLAN AND CROSS SECTIONS

| PROJECT: 17266 | BY: RR | DATE: JAN 2018 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 01/19/18 - 10:42am, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL130.dwg




APPROXIMATE SCALE: 1" = 400'

0 200 400 800

NOTES:

PRIMARY POND DECANT WATER VOLUME CAPACITY. APPROXIMATELY 1,520 AC-FT TO TOP OF DIKE.

SECONDARY POND DECANT WATER VOLUME CAPACITY. APPROXIMATELY 200 AC-FT TO TOP OF DIKE.

SOURCES:

ON-GROUND TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY NAISMITH MARINE SERVICES ON JULY 2016. HORIZONTAL DATUM: NAD83, TEXAS CENTRAL SOUTH ZONE, US FEET. VERTICAL DATUM: NAVD88.

AERIAL PHOTO PROVIDED BY IMAGEPATCH.COM EARTHSTAR GEOGRAPHICS, DATE: MAY-OCT 2011.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

12-28-201

**Coleto Creek Power, LP**

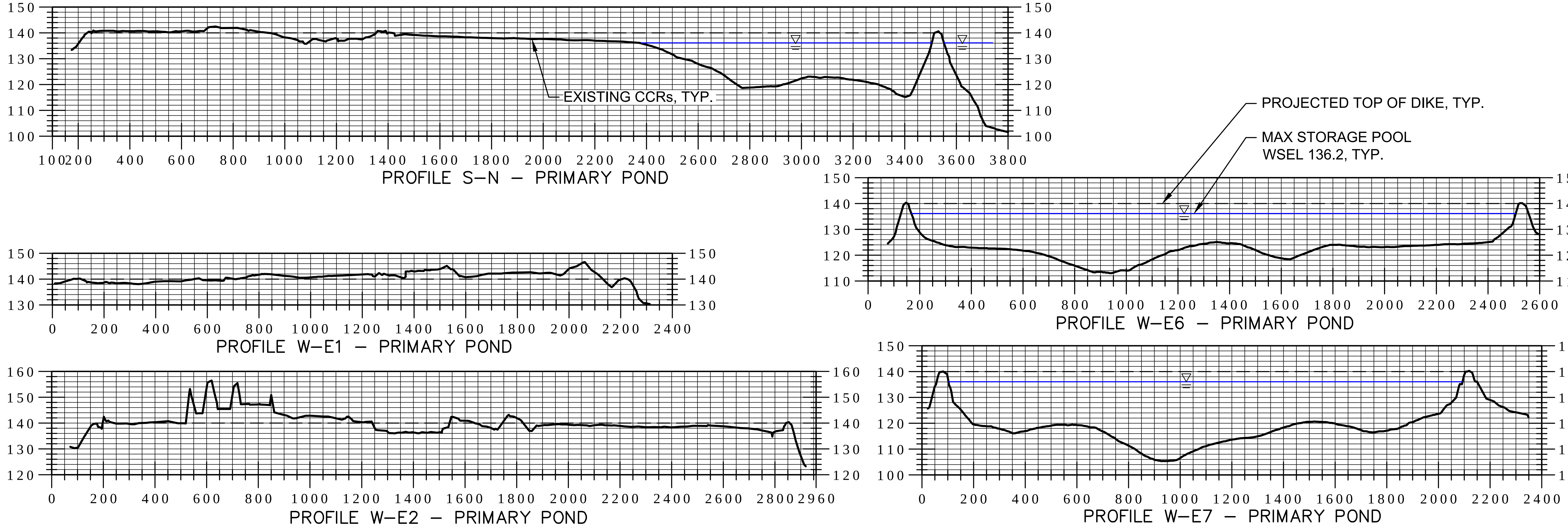
Figure 2-5B

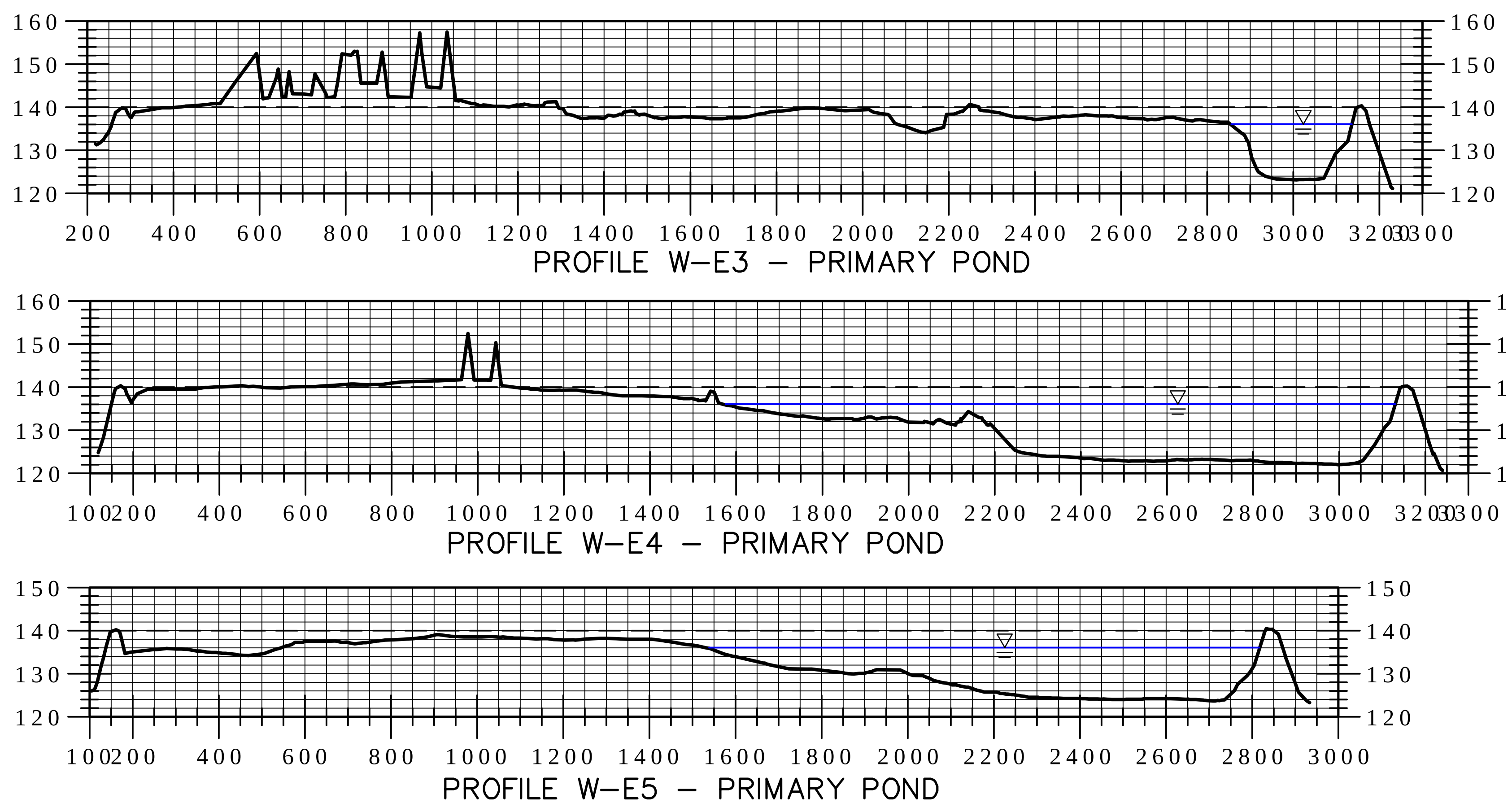
BATHYMETRIC SURVEY
PLAN VIEW

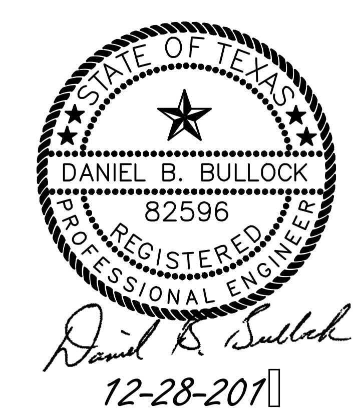
| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:56□m, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: C-ST-PL119.dwg




SOURCES:

ON-GROUND TOPOGRAPHIC AND BATHYMETRIC SURVEY PROVIDED BY NAISMITH MARINE SERVICES ON JULY 2016. HORIZONTAL DATUM: NAD83, TEXAS CENTRAL SOUTH ZONE, US FEET. VERTICAL DATUM: NAVD88.

**Coleto Creek Power, LP**

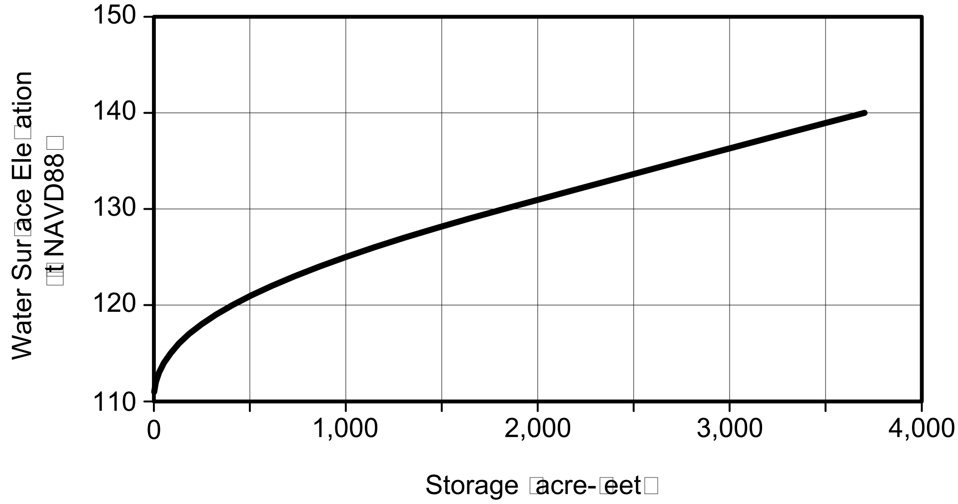
Figure 2-5C

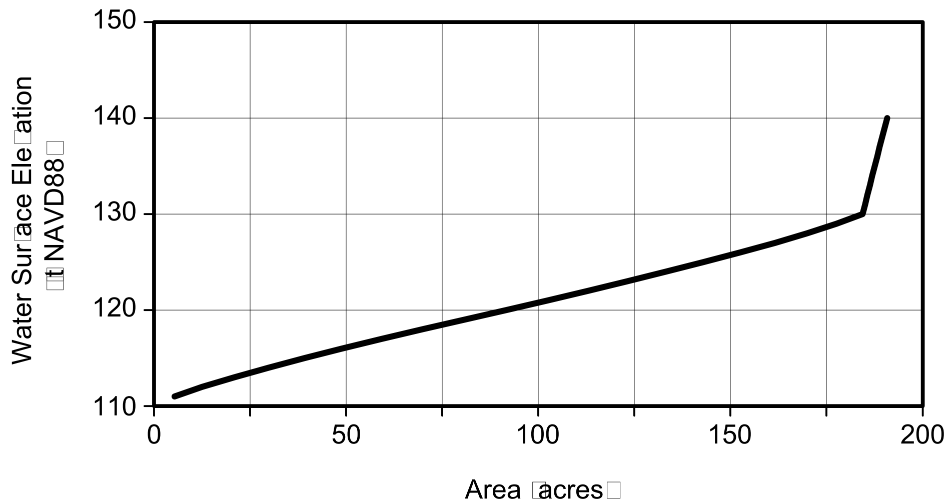
# BATHYMETRIC SURVEY SECTIONS

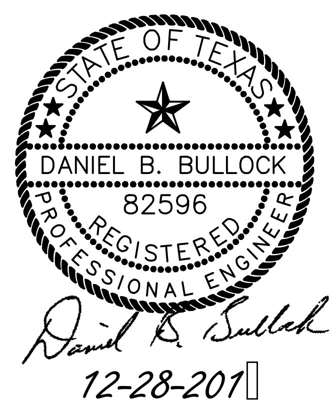
| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 12/28/17 - 2:58 :m, Plotted by: roodrj
Drawing Path: K:\clients\bba\Coleto Ck\, Drawing Name: X-EG-15JULY2016 working ile.dwg




**Coleto Creek Power, LP**

Figure 2-6

CAPACITY FOR PRIMARY POND

| PROJECT: 17266 | BY: RR | DATE: DEC 2017 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

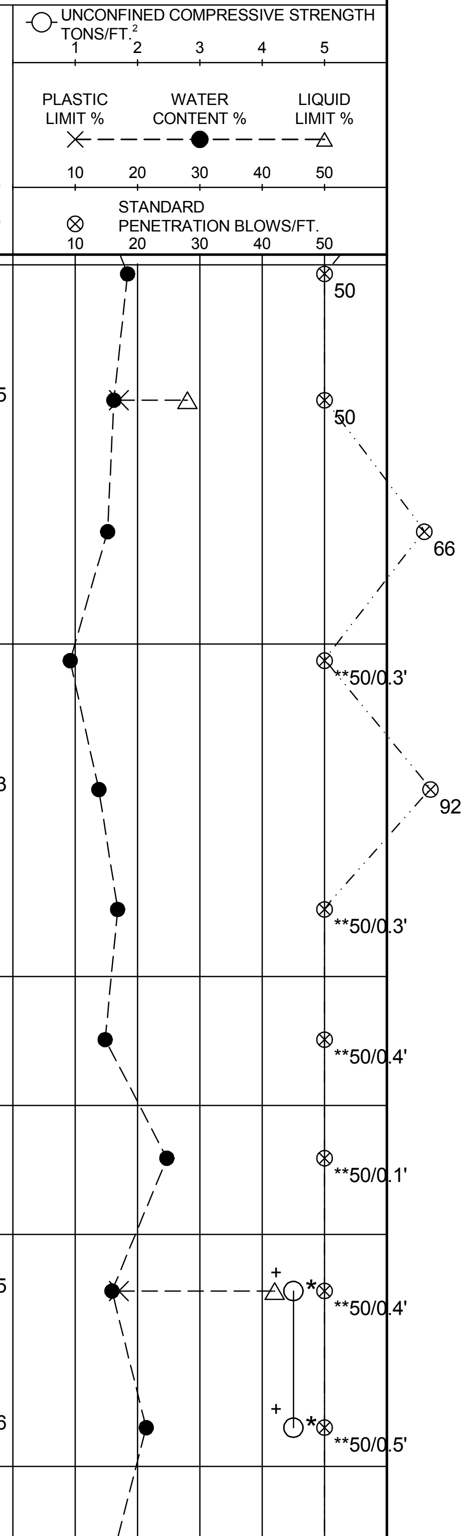
APPENDIX A:  GEOTECHNICAL BORELOGS

| AECOM | CLIENT: IPR-GDF SUEZ North America | LOG OF BORING NUMBER: B-1-1 |
|---|---|---|
| | PROJECT NAME: Coleto Creek Energy Facility Ash Pond | ARCHITECT/ENGINEER |

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.6 (Continued)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | STRATA DEPTH | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 52.0 | 26 | SS | 50.4 | Grayish brown fine to coarse sand (SP), trace fine to coarse gravel - wet - very dense | |
| 56.0 | 27 | SS | | | 113.5 |
| 62.0 | 28 | SS | 65.1 | | |
| 66.0 | 29 | SS | | White and gray clayey fine to coarse sand (SC-caliche) - wet - extremely dense | |
| 72.0 | 30 | SS | | | 117.3 |
| 76.0 | 31 | SS | 78.0 | | |
| 82.0 | 32 | SS | 83.0 | Light brown fine to coarse sand (SP) with occasional thin layers of white and gray silty fine to coarse sand (SM-Caliche) - moist to wet - extremely dense. Drillers noted hard drilling and gravel while drilling form 80.0 to 85.0 feet | |
| 86.0 | 33 | SS | 88.0 | Gray and white silty fine to medium sand (SM) with caliche - wet - extremely dense | |
| 90.0 | 34 | SS | | Light gray silty clay (CL), some sand, trace caliche - moist to wet - hard | 126.5 |
| 96.0 | 35 | SS | 97.0 | | 107.6 |
| 100.0 | | | | Light gray clayey fine to coarse sand (SC) - moist - extremely dense | |




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 2 OF 3

| | | |
|---|---|---|
| **AECOM** | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-1-1** |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

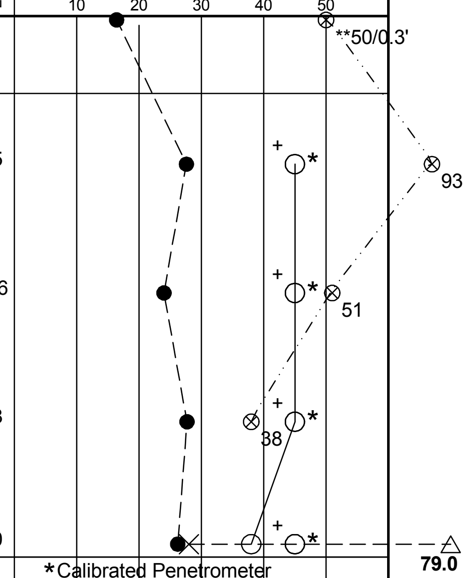
UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. — 10 20 30 40 50

SURFACE ELEVATION: +139.6 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| | | 36 | SS | Light gray clayey fine to coarse sand (SC) - moist - extremely dense | |
| 102.0 | | | | | |
| 103.0 | | | | Brown silty clay (CH) with irrgular gray silty clay lenses - moist - hard | |
| 104.0 | | | | | |
| 106.0 | | 37 | SS | | 92.5 |
| 108.0 | | | | | |
| 110.0 | | 38 | SS | | 102.6 |
| 112.0 | | | | | |
| 114.0 | | | | | |
| 116.0 | | 39 | SS | | 94.8 |
| 118.0 | | | | | |
| 120.0 | | 40 | ST | | 98.0 |
| 121.0 | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 50.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 50.0 feet to 100.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/5/11** | AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311** | |
| WL **10.0 to 12.0 feet WS** | BORING COMPLETED **11/6/11** | ENTERED BY **CAH** | SHEET NO. **3** OF **3** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

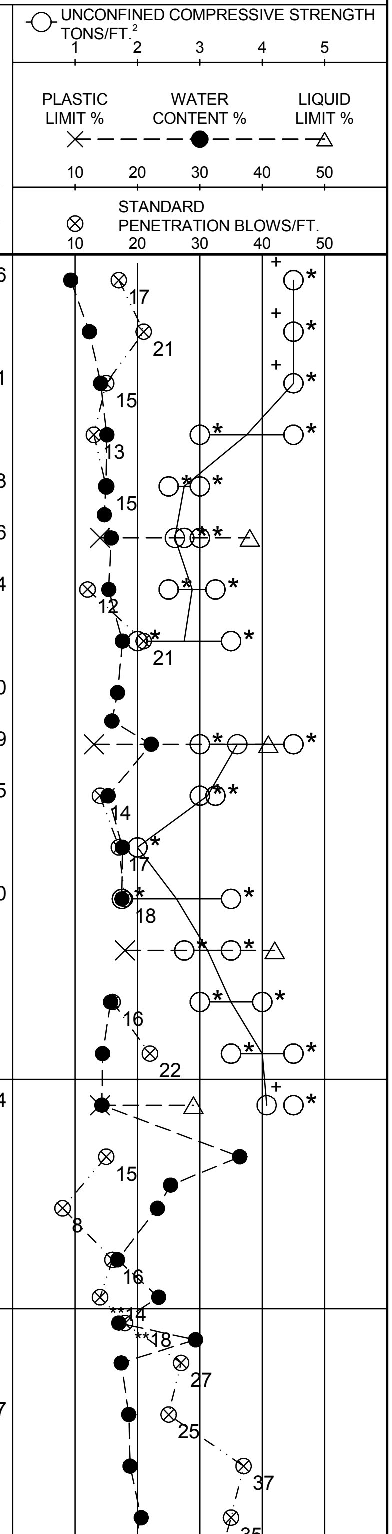
STS060701 60225561.GPJ STS.GDT 1/4/12

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-2-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 2.0 | | 1 | SS | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, trace caliche nodules and layers, occasional thin, saturated silty sand lenses - moist to wet - very stiff to hard | 121.6 |
| 4.0 | | 2 | SS | | |
| 6.0 | | 3 | SS | | 116.1 |
| 8.0 | | 4 | SS | | |
| 10.0 | | 5 | SS | | 121.3 |
| 12.0 | | 6 | ST | | 118.6 |
| 14.0 | | 7 | SS | | 117.4 |
| 16.0 | | 8 | SS | | |
| 18.0 | | 9 | 3" ST | | 114.0 |
| 20.0 | | 10 | ST | | 110.9 |
| 22.0 | | 11 | SS | | 114.5 |
| 24.0 | | 12 | SS | | |
| 26.0 | | 13 | SS | | 113.0 |
| 28.0 | | 14 | 3" ST | | |
| 30.0 | | 15 | SS | | |
| 32.0 | | 16 | SS | 32.0 | |
| 34.0 | | 17 | ST | White and light gray clayey sand (SC-caliche) - wet - loose to medium dense | 118.4 |
| 36.0 | | 18 | SS | | |
| 38.0 | | 19 | SS | Note: Saturated loose zone from 36.0 feet to 36.9 feet | |
| 40.0 | | 20 | SS | | |
| | | 21 | SS | 40.9 | |
| 42.0 | | 21A | SS | Grayish brown fine to coarse sand (SP) - wet - medium dense to dense | |
| 44.0 | | 22 | SS | Note: Clayey sand (SC-Caliche) layers encountered from 42.9 feet to 43.3 feet and 44.0 feet to 45.0 feet | |
| 46.0 | | 23 | SS | | 136.7 |
| 48.0 | | 24 | SS | | |
| 50.0 | | 25 | SS | 50.0 | |




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 3

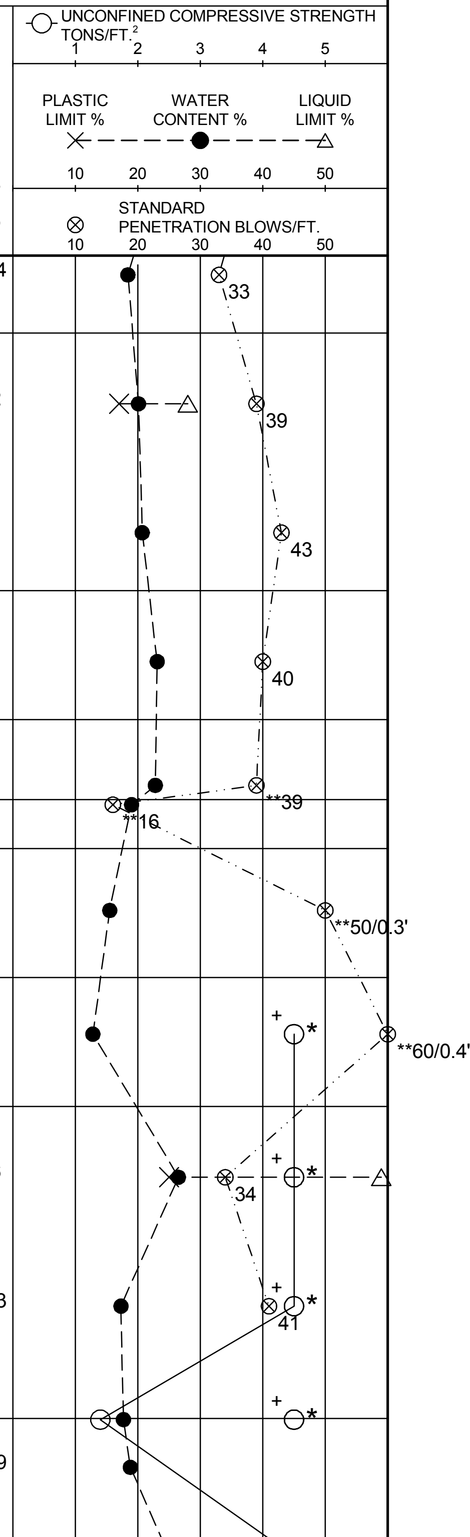
STS060701 60225561.GPJ STS.GDT 1/4/12

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-2-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| | 26 | SS | Grayish brown silty fine sand (SM) - wet - dense | 110.4 |
| 52.0 | | | | |
| 53.0 | | | Light gray clayey fine sand (SC) - wet - dense | |
| 54.0 | | | | |
| 56.0 | 27 | SS | | 99.2 |
| 58.0 | | | | |
| 60.0 | | | | |
| | 28 | SS | | |
| 62.0 | | | | |
| 63.0 | | | Light gray fine sand (SP-SM), trace silt - wet - dense | |
| 64.0 | | | | |
| 66.0 | 29 | SS | | |
| 68.0 | | | Light gray fine to coarse sand (SP) - wet - dense | |
| 70.0 | | | | |
| | 30 | SS | | |
| 71.1 | 30A | SS | Light gray and white clayey sand (SC-caliche) - wet - medium dense | |
| 72.0 | | | | |
| 73.0 | | | Light gray silty fine to medium sand (SM), trace to little clay, trace fine gravel - moist to wet - extremely dense | |
| 74.0 | | | | |
| 76.0 | 31 | SS | | |
| 78.0 | | | Tan clayey silt (CL-ML-Weathered Sandstone) - moist to wet - hard | |
| 80.0 | | | | |
| | 32 | SS | | |
| 82.0 | | | | |
| 83.0 | | | Light gray and brown mottled silty clay (CH), trace sand - moist - hard | |
| 84.0 | | | | |
| 86.0 | 33 | SS | | 91.6 |
| 88.0 | | | | |
| 90.0 | | | | |
| | 34 | SS | | 117.3 |
| 92.0 | | | | |
| 94.0 | | | | |
| 95.1 | 35 | ST | Light gray clayey fine sand (SC) - moist - extremely dense | |
| 96.0 | | | | |
| 98.0 | | | | 110.9 |
| 100.0 | | | | |




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 2 OF 3

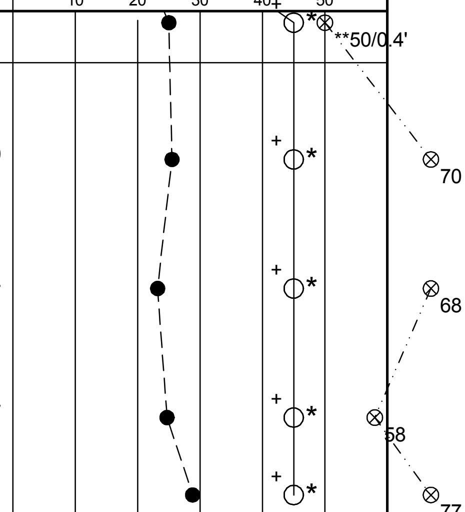
STS060701 60225561.GPJ STS.GDT 1/4/12

| AECOM | CLIENT **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-1** |
|---|---|---|
| | PROJECT NAME **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ (1, 2, 3, 4, 5)
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10, 20, 30, 40, 50)
STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL<br>SURFACE ELEVATION: +139.2 (Continued) | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|---|---|
| | | 36 | SS | | | Light gray clayey fine sand (SC) - moist - extremely dense | |
| 102.0 | | | | | | 102.0 | |
| | | | | | | Brown silty clay (CH) with gray silty clay and silt lenses, trace thin sand lenses - moist - hard | |
| 104.0 | | | | | | | |
| 106.0 | | 37 | SS | | | | 99.9 |
| 108.0 | | | | | | | |
| 110.0 | | | | | | | |
| | | 38 | SS | | | | 96.4 |
| 112.0 | | | | | | | |
| 114.0 | | | | | | | |
| 116.0 | | 39 | SS | | | | 96.7 |
| 118.0 | | | | | | | |
| | | 40 | SS | | | 119.5 | |
| 119.5 | | | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 50.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 50.0 feet to 118.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/3/11** | AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311** | |
| WL **8.0 to 10.0 feet WS** | BORING COMPLETED **11/4/11** | ENTERED BY **CAH** | SHEET NO. **3** OF **3** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

STS060701 60225561.GPJ STS.GDT 1/4/12

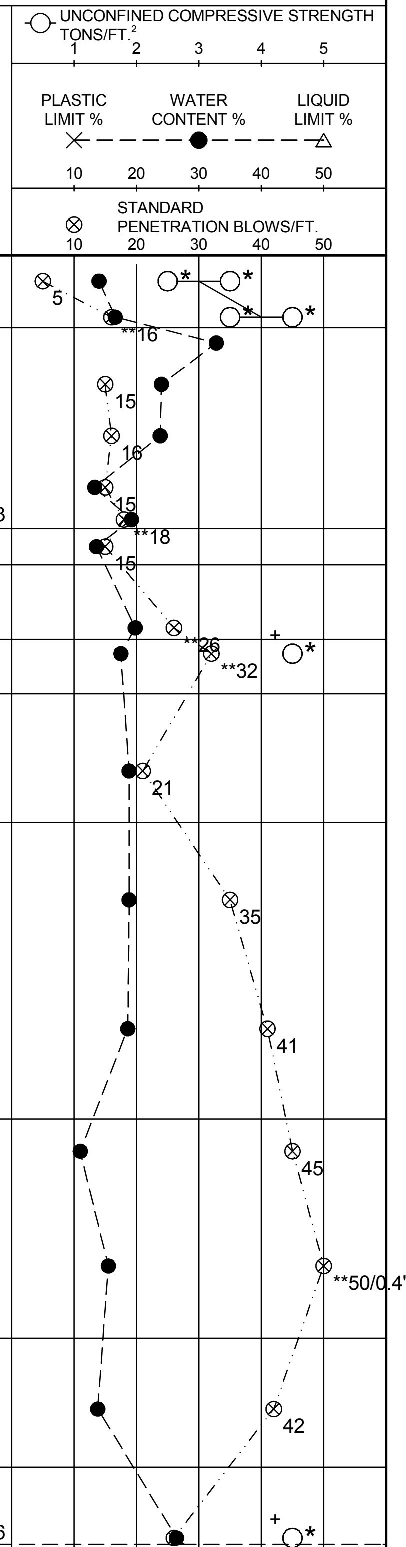
| AECOM | CLIENT: **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-2** |
|---|---|---|
| | PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +105.1

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | Bottom depth (FT) | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 0.0–2.8 | 1, 2 | SS, SS | Black and dark brown organic sandy clay (OL), little fine gravel, trace wood - moist - very stiff to hard | 2.8 | |
| 2.8–10.6 | 2A, 3, 4, 5, 6 | SS, SS, SS, SS, SS | Light gray and white clayey fine to coarse sand (SC-Caliche), trace fine to coarse gravel - moist to wet - dense to medium dense<br>Note: Light brown fine to coarse sand (SP) layers encountered from 6.5 feet to 7.0 feet and 8.3 feet to 8.9 feet | 10.6 | 90.9, 113.3 |
| 10.6–12.0 | 6A | SS | Light gray fine to coarse sand (SP) - wet - medium dense | 12.0 | |
| 12.0–14.9 | 7 | SS | Light gray and brown mottled silt (ML), trace clay, trace sand - moist - medium dense | 14.9 | |
| 14.9–17.0 | 7A | SS | Light gray silty clay (CL), trace sand - moist - hard | 17.0 | |
| 17.0–22.0 | 8 | SS | Light gray silt (ML), trace to little sand, trace clay - moist - medium dense | 22.0 | |
| 22.0–33.5 | 9, 10 | SS, SS | Light brown fine sand (SP) - wet - dense | 33.5 | |
| 33.5–42.0 | 11, 12 | SS, SS | Light gray and light brown mottled clayey fine to coarse sand (SC), trace fine to coarse gravel - moist - dense to extremely dense<br>Drillers noted hard drilling from 34.0 to 39.0 feet and gravel while drilling | 42.0 | |
| 42.0–47.0 | 13 | SS | Light brown fine to coarse sand (SP) - wet - dense | 47.0 | |
| 47.0–50.0 | | | Light gray and brown mottled silty clay (CL), trace sand - moist - hard | | 100.6 |

. . . continued




* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

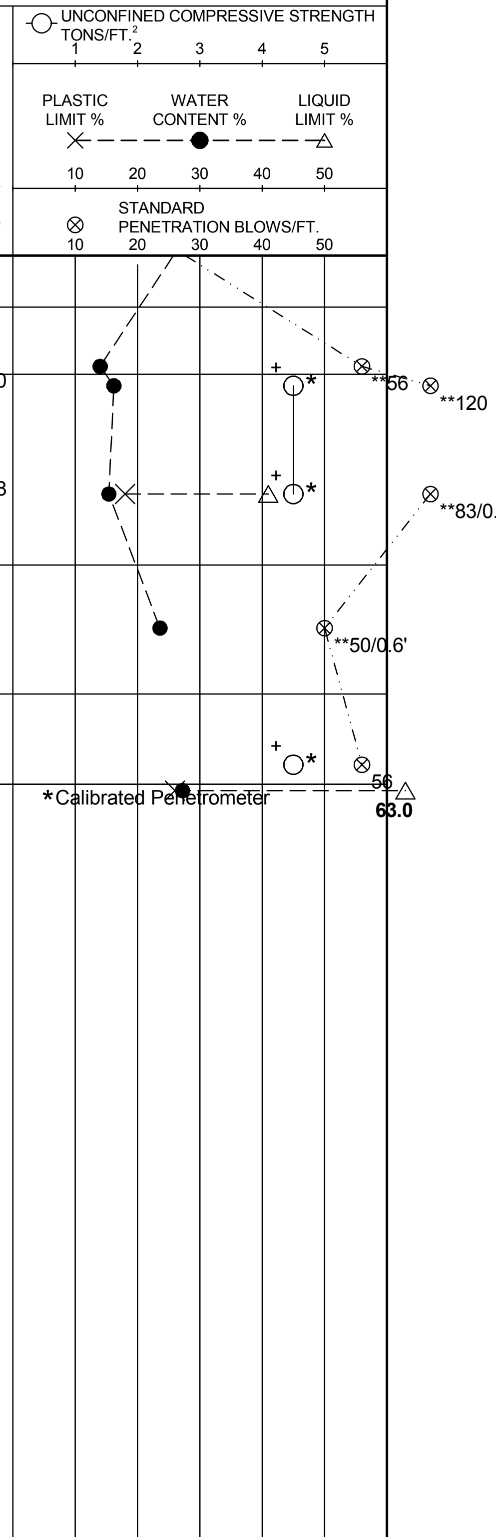
AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

| AECOM | CLIENT: **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-2** |
|---|---|---|
| | PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +105.1 (Continued)

| DEPTH (FT) / ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| | 14 | SS | Light gray and brown mottled silty clay (CL), trace sand - moist - hard (52.0) | |
| 52.0 | | | Light brown fine to coarse sand (SP) - wet - very dense (54.6) | |
| 54.0 | 15 | SS | | |
| 56.0 | 15A | SS | Light brown and light gray mottled silty sandy clay (CL), trace thin poorly-graded sand seams (SP) - moist - hard (62.0) | 115.0 |
| 58.0 | | | | |
| 60.0 | 16 | SS | | 117.8 |
| 62.0 | | | Light brown and brown mottled silty fine sand (SM) - wet - extremely dense (67.0) | |
| 64.0 | 17 | SS | | |
| 66.0 | | | | |
| 68.0 | | | Light gray silty clay (CH), trace sand, trace fine to coarse gravel - moist - hard (70.5) | |
| 70.0 | 18 | SS | | |
| 70.5 | | SS | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 8.0 feet<br>Boring advanced from 6.0 feet to 16.0 feet with 3-inch rock bit and drilling fluid<br>HW casing driven from 8.0 feet to 10.0 feet<br>Boring advanced from 16.0 feet to 69.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL 3.5 feet WS | BORING STARTED 11/1/11 | AECOM OFFICE 1035 Kepler Drive Green Bay, Wisconsin 54311 | |
| WL 3.5 feet before casing installation | BORING COMPLETED 11/1/11 | ENTERED BY CAH | SHEET NO. 2 OF 2 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT | AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

**AECOM**

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| IPR-GDF SUEZ North America | B-3-1 |
| PROJECT NAME | ARCHITECT/ENGINEER |
| Coleto Creek Energy Facility Ash Pond | |

SITE LOCATION
**Goliad County, Fannin, Texas**

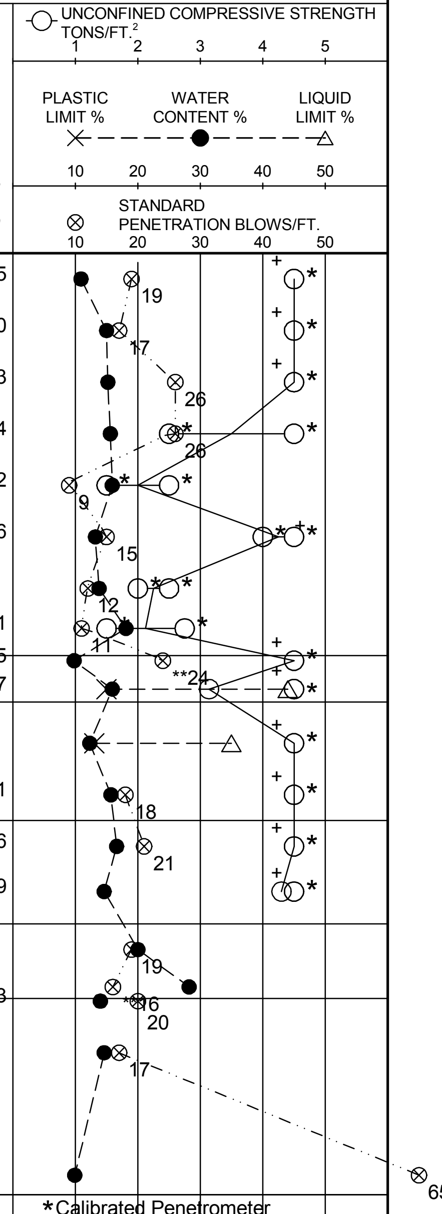
SURFACE ELEVATION: +139.3

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|
| 0.0–2.0 | 1 | SS | 114.5 |
| 2.0–4.0 | 2 | SS | 114.0 |
| 4.0–6.0 | 3 | SS | 115.3 |
| 6.0–8.0 | 4 | SS | 110.4 |
| 8.0–10.0 | 5 | SS | 112.2 |
| 10.0–12.0 | 6 | SS | 124.6 |
| 12.0–14.0 | 7 | SS | |
| 14.0–15.5 | 8 | SS | 106.1 |
| 15.5–16.0 | 8A | SS | 121.5 |
| 16.0–18.0 | 9 | ST | 113.7 |
| 18.0–20.0 | 10 | SS | |
| 20.0–22.0 | 11 | SS | 109.1 |
| 22.0–24.0 | 12 | SS | 113.6 |
| 24.0–26.0 | 13 | SS | 117.9 |
| 26.0–28.0 | 14 | SS | |
| 28.0–29.5 | 15 | SS | |
| 29.5–30.0 | 15A | SS | 111.3 |
| 30.0–32.0 | 16 | SS | |
| 35.0–36.5 | 17 | SS | |

DESCRIPTION OF MATERIAL

- 0.0–15.6: Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, occasional irregular thin silty sand seams and lenses, trace caliche nodules and layers - moist to wet - stiff to hard
  Note: Saturated silty sand seams encountered from 10.5 feet to 10.9 feet, 12.5 feet to 12.7 feet, and from 15.4 feet to 15.5 feet
- 15.6–17.4: Gray clayey fine to medium sand (SC), trace caliche nodules, trace thin silty sand seams - moist to wet - very stiff to hard
- 17.4–22.0: Dark brown clayey sand (SC), trace caliche nodules - moist to wet - hard
- 22.0–26.0: Light gray silty sandy clay (CL), occasional irregular silty clayey caliche (CL-caliche) layers and lenses - moist to wet - hard
- 26.0–28.9: Light gray clayey sand (SC), occasional silty clay (CL-caliche) layers and lenses, trace fine gravel - moist to wet - medium dense
  Note: Saturated zone encountered from 28.0 feet to 28.5 feet
- 28.9–36.5: Light gray silty fine to coarse and (SM), trace to little clay, trace fine gravel, trace caliche nodules - moist to wet - medium dense to very dense

36.5 End of Boring
Boring advanced to 6.0 feet with solid-stem auger
HW casing driven to 5.0 feet
Boring advanced from 6.0 feet to 30.0 feet with 4-inch rock bit and drilling fluid
Boring advanced from 30.0 feet to 35.0 feet with 3-inch rock bit and drilling fluid
Boring abandoned with bentonite quick grout using tremie method
Split-spoons were driven with cathead and rope




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/8/11 | AECOM OFFICE | 1035 Kepler Drive Green Bay, Wisconsin 54311 |
| WL 8.0 to 10.0 feet WS | BORING COMPLETED 11/8/11 | ENTERED BY CAH | SHEET NO. 1 OF 1 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT | AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

| | | |
|---|---|---|
| **AECOM** | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-3-2** |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

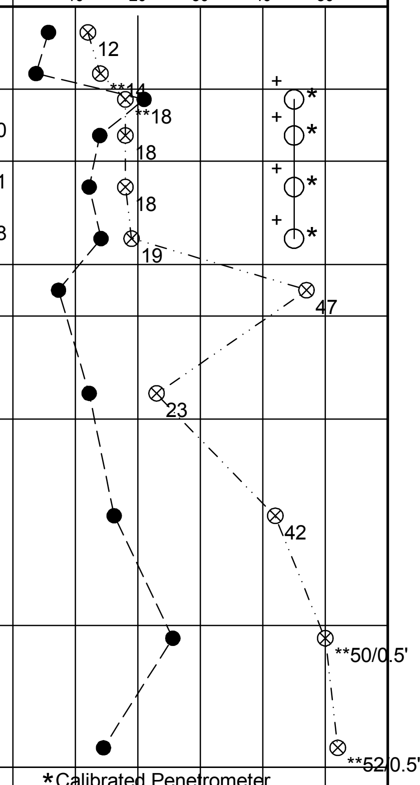
-O- UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ 1 2 3 4 5

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % △ (10 20 30 40 50)

⊗ STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

SURFACE ELEVATION: +122.8

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| 2.0 | 1 | SS | Fill: Dark brown or brown silty fine sand (SM), trace clay, trace roots - moist - medium dense | |
| | 2 | SS | 3.2 | |
| 4.0 | 2A | SS | Fill: Brown and gray mottled silty sandy clay (CL), trace fine gravel, trace roots - desiccated - hard | |
| 6.0 | 3 | SS | 6.0 | 117.0 |
| 8.0 | 4 | SS | Light gray and white silty sandy clay (CL-caliche), trace to little fine gravel - moist - hard | 122.1 |
| 10.0 | 5 | SS | 10.0 | 113.8 |
| 12.0 | 6 | SS | White silty fine sand (SM-caliche), trace to little clay - moist - dense 12.0 | |
| 14.0 | | | Light brown fine to coarse sand (SP), trace fine gravel - wet - dense to medium dense | |
| 16.0 | 7 | SS | 16.0 | |
| 18.0 | | | Brown sitly fine to coarse sand (SM), trace to little fine gravel - wet - dense | |
| 20.0 | 8 | SS | Drillers noted gravel while drilling from 16.0 feet to 19.0 feet and 23.0 feet and 24.0 feet | |
| 22.0 | | | | |
| 24.0 | | | 24.0 | |
| 26.0 | 9 | SS | Light brown fine to coarse sand (SP) - wet - extremely dense | |
| 28.0 | 10 | SS | 29.5 | |
| 29.5 | | | End of Boring<br>Boring advanced to 10.0 feet with solid-stem auger<br>HW casing driven to 10.0 feet<br>Boring advanced from 10.0 feet to 20.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/2/11 | AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311** | |
| WL 14.0 feet WS | BORING COMPLETED 11/2/11 | ENTERED BY CAH | SHEET NO. 1 OF 1 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT | AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

**AECOM**

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-4-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

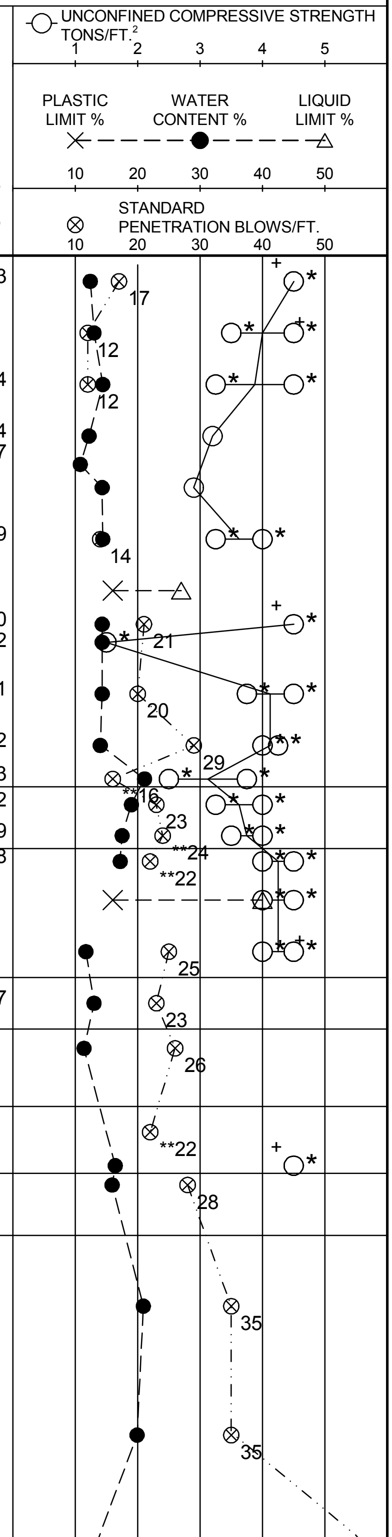
SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|
| 0.0–2.0 | 1 | SS | 117.3 |
| 2.0–4.0 | 2 | SS | |
| 4.0–6.0 | 3 | SS | 111.4 |
| 6.0–8.0 | ~~4~~ | ~~ST~~ | 124.4 |
| 8.0–10.0 | 5 | ST | 117.7 |
| 10.0–12.0 | 6 | SS | 114.9 |
| 12.0–14.0 | 7 | 3" ST | |
| 14.0–16.0 | 8 | SS | 122.0 / 118.2 |
| 16.0–18.0 | 9 | SS | 110.1 |
| 18.0–20.0 | 10 | SS | 115.2 |
| 20.0–21.0 | 11 | SS | 102.3 |
| 21.0–22.5 | 11A | SS | 110.2 |
| 22.5–23.5 | 12 | SS | 107.9 |
| 23.5–24.5 | 12A | SS | 110.8 |
| 24.5–26.5 | 13 | 3" ST | |
| 26.5–28.5 | 14 | SS | |
| 28.5–30.5 | 15 | SS | 115.7 |
| 30.5–32.0 | 16 | SS | |
| 35.0–36.0 | 17 | SS | |
| 36.0–37.0 | 17A | SS | |
| 40.5–42.0 | 18 | SS | |
| 45.5–47.0 | 19 | SS | |

DESCRIPTION OF MATERIAL

| Depth to bottom of stratum (ft) | Description |
|---|---|
| 20.6 | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, trace thin irregular silty sand seams and lenses, trace silty clay caliche nodules and layers - moist - very stiff to hard |
| 23.0 | Light brown silty sandy clay (CL) with caliche - moist to wet - very stiff to hard |
| 28.0 | Light brown, dark brown, and gray mottled clayey sand (SC), trace organics, trace fine gravel, trace thin irregular silty sand seams and lenses - moist - hard<br>**Triaxial Test S-14**<br>**Dry Unit Weight = 121 pcf** **Ø' = 27 deg** |
| 30.0 | Light brown clayey sand (SC) - moist to wet - medium dense |
| 33.0 | Light brown silty fine to coarse sand (SM), trace clay - moist to wet - medium dense |
| 35.6 | Light brown silty sandy clay (CL) with caliche, trace fine gravel - moist to wet - hard |
| 38.0 | Light brown fine to coarse sand (SP) - wet - medium dense |
| 50.0 | Grayish brown fine to coarse sand (SP) - wet - dense<br><br>Drillers noted sporadic, thin gravel layers while drilling from 35.0 to 50.0 feet |

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* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

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AECOM

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-4-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ | Tests |
|---|---|---|---|---|---|---|---|---|
| 51.5 | | 20 | SS | | | 51.5 Grayish bown fine to coarse sand (SP), trace to little fine gravel, occasional thin layers of gray silty clay and caliche - moist to wet - very dense | | SPT 60 |

End of Boring
Boring advanced to 6.0 feet with solid-stem auger
HW casing driven to 5.5 feet
Boring advanced from 6.0 feet to 30.0 feet with 4-inch rock bit and drilling fluid
Boring advanced from 30.0 feet to 50.0 feet with 3-inch rock bit and drilling fluid
Boring abandoned with bentonite quick grout using tremie method
Split-spoons were driven with cathead and rope

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/7/11** | AECOM OFFICE | **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **10.0 to 12.0 feet** | BORING COMPLETED **11/7/11** | ENTERED BY **CAH** | SHEET NO. **2** OF **2** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

STS060701 60225561.GPJ STS.GDT 1/4/12

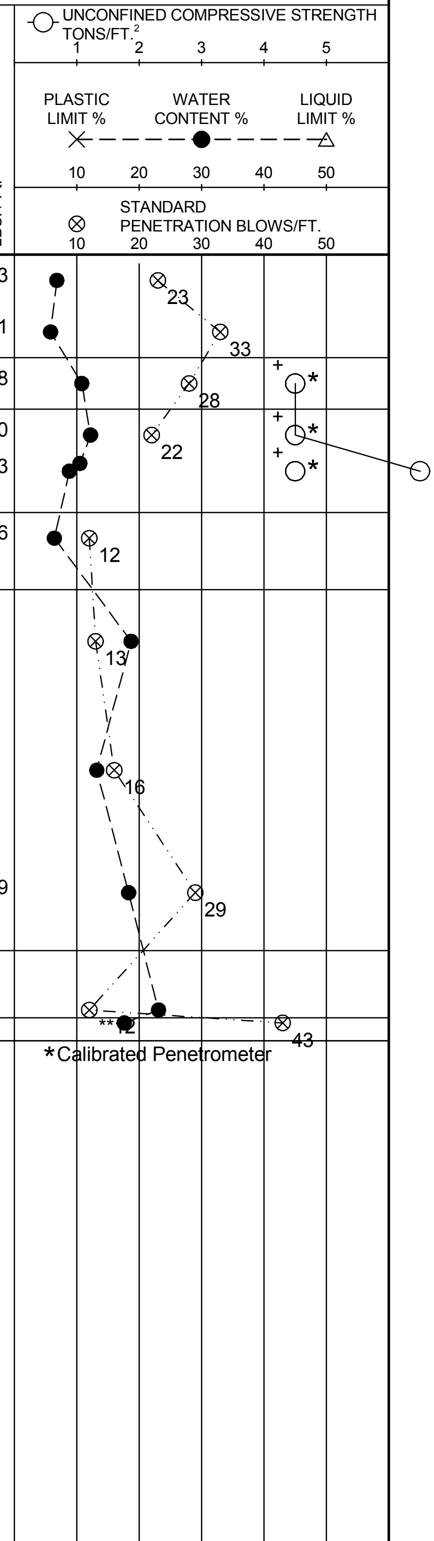
**AECOM**

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-4-2** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +119.6

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.³ |
|---|---|---|---|---|
| 2.0 | 1 | SS | Fill: Dark brown and brown silty fine to medium sand (SM), trace fine gravel, trace roots, trace clay - moist - medium dense | 115.3 |
| 4.0 | 2 | SS | (4.0) | 122.1 |
| 6.0 | 3 | SS | Buried Topsoil: Dark brown and black organic silty clay (OL), trace to little sand - desiccated - hard (6.0) | 125.8 |
| 8.0 | 4 | SS | Light brown and light gray mottled silty clayey sand (SC), trace fine gravel, trace irregular caliche nodules - moist - hard | 126.0 |
| | 5 | ST | Note: Dark gray silty sandy clay (CL) layer from 8.0 feet to 8.3 feet | 129.3 |
| 10.0 | | | (10.0) | |
| 12.0 | 6 | SS | Light brown silty fine sand (SM), trace clay - moist - medium dense<br>Note: Plastic liner was used within split-spoon for Sample 6 (13.0) | 124.6 |
| 14.0 | | | | |
| 16.0 | 7 | SS | Light brown fine to coarse sand (SP) - wet - medium dense | |
| 18.0 | | | | |
| 20.0 | 8 | SS | | |
| 22.0 | | | Drillers noted hard drilling at 22.0 feet | |
| 24.0 | | | | |
| 26.0 | 9 | SS | Note: White silty clay (CL-caliche) layer from 24.7 feet to 25.1 feet (27.0) | 106.9 |
| 28.0 | | | Light gray silty fine sand (SM), trace clay - wet - medium dense (29.6) | |
| 30.0 | 10 | SS | | |
| | 10A | SS | Light brown fine to coarse sand (SP) - wet - dense (30.5) | |
| 30.5 | | | End of Boring<br>Boring advanced to 10.0 feet with solid-stem auger<br>HW casing driven to 8.0 feet<br>Boring advanced from 10.0 feet to 29.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/2/11** | AECOM OFFICE | **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **14.0 feet WS** | BORING COMPLETED **11/2/11** | ENTERED BY **CAH** | SHEET NO. **1** OF **1** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

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**AECOM**

CLIENT: **IPR-GDF SUEZ North America**

LOG OF BORING NUMBER **B-5-1**

PROJECT NAME: **Coleto Creek Energy Facility Ash Pond**

ARCHITECT/ENGINEER

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.6

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.³ |
|---|---|---|---|---|
| | 1 | SS | Fill: Light gray and brown mottled clayey sand (SC), trace fine gravel, occasional thin irregular silty sand seams, trace silty clay caliche nodules and layers - moist to wet - very stiff to hard | 128.2 |
| 2.0 | 2 | SS | | 124.7 |
| 4.0 | 3 | SS | | 127.5 |
| 6.0 | 4 | SS | | 111.9 |
| 8.0 | 5 | SS | | |
| 10.0 | 6 | SS | | 118.7 |
| 12.0 | 7 | SS | | |
| | 7A | SS | | 108.9 |
| 14.0 | 8 | SS | | |
| 16.0 | 9 | SS | | 111.3 |
| 18.0 | ~~10~~ | ~~SS~~ | | |
| 20.0 | 11 | SS | 20.8 | |
| | 11A | SS | Gray and brown silty clay (CL), trace organics, trace sand, trace thin saturated silty sand seams and lenses - moist to wet - very stiff to hard | 116.1<br>118.2 |
| 22.0 | 12 | ST | 24.0 | |
| 24.0 | 13 | SS | White and gray silty clay (CL-caliche), little sand - moist to wet - stiff to hard | 107.5 |
| 26.0 | 14 | ST | | 99.1 |
| 28.0 | | | | |
| | 15 | SS | | 102.5 |
| 30.0 | 16 | SS | 32.0 | 103.6 |
| 32.0 | 17 | SS | Gray silty fine to coarse sand (SM), trace fine gravel, trace clay - wet - dense | |
| 34.0 | | | 35.0 | |
| 36.0 | 18 | SS | Gray fine to coarse sand (SP), trace fine gravel - wet - extremely dense to very dense<br>Note: Hard white silty clay (CL-caliche) in tip of Sample 18 | |
| 38.0 | | | | |
| 40.0 | | | | |
| | 19 | SS | | |
| 42.0 | | | 43.0 | |
| 44.0 | | | Gray silty fine sand (SM) - wet - dense to extremely dense | |
| 46.0 | 20 | SS | Drillers noted hard drilling and gravel and cobbles from 43.0 to 45.0 feet | |
| 48.0 | | | | |
| 50.0 | | | | |

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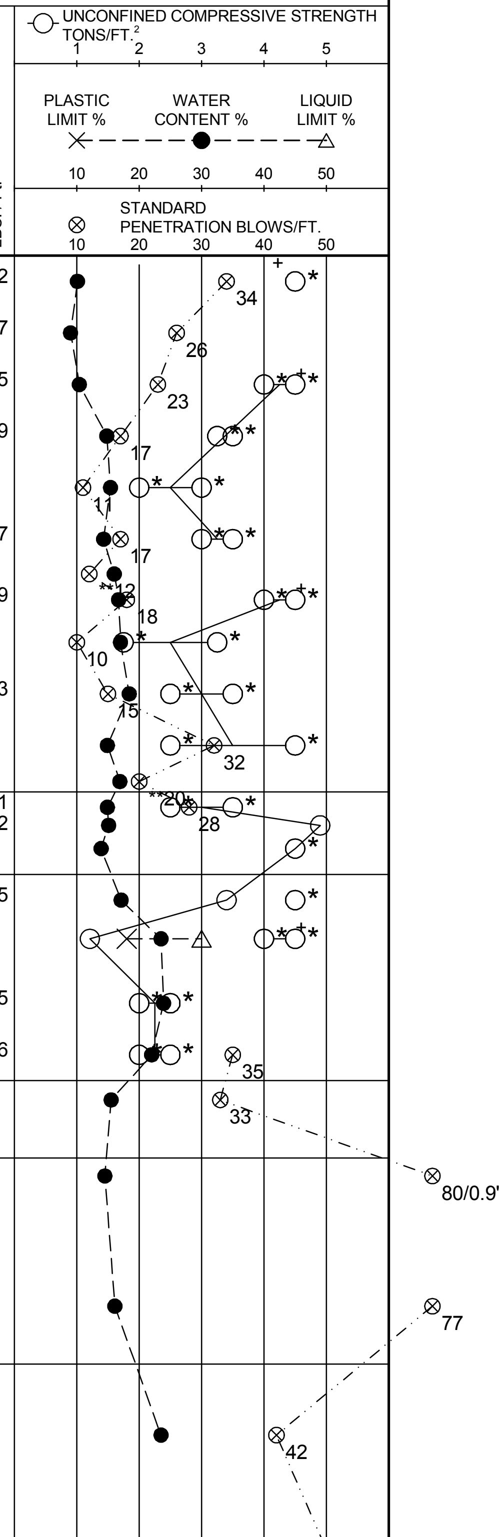



The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

STS060701 60225561.GPJ STS.GDT 1/4/12

| | |
|---|---|
| CLIENT: IPR-GDF SUEZ North America | LOG OF BORING NUMBER: B-5-1 |
| PROJECT NAME: Coleto Creek Energy Facility Ash Pond | ARCHITECT/ENGINEER: |

SITE LOCATION: Goliad County, Fannin, Texas

SURFACE ELEVATION: +139.6 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ | STANDARD PENETRATION BLOWS/FT. |
|---|---|---|---|---|---|---|---|---|
| 50.4 | | 21 | SS | I | | 50.4 No recovery Sample 21<br>End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 32.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 32.0 feet to 50.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | | 50/0.4' |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/7/11 | AECOM OFFICE 1035 Kepler Drive Green Bay, Wisconsin 54311 | |
| WL 8.0 to 10.0 feet WS | BORING COMPLETED 11/7/11 | ENTERED BY CAH | SHEET NO. 2 OF 2 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT | AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

## (1) GENERAL INFORMATION

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-1-1 | Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location
13453086.8 ft. ☒ N. ☐ S., 2543146.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ___ ft. N. ___ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/5/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ___

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 121.0
Casing Diameter (in.): 4.0
Casing Depth (ft.): 5.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet): 14.0

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☐ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

## (5)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 121.0 | 50 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/6/11

Signature of Person Doing Work | Date Signed: 11/6/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-2-1 ______ Gov't Lot (if applicable)

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location

13453065.2 ft. ☒ N. ☐ S., 2543576.6 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID:

License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date 11/3/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ______

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) 119.5

Casing Diameter (in.) 4.0

Casing Depth (ft.) 5.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) ______

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☐ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 19.5 | 50 gallons | |
| | | | | |
| | | | | |

(6) Comments ______

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/4/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/4/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

## (1) GENERAL INFORMATION

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-2-2 ______ Gov't Lot (if applicable)

Grid Location ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

13452977.2 ft. ☒ N. ☐ S., 2543676.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ________ ft. N. ________ ft. E. ☐S ☐C ☐N Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

| Facility ID | License/Permit/Monitoring No. |
|---|---|
| | |

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

| Present Well Owner | Original Owner |
|---|---|
| Coleto Creek Energy Facility | Same |

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date 11/1/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ________

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) 70.5 Casing Diameter (in.) 4.0

Casing Depth (ft.) 10.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) 3.5

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

| | Yes | No | Not Applicable |
|---|---|---|---|
| Pump & Piping Removed? | ☐ | ☐ | ☒ |
| Liner(s) Removed? | ☐ | ☐ | ☒ |
| Screen Removed? | ☐ | ☐ | ☒ |
| Casing Left in Place? | ☐ | ☒ | |

| | Yes | No |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ | ☒ |
| Did Sealing Material Rise to Surface? | ☒ | ☐ |
| Did Material Settle After 24 Hours? | ☐ | ☒ |
| If Yes, Was Hole Retopped? | ☐ | ☒ |

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 70.5 | 30 gallons | |
| | | | | |
| | | | | |

(6) Comments ________

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/2/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/2/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

## (1) GENERAL INFORMATION

Unique Well No.: | Well ID No.: | County: Goliad

Common Well Name: B-3-1 | Gov't Lot (if applicable): ____

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location: 13451245.3 ft. ☒ N. ☐ S., 2543663.1 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well:

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/8/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): ____

Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): N/A

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 36.5 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/8/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/8/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

## (1) GENERAL INFORMATION

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name: B-3-2 ______ Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location: 1341251.3 ft. ☒ N. ☐ S., 2543721.2 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ______ ft. N. ______ ft. E. S ☐ C ☐ N ☐ Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

| Present Well Owner | Original Owner |
|---|---|
| Coleto Creek Energy Facility | Same |

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/2/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ______

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 29.5
Casing Diameter (in.): 4.0
Casing Depth (ft.): 5.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet

Depth to Water (Feet): 14.0

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 29.5 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ______

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/2/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/2/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-4-1 | Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location: 1340613.7 ft. ☒ N. ☐ S., 2543740.9 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ___ ft. N. ___ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/7/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ___

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 51.5
Casing Diameter (in.): 5.0
Casing Depth (ft.): 4.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet): N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 51.5 | 25 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/7/11

Signature of Person Doing Work | Date Signed: 11/7/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

## WELL/DRILLHOLE/BOREHOLE ABANDONMENT

### (1) GENERAL INFORMATION

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-4-2 | Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location
13450619.3 ft. ☒ N. ☐ S., 2543806.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ___ ft. N. ___ ft. E. ☐S ☐C ☐N Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well

### (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

### (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/2/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ___

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 31.0
Casing Diameter (in.): 4.0
Casing Depth (ft.): 5.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet): 14.0

### (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 31.0 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/2/11

Signature of Person Doing Work | Date Signed: 11/2/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-5-1 ____ Gov't Lot (if applicable)

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ [ ] E [ ] W

Grid Location

13451003.7 ft. [X] N. [ ] S., 2543693.8 ft. [X] E. [ ] W.

Local Grid Origin [ ] (estimated: [ ] ) or Well Location [ ]

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. S [ ] C [ ] N [ ] Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/7/11

[ ] Monitoring Well
[ ] Water Well
[X] Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

[X] Drilled [ ] Driven (Sandpoint) [ ] Dug

[ ] Other (Specify) ____

Formation Type:

[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft) (From ground surface): 50.9

Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? [ ] Yes [ ] No [X] Not Applicable
Liner(s) Removed? [ ] Yes [ ] No [X] Not Applicable
Screen Removed? [ ] Yes [ ] No [X] Not Applicable
Casing Left in Place? [ ] Yes [X] No

Was Casing Cut Off Below Surface? [ ] Yes [X] No
Did Sealing Material Rise to Surface? [X] Yes [ ] No
Did Material Settle After 24 Hours? [ ] Yes [X] No
If Yes, Was Hole Retopped? [ ] Yes [X] No

Required Method of Placing Sealing Material

[ ] Conductor Pipe - Gravity [X] Conductor Pipe - Pumped
[ ] Screened & Poured (Bentonite Chips) [ ] Other (Explain)

Sealing Materials

[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[X] Bentonite-Sand Slurry
[ ] Chipped Bentonite

For monitoring wells and monitoring well boreholes only

[ ] Bentonite Chips
[ ] Granular Bentonite
[ ] Bentonite-Cement Grout
[ ] Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 50.9 | 25 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/7/11

Signature of Person Doing Work | Date Signed: 11/7/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

AECOM

## AECOM General Notes

### Drilling and Sampling Symbols:

| | |
|---|---|
| SS : Split Spoon - 1-3/8" I.D. 2" O.D. (Unless otherwise noted) | HS : Hollow Stem Auger |
| ST : Shelby Tube-2" O.D. (Unless otherwise noted) | WS : Wash Sample |
| PA : Power Auger | FT : Fish Tail |
| DB : Diamond Bit-NX, BX, AX | RB : Rock Bit |
| AS : Auger Sample | BS : Bulk Sample |
| JS : Jar Sample | PM : Pressuremeter Test |
| VS : Vane Shear | GS : Giddings Sampler |
| OS : Osterberg Sampler | |

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

### Water Level Measurement Symbols:

| | |
|---|---|
| WL : Water Level | WCI : Wet Cave In |
| WS : While Sampling | DCI : Dry Cave In |
| WD : While Drilling | BCR : Before Casing Removal |
| AB : After Boring | ACR : After Casing Removal |

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

### Gradation Description and Terminology:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

| **Major Component of Sample** | **Size Range** | **Description of Other Components Present in Sample** | **Percent Dry Weight** |
|---|---|---|---|
| Boulders | Over 8 in. (200 mm) | Trace | 1-9 |
| Cobbles | 8 inches to 3 inches (200 mm to 75 mm) | Little | 10-19 |
| Gravel | 3 inches to #4 sieve (75 mm to 4.76 mm) | Some | 20-34 |
| Sand | #4 to #200 sieve (4.76 mm to 0.074 mm) | And | 35-50 |
| Silt | Passing #200 sieve (0.074 mm to 0.005 mm) | | |
| Clay | Smaller than 0.005 mm | | |

### Consistency of Cohesive Soils: / Relative Density of Granular Soils:

| **Unconfined Compressive Strength, Qu, tsf** | **Consistency** | **N-Blows per foot** | **Relative Density** |
|---|---|---|---|
| <0.25 | Very Soft | 0 - 3 | Very Loose |
| 0.25 - 0.49 | Soft | 4 - 9 | Loose |
| 0.50 - 0.99 | Medium (firm) | 10 - 29 | Medium Dense |
| 1.00 - 1.99 | Stiff | 30 - 49 | Dense |
| 2.00 - 3.99 | Very Stiff | 50 - 80 | Very Dense |
| 4.00 - 8.00 | Hard | >80 | Extremely Dense |
| >8.00 | Very Hard | | |

# AECOM Field and Laboratory Procedures

Field Sampling Procedures

## Auger Sampling (AS)

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

## Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

## Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

## Giddings Sampler (GS)

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.

# AECOM Field and Laboratory Procedures

Subsurface Exploration Procedures

## Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

## Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

## Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

## Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

## Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

# AECOM Laboratory Procedures

## Water Content (Wc)
The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

## Hand Penetrometer (Qp)
In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

## Unconfined Compression Tests (Qu)
In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

## Dry Density (γd)
The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

## Classification of Samples
In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the AECOM Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "AECOM General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the AECOM Soil Classification System.

# AECOM Standard Boring Log Procedures

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

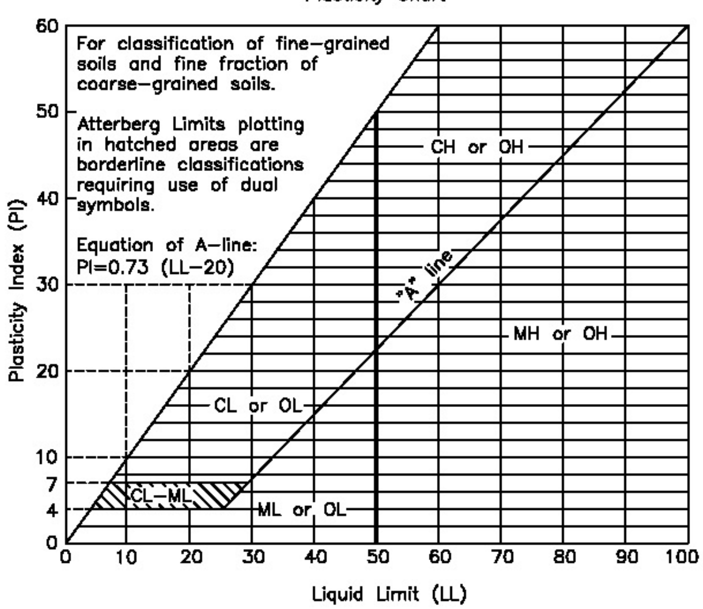
Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.

![AECOM logo]

# AECOM Soil Classification System (1)

| Major Divisions | | | Group Symbols | Typical Names | Laboratory Classification Criteria | | |
|---|---|---|---|---|---|---|---|
| Coarse-grained soils (More than half of material is ***larger*** than No. 200 sieve size) | Gravel (More than half of coarse fraction is larger than No. 4 sieve size) | Clean gravel (Little or no fines) | GW | Well-graded, gravel, gravel-sand mixtures, little or no fines | Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent . . . . . GW, GP, SW, SP; More than 12 percent . . . . . GM, GC, SM, SC; 5 to 12 percent . . . . . Borderline cases ***requiring*** dual symbols (3) | $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3 | |
| | | | GP | Poorly graded gravel, gravel-sand mixtures, little or no fines | | Not meeting all gradation requirements for GW | |
| | | Gravel with fines (Appreciable amount of fines) | GM | Silty gravel, gravel-sand-silt mixtures | | Atterberg limits below "A" line or PI less than 4 | Above "A" line with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols |
| | | | GC | Clayey gravel, gravel-sand-clay mixtures | | Atterberg limits above "A" line or PI greater than 7 | |
| | Sand (More than half of coarse fraction is smaller than No. 4 sieve size) | Clean sand (Little or no fines) | SW | Well-graded sand, gravelly sand, little or no fines | | $C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3 | |
| | | | SP | Poorly graded sand, gravelly sand, little or no fines | | Not meeting all gradation requirements for SW | |
| | | Sand with fines (Appreciable amount of fines) | SM | Silty sand, sand-silt mixtures | | Atterberg limits below "A" line or PI less than 4 | Limits plotting in hatched zone with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols |
| | | | SC | Clayey sand, sand-clay mixtures | | Atterberg limits above "A" line or PI greater than 7 | |
| Fine-grained soils (More than half of material is ***smaller*** than No. 200 sieve size) | Silt and clay (Liquid limit less than 50) | | ML | Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity | Plasticity Chart (2) | | |
| | | | CL | Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay | | | |
| | | | OL | Organic silt and organic silty clay of low plasticity | | | |
| | Silt and clay (Liquid limit greater than 50) | | MH | Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt | | | |
| | | | CH | Inorganic clay of high plasticity, fat clay | | | |
| | | | OH | Organic clay of medium to high plasticity, organic silt | | | |
| | Highly organic soils | | PT | Peat and other highly organic soil | | | |

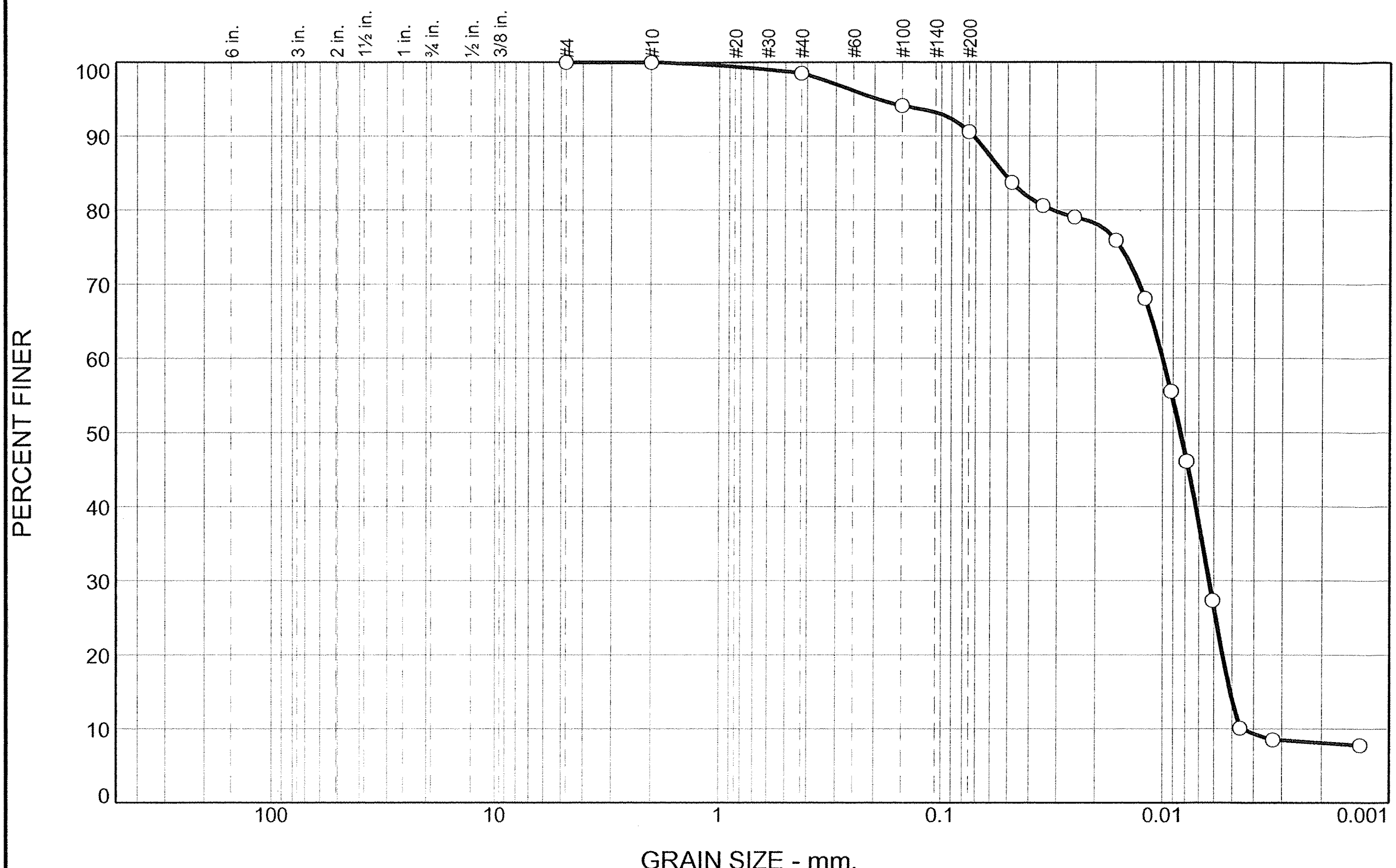
Plasticity Chart (2)




1. See AECOM General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
2. Reference: Unified Soil Classification Systems
3. Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

# APPENDIX B: GEOTECHNICAL LABORATORY DATA

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 7.9 | 76.7 | 13.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 100.0 | | |
| #40 | 98.5 | | |
| #100 | 94.1 | | |
| #200 | 90.6 | | |

* (no specification provided)

**Material Description**

LIGHT GRAY SILTY CLAY, TRACE SAND

**Atterberg Limits**

PL= 14 LL= 22 PI= 8

**Coefficients**

$D_{90}$= 0.0716 $D_{85}$= 0.0523 $D_{60}$= 0.0100
$D_{50}$= 0.0084 $D_{30}$= 0.0063 $D_{15}$= 0.0051
$D_{10}$= 0.0045 $C_u$= 2.21 $C_c$= 0.88

**Classification**

USCS= CL AASHTO= A-4(5)

**Remarks**

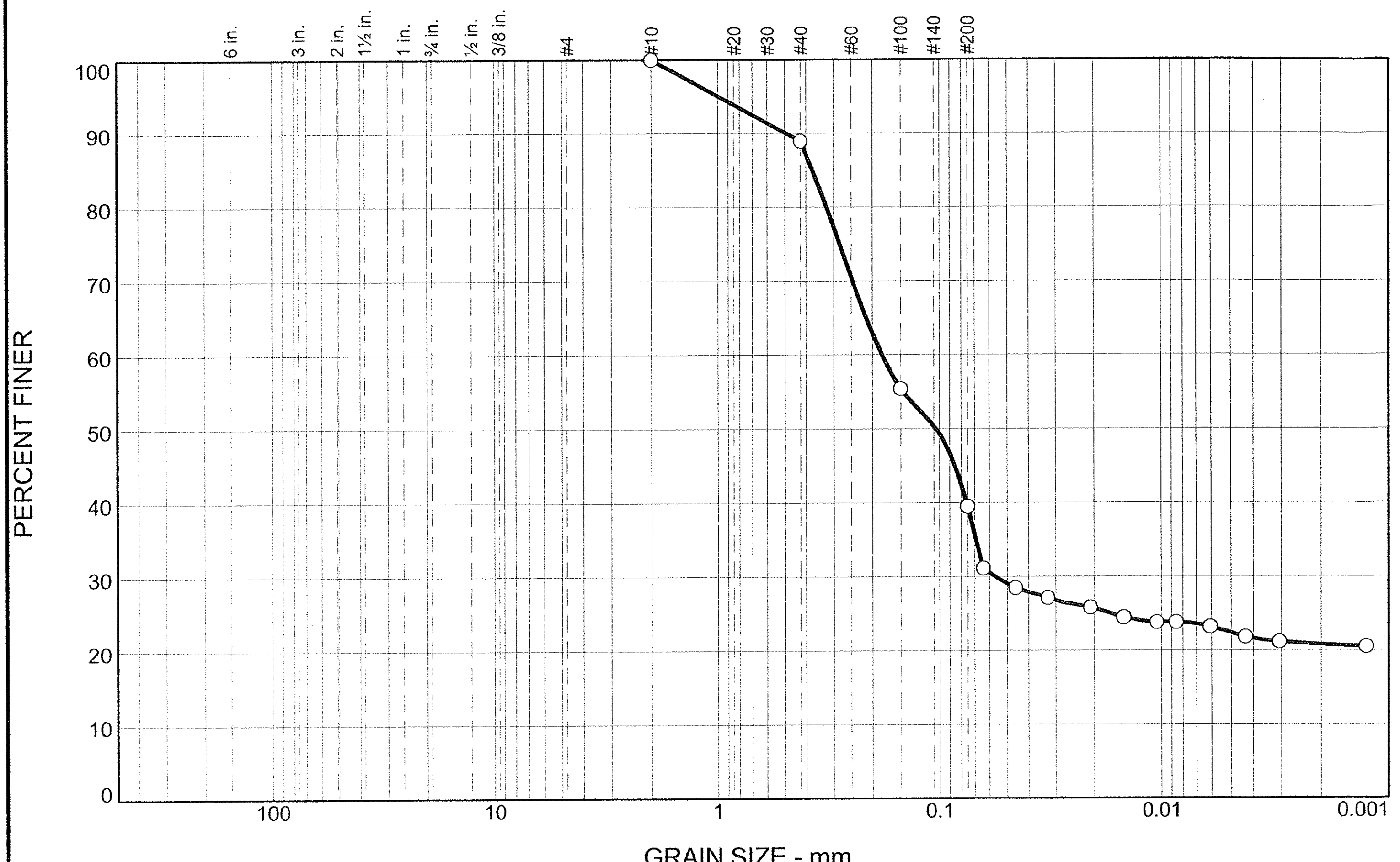
**Source of Sample:** B-1-1 **Depth:** 8'-10'
**Sample Number:** B-1-1 S-5 **Date:** 12/09/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 11.0 | 49.5 | 17.1 | 22.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 89.0 | | |
| #100 | 55.5 | | |
| #200 | 39.5 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, BROWNISH GRAY

**Atterberg Limits**

PL= 14 LL= 38 PI= 24

**Coefficients**

$D_{90}$= 0.4902 $D_{85}$= 0.3732 $D_{60}$= 0.1816
$D_{50}$= 0.1036 $D_{30}$= 0.0564 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(4)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 20'-22'
**Sample Number:** B-1-1 S-11

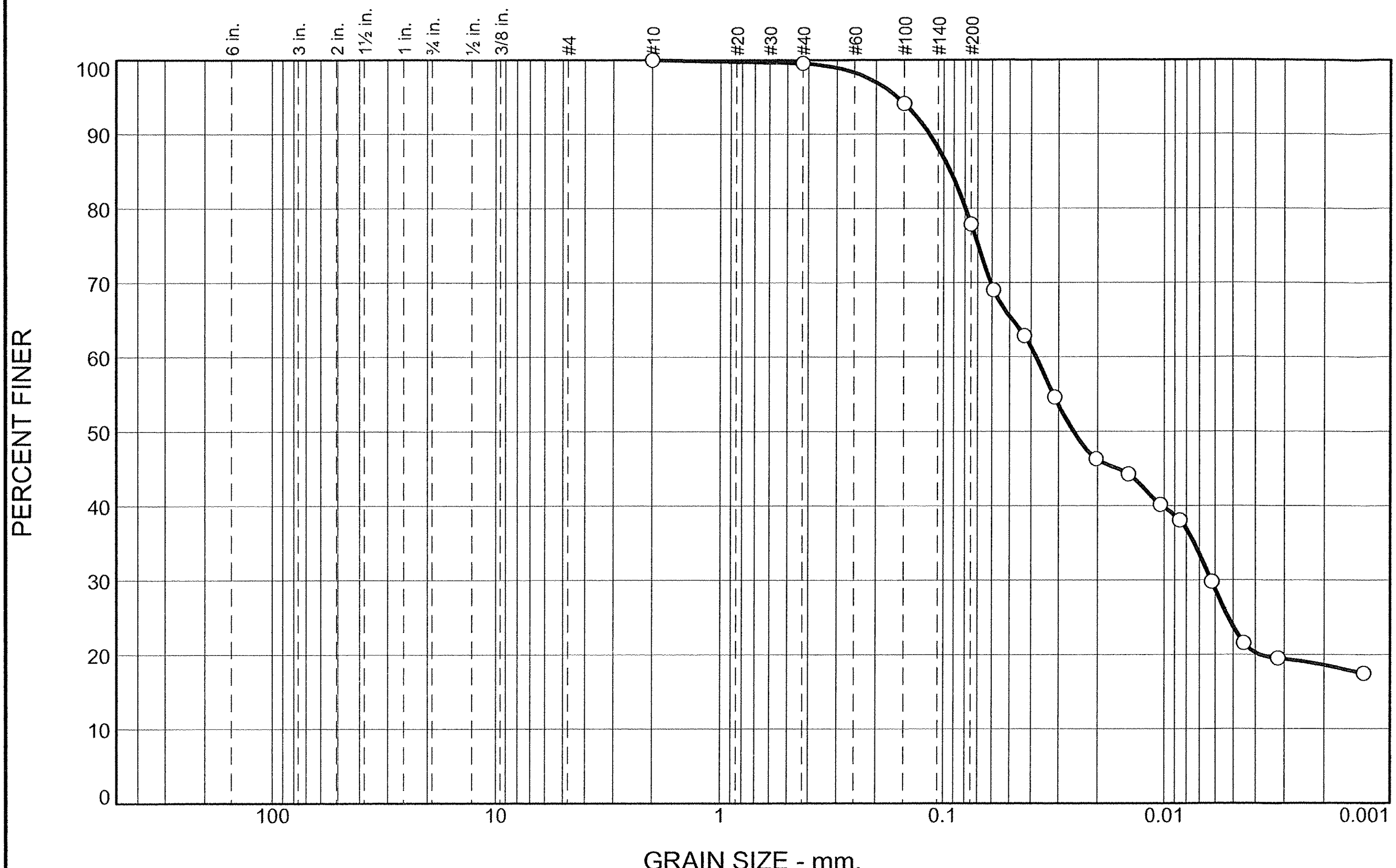
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 21.7 | 54.2 | 23.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 99.6 | | |
| #100 | 94.1 | | |
| #200 | 77.9 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, SOME SAND, LIGHT GRAY

**Atterberg Limits**

PL= 17 LL= 42 PI= 25

**Coefficients**

$D_{90}$= 0.1156 $D_{85}$= 0.0934 $D_{60}$= 0.0380
$D_{50}$= 0.0258 $D_{30}$= 0.0062 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-7-6(18)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 90'-90.4'
**Sample Number:** B-1-1 S-34

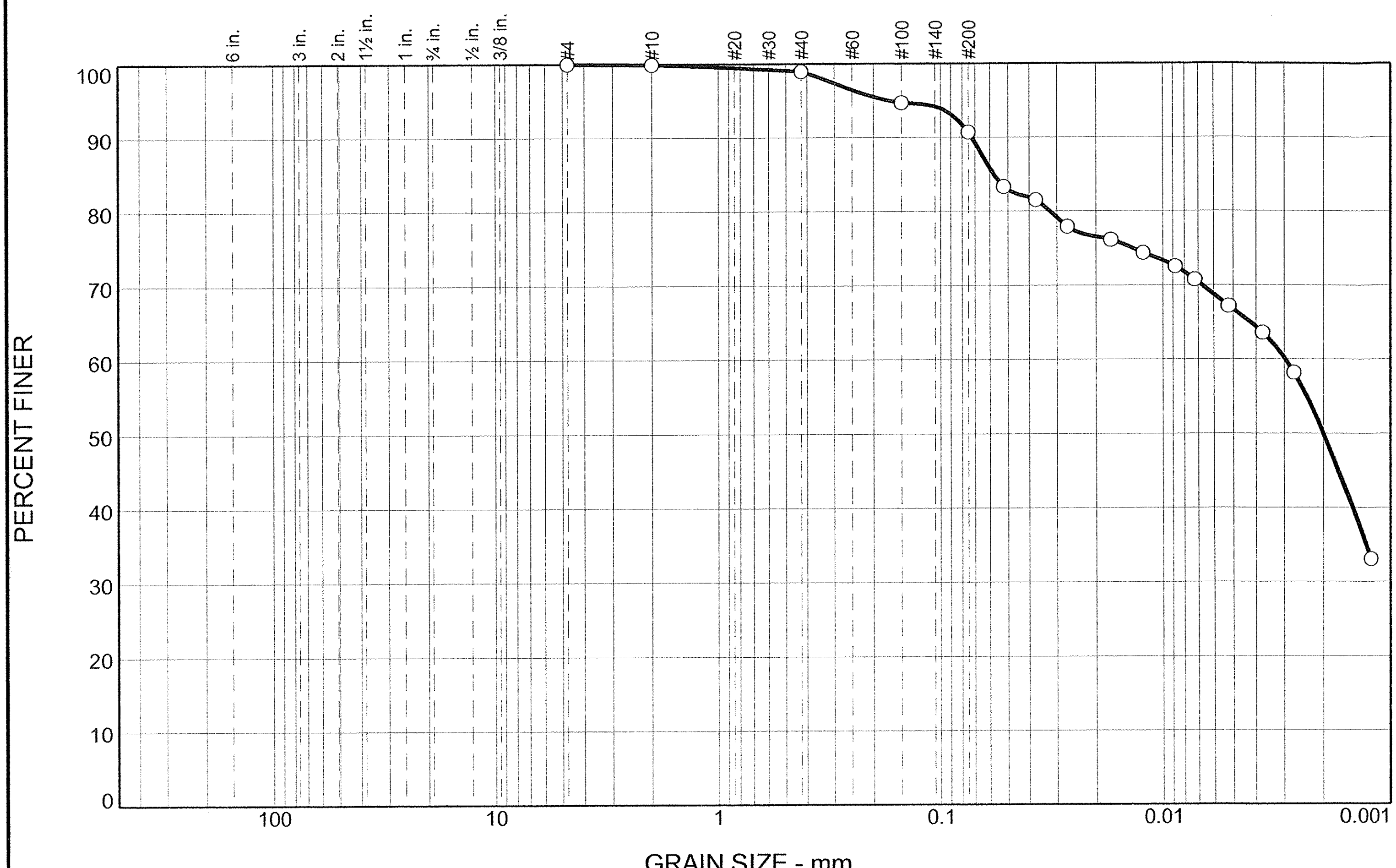
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 8.2 | 23.9 | 66.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #40 | 98.9 | | |
| #100 | 94.7 | | |
| #200 | 90.7 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, TRACE SAND, BROWN

**Atterberg Limits**

PL= 28 LL= 79 PI= 51

**Coefficients**

$D_{90}$= 0.0724 $D_{85}$= 0.0576 $D_{60}$= 0.0030
$D_{50}$= 0.0020 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CH AASHTO= A-7-6(53)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 120'-121'
**Sample Number:** B-1-1 S-40

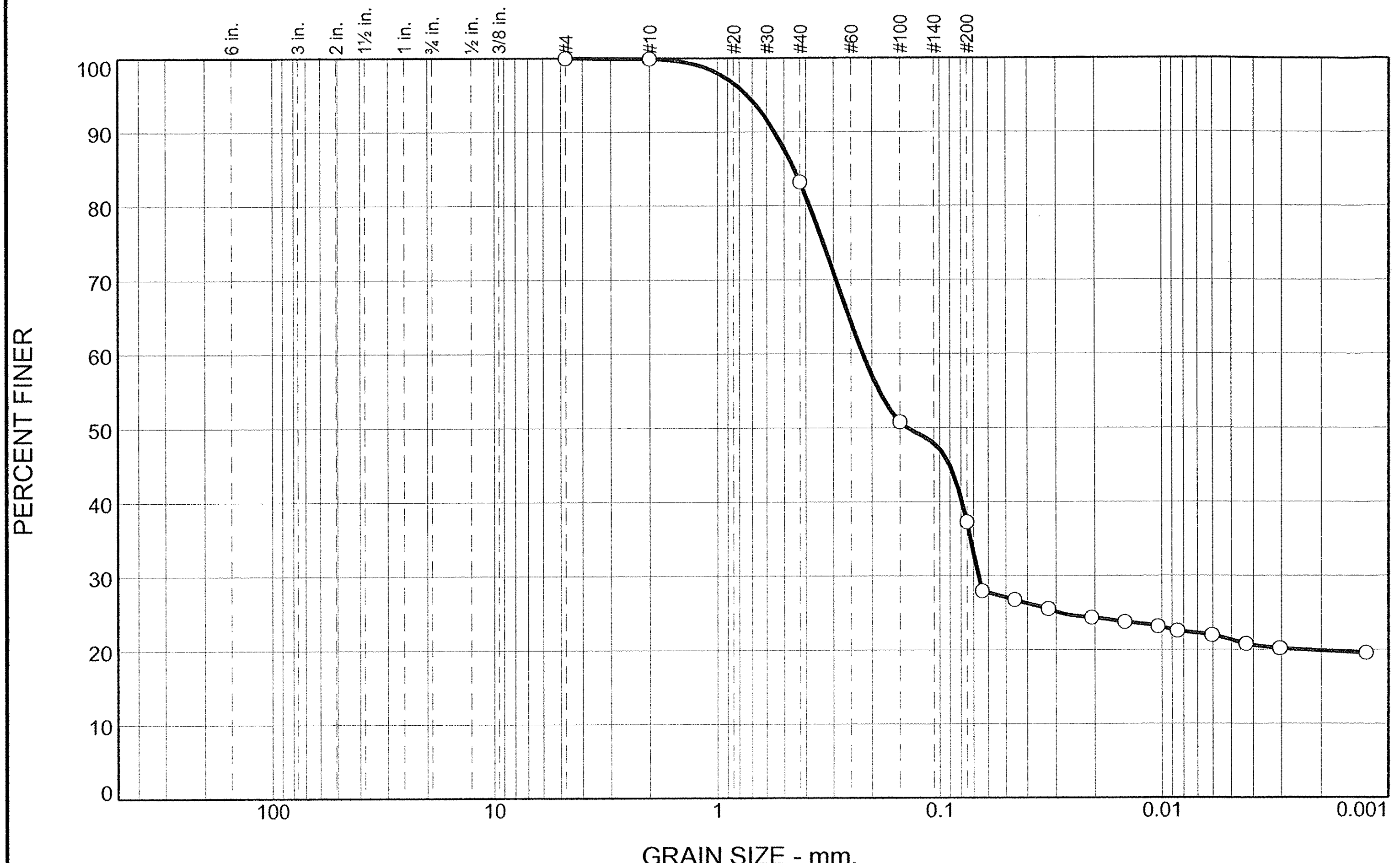
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 16.7 | 45.9 | 15.9 | 21.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #40 | 83.2 | | |
| #100 | 50.8 | | |
| #200 | 37.3 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAYISH BROWN

**Atterberg Limits**

PL= 14 LL= 38 PI= 24

**Coefficients**

$D_{90}$= 0.5520 $D_{85}$= 0.4512 $D_{60}$= 0.2202
$D_{50}$= 0.1389 $D_{30}$= 0.0666 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(3)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 10'-12'
**Sample Number:** B-2-1 S-6

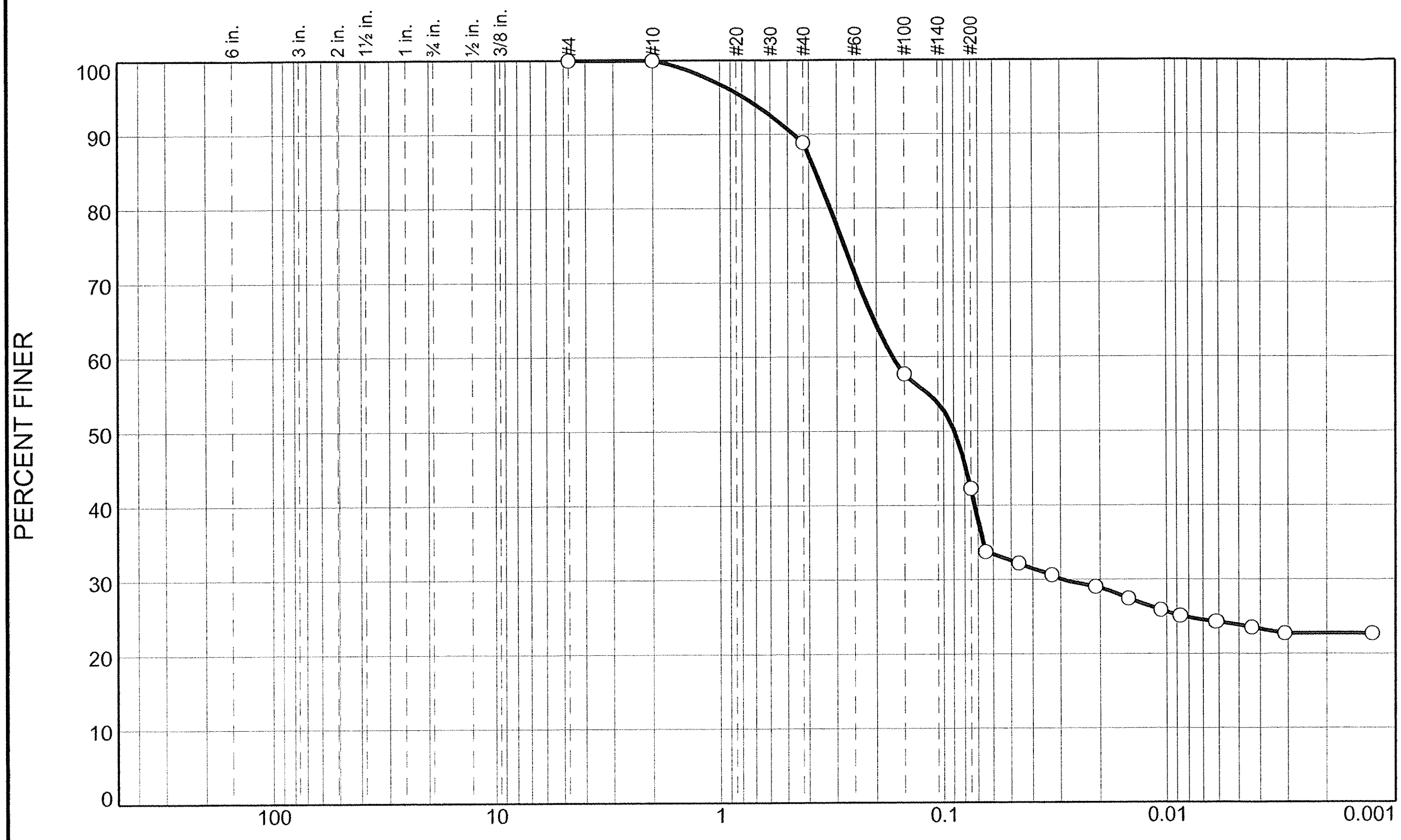
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 11.1 | 46.6 | 18.4 | 23.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 100.0 | | |
| #40 | 88.9 | | |
| #100 | 57.7 | | |
| #200 | 42.3 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAYISH BROWN

**Atterberg Limits**

PL= 13 LL= 41 PI= 28

**Coefficients**

$D_{90}$= 0.4679 $D_{85}$= 0.3722 $D_{60}$= 0.1697
$D_{50}$= 0.0893 $D_{30}$= 0.0293 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-7-6(6)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 18'-20'
**Sample Number:** B-2-1 S-10

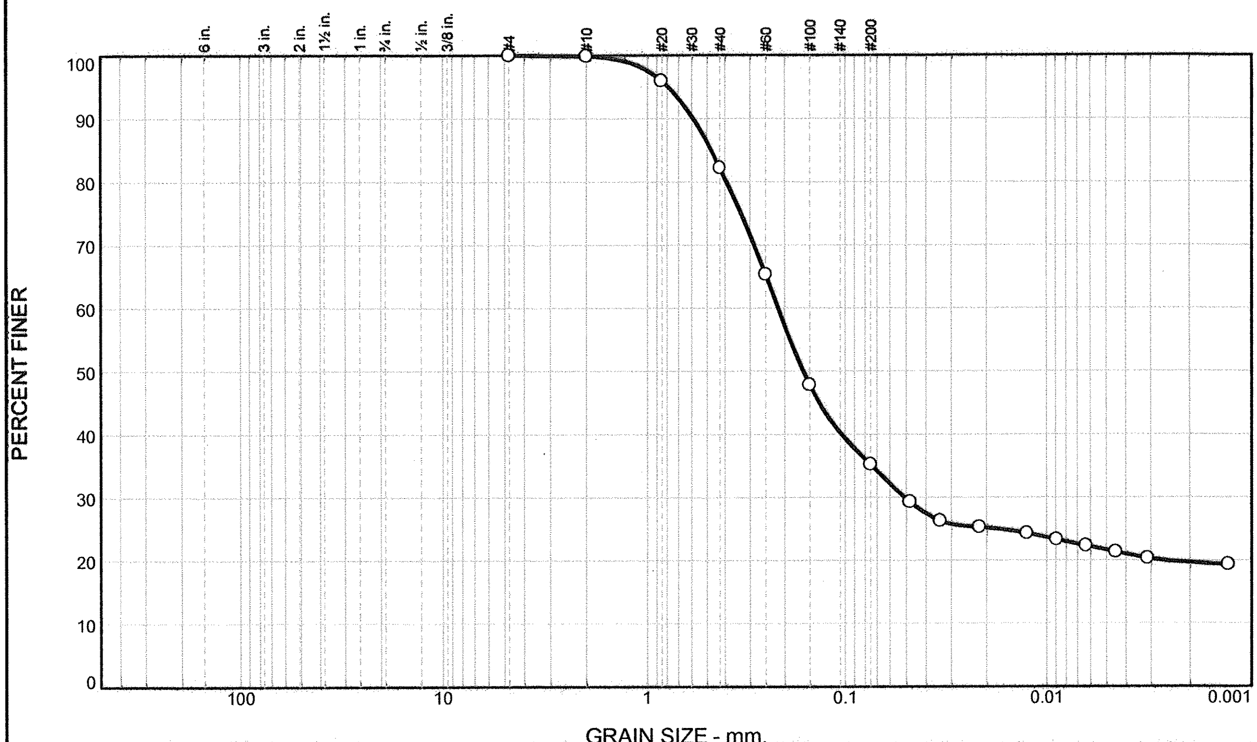
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 17.7 | 47.0 | 13.6 | 21.6 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #20 | 96.0 | | |
| #40 | 82.2 | | |
| #60 | 65.3 | | |
| #100 | 47.8 | | |
| #200 | 35.2 | | |

* (no specification provided)

**Material Description**

Clayey F-M Sand Little Silt - Brownish Gray

**Atterberg Limits**

PL= 18 LL= 42 PI= 24

**Coefficients**

$D_{90}$= 0.5889 $D_{85}$= 0.4733 $D_{60}$= 0.2159
$D_{50}$= 0.1616 $D_{30}$= 0.0509 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-2-7(3)

**Remarks**

**Source of Sample:** Boring 2-1 **Depth:** 26.0-28.0
**Sample Number:** S-14

**Date:** 12/7/2011

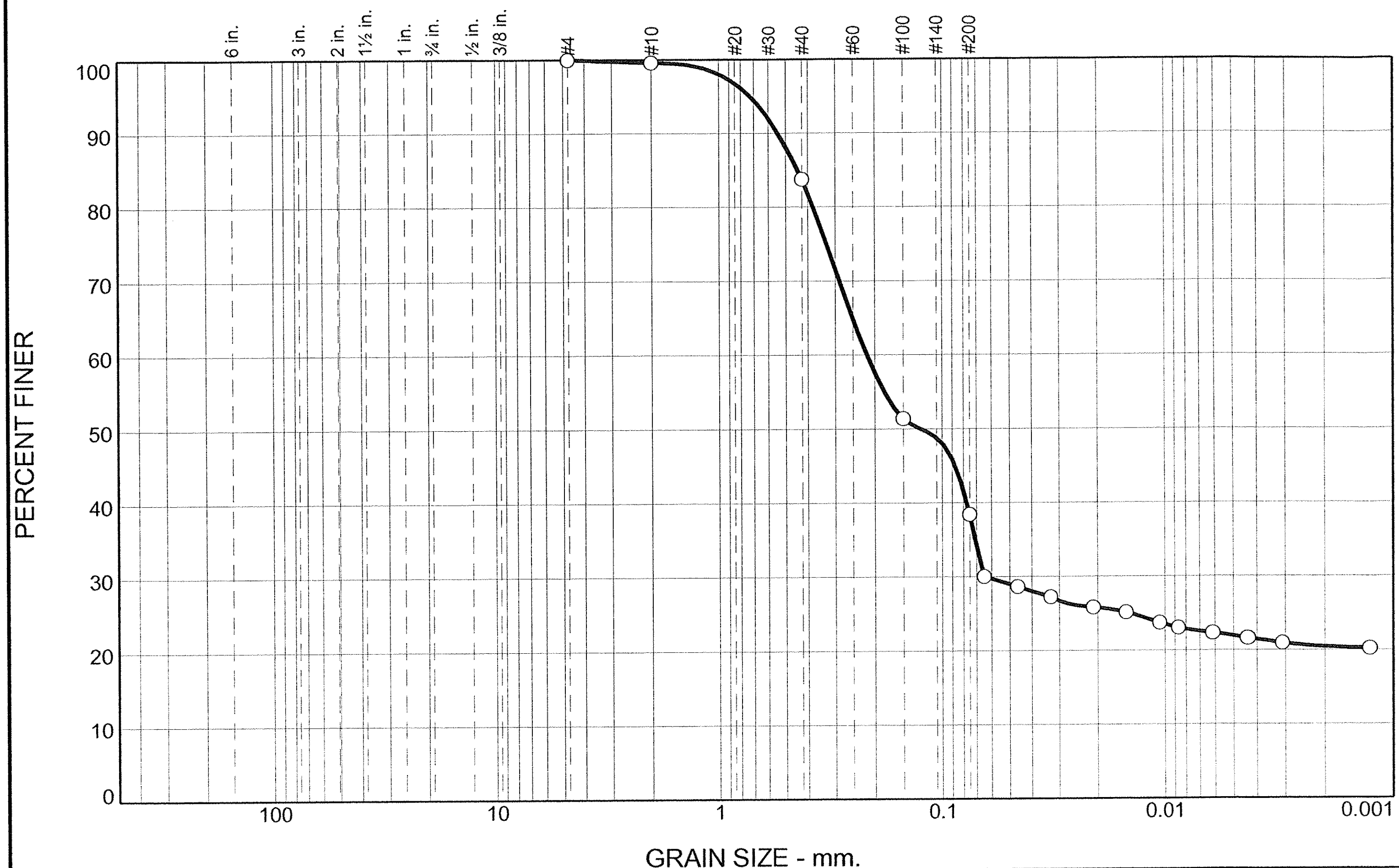
AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility

**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.4 | 15.8 | 45.4 | 16.4 | 22.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.6 | | |
| #40 | 83.8 | | |
| #100 | 51.4 | | |
| #200 | 38.4 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAY

**Atterberg Limits**

PL= 14 LL= 29 PI= 15

**Coefficients**

$D_{90}$= 0.5414 $D_{85}$= 0.4433 $D_{60}$= 0.2165
$D_{50}$= 0.1251 $D_{30}$= 0.0637 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(2)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 32'-34'
**Sample Number:** B-2-1 S-17

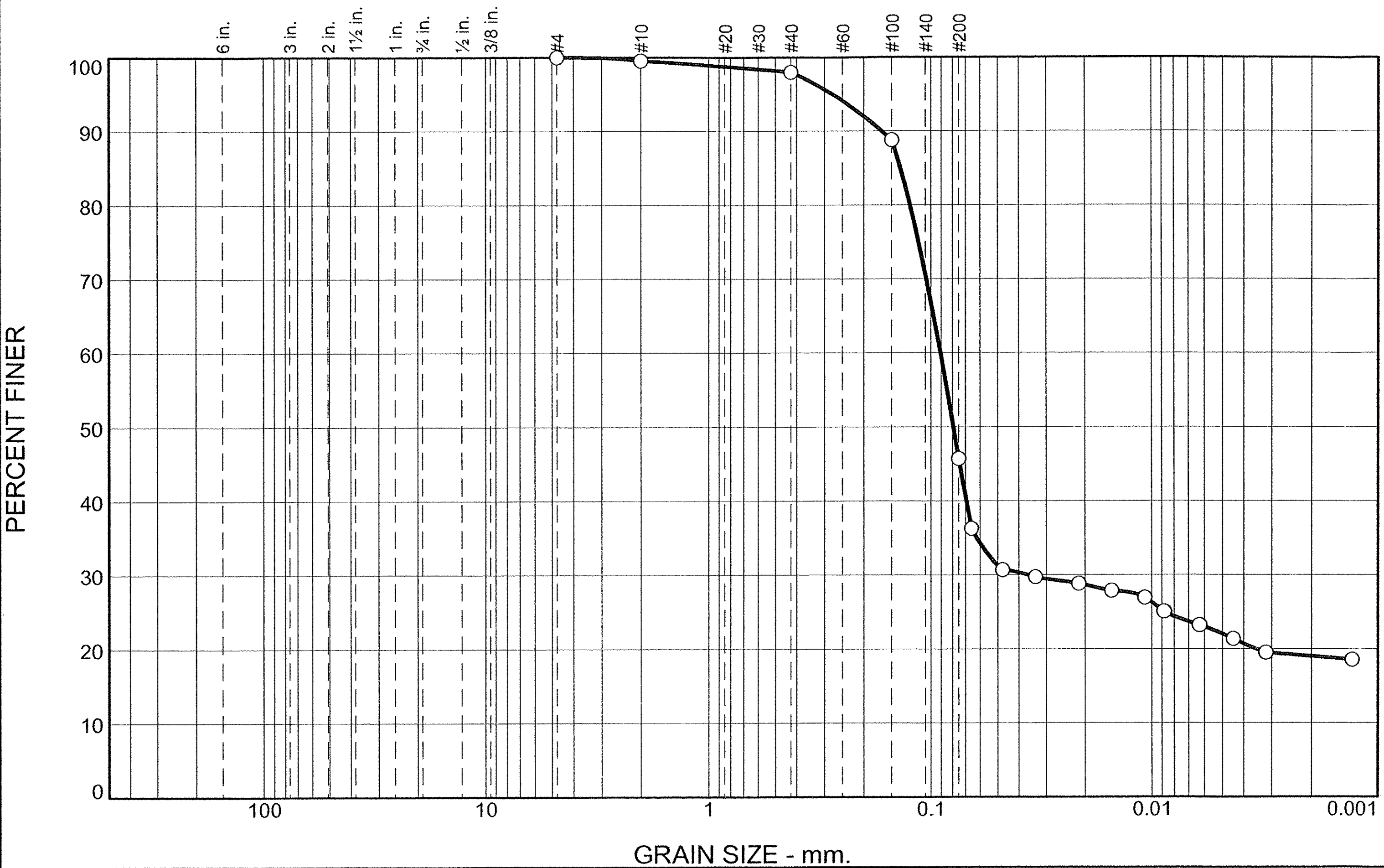
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.5 | 1.5 | 52.3 | 23.7 | 22.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.5 | | |
| #40 | 98.0 | | |
| #100 | 88.8 | | |
| #200 | 45.7 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE SAND, LIGHT GRAY

**Atterberg Limits**

PL= 17 LL= 28 PI= 11

**Coefficients**

$D_{90}$= 0.1663 $D_{85}$= 0.1371 $D_{60}$= 0.0906
$D_{50}$= 0.0793 $D_{30}$= 0.0362 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(2)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 55.0'-56.6'
**Sample Number:** B-2-1 S-27

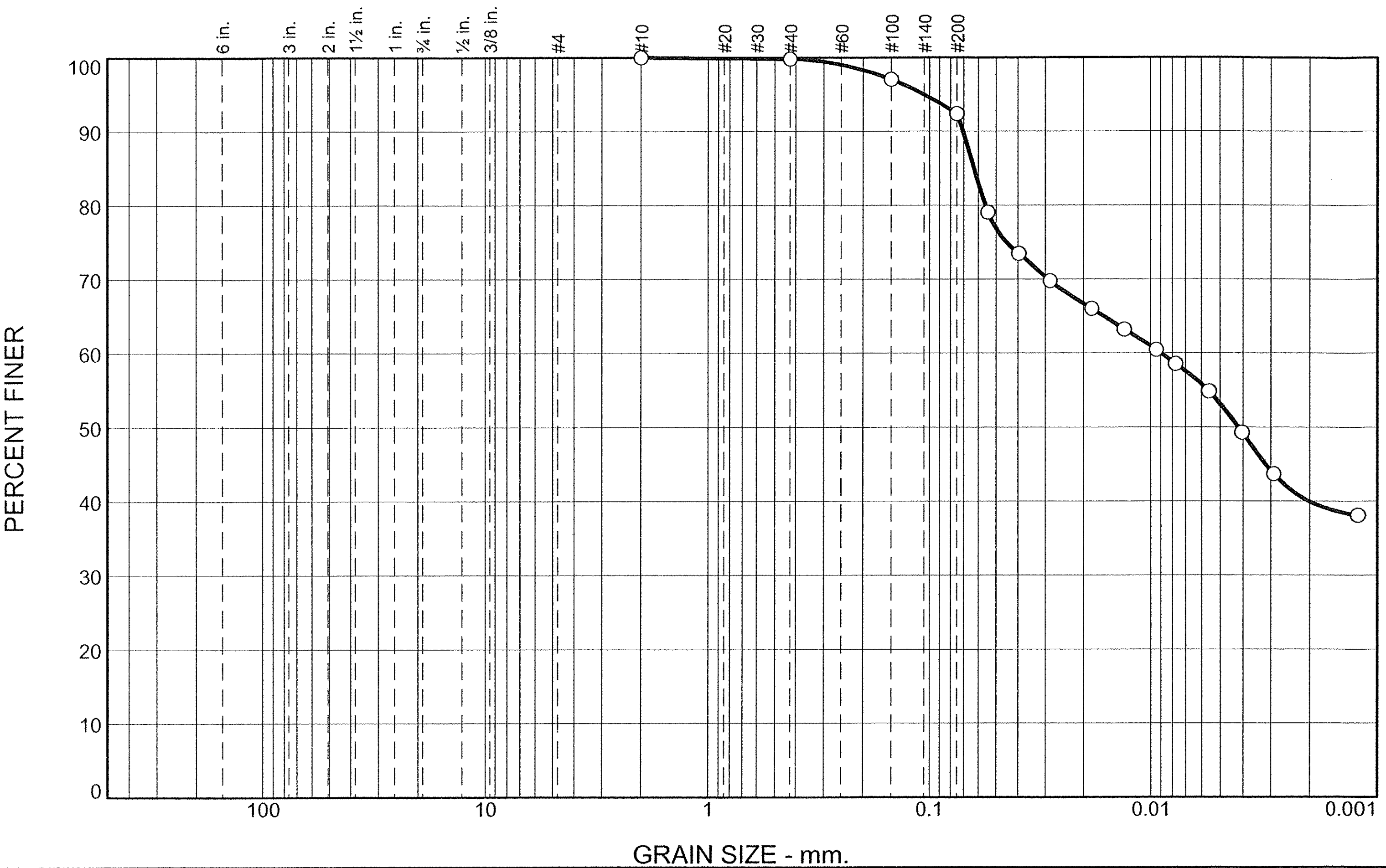
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 7.4 | 39.2 | 53.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 99.8 | | |
| #100 | 97.0 | | |
| #200 | 92.4 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, TRACE SAND, LIGHT GRAYISH BROWN

**Atterberg Limits**

PL= 25 LL= 59 PI= 34

**Coefficients**

$D_{90}$= 0.0705 $D_{85}$= 0.0630 $D_{60}$= 0.0090
$D_{50}$= 0.0042 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CH AASHTO= A-7-6(35)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 85.0'-86.5'
**Sample Number:** B-2-1 S-33

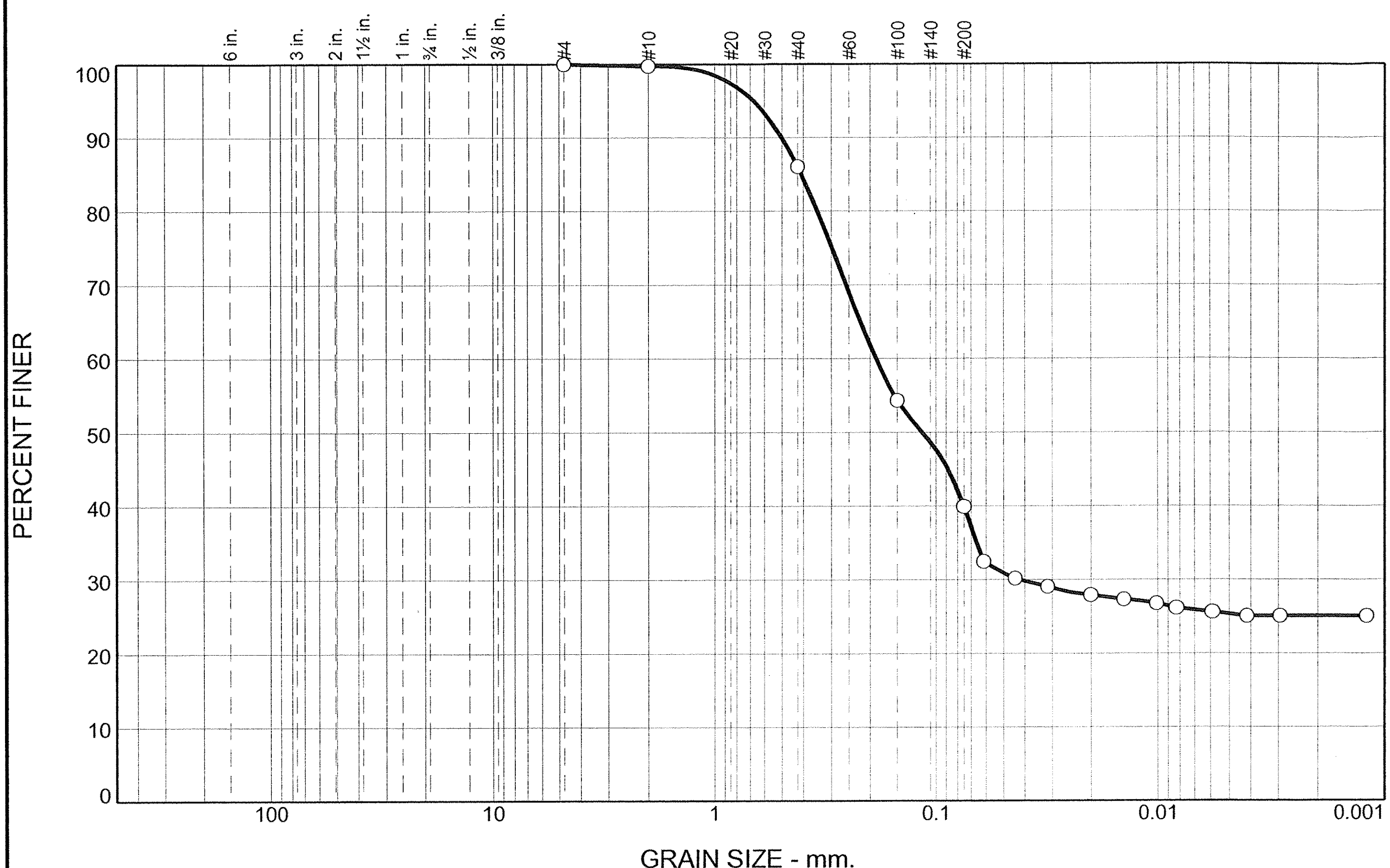
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.3 | 13.6 | 46.1 | 14.6 | 25.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.7 | | |
| #40 | 86.1 | | |
| #100 | 54.4 | | |
| #200 | 40.0 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAY

**Atterberg Limits**

PL= 15 LL= 44 PI= 29

**Coefficients**

$D_{90}$= 0.5011 $D_{85}$= 0.4085 $D_{60}$= 0.1882
$D_{50}$= 0.1152 $D_{30}$= 0.0416 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-7-6(6)

**Remarks**

**Source of Sample:** B-3-1 **Depth:** 16.0'-17.8'
**Sample Number:** B-3-1 S-9

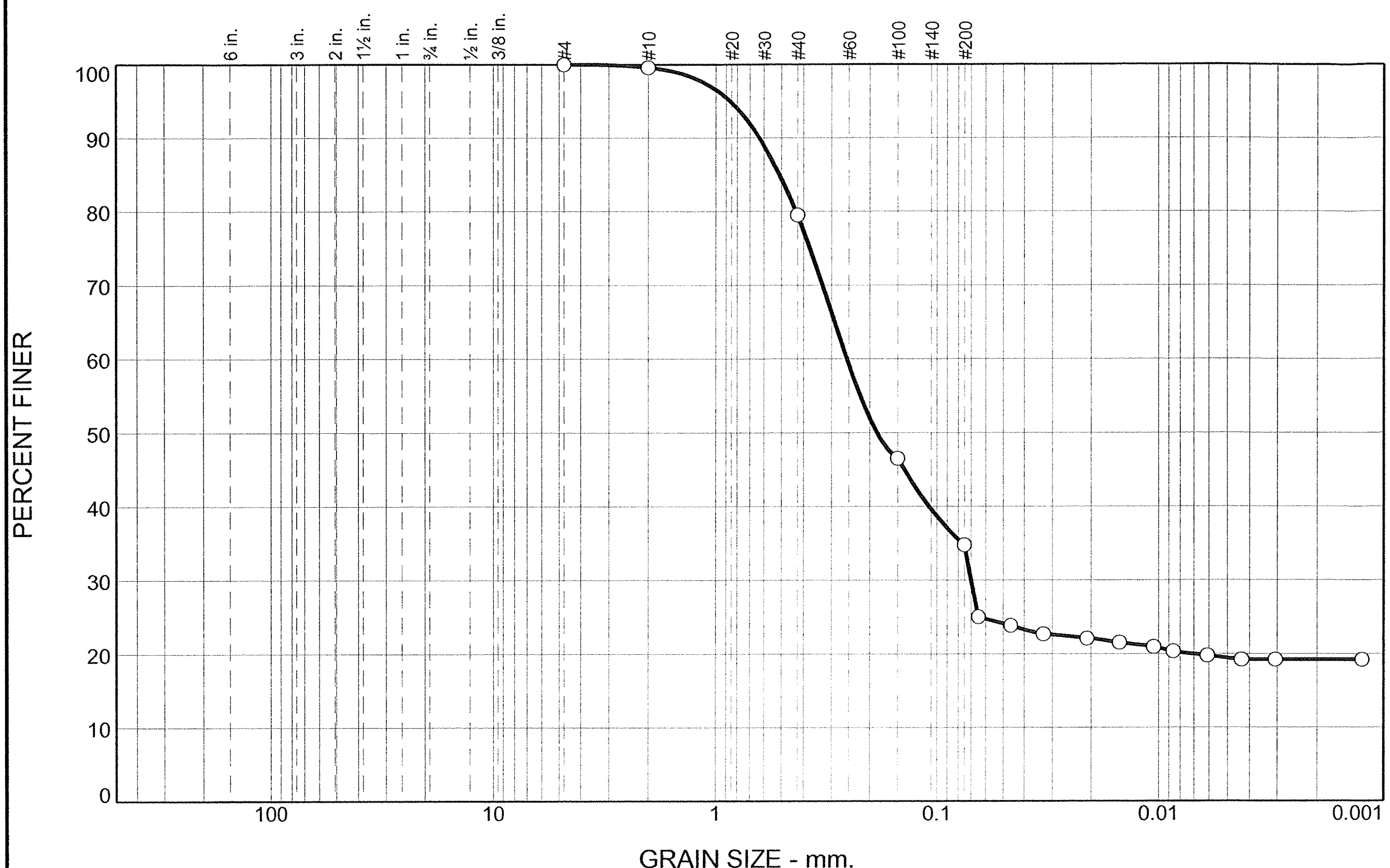
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.4 | 20.1 | 44.7 | 15.4 | 19.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.6 | | |
| #40 | 79.5 | | |
| #100 | 46.5 | | |
| #200 | 34.8 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, DARK BROWN

**Atterberg Limits**

PL= 13 LL= 35 PI= 22

**Coefficients**

$D_{90}$= 0.6299 $D_{85}$= 0.5094 $D_{60}$= 0.2547
$D_{50}$= 0.1856 $D_{30}$= 0.0701 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-2-6(2)

**Remarks**

**Source of Sample:** B-3-1 **Depth:** 18'-20'
**Sample Number:** B-3-1 S-10

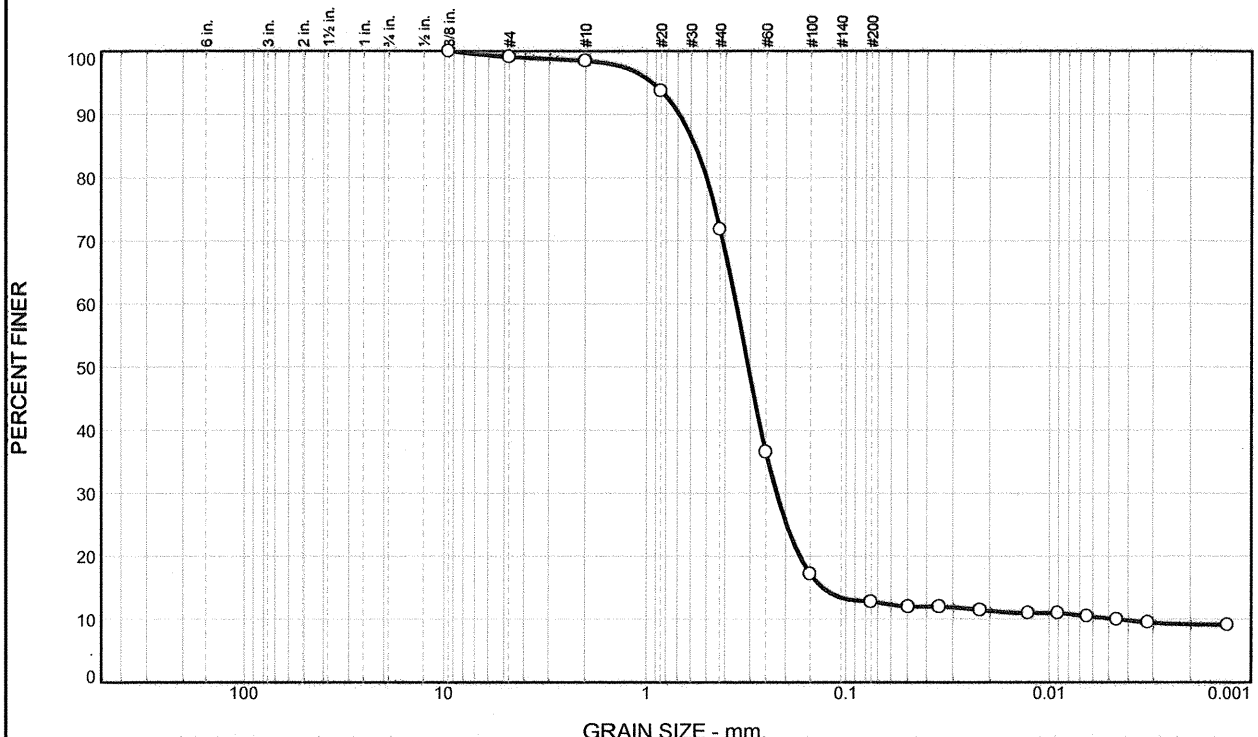
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.9 | 0.6 | 26.7 | 59.0 | 2.7 | 10.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| .375 | 100.0 | | |
| #4 | 99.1 | | |
| #10 | 98.5 | | |
| #20 | 93.7 | | |
| #40 | 71.8 | | |
| #60 | 36.5 | | |
| #100 | 17.2 | | |
| #200 | 12.8 | | |

* (no specification provided)

**Material Description**

F-M Sand Little Clay Trace Silt - Brownish Gray

**Atterberg Limits**

PL= 16 LL= 27 PI= 11

**Coefficients**

$D_{90}$= 0.6879 $D_{85}$= 0.5721 $D_{60}$= 0.3538
$D_{50}$= 0.3070 $D_{30}$= 0.2214 $D_{15}$= 0.1304
$D_{10}$= 0.0046 $C_u$= 76.58 $C_c$= 29.98

**Classification**

USCS= SC AASHTO= A-2-6(0)

**Remarks**

**Source of Sample:** Boring 4-1 **Depth:** 12.0-14.0
**Sample Number:** S-7

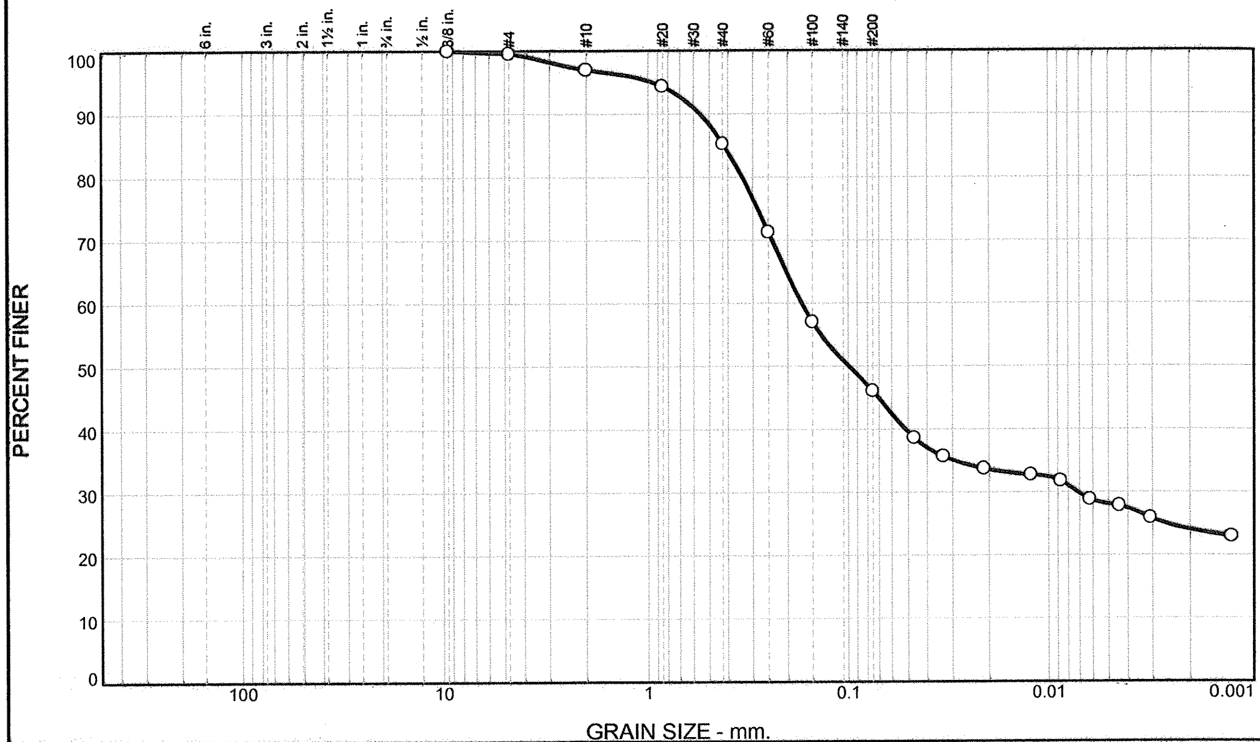
**Date:** 12/7/11

AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility
**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.4 | 2.6 | 11.8 | 39.2 | 17.9 | 28.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| .375 | 100.0 | | |
| #4 | 99.6 | | |
| #10 | 97.0 | | |
| #20 | 94.3 | | |
| #40 | 85.2 | | |
| #60 | 71.3 | | |
| #100 | 57.0 | | |
| #200 | 46.0 | | |

* (no specification provided)

**Material Description**

Clayey F-M Sand Little Silt - Brownish Gray

**Atterberg Limits**

PL= 16 LL= 40 PI= 24

**Coefficients**

$D_{90}$= 0.5576 $D_{85}$= 0.4206 $D_{60}$= 0.1695
$D_{50}$= 0.0994 $D_{30}$= 0.0071 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(7)

**Remarks**

**Source of Sample:** Boring 4-1 **Depth:** 24.0-26.0
**Sample Number:** S-13

**Date:** 12/7/11

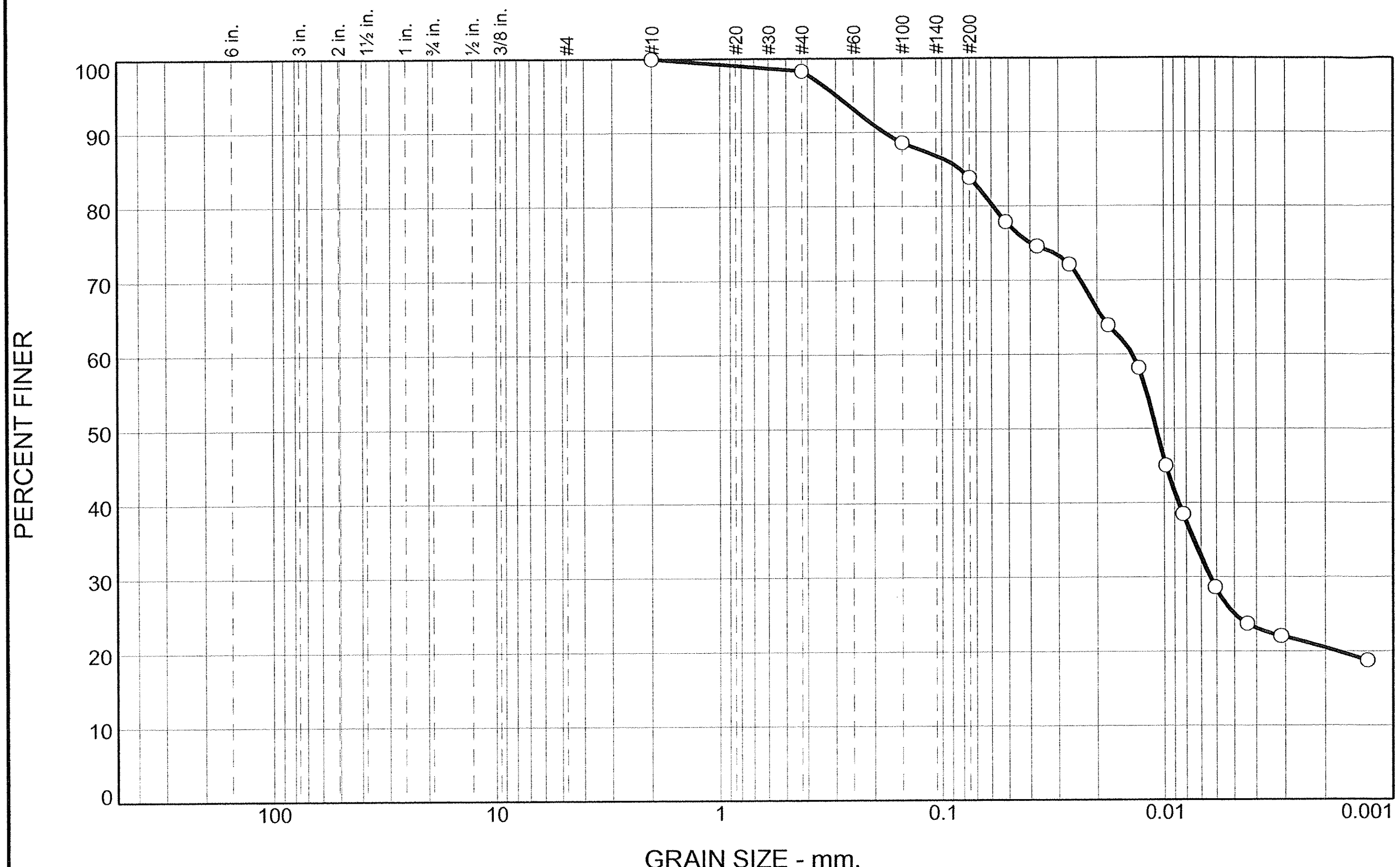
AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility

**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 14.4 | 58.8 | 25.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 98.3 | | |
| #100 | 88.6 | | |
| #200 | 83.9 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, LITTLE FINE TO MEDIUM SAND, WHITE AND GRAY

**Atterberg Limits**

PL= 18 LL= 30 PI= 12

**Coefficients**

$D_{90}$= 0.1803 $D_{85}$= 0.0826 $D_{60}$= 0.0138
$D_{50}$= 0.0108 $D_{30}$= 0.0064 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-6(9)

**Remarks**

**Source of Sample:** B-5-1 **Depth:** 26'-27'
**Sample Number:** B-5-1 S-14

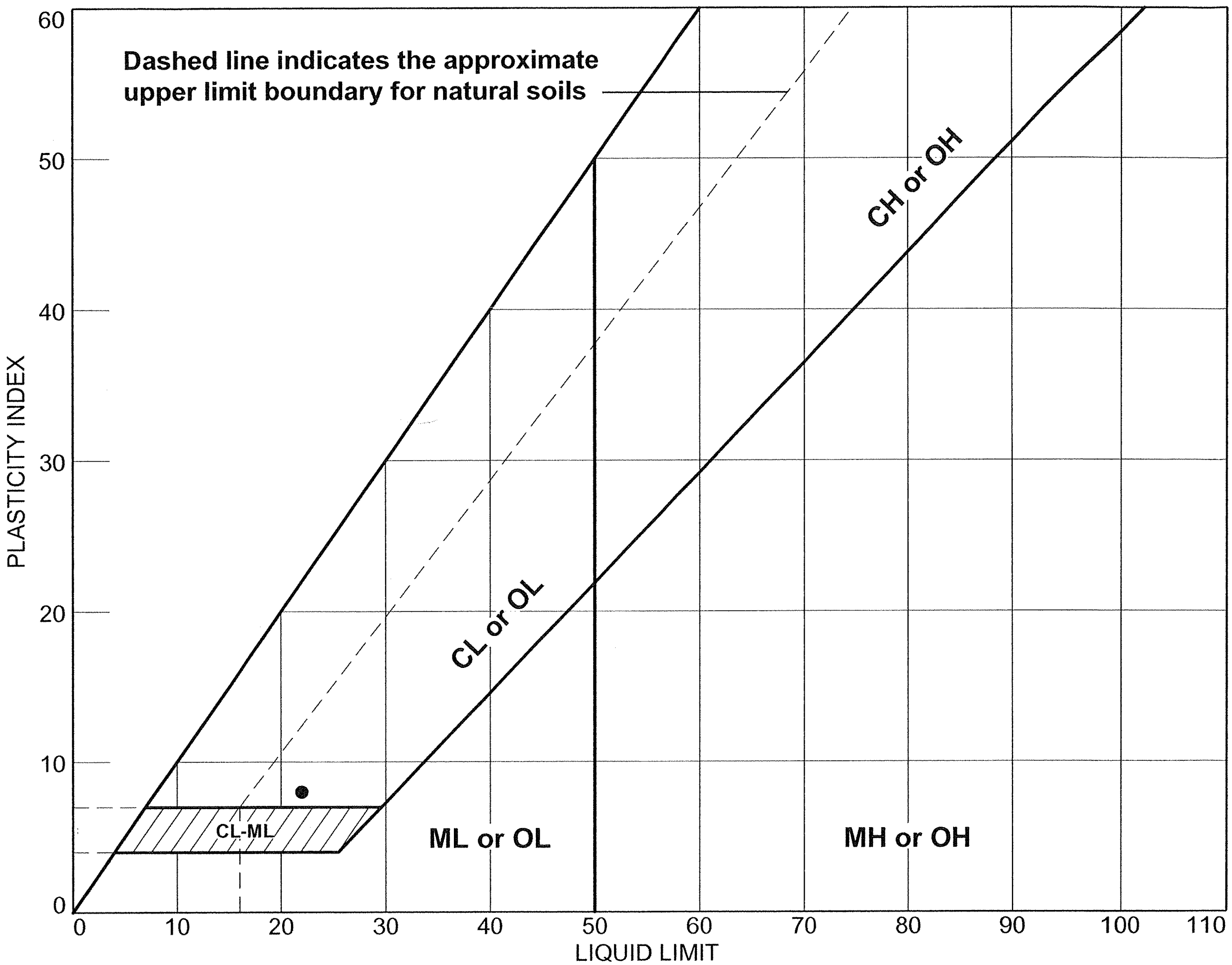
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



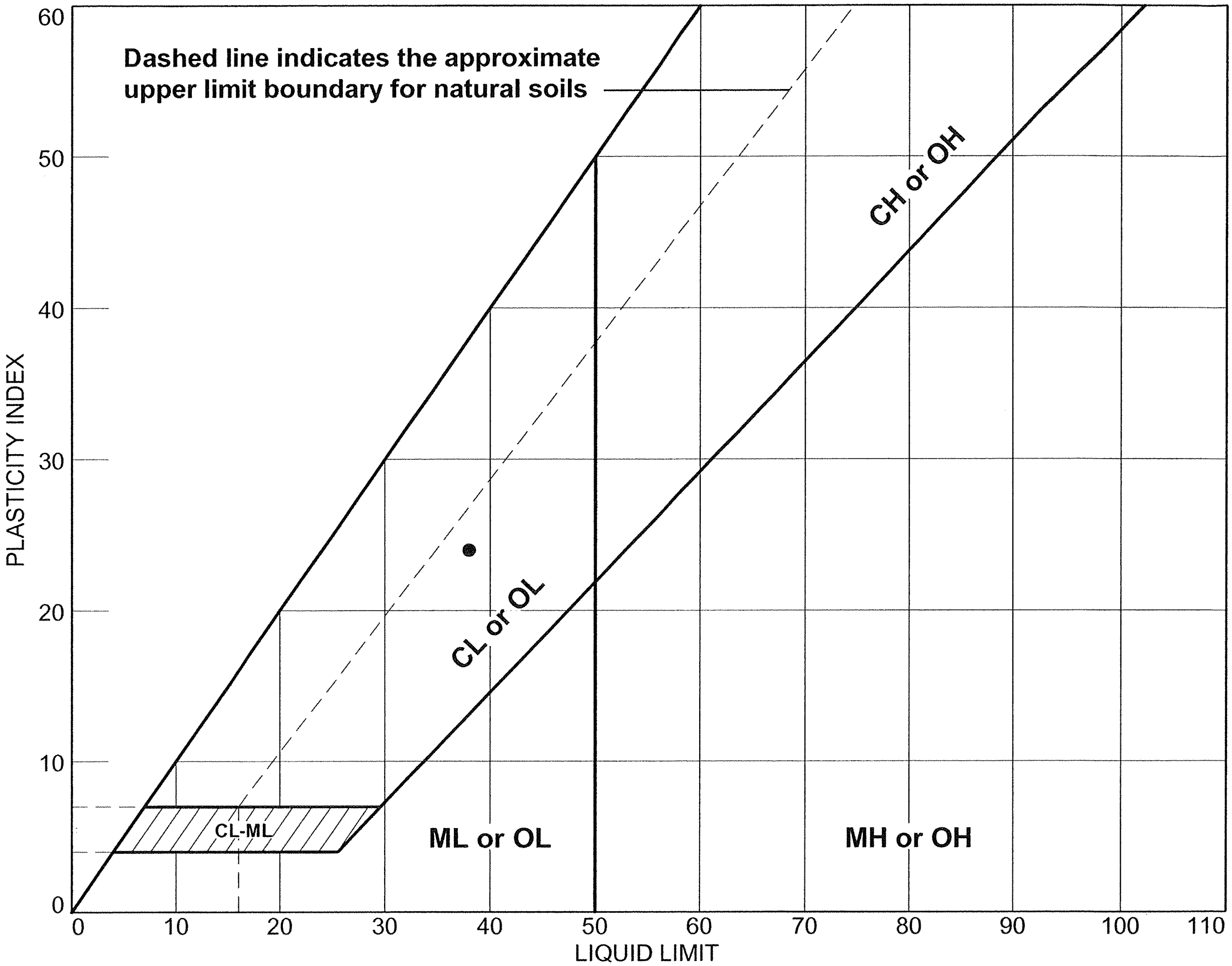

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-5 | 8'-10' | | 14 | 22 | 8 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-11 | 20'-22' | | 14 | 38 | 24 | SC |

AECOM

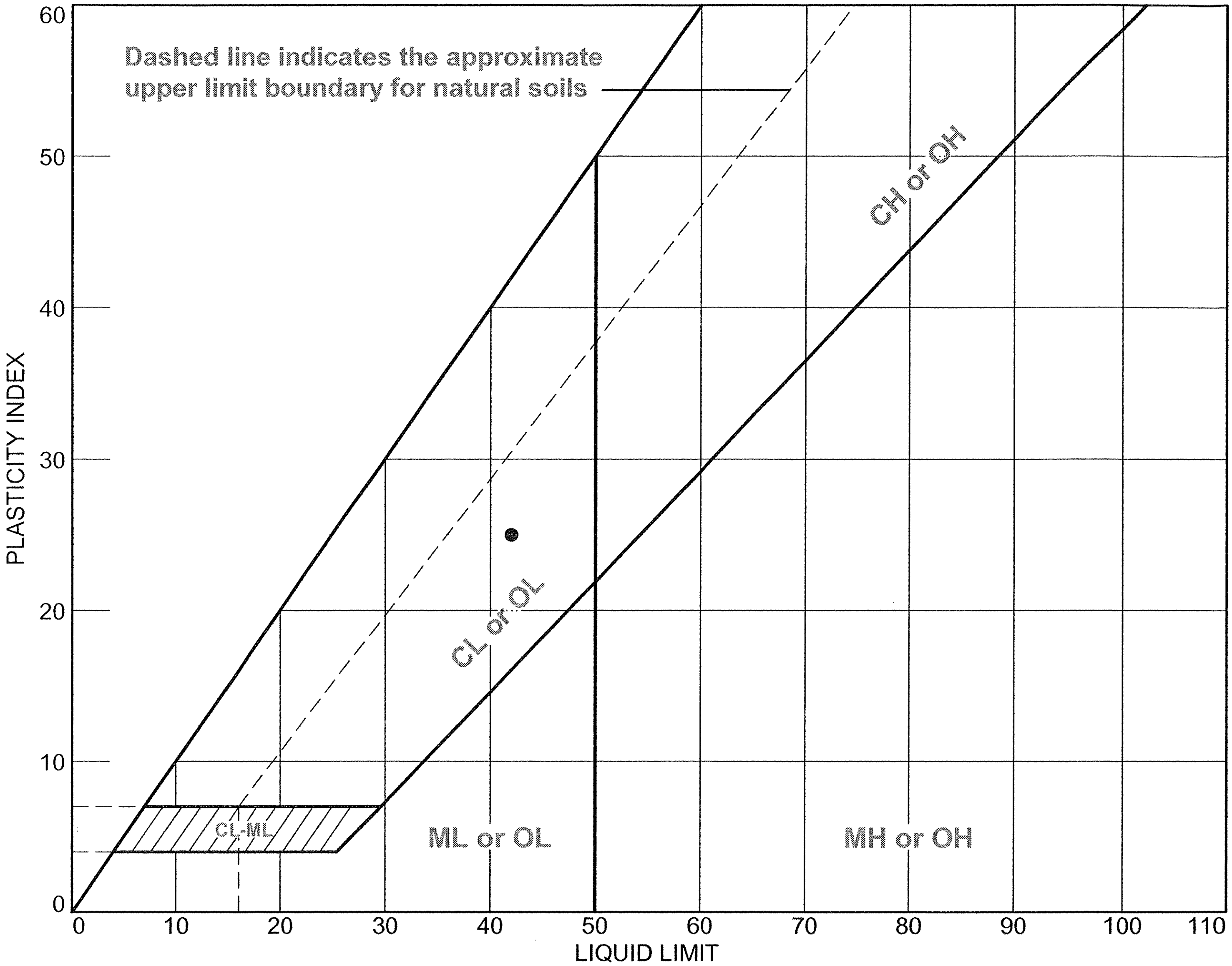
**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561

**Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT

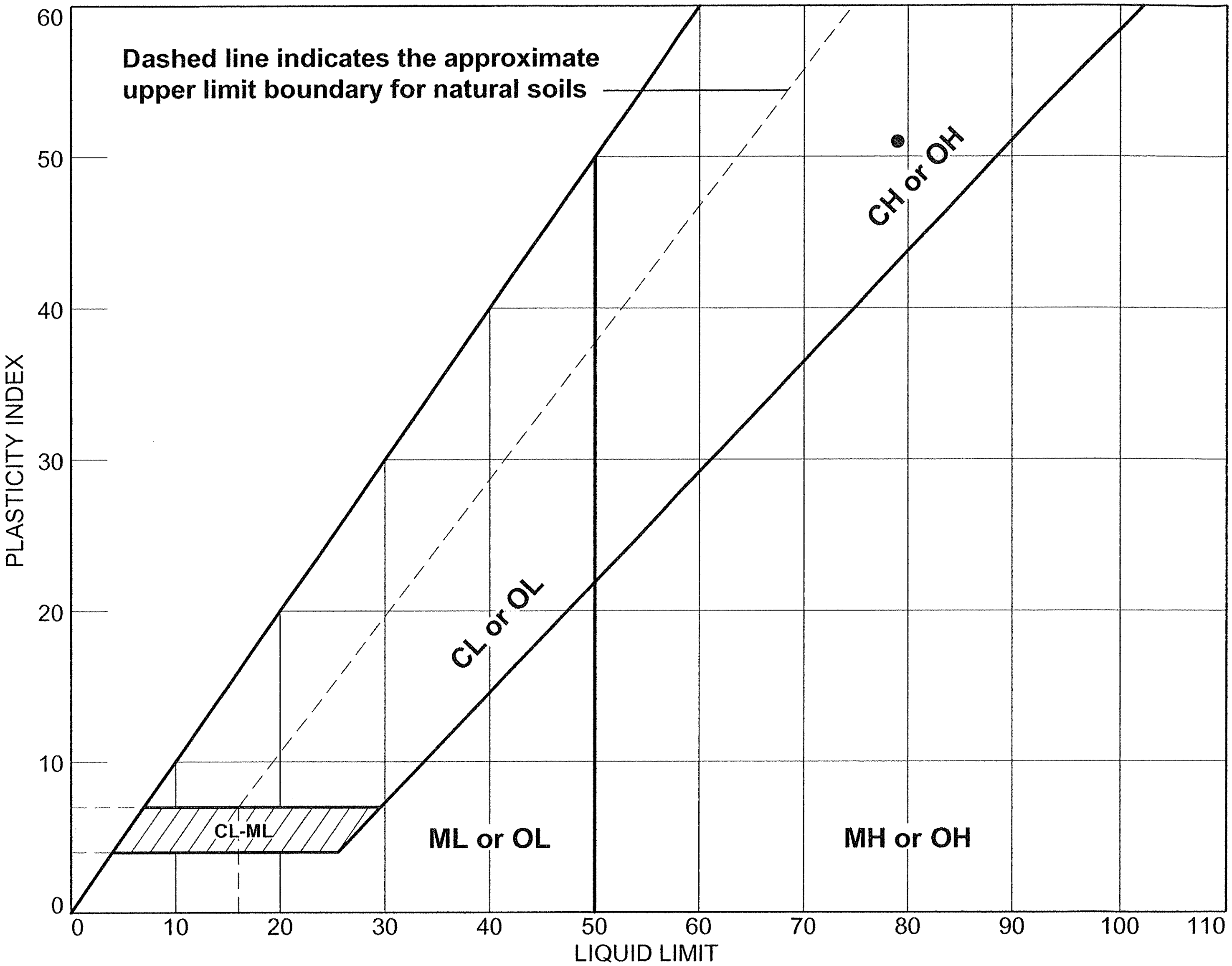



| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-34 | 90'-90.4' | | 17 | 42 | 25 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



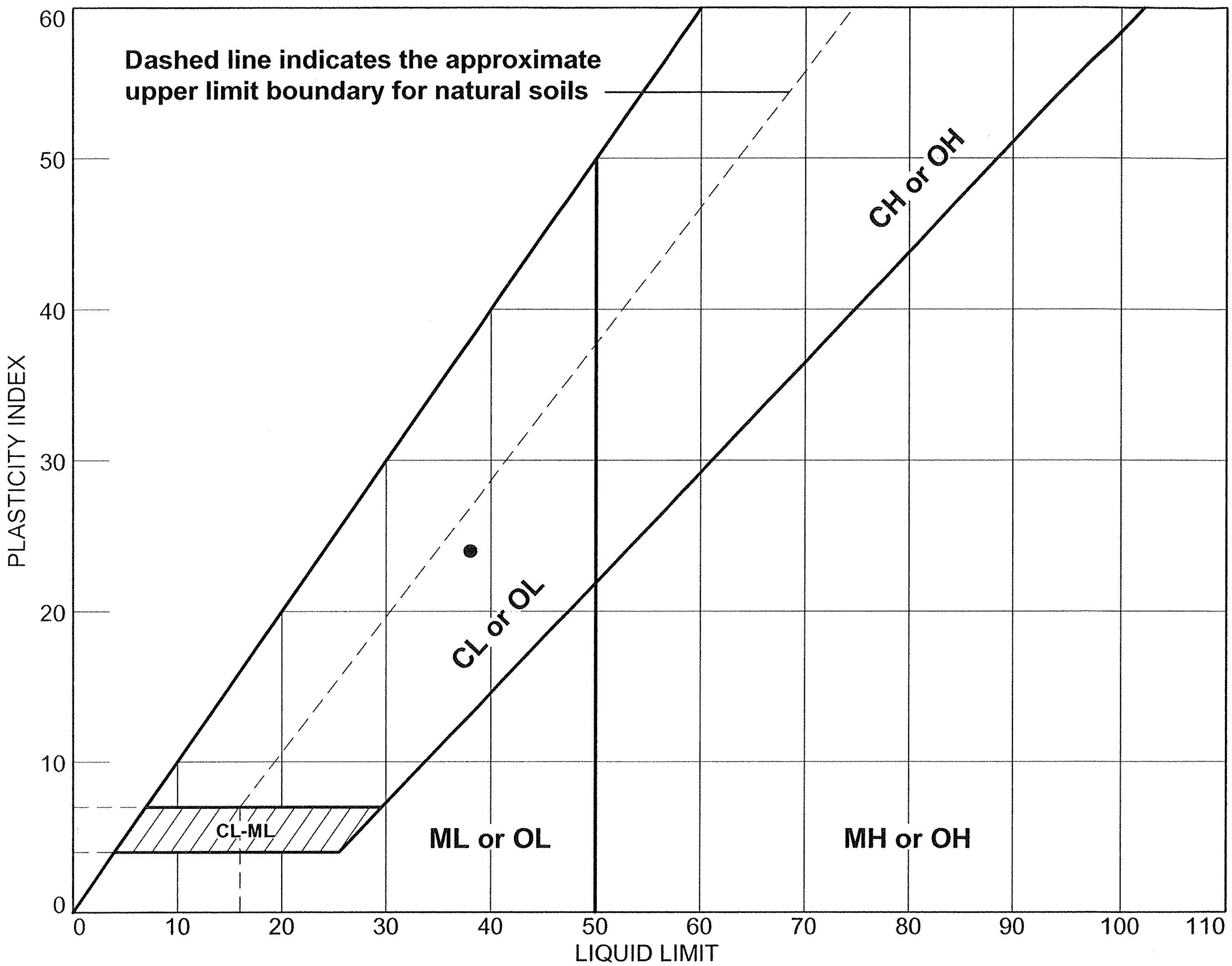

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-40 | 120'-121' | | 28 | 79 | 51 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



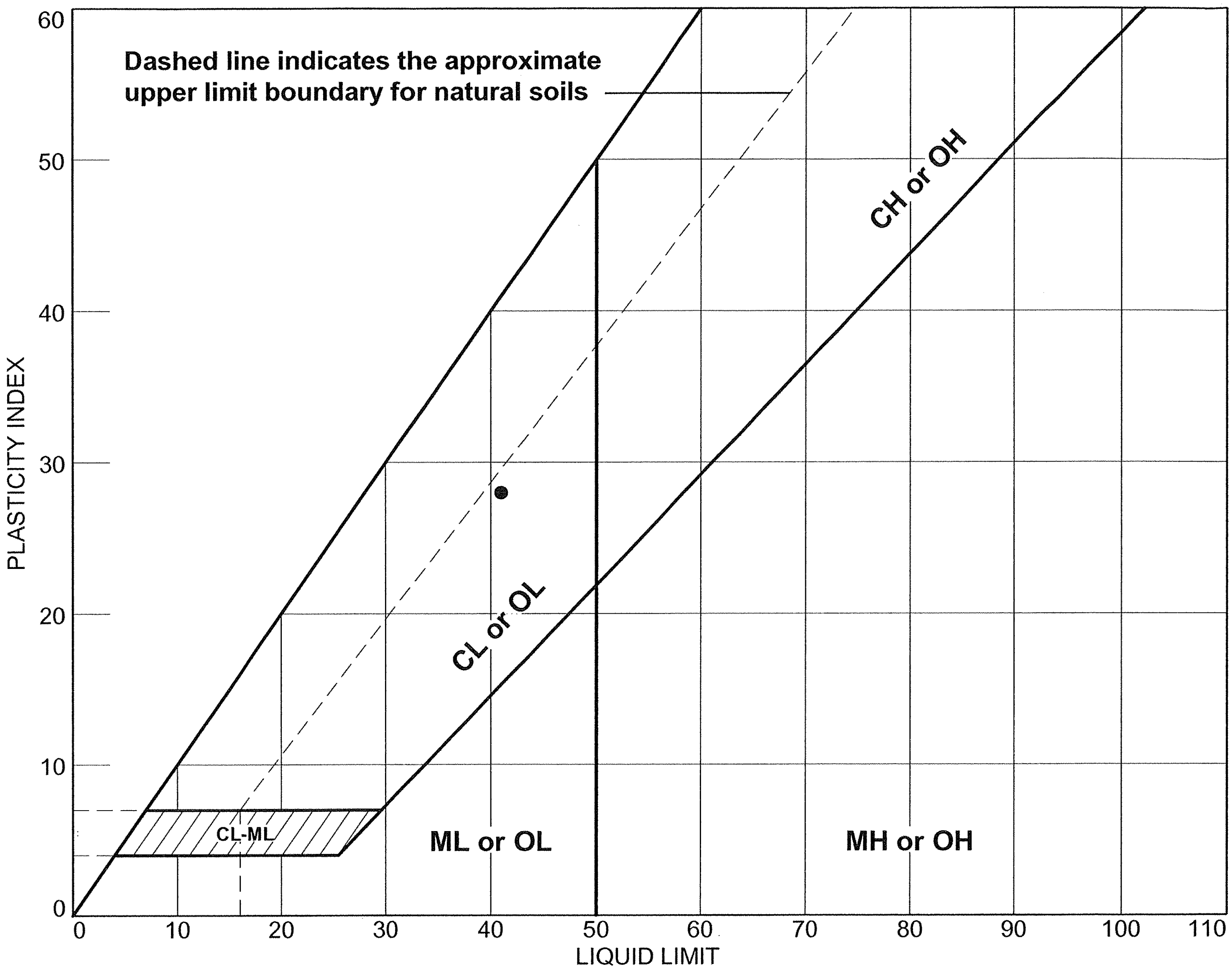

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-6 | 10'-12' | | 14 | 38 | 24 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



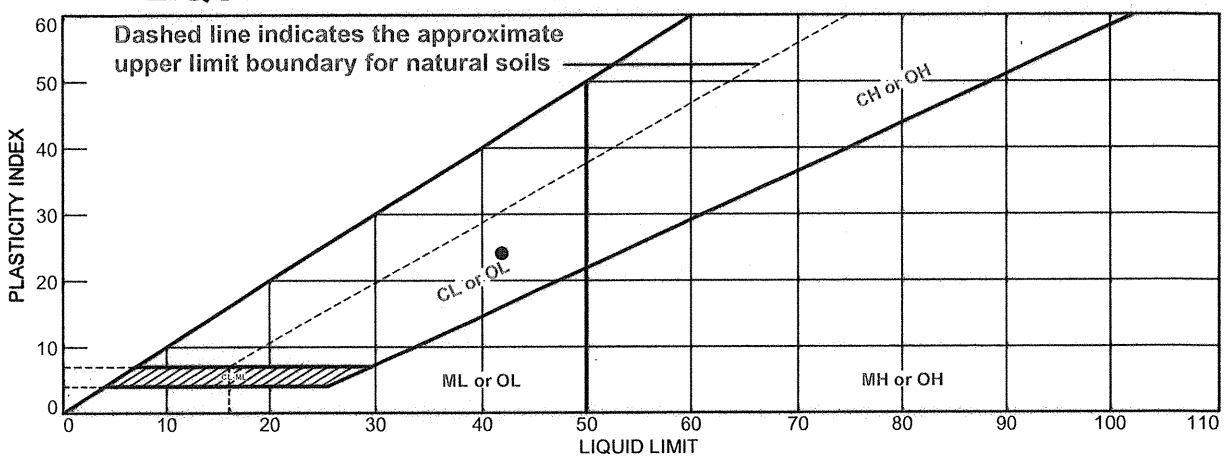

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-10 | 18'-20' | | 13 | 41 | 28 | SC |

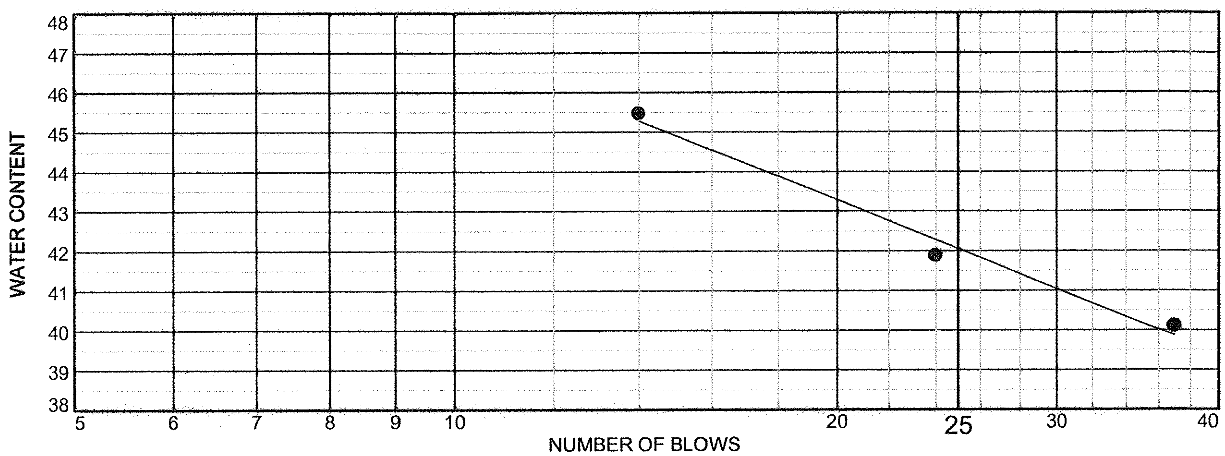
AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Clayey F-M Sand Little Silt - Brownish Gray | 42 | 18 | 24 | 82.2 | 35.2 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

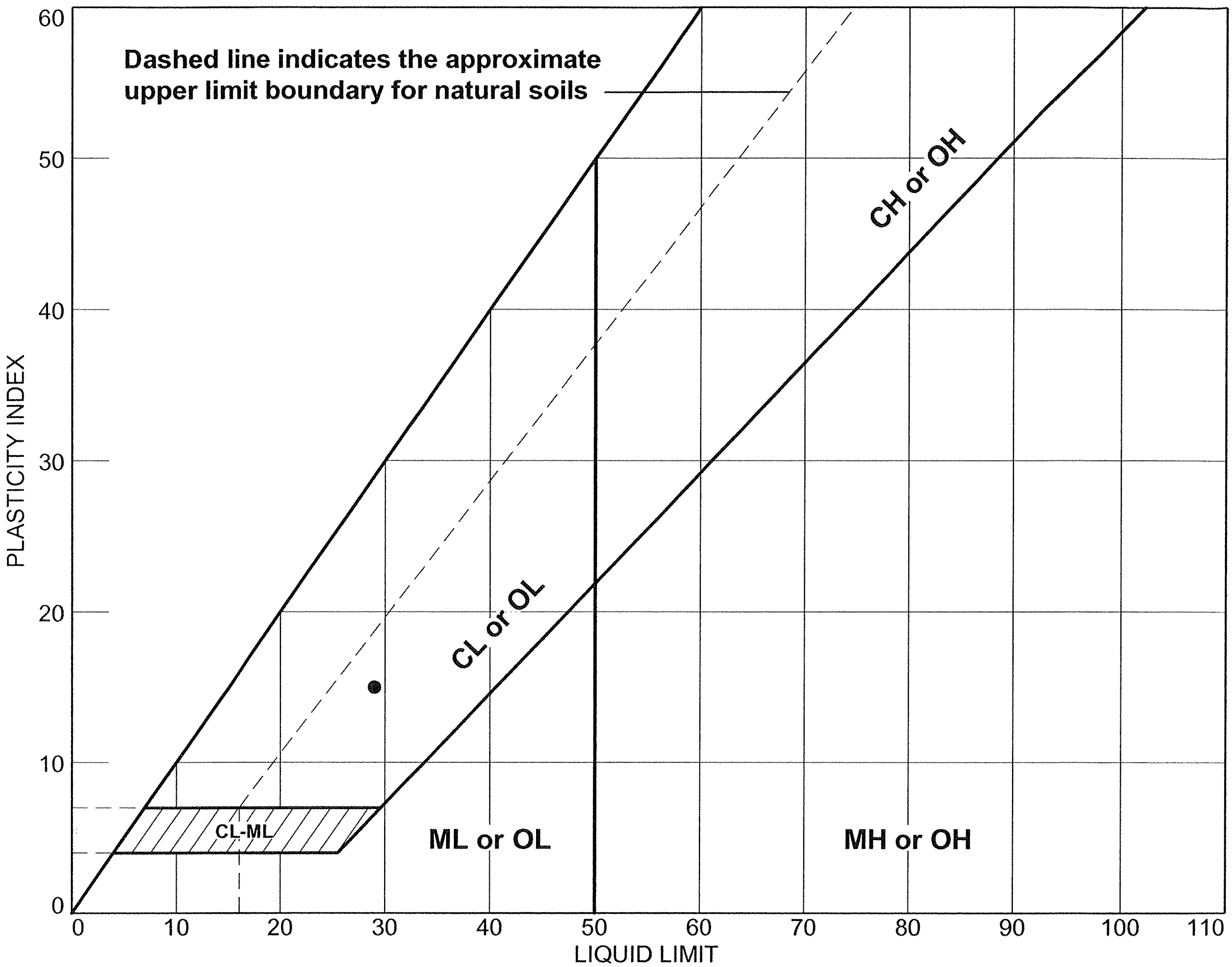
**Project:** Coleto Creek Facility

●**Source of Sample:** Boring 2-1 **Depth:** 26.0-28.0 **Sample Number:** S-14

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST REPORT



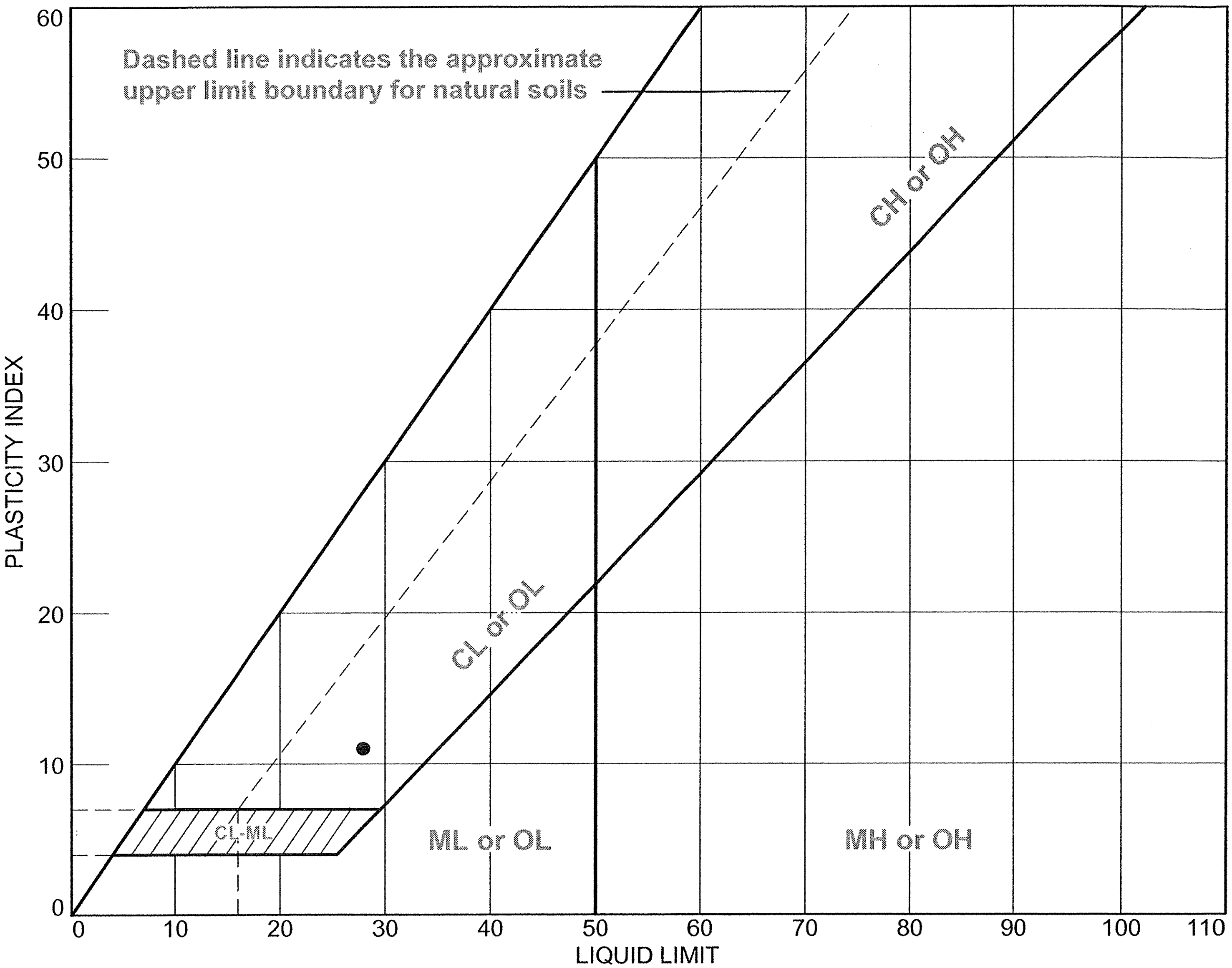

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-17 | 32'-34' | | 14 | 29 | 15 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT

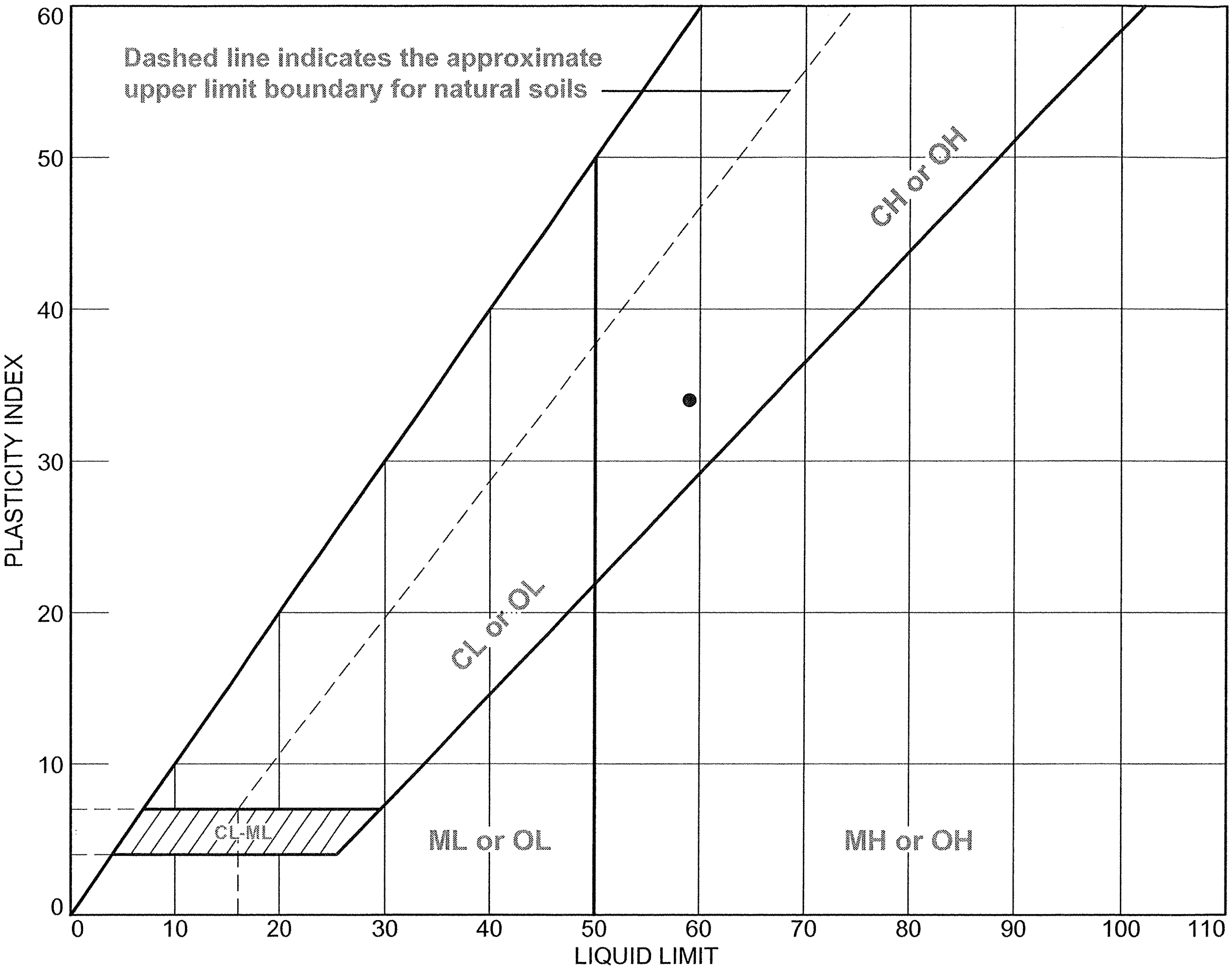



| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-27 | 55.0'-56.6' | | 17 | 28 | 11 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



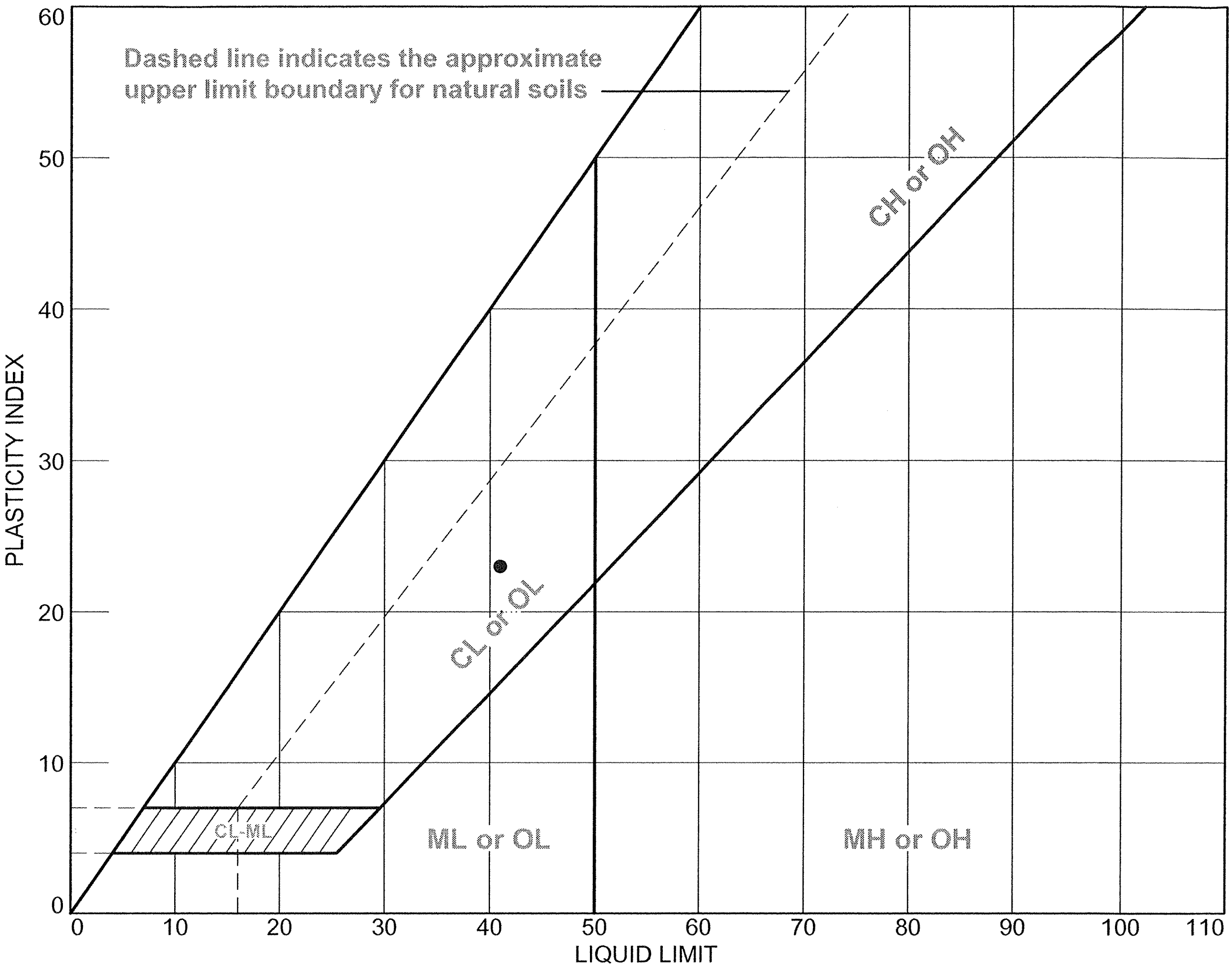

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-33 | 85.0'-86.5' | | 25 | 59 | 34 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



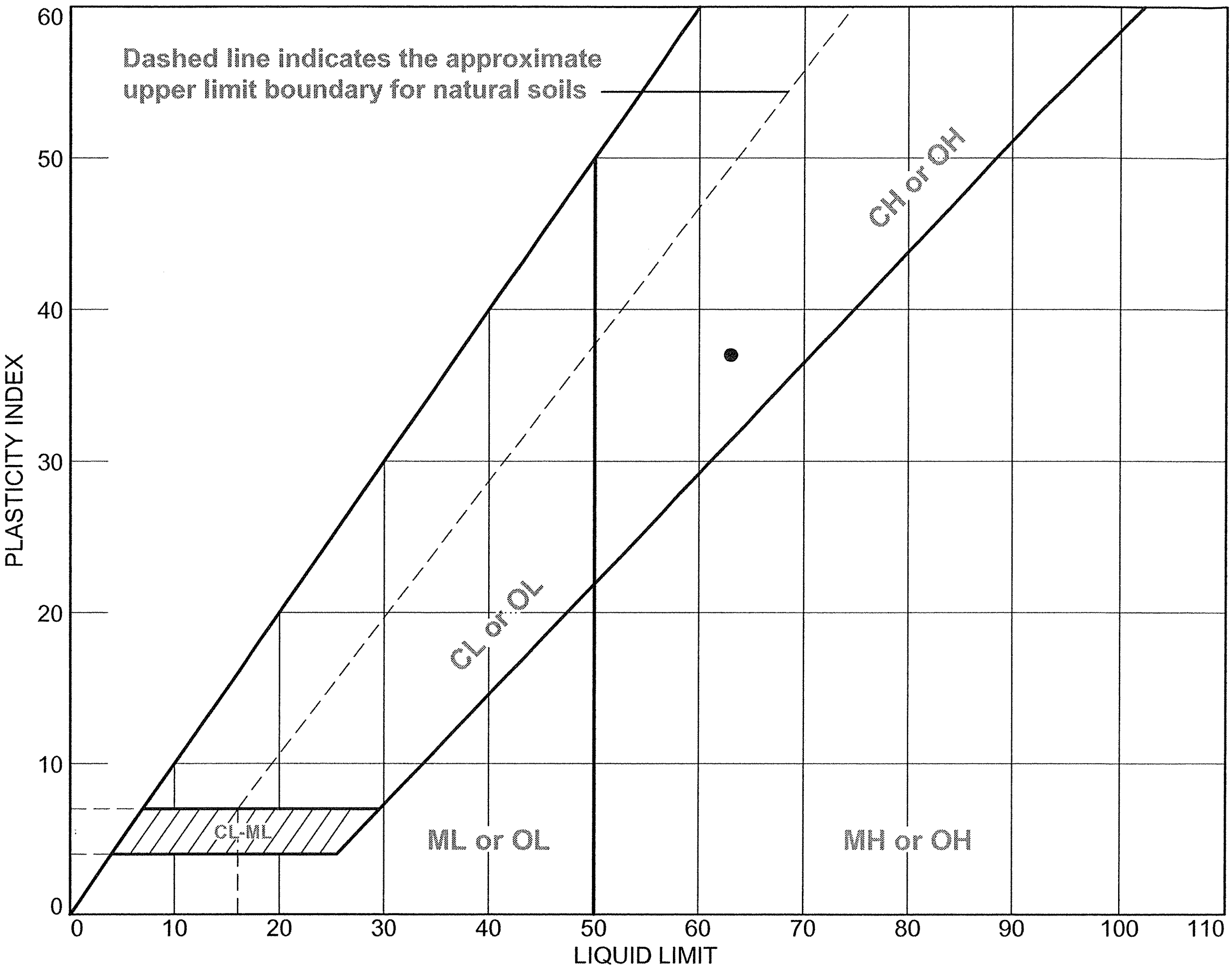

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-2 | B-2-2 S-16 | 59.0'-60.5' | | 18 | 41 | 23 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT

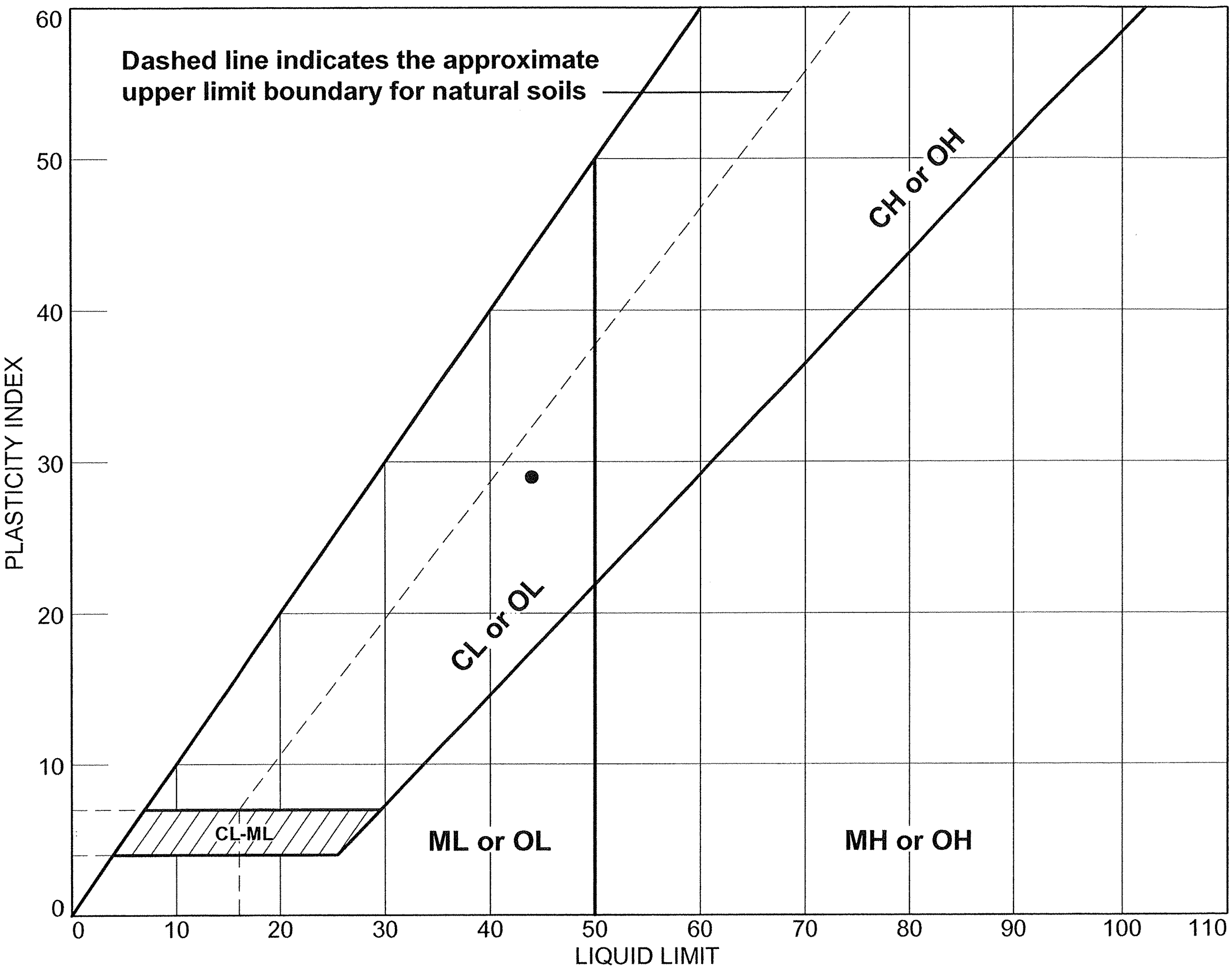



| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-2 | B-2-2 S-18 | 69.0'-70.5' | | 26 | 63 | 37 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




## SOIL DATA

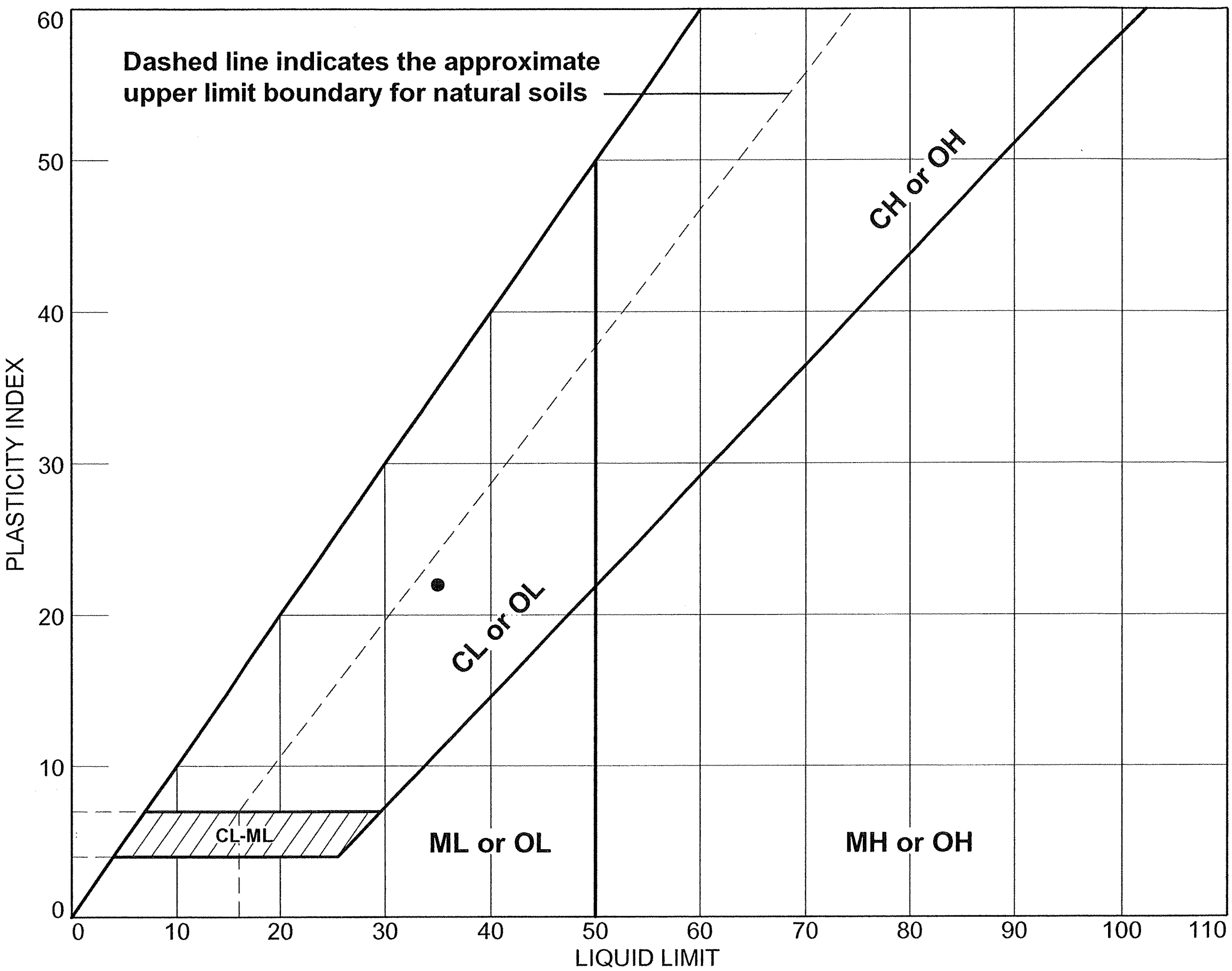
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | B-3-1 | B-3-1 S-9 | 16.0'-17.8' | | 15 | 44 | 29 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-3-1 | B-3-1 S-10 | 18'-20' | | 13 | 35 | 22 | SC |

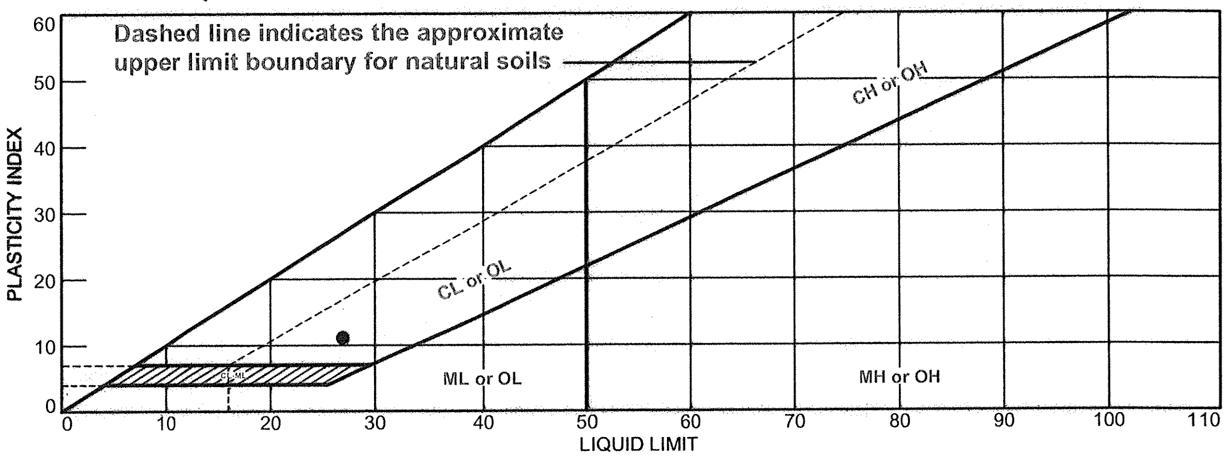
AECOM

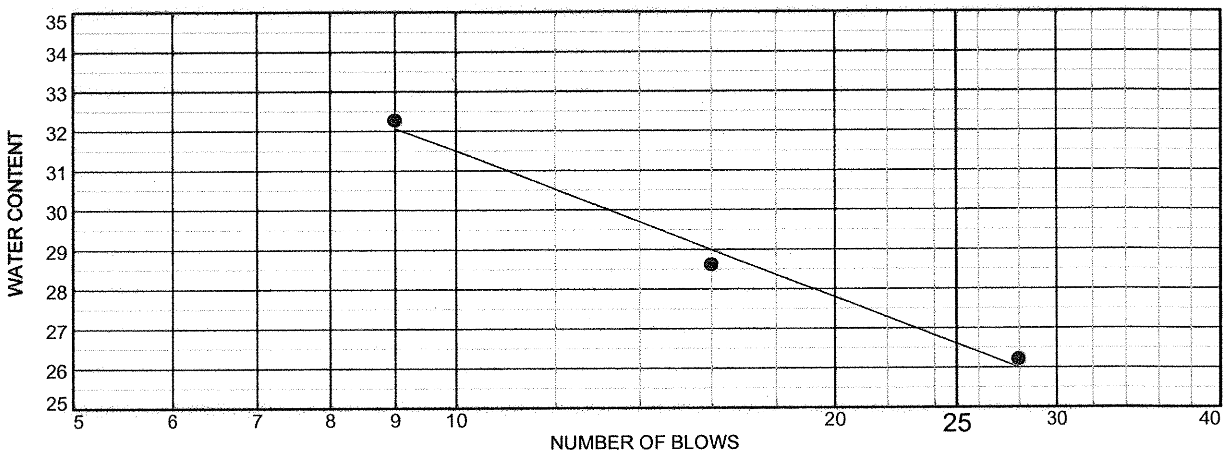
**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | F-M Sand Little Clay Trace Silt - Brownish Gray | 27 | 16 | 11 | 71.8 | 12.8 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

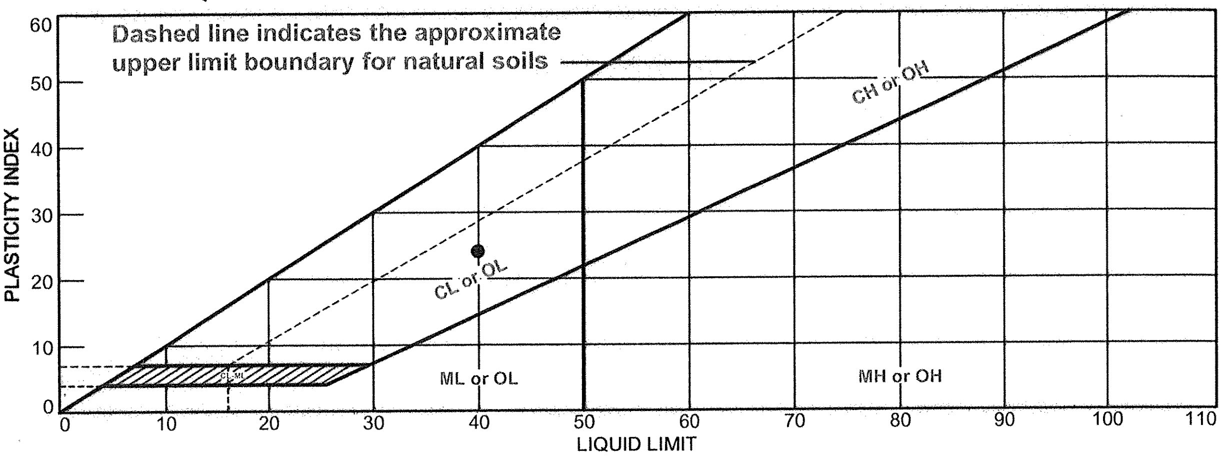
**Project:** Coleto Creek Facility

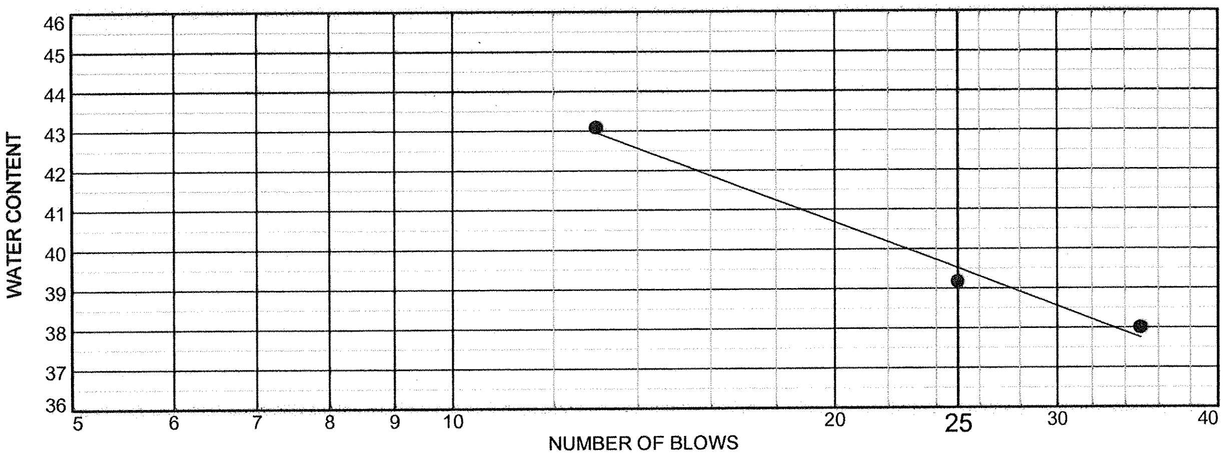
● **Source of Sample:** Boring 4-1 **Depth:** 12.0-14.0 **Sample Number:** S-7

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Clayey F-M Sand Little Silt - Brownish Gray | 40 | 16 | 24 | 85.2 | 46.0 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

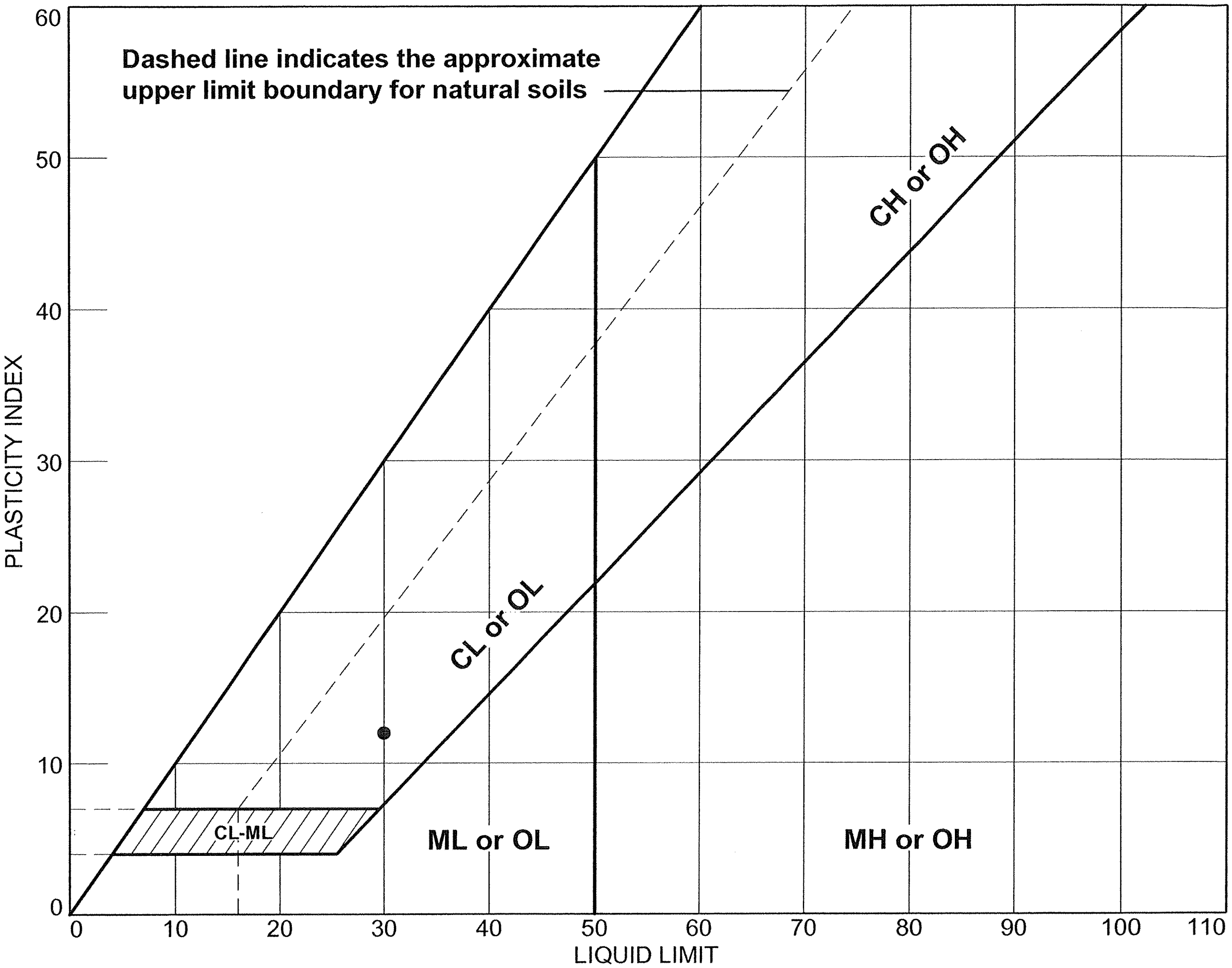
**Project:** Coleto Creek Facility

● **Source of Sample:** Boring 4-1 **Depth:** 24.0-26.0 **Sample Number:** S-13

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-5-1 | B-5-1 S-14 | 26'-27' | | 18 | 30 | 12 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

AECOM

# SPECIFIC GRAVITY OF SOIL SOLIDS
## ASTM D-854

*Laboratory Services Group* *750 Corporate Woods Parkway* *Vernon Hills, IL 60061* *Phone: (847) 279-2500* *Fax: (847) 279-2550*

**AECOM Project No.: 60225561** **Test Date: 12/6/2011**
**Project Name: Coleto Creek Facility**
**IPR-GDP Suez**

Boring/Source: 1-1
Sample No.: 16,17,18
Depth (ft.): 30.0-36.7
Description: Caliche - White

| | Test 1 |
|---|---|
| **Flask No.** | **SG-3** |
| **Wt. Flask + Soil + Water (W2)** | 742.20 |
| **Wt. Flask + Water (W3)** | 677.46 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-4** |
| **Wt. Tare** | 578.17 |
| **Wt. Tare + Soil** | 681.20 |
| **Wt. Soil (W2-W3)** | 103.03 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.690** |

Boring/Source: 4-1
Sample No.: 7
Depth (ft.): 12.0-14.0
Description: F-M Sand Little Clay Trace Silt - Brownish Gray SC

| | Test 2 |
|---|---|
| **Flask No.** | **SG-10** |
| **Wt. Flask + Soil + Water (W2)** | 742.38 |
| **Wt. Flask + Water (W3)** | 668.44 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-4** |
| **Wt. Tare** | 576.51 |
| **Wt. Tare + Soil** | 695.11 |
| **Wt. Soil (W2-W3)** | 118.60 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.655** |

Boring/Source: 4-1
Sample No.: 13
Depth (ft.): 24.0-26.0
Description: Clayey F-M Sand Little Silt - Brownish Gray SC

| | Test 3 |
|---|---|
| **Flask No.** | **SG-1** |
| **Wt. Flask + Soil + Water (W2)** | 726.62 |
| **Wt. Flask + Water (W3)** | 675.32 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-6** |
| **Wt. Tare** | 602.23 |
| **Wt. Tare + Soil** | 684.30 |
| **Wt. Soil (W2-W3)** | 82.07 |
| **(k) Temp. Correction** | 0.99680 |
| **Specific Gravity (Gs)** | **2.659** |

Boring/Source: 2-1
Sample No.: 14
Depth (ft.): 26.0-28..0
Description: Clayey F-M Sand Little Silt - Brownish Gray SC

| | Test 4 |
|---|---|
| **Flask No.** | **SG-2** |
| **Wt. Flask + Soil + Water (W2)** | 738.44 |
| **Wt. Flask + Water (W3)** | 668.48 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-10** |
| **Wt. Tare** | 619.18 |
| **Wt. Tare + Soil** | 730.96 |
| **Wt. Soil (W2-W3)** | 111.78 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.672** |

Technician **BCM** Date **12/2/11**
Calculated **BCM** Date **12/2/11**
Checked **WPQ** Date **12/6/11**

# ORGANIC CONTENT TEST
**ASTM D-2974**
**Method C**

*Laboratory Services Group* | *750 Corporate Woods Parkway, Vernon Hills, Illinois 60061* | *Phone: (847) 279-2500 Fax:(847) 279-2550*

| | |
|---|---|
| **AECOM Project No.:** | 60225561 |
| **Project Name:** | Coleto Creek Facility - IPR-GDP Suez |
| **Date Tested:** | 12/6/2011 |

## Sample Information

| | |
|---|---|
| Boring / Source: | B-4-1 |
| Sample No.: | 13 |
| Depth (ft.): | 24.0-26.0 |

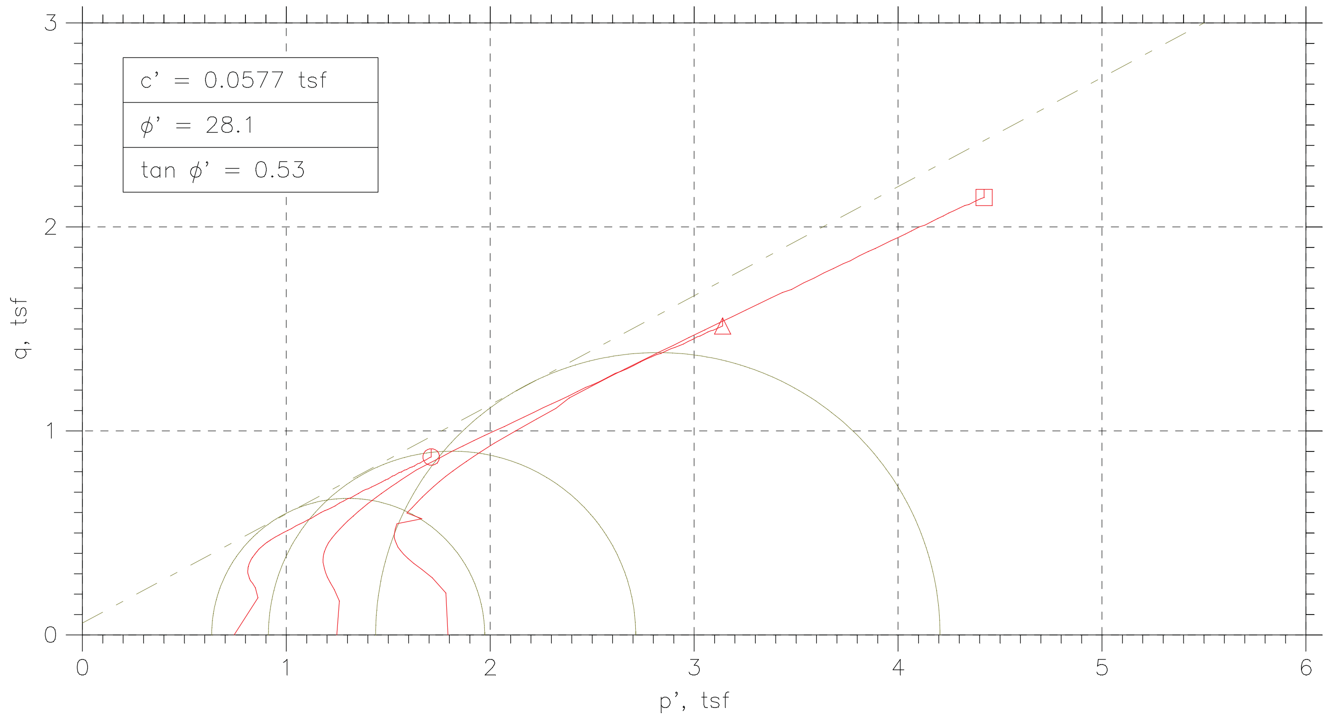
## Organic Content Test Data

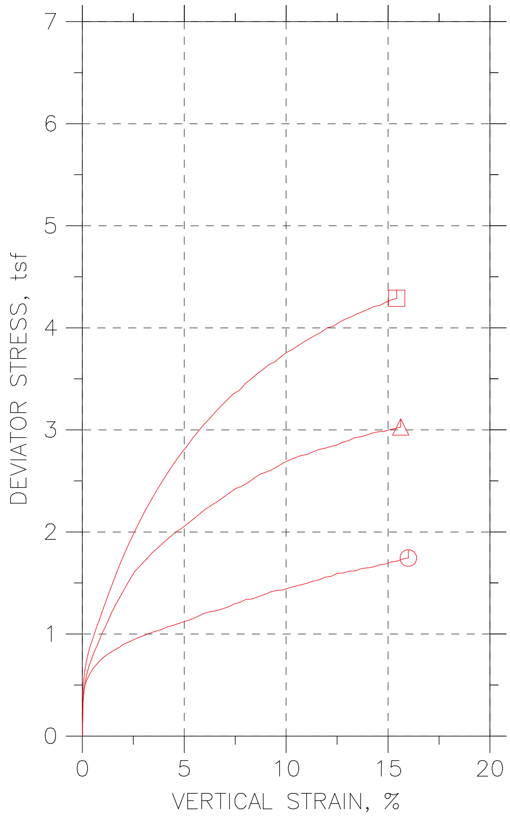
| | |
|---|---|
| Tare No.: | N |
| Tare Wt. (gm): T | 17.71 |
| Wet Wt. + Tare (gm): A+T | 48.27 |
| Dry Wt. + Tare (gm): B+T | 44.70 |
| **Moisture Content (%):** | **13.23** |
| Wt. of Ash + Tare (gm): D+T | 44.65 |
| Percent Ash: (D-T/B-T)x100 = E | 99.81 |
| **Organic Content (%):** | **0.19** |

** Note: Test performed by heating the sample to 440 degrees centigrade for a period of three hours.

# TRIAXIAL COMPRESSION TEST REPORT

AECOM



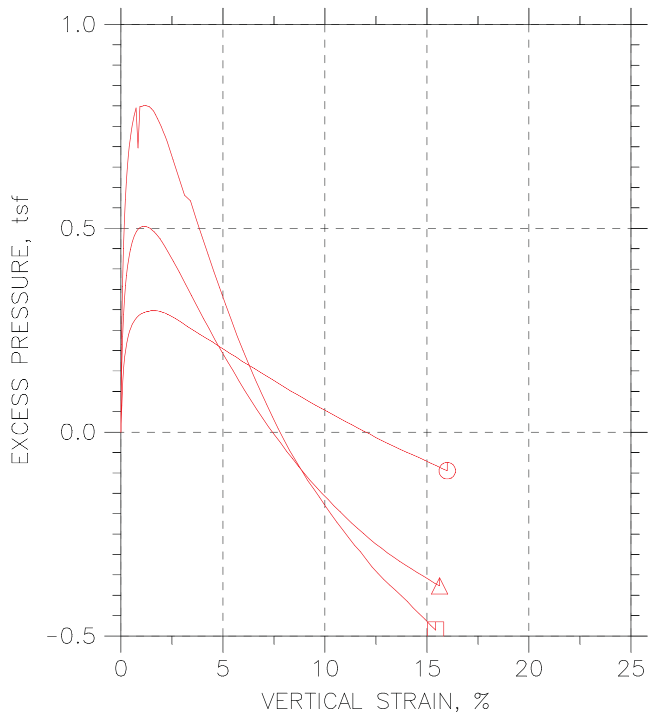



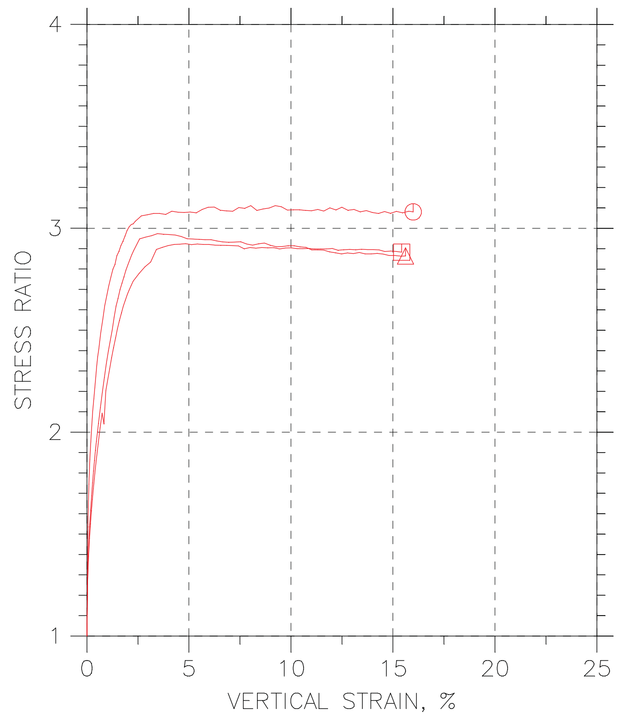

| | | | | | |
|---|---|---|---|---|---|
| Symbol | | ○ | △ | □ | |
| Test No. | | 10.4 PSI | 17.4 PSI | 24.3 PSI | |
| Initial | Diameter, in | 2.8362 | 2.8441 | 2.8457 | |
| | Height, in | 5.9134 | 6.0831 | 6.0173 | |
| | Water Content, % | 21.81 | 14.93 | 13.70 | |
| | Dry Density, pcf | 105.5 | 115.9 | 120.2 | |
| | Saturation, % | 100.17 | 90.88 | 94.34 | |
| | Void Ratio | 0.58172 | 0.4389 | 0.38805 | |
| Before Shear | Water Content, % | 21.39 | 15.80 | 14.06 | |
| | Dry Density, pcf | 106.1 | 117.3 | 121.3 | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.57165 | 0.42209 | 0.37567 | |
| | Back Press., tsf | 5.0449 | 5.0454 | 5.0404 | |
| Minor Prin. Stress, tsf | | 0.74395 | 1.2474 | 1.7924 | |
| Max. Dev. Stress, tsf | | 1.7444 | 3.0288 | 4.2889 | |
| Time to Failure, min | | 1612.1 | 1613.1 | 1614.3 | |
| Strain Rate, %/min | | 0.02 | 0.02 | 0.03 | |
| B-Value | | .98 | .97 | .95 | |
| Measured Specific Gravity | | 2.67 | 2.67 | 2.67 | |
| Liquid Limit | | 42 | 42 | 42 | |
| Plastic Limit | | 24 | 24 | 24 | |
| Plasticity Index | | 18 | 18 | 18 | |
| Failure Sketch | |  |  |  | |

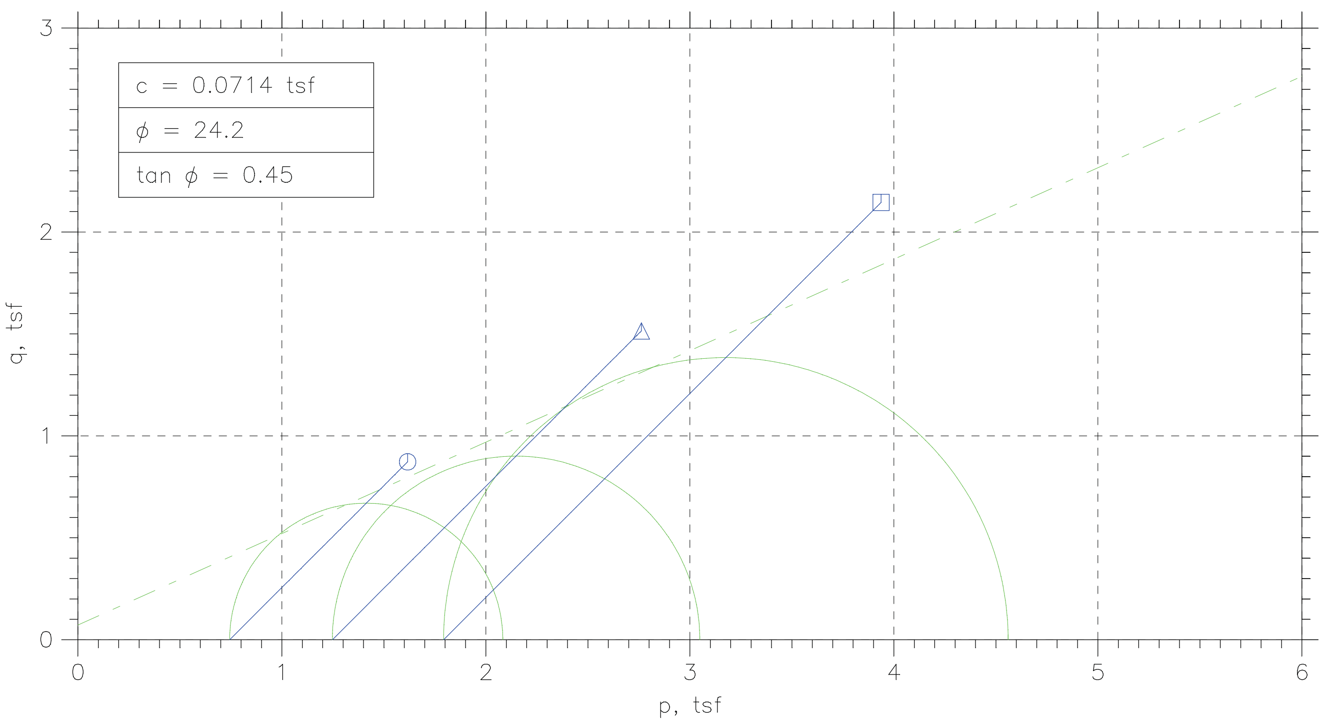
| | |
|---|---|
| Project: COLETO CREEK FACILITY | |
| Location: IPR-GDF SUEZ | |
| Project No.: 60225561 | |
| Boring No.: B-2-1 S-14 | |
| Sample Type: 3" ST | |
| Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | |

Mon, 12-DEC-2011 10:07:19

# TRIAXIAL COMPRESSION TEST REPORT




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-2-1 S-14 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-14 | Test Date: 12/5/11 | Depth: 26.0'-28.0' |
| Test No.: B-2-1 S-14 | Sample Type: 3" ST | Elevation: ---- |
| Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | | |
| | | |

Mon, 12-DEC-2011 10:08:34

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY  SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO  TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.91 in
Specimen Area: 6.32 in^2
Specimen Volume: 37.36 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3179 | 0 | 0 | 5.0449 | 5.7888 | 5.7888 |
| 2 | 5.0001 | 0.045204 | 6.3207 | 31.887 | 0.36323 | 5.1097 | 5.7888 | 6.152 |
| 3 | 10 | 0.094782 | 6.3239 | 40.44 | 0.46042 | 5.1704 | 5.7888 | 6.2492 |
| 4 | 15 | 0.14144 | 6.3268 | 44.344 | 0.50464 | 5.2061 | 5.7888 | 6.2934 |
| 5 | 20 | 0.18956 | 6.3299 | 46.761 | 0.53189 | 5.2306 | 5.7888 | 6.3207 |
| 6 | 25 | 0.23768 | 6.3329 | 48.992 | 0.557 | 5.2487 | 5.7888 | 6.3458 |
| 7 | 30.001 | 0.28726 | 6.3361 | 51.038 | 0.57997 | 5.2633 | 5.7888 | 6.3688 |
| 8 | 35.001 | 0.33538 | 6.3391 | 52.618 | 0.59764 | 5.275 | 5.7888 | 6.3864 |
| 9 | 40.001 | 0.3835 | 6.3422 | 54.012 | 0.61318 | 5.2849 | 5.7888 | 6.402 |
| 10 | 45.001 | 0.43308 | 6.3453 | 55.5 | 0.62975 | 5.2931 | 5.7888 | 6.4186 |
| 11 | 50.001 | 0.4812 | 6.3484 | 57.08 | 0.64737 | 5.3001 | 5.7888 | 6.4362 |
| 12 | 55.001 | 0.53078 | 6.3516 | 58.289 | 0.66075 | 5.3066 | 5.7888 | 6.4495 |
| 13 | 60.001 | 0.5789 | 6.3546 | 59.311 | 0.67202 | 5.3112 | 5.7888 | 6.4608 |
| 14 | 70.001 | 0.6766 | 6.3609 | 61.636 | 0.69766 | 5.3194 | 5.7888 | 6.4865 |
| 15 | 80.001 | 0.77576 | 6.3673 | 63.588 | 0.71904 | 5.3258 | 5.7888 | 6.5078 |
| 16 | 90.002 | 0.87346 | 6.3735 | 65.633 | 0.74144 | 5.3311 | 5.7888 | 6.5302 |
| 17 | 100 | 0.97115 | 6.3798 | 67.213 | 0.75854 | 5.3346 | 5.7888 | 6.5473 |
| 18 | 110 | 1.0703 | 6.3862 | 68.794 | 0.7756 | 5.3369 | 5.7888 | 6.5644 |
| 19 | 120 | 1.1695 | 6.3926 | 70.281 | 0.79158 | 5.3387 | 5.7888 | 6.5804 |
| 20 | 130 | 1.2701 | 6.3991 | 71.676 | 0.80646 | 5.3404 | 5.7888 | 6.5953 |
| 21 | 140 | 1.3707 | 6.4057 | 72.605 | 0.81609 | 5.341 | 5.7888 | 6.6049 |
| 22 | 150 | 1.4699 | 6.4121 | 74.093 | 0.83197 | 5.3428 | 5.7888 | 6.6208 |
| 23 | 160 | 1.5676 | 6.4185 | 75.023 | 0.84157 | 5.3428 | 5.7888 | 6.6304 |
| 24 | 170 | 1.6682 | 6.425 | 76.231 | 0.85426 | 5.3428 | 5.7888 | 6.6431 |
| 25 | 180 | 1.7688 | 6.4316 | 77.254 | 0.86483 | 5.3422 | 5.7888 | 6.6536 |
| 26 | 190 | 1.8694 | 6.4382 | 78.462 | 0.87746 | 5.3416 | 5.7888 | 6.6663 |
| 27 | 200 | 1.9715 | 6.4449 | 79.95 | 0.89316 | 5.3399 | 5.7888 | 6.682 |
| 28 | 210 | 2.0706 | 6.4514 | 81.065 | 0.90471 | 5.3381 | 5.7888 | 6.6935 |
| 29 | 220 | 2.1712 | 6.4581 | 81.809 | 0.91207 | 5.3369 | 5.7888 | 6.7009 |
| 30 | 230 | 2.2719 | 6.4647 | 82.553 | 0.91942 | 5.334 | 5.7888 | 6.7082 |
| 31 | 240 | 2.3725 | 6.4714 | 83.575 | 0.92985 | 5.3317 | 5.7888 | 6.7186 |
| 32 | 270 | 2.6699 | 6.4912 | 86.457 | 0.95898 | 5.3235 | 5.7888 | 6.7478 |
| 33 | 300 | 2.9674 | 6.5111 | 88.688 | 0.98072 | 5.3142 | 5.7888 | 6.7695 |
| 34 | 330 | 3.2678 | 6.5313 | 91.198 | 1.0054 | 5.3036 | 5.7888 | 6.7942 |
| 35 | 360 | 3.5609 | 6.5511 | 93.244 | 1.0248 | 5.2943 | 5.7888 | 6.8136 |
| 36 | 390 | 3.8584 | 6.5714 | 95.103 | 1.042 | 5.2849 | 5.7888 | 6.8308 |
| 37 | 420 | 4.1602 | 6.5921 | 97.892 | 1.0692 | 5.2756 | 5.7888 | 6.858 |
| 38 | 450 | 4.4621 | 6.6129 | 99.658 | 1.0851 | 5.2668 | 5.7888 | 6.8739 |
| 39 | 480 | 4.761 | 6.6337 | 101.8 | 1.1049 | 5.2569 | 5.7888 | 6.8937 |
| 40 | 510 | 5.0585 | 6.6545 | 104.03 | 1.1256 | 5.2476 | 5.7888 | 6.9144 |
| 41 | 540 | 5.3574 | 6.6755 | 106.07 | 1.1441 | 5.2376 | 5.7888 | 6.9329 |
| 42 | 570 | 5.6505 | 6.6962 | 108.95 | 1.1715 | 5.2289 | 5.7888 | 6.9603 |
| 43 | 600 | 5.9465 | 6.7173 | 111.93 | 1.1997 | 5.2184 | 5.7888 | 6.9885 |
| 44 | 630 | 6.244 | 6.7386 | 114.07 | 1.2188 | 5.2096 | 5.7888 | 7.0076 |
| 45 | 660 | 6.5458 | 6.7604 | 115.28 | 1.2277 | 5.2008 | 5.7888 | 7.0165 |
| 46 | 690 | 6.8477 | 6.7823 | 117.32 | 1.2455 | 5.1915 | 5.7888 | 7.0343 |
| 47 | 720 | 7.1466 | 6.8041 | 119.46 | 1.2641 | 5.1821 | 5.7888 | 7.0529 |
| 48 | 750 | 7.4441 | 6.826 | 122.62 | 1.2934 | 5.1734 | 5.7888 | 7.0822 |
| 49 | 780 | 7.7386 | 6.8478 | 124.67 | 1.3108 | 5.164 | 5.7888 | 7.0996 |
| 50 | 810 | 8.0332 | 6.8697 | 127.73 | 1.3387 | 5.1547 | 5.7888 | 7.1275 |
| 51 | 840 | 8.3306 | 6.892 | 128.57 | 1.3432 | 5.1453 | 5.7888 | 7.132 |
| 52 | 870 | 8.6296 | 6.9146 | 131.08 | 1.3649 | 5.1372 | 5.7888 | 7.1537 |
| 53 | 900 | 8.9329 | 6.9376 | 133.59 | 1.3864 | 5.1284 | 5.7888 | 7.1752 |
| 54 | 930 | 9.2333 | 6.9605 | 136.57 | 1.4126 | 5.1196 | 5.7888 | 7.2014 |
| 55 | 960 | 9.5336 | 6.9837 | 138.42 | 1.4271 | 5.1109 | 5.7888 | 7.2159 |
| 56 | 990 | 9.8282 | 7.0065 | 139.35 | 1.432 | 5.1033 | 5.7888 | 7.2208 |
| 57 | 1020 | 10.121 | 7.0293 | 141.59 | 1.4502 | 5.0951 | 5.7888 | 7.239 |
| 58 | 1050 | 10.419 | 7.0527 | 143.72 | 1.4673 | 5.0869 | 5.7888 | 7.2561 |
| 59 | 1080 | 10.718 | 7.0763 | 145.68 | 1.4822 | 5.0787 | 5.7888 | 7.271 |
| 60 | 1110 | 11.017 | 7.1 | 147.72 | 1.498 | 5.0706 | 5.7888 | 7.2868 |
| 61 | 1140 | 11.317 | 7.1241 | 150.23 | 1.5183 | 5.063 | 5.7888 | 7.3071 |
| 62 | 1170 | 11.613 | 7.148 | 151.9 | 1.5301 | 5.0548 | 5.7888 | 7.3189 |
| 63 | 1200 | 11.91 | 7.1721 | 155.16 | 1.5576 | 5.0472 | 5.7888 | 7.3464 |
| 64 | 1230 | 12.205 | 7.1962 | 156.37 | 1.5645 | 5.0402 | 5.7888 | 7.3533 |
| 65 | 1260 | 12.5 | 7.2204 | 159.71 | 1.5926 | 5.0314 | 5.7888 | 7.3814 |
| 66 | 1290 | 12.794 | 7.2448 | 160.74 | 1.5974 | 5.0238 | 5.7888 | 7.3862 |
| 67 | 1320 | 13.092 | 7.2696 | 163.06 | 1.615 | 5.0168 | 5.7888 | 7.4038 |
| 68 | 1350 | 13.395 | 7.295 | 164.18 | 1.6204 | 5.0098 | 5.7888 | 7.4092 |
| 69 | 1380 | 13.697 | 7.3205 | 166.87 | 1.6412 | 5.0022 | 5.7888 | 7.43 |
| 70 | 1410 | 13.996 | 7.346 | 168.08 | 1.6474 | 4.9958 | 5.7888 | 7.4362 |
| 71 | 1440 | 14.293 | 7.3715 | 169.66 | 1.6571 | 4.9894 | 5.7888 | 7.4459 |
| 72 | 1470 | 14.589 | 7.397 | 172.36 | 1.6777 | 4.9829 | 5.7888 | 7.4665 |
| 73 | 1500 | 14.881 | 7.4224 | 173.75 | 1.6855 | 4.9759 | 5.7888 | 7.4743 |
| 74 | 1530 | 15.174 | 7.448 | 176.63 | 1.7075 | 4.9689 | 5.7888 | 7.4963 |
| 75 | 1560 | 15.473 | 7.4744 | 178.03 | 1.7149 | 4.9625 | 5.7888 | 7.5037 |
| 76 | 1590 | 15.773 | 7.501 | 181 | 1.7374 | 4.9549 | 5.7888 | 7.5262 |
| 77 | 1612.1 | 15.995 | 7.5208 | 182.21 | 1.7444 | 4.9502 | 5.7888 | 7.5332 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.91 in
Specimen Area: 6.32 in^2
Specimen Volume: 37.36 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.7888 | 5.7888 | 0 | 0.000 | 0.74395 | 0.74395 | 1.000 | 0.74395 | 0 |
| 2 | 0.05 | 6.152 | 5.7888 | 0.064842 | 0.179 | 1.0423 | 0.6791 | 1.535 | 0.86072 | 0.18161 |
| 3 | 0.09 | 6.2492 | 5.7888 | 0.1256 | 0.273 | 1.0788 | 0.61835 | 1.745 | 0.84856 | 0.23021 |
| 4 | 0.14 | 6.2934 | 5.7888 | 0.16123 | 0.319 | 1.0874 | 0.58272 | 1.866 | 0.83504 | 0.25232 |
| 5 | 0.19 | 6.3207 | 5.7888 | 0.18576 | 0.349 | 1.0901 | 0.55818 | 1.953 | 0.82413 | 0.26595 |
| 6 | 0.24 | 6.3458 | 5.7888 | 0.20387 | 0.366 | 1.0971 | 0.54007 | 2.031 | 0.81857 | 0.2785 |
| 7 | 0.29 | 6.3688 | 5.7888 | 0.21848 | 0.377 | 1.1054 | 0.52547 | 2.104 | 0.81545 | 0.28998 |
| 8 | 0.34 | 6.3864 | 5.7888 | 0.23016 | 0.385 | 1.1114 | 0.51379 | 2.163 | 0.8126 | 0.29882 |
| 9 | 0.38 | 6.402 | 5.7888 | 0.24009 | 0.392 | 1.117 | 0.50385 | 2.217 | 0.81044 | 0.30659 |
| 10 | 0.43 | 6.4186 | 5.7888 | 0.24827 | 0.394 | 1.1254 | 0.49568 | 2.270 | 0.81055 | 0.31488 |
| 11 | 0.48 | 6.4362 | 5.7888 | 0.25528 | 0.394 | 1.136 | 0.48867 | 2.325 | 0.81235 | 0.32369 |
| 12 | 0.53 | 6.4495 | 5.7888 | 0.26171 | 0.396 | 1.143 | 0.48224 | 2.370 | 0.81262 | 0.33037 |
| 13 | 0.58 | 6.4608 | 5.7888 | 0.26638 | 0.396 | 1.1496 | 0.47757 | 2.407 | 0.81358 | 0.33601 |
| 14 | 0.68 | 6.4865 | 5.7888 | 0.27456 | 0.394 | 1.1671 | 0.46939 | 2.486 | 0.81822 | 0.34883 |
| 15 | 0.78 | 6.5078 | 5.7888 | 0.28098 | 0.391 | 1.182 | 0.46296 | 2.553 | 0.82248 | 0.35952 |
| 16 | 0.87 | 6.5302 | 5.7888 | 0.28624 | 0.386 | 1.1991 | 0.45771 | 2.620 | 0.82842 | 0.37072 |
| 17 | 0.97 | 6.5473 | 5.7888 | 0.28975 | 0.382 | 1.2127 | 0.4542 | 2.670 | 0.83347 | 0.37927 |
| 18 | 1.07 | 6.5644 | 5.7888 | 0.29208 | 0.377 | 1.2275 | 0.45186 | 2.716 | 0.83966 | 0.3878 |
| 19 | 1.17 | 6.5804 | 5.7888 | 0.29384 | 0.371 | 1.2417 | 0.45011 | 2.759 | 0.8459 | 0.39579 |
| 20 | 1.27 | 6.5953 | 5.7888 | 0.29559 | 0.367 | 1.2548 | 0.44836 | 2.799 | 0.85159 | 0.40323 |
| 21 | 1.37 | 6.6049 | 5.7888 | 0.29617 | 0.363 | 1.2639 | 0.44777 | 2.823 | 0.85582 | 0.40804 |
| 22 | 1.47 | 6.6208 | 5.7888 | 0.29792 | 0.358 | 1.278 | 0.44602 | 2.865 | 0.86201 | 0.41599 |
| 23 | 1.57 | 6.6304 | 5.7888 | 0.29792 | 0.354 | 1.2876 | 0.44602 | 2.887 | 0.86681 | 0.42079 |
| 24 | 1.67 | 6.6431 | 5.7888 | 0.29792 | 0.349 | 1.3003 | 0.44602 | 2.915 | 0.87315 | 0.42713 |
| 25 | 1.77 | 6.6536 | 5.7888 | 0.29734 | 0.344 | 1.3114 | 0.44661 | 2.936 | 0.87902 | 0.43242 |
| 26 | 1.87 | 6.6663 | 5.7888 | 0.29676 | 0.338 | 1.3247 | 0.44719 | 2.962 | 0.88592 | 0.43873 |
| 27 | 1.97 | 6.682 | 5.7888 | 0.295 | 0.330 | 1.3421 | 0.44894 | 2.989 | 0.89553 | 0.44658 |
| 28 | 2.07 | 6.6935 | 5.7888 | 0.29325 | 0.324 | 1.3554 | 0.4507 | 3.007 | 0.90305 | 0.45236 |
| 29 | 2.17 | 6.7009 | 5.7888 | 0.29208 | 0.320 | 1.3639 | 0.45186 | 3.018 | 0.9079 | 0.45604 |
| 30 | 2.27 | 6.7082 | 5.7888 | 0.28916 | 0.315 | 1.3742 | 0.45478 | 3.022 | 0.91449 | 0.45971 |
| 31 | 2.37 | 6.7186 | 5.7888 | 0.28683 | 0.308 | 1.387 | 0.45712 | 3.034 | 0.92205 | 0.46492 |
| 32 | 2.67 | 6.7478 | 5.7888 | 0.27865 | 0.291 | 1.4243 | 0.4653 | 3.061 | 0.94479 | 0.47949 |
| 33 | 2.97 | 6.7695 | 5.7888 | 0.2693 | 0.275 | 1.4554 | 0.47465 | 3.066 | 0.96501 | 0.49036 |
| 34 | 3.27 | 6.7942 | 5.7888 | 0.25879 | 0.257 | 1.4905 | 0.48516 | 3.072 | 0.98784 | 0.50268 |
| 35 | 3.56 | 6.8136 | 5.7888 | 0.24944 | 0.243 | 1.5193 | 0.49451 | 3.072 | 1.0069 | 0.51239 |
| 36 | 3.86 | 6.8308 | 5.7888 | 0.24009 | 0.230 | 1.5459 | 0.50385 | 3.068 | 1.0249 | 0.521 |
| 37 | 4.16 | 6.858 | 5.7888 | 0.23075 | 0.216 | 1.5824 | 0.5132 | 3.083 | 1.0478 | 0.5346 |
| 38 | 4.46 | 6.8739 | 5.7888 | 0.22198 | 0.205 | 1.607 | 0.52196 | 3.079 | 1.0645 | 0.54253 |
| 39 | 4.76 | 6.8937 | 5.7888 | 0.21205 | 0.192 | 1.6368 | 0.53189 | 3.077 | 1.0843 | 0.55243 |
| 40 | 5.06 | 6.9144 | 5.7888 | 0.20271 | 0.180 | 1.6668 | 0.54124 | 3.080 | 1.104 | 0.56278 |
| 41 | 5.36 | 6.9329 | 5.7888 | 0.19277 | 0.168 | 1.6952 | 0.55117 | 3.076 | 1.1232 | 0.57204 |
| 42 | 5.65 | 6.9603 | 5.7888 | 0.18401 | 0.157 | 1.7314 | 0.55993 | 3.092 | 1.1457 | 0.58576 |
| 43 | 5.95 | 6.9885 | 5.7888 | 0.1735 | 0.145 | 1.7702 | 0.57045 | 3.103 | 1.1703 | 0.59986 |
| 44 | 6.24 | 7.0076 | 5.7888 | 0.16473 | 0.135 | 1.798 | 0.57921 | 3.104 | 1.1886 | 0.60939 |
| 45 | 6.55 | 7.0165 | 5.7888 | 0.15597 | 0.127 | 1.8157 | 0.58797 | 3.088 | 1.2018 | 0.61386 |
| 46 | 6.85 | 7.0343 | 5.7888 | 0.14663 | 0.118 | 1.8428 | 0.59732 | 3.085 | 1.2201 | 0.62274 |
| 47 | 7.15 | 7.0529 | 5.7888 | 0.13728 | 0.109 | 1.8708 | 0.60667 | 3.084 | 1.2387 | 0.63205 |
| 48 | 7.44 | 7.0822 | 5.7888 | 0.12852 | 0.099 | 1.9088 | 0.61543 | 3.102 | 1.2621 | 0.6467 |
| 49 | 7.74 | 7.0996 | 5.7888 | 0.11917 | 0.091 | 1.9356 | 0.62478 | 3.098 | 1.2802 | 0.65539 |
| 50 | 8.03 | 7.1275 | 5.7888 | 0.10982 | 0.082 | 1.9729 | 0.63412 | 3.111 | 1.3035 | 0.66937 |
| 51 | 8.33 | 7.132 | 5.7888 | 0.10048 | 0.075 | 1.9866 | 0.64347 | 3.087 | 1.315 | 0.67158 |
| 52 | 8.63 | 7.1537 | 5.7888 | 0.092298 | 0.068 | 2.0166 | 0.65165 | 3.095 | 1.3341 | 0.68246 |
| 53 | 8.93 | 7.1752 | 5.7888 | 0.083536 | 0.060 | 2.0468 | 0.66041 | 3.099 | 1.3536 | 0.69322 |
| 54 | 9.23 | 7.2014 | 5.7888 | 0.074773 | 0.053 | 2.0818 | 0.66917 | 3.111 | 1.3755 | 0.70632 |
| 55 | 9.53 | 7.2159 | 5.7888 | 0.066011 | 0.046 | 2.1051 | 0.67794 | 3.105 | 1.3915 | 0.71356 |
| 56 | 9.83 | 7.2208 | 5.7888 | 0.058417 | 0.041 | 2.1176 | 0.68553 | 3.089 | 1.4015 | 0.71602 |
| 57 | 10.12 | 7.239 | 5.7888 | 0.050238 | 0.035 | 2.1439 | 0.69371 | 3.091 | 1.4188 | 0.72512 |
| 58 | 10.42 | 7.2561 | 5.7888 | 0.04206 | 0.029 | 2.1691 | 0.70189 | 3.090 | 1.4355 | 0.73363 |
| 59 | 10.72 | 7.271 | 5.7888 | 0.033882 | 0.023 | 2.1923 | 0.71006 | 3.087 | 1.4512 | 0.74111 |
| 60 | 11.02 | 7.2868 | 5.7888 | 0.025703 | 0.017 | 2.2162 | 0.71824 | 3.086 | 1.4672 | 0.749 |
| 61 | 11.32 | 7.3071 | 5.7888 | 0.018109 | 0.012 | 2.2442 | 0.72584 | 3.092 | 1.485 | 0.75916 |
| 62 | 11.61 | 7.3189 | 5.7888 | 0.0099308 | 0.006 | 2.2641 | 0.73402 | 3.085 | 1.4991 | 0.76505 |
| 63 | 11.91 | 7.3464 | 5.7888 | 0.0023367 | 0.002 | 2.2992 | 0.74161 | 3.100 | 1.5204 | 0.77881 |
| 64 | 12.21 | 7.3533 | 5.7888 | -0.0046733 | -0.003 | 2.3131 | 0.74862 | 3.090 | 1.5309 | 0.78225 |
| 65 | 12.50 | 7.3814 | 5.7888 | -0.013436 | -0.008 | 2.35 | 0.75738 | 3.103 | 1.5537 | 0.79631 |
| 66 | 12.79 | 7.3862 | 5.7888 | -0.02103 | -0.013 | 2.3624 | 0.76498 | 3.088 | 1.5637 | 0.79871 |
| 67 | 13.09 | 7.4038 | 5.7888 | -0.02804 | -0.017 | 2.387 | 0.77199 | 3.092 | 1.5795 | 0.8075 |
| 68 | 13.39 | 7.4092 | 5.7888 | -0.03505 | -0.022 | 2.3994 | 0.779 | 3.080 | 1.5892 | 0.81019 |
| 69 | 13.70 | 7.43 | 5.7888 | -0.042644 | -0.026 | 2.4278 | 0.78659 | 3.087 | 1.6072 | 0.82062 |
| 70 | 14.00 | 7.4362 | 5.7888 | -0.04907 | -0.030 | 2.4404 | 0.79302 | 3.077 | 1.6167 | 0.8237 |
| 71 | 14.29 | 7.4459 | 5.7888 | -0.055496 | -0.033 | 2.4566 | 0.79944 | 3.073 | 1.628 | 0.82857 |
| 72 | 14.59 | 7.4665 | 5.7888 | -0.061922 | -0.037 | 2.4835 | 0.80587 | 3.082 | 1.6447 | 0.83883 |
| 73 | 14.88 | 7.4743 | 5.7888 | -0.068932 | -0.041 | 2.4983 | 0.81288 | 3.073 | 1.6556 | 0.84273 |
| 74 | 15.17 | 7.4963 | 5.7888 | -0.075942 | -0.044 | 2.5274 | 0.81989 | 3.083 | 1.6736 | 0.85376 |
| 75 | 15.47 | 7.5037 | 5.7888 | -0.082367 | -0.048 | 2.5412 | 0.82631 | 3.075 | 1.6838 | 0.85746 |
| 76 | 15.77 | 7.5262 | 5.7888 | -0.089961 | -0.052 | 2.5713 | 0.83391 | 3.083 | 1.7026 | 0.86869 |
| 77 | 15.99 | 7.5332 | 5.7888 | -0.094635 | -0.054 | 2.583 | 0.83858 | 3.080 | 1.7108 | 0.87219 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.08 in
Specimen Area: 6.35 in^2
Specimen Volume: 38.65 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.353 | 0 | 0 | 5.0454 | 6.2928 | 6.2928 |
| 2 | 5.0038 | 0.0388 | 6.3555 | 29.35 | 0.3325 | 5.1985 | 6.2928 | 6.6253 |
| 3 | 10.004 | 0.085062 | 6.3584 | 39.31 | 0.44513 | 5.2806 | 6.2928 | 6.7379 |
| 4 | 15.004 | 0.13132 | 6.3613 | 45.38 | 0.51363 | 5.3339 | 6.2928 | 6.8064 |
| 5 | 20.004 | 0.17908 | 6.3644 | 50.036 | 0.56606 | 5.3744 | 6.2928 | 6.8589 |
| 6 | 25 | 0.22683 | 6.3674 | 53.985 | 0.61044 | 5.4054 | 6.2928 | 6.9032 |
| 7 | 30 | 0.27459 | 6.3705 | 57.344 | 0.64811 | 5.4298 | 6.2928 | 6.9409 |
| 8 | 35 | 0.32234 | 6.3735 | 60.35 | 0.68176 | 5.4504 | 6.2928 | 6.9746 |
| 9 | 40 | 0.37159 | 6.3767 | 62.884 | 0.71004 | 5.4676 | 6.2928 | 7.0028 |
| 10 | 45 | 0.42083 | 6.3798 | 65.477 | 0.73895 | 5.482 | 6.2928 | 7.0317 |
| 11 | 50 | 0.46859 | 6.3829 | 67.658 | 0.76319 | 5.4936 | 6.2928 | 7.056 |
| 12 | 55.001 | 0.51634 | 6.386 | 70.074 | 0.79007 | 5.5042 | 6.2928 | 7.0829 |
| 13 | 60.001 | 0.5641 | 6.389 | 72.196 | 0.8136 | 5.513 | 6.2928 | 7.1064 |
| 14 | 70.001 | 0.65961 | 6.3952 | 76.204 | 0.85794 | 5.5269 | 6.2928 | 7.1507 |
| 15 | 80.001 | 0.75512 | 6.4013 | 80.27 | 0.90285 | 5.5375 | 6.2928 | 7.1957 |
| 16 | 90.001 | 0.85361 | 6.4077 | 84.573 | 0.9503 | 5.5436 | 6.2928 | 7.2431 |
| 17 | 100 | 0.95061 | 6.414 | 88.698 | 0.99568 | 5.5474 | 6.2928 | 7.2885 |
| 18 | 110 | 1.0491 | 6.4203 | 92.706 | 1.0396 | 5.5497 | 6.2928 | 7.3324 |
| 19 | 120 | 1.1446 | 6.4265 | 96.124 | 1.0769 | 5.5502 | 6.2928 | 7.3697 |
| 20 | 130 | 1.2401 | 6.4328 | 99.719 | 1.1161 | 5.5497 | 6.2928 | 7.4089 |
| 21 | 140 | 1.3356 | 6.439 | 104.26 | 1.1658 | 5.5474 | 6.2928 | 7.4586 |
| 22 | 150 | 1.4326 | 6.4453 | 108.32 | 1.2101 | 5.5452 | 6.2928 | 7.5029 |
| 23 | 160 | 1.5266 | 6.4515 | 111.57 | 1.2451 | 5.5408 | 6.2928 | 7.5379 |
| 24 | 170 | 1.6251 | 6.4579 | 115.28 | 1.2852 | 5.5369 | 6.2928 | 7.578 |
| 25 | 180 | 1.7206 | 6.4642 | 118.28 | 1.3175 | 5.5314 | 6.2928 | 7.6103 |
| 26 | 190 | 1.8162 | 6.4705 | 121.41 | 1.351 | 5.5258 | 6.2928 | 7.6438 |
| 27 | 200 | 1.9102 | 6.4767 | 124.71 | 1.3863 | 5.5197 | 6.2928 | 7.6791 |
| 28 | 210 | 2.0057 | 6.483 | 127.83 | 1.4197 | 5.5125 | 6.2928 | 7.7125 |
| 29 | 220 | 2.1012 | 6.4893 | 131.01 | 1.4536 | 5.5053 | 6.2928 | 7.7464 |
| 30 | 230 | 2.1967 | 6.4957 | 134.2 | 1.4875 | 5.4975 | 6.2928 | 7.7803 |
| 31 | 240 | 2.2907 | 6.5019 | 137.2 | 1.5193 | 5.4892 | 6.2928 | 7.8121 |
| 32 | 270 | 2.5817 | 6.5213 | 146.28 | 1.615 | 5.4637 | 6.2928 | 7.9078 |
| 33 | 300 | 2.8757 | 6.5411 | 152.23 | 1.6757 | 5.4365 | 6.2928 | 7.9685 |
| 34 | 330 | 3.1682 | 6.5608 | 158.3 | 1.7372 | 5.4082 | 6.2928 | 8.03 |
| 35 | 360 | 3.4592 | 6.5806 | 164.61 | 1.801 | 5.3805 | 6.2928 | 8.0938 |
| 36 | 390 | 3.7502 | 6.6005 | 169.79 | 1.8521 | 5.3527 | 6.2928 | 8.1449 |
| 37 | 420 | 4.0397 | 6.6204 | 175.22 | 1.9055 | 5.325 | 6.2928 | 8.1983 |
| 38 | 450 | 4.3292 | 6.6405 | 180.28 | 1.9547 | 5.2989 | 6.2928 | 8.2475 |
| 39 | 480 | 4.6202 | 6.6607 | 185.23 | 2.0023 | 5.2712 | 6.2928 | 8.2951 |
| 40 | 510 | 4.9127 | 6.6812 | 189.48 | 2.0419 | 5.2451 | 6.2928 | 8.3347 |
| 41 | 540 | 5.2082 | 6.702 | 194.43 | 2.0887 | 5.2201 | 6.2928 | 8.3815 |
| 42 | 570 | 5.5007 | 6.7228 | 199.32 | 2.1347 | 5.1957 | 6.2928 | 8.4275 |
| 43 | 600 | 5.7902 | 6.7434 | 204.39 | 2.1823 | 5.1702 | 6.2928 | 8.4751 |
| 44 | 630 | 6.0782 | 6.7641 | 209.28 | 2.2277 | 5.1469 | 6.2928 | 8.5205 |
| 45 | 660 | 6.3692 | 6.7851 | 213.41 | 2.2645 | 5.1242 | 6.2928 | 8.5573 |
| 46 | 690 | 6.6587 | 6.8062 | 217.65 | 2.3024 | 5.1014 | 6.2928 | 8.5952 |
| 47 | 720 | 6.9497 | 6.8275 | 222.13 | 2.3425 | 5.0798 | 6.2928 | 8.6353 |
| 48 | 750 | 7.2407 | 6.8489 | 226.9 | 2.3853 | 5.0582 | 6.2928 | 8.6781 |
| 49 | 780 | 7.5362 | 6.8708 | 231.56 | 2.4265 | 5.0382 | 6.2928 | 8.7193 |
| 50 | 810 | 7.8302 | 6.8927 | 234.5 | 2.4496 | 5.0188 | 6.2928 | 8.7424 |
| 51 | 840 | 8.1197 | 6.9144 | 238.39 | 2.4824 | 4.9982 | 6.2928 | 8.7752 |
| 52 | 870 | 8.4107 | 6.9364 | 243.17 | 2.5241 | 4.9805 | 6.2928 | 8.8169 |
| 53 | 900 | 8.6987 | 6.9583 | 247.82 | 2.5643 | 4.9622 | 6.2928 | 8.8571 |
| 54 | 930 | 8.9883 | 6.9804 | 250.54 | 2.5842 | 4.9444 | 6.2928 | 8.877 |
| 55 | 960 | 9.2793 | 7.0028 | 253.72 | 2.6086 | 4.9267 | 6.2928 | 8.9014 |
| 56 | 990 | 9.5718 | 7.0254 | 257.61 | 2.6401 | 4.9106 | 6.2928 | 8.9329 |
| 57 | 1020 | 9.8643 | 7.0482 | 261.97 | 2.6761 | 4.8945 | 6.2928 | 8.9689 |
| 58 | 1050 | 10.157 | 7.0712 | 265.5 | 2.7034 | 4.8806 | 6.2928 | 8.9962 |
| 59 | 1080 | 10.446 | 7.094 | 268.63 | 2.7264 | 4.8646 | 6.2928 | 9.0192 |
| 60 | 1110 | 10.736 | 7.1171 | 271.69 | 2.7486 | 4.8507 | 6.2928 | 9.0414 |
| 61 | 1140 | 11.024 | 7.1401 | 273.58 | 2.7587 | 4.8363 | 6.2928 | 9.0515 |
| 62 | 1170 | 11.31 | 7.1632 | 277 | 2.7842 | 4.8224 | 6.2928 | 9.077 |
| 63 | 1200 | 11.6 | 7.1866 | 280.18 | 2.807 | 4.8096 | 6.2928 | 9.0998 |
| 64 | 1230 | 11.889 | 7.2102 | 282.3 | 2.819 | 4.7969 | 6.2928 | 9.1118 |
| 65 | 1260 | 12.183 | 7.2344 | 285.01 | 2.8366 | 4.7836 | 6.2928 | 9.1294 |
| 66 | 1290 | 12.477 | 7.2587 | 287.49 | 2.8516 | 4.7714 | 6.2928 | 9.1444 |
| 67 | 1320 | 12.771 | 7.2831 | 291.2 | 2.8788 | 4.7608 | 6.2928 | 9.1716 |
| 68 | 1350 | 13.064 | 7.3076 | 293.85 | 2.8952 | 4.7492 | 6.2928 | 9.188 |
| 69 | 1380 | 13.355 | 7.3322 | 297.62 | 2.9226 | 4.7392 | 6.2928 | 9.2154 |
| 70 | 1410 | 13.643 | 7.3566 | 299.45 | 2.9308 | 4.7292 | 6.2928 | 9.2236 |
| 71 | 1440 | 13.932 | 7.3814 | 302.28 | 2.9485 | 4.7198 | 6.2928 | 9.2413 |
| 72 | 1470 | 14.226 | 7.4067 | 305.4 | 2.9688 | 4.7109 | 6.2928 | 9.2616 |
| 73 | 1500 | 14.519 | 7.432 | 307.76 | 2.9815 | 4.7015 | 6.2928 | 9.2743 |
| 74 | 1530 | 14.814 | 7.4578 | 309.29 | 2.986 | 4.6926 | 6.2928 | 9.2788 |
| 75 | 1560 | 15.107 | 7.4835 | 312.12 | 3.003 | 4.6837 | 6.2928 | 9.2958 |
| 76 | 1590 | 15.398 | 7.5092 | 314.54 | 3.0159 | 4.6743 | 6.2928 | 9.3087 |
| 77 | 1613.1 | 15.62 | 7.529 | 316.72 | 3.0288 | 4.6682 | 6.2928 | 9.3216 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.08 in
Specimen Area: 6.35 in^2
Specimen Volume: 38.65 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.2928 | 6.2928 | 0 | 0.000 | 1.2474 | 1.2474 | 1.000 | 1.2474 | 0 |
| 2 | 0.04 | 6.6253 | 6.2928 | 0.15311 | 0.460 | 1.4268 | 1.0943 | 1.304 | 1.2605 | 0.16625 |
| 3 | 0.09 | 6.7379 | 6.2928 | 0.23521 | 0.528 | 1.4573 | 1.0122 | 1.440 | 1.2348 | 0.22257 |
| 4 | 0.13 | 6.8064 | 6.2928 | 0.28847 | 0.562 | 1.4726 | 0.95893 | 1.536 | 1.2158 | 0.25682 |
| 5 | 0.18 | 6.8589 | 6.2928 | 0.32896 | 0.581 | 1.4845 | 0.91844 | 1.616 | 1.2015 | 0.28303 |
| 6 | 0.23 | 6.9032 | 6.2928 | 0.36003 | 0.590 | 1.4978 | 0.88737 | 1.688 | 1.1926 | 0.30522 |
| 7 | 0.27 | 6.9409 | 6.2928 | 0.38444 | 0.593 | 1.5111 | 0.86296 | 1.751 | 1.187 | 0.32406 |
| 8 | 0.32 | 6.9746 | 6.2928 | 0.40496 | 0.594 | 1.5242 | 0.84244 | 1.809 | 1.1833 | 0.34088 |
| 9 | 0.37 | 7.0028 | 6.2928 | 0.42216 | 0.595 | 1.5353 | 0.82524 | 1.860 | 1.1803 | 0.35502 |
| 10 | 0.42 | 7.0317 | 6.2928 | 0.43658 | 0.591 | 1.5498 | 0.81082 | 1.911 | 1.1803 | 0.36947 |
| 11 | 0.47 | 7.056 | 6.2928 | 0.44823 | 0.587 | 1.5624 | 0.79917 | 1.955 | 1.1808 | 0.3816 |
| 12 | 0.52 | 7.0829 | 6.2928 | 0.45877 | 0.581 | 1.5787 | 0.78863 | 2.002 | 1.1837 | 0.39504 |
| 13 | 0.56 | 7.1064 | 6.2928 | 0.46765 | 0.575 | 1.5934 | 0.77975 | 2.043 | 1.1866 | 0.4068 |
| 14 | 0.66 | 7.1507 | 6.2928 | 0.48152 | 0.561 | 1.6238 | 0.76588 | 2.120 | 1.1949 | 0.42897 |
| 15 | 0.76 | 7.1957 | 6.2928 | 0.49206 | 0.545 | 1.6582 | 0.75534 | 2.195 | 1.2068 | 0.45143 |
| 16 | 0.85 | 7.2431 | 6.2928 | 0.49816 | 0.524 | 1.6995 | 0.74924 | 2.268 | 1.2244 | 0.47515 |
| 17 | 0.95 | 7.2885 | 6.2928 | 0.50204 | 0.504 | 1.741 | 0.74536 | 2.336 | 1.2432 | 0.49784 |
| 18 | 1.05 | 7.3324 | 6.2928 | 0.50426 | 0.485 | 1.7828 | 0.74314 | 2.399 | 1.263 | 0.51982 |
| 19 | 1.14 | 7.3697 | 6.2928 | 0.50482 | 0.469 | 1.8195 | 0.74258 | 2.450 | 1.281 | 0.53846 |
| 20 | 1.24 | 7.4089 | 6.2928 | 0.50426 | 0.452 | 1.8593 | 0.74314 | 2.502 | 1.3012 | 0.55806 |
| 21 | 1.34 | 7.4586 | 6.2928 | 0.50204 | 0.431 | 1.9111 | 0.74536 | 2.564 | 1.3283 | 0.5829 |
| 22 | 1.43 | 7.5029 | 6.2928 | 0.49982 | 0.413 | 1.9576 | 0.74758 | 2.619 | 1.3526 | 0.60504 |
| 23 | 1.53 | 7.5379 | 6.2928 | 0.49539 | 0.398 | 1.9971 | 0.75202 | 2.656 | 1.3746 | 0.62255 |
| 24 | 1.63 | 7.578 | 6.2928 | 0.4915 | 0.382 | 2.0411 | 0.7559 | 2.700 | 1.3985 | 0.64262 |
| 25 | 1.72 | 7.6103 | 6.2928 | 0.48596 | 0.369 | 2.0789 | 0.76145 | 2.730 | 1.4202 | 0.65874 |
| 26 | 1.82 | 7.6438 | 6.2928 | 0.48041 | 0.356 | 2.1179 | 0.76699 | 2.761 | 1.4425 | 0.67548 |
| 27 | 1.91 | 7.6791 | 6.2928 | 0.47431 | 0.342 | 2.1594 | 0.7731 | 2.793 | 1.4663 | 0.69317 |
| 28 | 2.01 | 7.7125 | 6.2928 | 0.46709 | 0.329 | 2.2 | 0.78031 | 2.819 | 1.4902 | 0.70984 |
| 29 | 2.10 | 7.7464 | 6.2928 | 0.45988 | 0.316 | 2.2411 | 0.78752 | 2.846 | 1.5143 | 0.72681 |
| 30 | 2.20 | 7.7803 | 6.2928 | 0.45212 | 0.304 | 2.2828 | 0.79529 | 2.870 | 1.539 | 0.74374 |
| 31 | 2.29 | 7.8121 | 6.2928 | 0.4438 | 0.292 | 2.3229 | 0.80361 | 2.891 | 1.5633 | 0.75966 |
| 32 | 2.58 | 7.9078 | 6.2928 | 0.41828 | 0.259 | 2.4441 | 0.82912 | 2.948 | 1.6366 | 0.8075 |
| 33 | 2.88 | 7.9685 | 6.2928 | 0.39109 | 0.233 | 2.532 | 0.85631 | 2.957 | 1.6941 | 0.83783 |
| 34 | 3.17 | 8.03 | 6.2928 | 0.3628 | 0.209 | 2.6218 | 0.8846 | 2.964 | 1.7532 | 0.86861 |
| 35 | 3.46 | 8.0938 | 6.2928 | 0.33507 | 0.186 | 2.7133 | 0.91234 | 2.974 | 1.8128 | 0.9005 |
| 36 | 3.75 | 8.1449 | 6.2928 | 0.30733 | 0.166 | 2.7922 | 0.94007 | 2.970 | 1.8661 | 0.92607 |
| 37 | 4.04 | 8.1983 | 6.2928 | 0.27959 | 0.147 | 2.8734 | 0.96781 | 2.969 | 1.9206 | 0.95277 |
| 38 | 4.33 | 8.2475 | 6.2928 | 0.25352 | 0.130 | 2.9486 | 0.99388 | 2.967 | 1.9713 | 0.97737 |
| 39 | 4.62 | 8.2951 | 6.2928 | 0.22578 | 0.113 | 3.0239 | 1.0216 | 2.960 | 2.0228 | 1.0012 |
| 40 | 4.91 | 8.3347 | 6.2928 | 0.19971 | 0.098 | 3.0896 | 1.0477 | 2.949 | 2.0686 | 1.021 |
| 41 | 5.21 | 8.3815 | 6.2928 | 0.17474 | 0.084 | 3.1614 | 1.0727 | 2.947 | 2.117 | 1.0444 |
| 42 | 5.50 | 8.4275 | 6.2928 | 0.15034 | 0.070 | 3.2318 | 1.0971 | 2.946 | 2.1644 | 1.0673 |
| 43 | 5.79 | 8.4751 | 6.2928 | 0.12482 | 0.057 | 3.3048 | 1.1226 | 2.944 | 2.2137 | 1.0911 |
| 44 | 6.08 | 8.5205 | 6.2928 | 0.10152 | 0.046 | 3.3735 | 1.1459 | 2.944 | 2.2597 | 1.1138 |
| 45 | 6.37 | 8.5573 | 6.2928 | 0.078774 | 0.035 | 3.4332 | 1.1686 | 2.938 | 2.3009 | 1.1323 |
| 46 | 6.66 | 8.5952 | 6.2928 | 0.056029 | 0.024 | 3.4938 | 1.1914 | 2.933 | 2.3426 | 1.1512 |
| 47 | 6.95 | 8.6353 | 6.2928 | 0.034394 | 0.015 | 3.5555 | 1.213 | 2.931 | 2.3842 | 1.1712 |
| 48 | 7.24 | 8.6781 | 6.2928 | 0.012759 | 0.005 | 3.62 | 1.2346 | 2.932 | 2.4273 | 1.1927 |
| 49 | 7.54 | 8.7193 | 6.2928 | -0.0072117 | -0.003 | 3.6811 | 1.2546 | 2.934 | 2.4679 | 1.2133 |
| 50 | 7.83 | 8.7424 | 6.2928 | -0.026628 | -0.011 | 3.7236 | 1.274 | 2.923 | 2.4988 | 1.2248 |
| 51 | 8.12 | 8.7752 | 6.2928 | -0.047153 | -0.019 | 3.777 | 1.2946 | 2.918 | 2.5358 | 1.2412 |
| 52 | 8.41 | 8.8169 | 6.2928 | -0.064905 | -0.026 | 3.8364 | 1.3123 | 2.923 | 2.5744 | 1.262 |
| 53 | 8.70 | 8.8571 | 6.2928 | -0.083212 | -0.032 | 3.895 | 1.3306 | 2.927 | 2.6128 | 1.2822 |
| 54 | 8.99 | 8.877 | 6.2928 | -0.10096 | -0.039 | 3.9325 | 1.3484 | 2.917 | 2.6404 | 1.2921 |
| 55 | 9.28 | 8.9014 | 6.2928 | -0.11872 | -0.046 | 3.9747 | 1.3661 | 2.910 | 2.6704 | 1.3043 |
| 56 | 9.57 | 8.9329 | 6.2928 | -0.1348 | -0.051 | 4.0223 | 1.3822 | 2.910 | 2.7022 | 1.32 |
| 57 | 9.86 | 8.9689 | 6.2928 | -0.15089 | -0.056 | 4.0744 | 1.3983 | 2.914 | 2.7363 | 1.338 |
| 58 | 10.16 | 8.9962 | 6.2928 | -0.16476 | -0.061 | 4.1156 | 1.4122 | 2.914 | 2.7639 | 1.3517 |
| 59 | 10.45 | 9.0192 | 6.2928 | -0.18085 | -0.066 | 4.1547 | 1.4282 | 2.909 | 2.7915 | 1.3632 |
| 60 | 10.74 | 9.0414 | 6.2928 | -0.19472 | -0.071 | 4.1907 | 1.4421 | 2.906 | 2.8164 | 1.3743 |
| 61 | 11.02 | 9.0515 | 6.2928 | -0.20914 | -0.076 | 4.2153 | 1.4565 | 2.894 | 2.8359 | 1.3794 |
| 62 | 11.31 | 9.077 | 6.2928 | -0.22301 | -0.080 | 4.2546 | 1.4704 | 2.893 | 2.8625 | 1.3921 |
| 63 | 11.60 | 9.0998 | 6.2928 | -0.23577 | -0.084 | 4.2902 | 1.4832 | 2.893 | 2.8867 | 1.4035 |
| 64 | 11.89 | 9.1118 | 6.2928 | -0.24853 | -0.088 | 4.3149 | 1.4959 | 2.884 | 2.9054 | 1.4095 |
| 65 | 12.18 | 9.1294 | 6.2928 | -0.26184 | -0.092 | 4.3458 | 1.5092 | 2.879 | 2.9275 | 1.4183 |
| 66 | 12.48 | 9.1444 | 6.2928 | -0.27404 | -0.096 | 4.3731 | 1.5214 | 2.874 | 2.9473 | 1.4258 |
| 67 | 12.77 | 9.1716 | 6.2928 | -0.28458 | -0.099 | 4.4108 | 1.532 | 2.879 | 2.9714 | 1.4394 |
| 68 | 13.06 | 9.188 | 6.2928 | -0.29623 | -0.102 | 4.4389 | 1.5436 | 2.876 | 2.9913 | 1.4476 |
| 69 | 13.35 | 9.2154 | 6.2928 | -0.30622 | -0.105 | 4.4762 | 1.5536 | 2.881 | 3.0149 | 1.4613 |
| 70 | 13.64 | 9.2236 | 6.2928 | -0.3162 | -0.108 | 4.4944 | 1.5636 | 2.874 | 3.029 | 1.4654 |
| 71 | 13.93 | 9.2413 | 6.2928 | -0.32563 | -0.110 | 4.5216 | 1.573 | 2.874 | 3.0473 | 1.4743 |
| 72 | 14.23 | 9.2616 | 6.2928 | -0.33451 | -0.113 | 4.5507 | 1.5819 | 2.877 | 3.0663 | 1.4844 |
| 73 | 14.52 | 9.2743 | 6.2928 | -0.34394 | -0.115 | 4.5729 | 1.5913 | 2.874 | 3.0821 | 1.4908 |
| 74 | 14.81 | 9.2788 | 6.2928 | -0.35282 | -0.118 | 4.5862 | 1.6002 | 2.866 | 3.0932 | 1.493 |
| 75 | 15.11 | 9.2958 | 6.2928 | -0.36169 | -0.120 | 4.6121 | 1.6091 | 2.866 | 3.1106 | 1.5015 |
| 76 | 15.40 | 9.3087 | 6.2928 | -0.37112 | -0.123 | 4.6344 | 1.6185 | 2.863 | 3.1265 | 1.5079 |
| 77 | 15.62 | 9.3216 | 6.2928 | -0.37723 | -0.125 | 4.6534 | 1.6246 | 2.864 | 3.139 | 1.5144 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.02 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.27 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.36 | 0 | 0 | 5.0404 | 6.8328 | 6.8328 |
| 2 | 5.0037 | 0.032682 | 6.3621 | 36.347 | 0.41134 | 5.2561 | 6.8328 | 7.2441 |
| 3 | 10.004 | 0.078153 | 6.365 | 49.512 | 0.56007 | 5.3969 | 6.8328 | 7.3929 |
| 4 | 15.004 | 0.12504 | 6.368 | 56.855 | 0.64283 | 5.4904 | 6.8328 | 7.4756 |
| 5 | 20.004 | 0.17194 | 6.371 | 61.995 | 0.70062 | 5.5581 | 6.8328 | 7.5334 |
| 6 | 25.004 | 0.22025 | 6.3741 | 66.401 | 0.75005 | 5.6109 | 6.8328 | 7.5828 |
| 7 | 30 | 0.26714 | 6.3771 | 70.072 | 0.79115 | 5.6527 | 6.8328 | 7.6239 |
| 8 | 35 | 0.31261 | 6.38 | 73.376 | 0.82808 | 5.6874 | 6.8328 | 7.6609 |
| 9 | 40 | 0.3595 | 6.383 | 76.366 | 0.86141 | 5.716 | 6.8328 | 7.6942 |
| 10 | 45 | 0.40924 | 6.3862 | 79.355 | 0.89468 | 5.7402 | 6.8328 | 7.7275 |
| 11 | 50 | 0.45755 | 6.3893 | 81.978 | 0.9238 | 5.7605 | 6.8328 | 7.7566 |
| 12 | 55 | 0.50444 | 6.3923 | 84.443 | 0.95113 | 5.7781 | 6.8328 | 7.7839 |
| 13 | 60.001 | 0.55133 | 6.3953 | 86.961 | 0.97903 | 5.793 | 6.8328 | 7.8118 |
| 14 | 70.001 | 0.64512 | 6.4013 | 92.153 | 1.0365 | 5.8172 | 6.8328 | 7.8693 |
| 15 | 80.001 | 0.74458 | 6.4077 | 97.083 | 1.0909 | 5.8354 | 6.8328 | 7.9237 |
| 16 | 90.001 | 0.83695 | 6.4137 | 101.44 | 1.1387 | 5.7374 | 6.8328 | 7.9715 |
| 17 | 100 | 0.92789 | 6.4196 | 106.63 | 1.1959 | 5.8392 | 6.8328 | 8.0287 |
| 18 | 110 | 1.0217 | 6.4257 | 111.51 | 1.2494 | 5.8392 | 6.8328 | 8.0822 |
| 19 | 120 | 1.1169 | 6.4319 | 116.07 | 1.2993 | 5.8414 | 6.8328 | 8.1321 |
| 20 | 130 | 1.2107 | 6.438 | 120.95 | 1.3526 | 5.842 | 6.8328 | 8.1854 |
| 21 | 140 | 1.3059 | 6.4442 | 125.67 | 1.4041 | 5.8398 | 6.8328 | 8.2369 |
| 22 | 150 | 1.4039 | 6.4506 | 130.28 | 1.4542 | 5.8381 | 6.8328 | 8.287 |
| 23 | 160 | 1.4949 | 6.4565 | 134.85 | 1.5037 | 5.8337 | 6.8328 | 8.3365 |
| 24 | 170 | 1.5943 | 6.4631 | 139.57 | 1.5548 | 5.8282 | 6.8328 | 8.3876 |
| 25 | 180 | 1.6924 | 6.4695 | 144.34 | 1.6064 | 5.8194 | 6.8328 | 8.4392 |
| 26 | 190 | 1.7862 | 6.4757 | 148.8 | 1.6544 | 5.8101 | 6.8328 | 8.4872 |
| 27 | 200 | 1.8814 | 6.482 | 153.15 | 1.7012 | 5.8002 | 6.8328 | 8.534 |
| 28 | 210 | 1.9794 | 6.4885 | 157.5 | 1.7478 | 5.7892 | 6.8328 | 8.5806 |
| 29 | 220 | 2.076 | 6.4949 | 161.7 | 1.7926 | 5.777 | 6.8328 | 8.6254 |
| 30 | 230 | 2.1727 | 6.5013 | 165.74 | 1.8355 | 5.766 | 6.8328 | 8.6683 |
| 31 | 240 | 2.2707 | 6.5078 | 169.99 | 1.8807 | 5.7523 | 6.8328 | 8.7135 |
| 32 | 270 | 2.5577 | 6.527 | 181.26 | 1.9996 | 5.7083 | 6.8328 | 8.8324 |
| 33 | 300 | 2.8433 | 6.5462 | 192.44 | 2.1166 | 5.6637 | 6.8328 | 8.9494 |
| 34 | 330 | 3.1219 | 6.565 | 202.56 | 2.2215 | 5.6214 | 6.8328 | 9.0543 |
| 35 | 360 | 3.406 | 6.5843 | 212.47 | 2.3234 | 5.6076 | 6.8328 | 9.1562 |
| 36 | 390 | 3.6945 | 6.604 | 222.12 | 2.4217 | 5.5625 | 6.8328 | 9.2545 |
| 37 | 420 | 3.9815 | 6.6238 | 231.46 | 2.5159 | 5.519 | 6.8328 | 9.3487 |
| 38 | 450 | 4.2714 | 6.6438 | 240.43 | 2.6055 | 5.4761 | 6.8328 | 9.4383 |
| 39 | 480 | 4.557 | 6.6637 | 248.71 | 2.6873 | 5.4343 | 6.8328 | 9.5201 |
| 40 | 510 | 4.8398 | 6.6835 | 256.9 | 2.7675 | 5.3947 | 6.8328 | 9.6003 |
| 41 | 540 | 5.1254 | 6.7036 | 264.34 | 2.8392 | 5.354 | 6.8328 | 9.672 |
| 42 | 570 | 5.411 | 6.7239 | 272.37 | 2.9166 | 5.316 | 6.8328 | 9.7494 |
| 43 | 600 | 5.6995 | 6.7444 | 280.03 | 2.9894 | 5.2759 | 6.8328 | 9.8222 |
| 44 | 630 | 5.9894 | 6.7652 | 287.37 | 3.0584 | 5.2401 | 6.8328 | 9.8912 |
| 45 | 660 | 6.2778 | 6.786 | 294.03 | 3.1197 | 5.2054 | 6.8328 | 9.9525 |
| 46 | 690 | 6.5705 | 6.8073 | 301.01 | 3.1837 | 5.1713 | 6.8328 | 10.016 |
| 47 | 720 | 6.8604 | 6.8285 | 307.77 | 3.2452 | 5.1389 | 6.8328 | 10.078 |
| 48 | 750 | 7.1432 | 6.8493 | 314.07 | 3.3015 | 5.1086 | 6.8328 | 10.134 |
| 49 | 780 | 7.426 | 6.8702 | 320.31 | 3.3568 | 5.0784 | 6.8328 | 10.19 |
| 50 | 810 | 7.7101 | 6.8914 | 324.19 | 3.3871 | 5.0492 | 6.8328 | 10.22 |
| 51 | 840 | 7.9943 | 6.9126 | 331.48 | 3.4526 | 5.0212 | 6.8328 | 10.285 |
| 52 | 870 | 8.2828 | 6.9344 | 336.93 | 3.4984 | 4.9942 | 6.8328 | 10.331 |
| 53 | 900 | 8.5741 | 6.9565 | 342.91 | 3.5492 | 4.9705 | 6.8328 | 10.382 |
| 54 | 930 | 8.8668 | 6.9788 | 348.21 | 3.5925 | 4.9458 | 6.8328 | 10.425 |
| 55 | 960 | 9.1609 | 7.0014 | 353.93 | 3.6396 | 4.9216 | 6.8328 | 10.472 |
| 56 | 990 | 9.448 | 7.0236 | 357.76 | 3.6674 | 4.9012 | 6.8328 | 10.5 |
| 57 | 1020 | 9.7336 | 7.0458 | 363.58 | 3.7153 | 4.8809 | 6.8328 | 10.548 |
| 58 | 1050 | 10.022 | 7.0684 | 368.98 | 3.7585 | 4.8589 | 6.8328 | 10.591 |
| 59 | 1080 | 10.301 | 7.0904 | 373.02 | 3.7879 | 4.8391 | 6.8328 | 10.621 |
| 60 | 1110 | 10.585 | 7.1129 | 377.95 | 3.8258 | 4.8192 | 6.8328 | 10.659 |
| 61 | 1140 | 10.877 | 7.1363 | 382.93 | 3.8635 | 4.8005 | 6.8328 | 10.696 |
| 62 | 1170 | 11.167 | 7.1596 | 387.34 | 3.8952 | 4.7813 | 6.8328 | 10.728 |
| 63 | 1200 | 11.457 | 7.183 | 392.06 | 3.9299 | 4.7626 | 6.8328 | 10.763 |
| 64 | 1230 | 11.743 | 7.2062 | 396.36 | 3.9601 | 4.7472 | 6.8328 | 10.793 |
| 65 | 1260 | 12.027 | 7.2295 | 401.76 | 4.0012 | 4.7279 | 6.8328 | 10.834 |
| 66 | 1290 | 12.308 | 7.2527 | 404.59 | 4.0165 | 4.7098 | 6.8328 | 10.849 |
| 67 | 1320 | 12.591 | 7.2762 | 409.47 | 4.0518 | 4.6944 | 6.8328 | 10.885 |
| 68 | 1350 | 12.88 | 7.3003 | 413.98 | 4.0829 | 4.6795 | 6.8328 | 10.916 |
| 69 | 1380 | 13.172 | 7.3249 | 417.76 | 4.1063 | 4.6652 | 6.8328 | 10.939 |
| 70 | 1410 | 13.464 | 7.3495 | 422.16 | 4.1357 | 4.6526 | 6.8328 | 10.969 |
| 71 | 1440 | 13.758 | 7.3746 | 425.99 | 4.1591 | 4.6388 | 6.8328 | 10.992 |
| 72 | 1470 | 14.042 | 7.399 | 429.93 | 4.1836 | 4.625 | 6.8328 | 11.016 |
| 73 | 1500 | 14.323 | 7.4233 | 434.02 | 4.2096 | 4.6096 | 6.8328 | 11.042 |
| 74 | 1530 | 14.609 | 7.4481 | 436.53 | 4.2199 | 4.5953 | 6.8328 | 11.053 |
| 75 | 1560 | 14.897 | 7.4734 | 441.31 | 4.2516 | 4.5816 | 6.8328 | 11.084 |
| 76 | 1590 | 15.19 | 7.4992 | 445.29 | 4.2753 | 4.5662 | 6.8328 | 11.108 |
| 77 | 1614.3 | 15.429 | 7.5203 | 447.97 | 4.2889 | 4.5552 | 6.8328 | 11.122 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.02 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.27 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

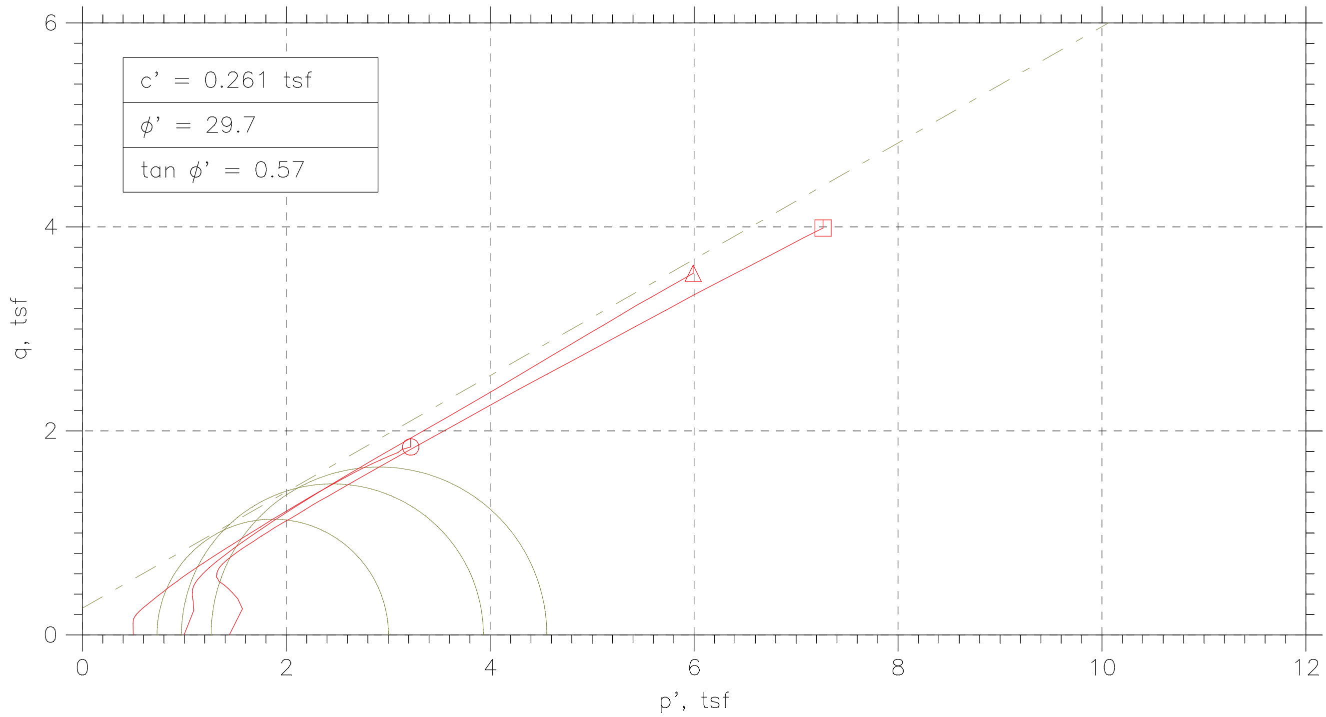
Plastic Limit: 24

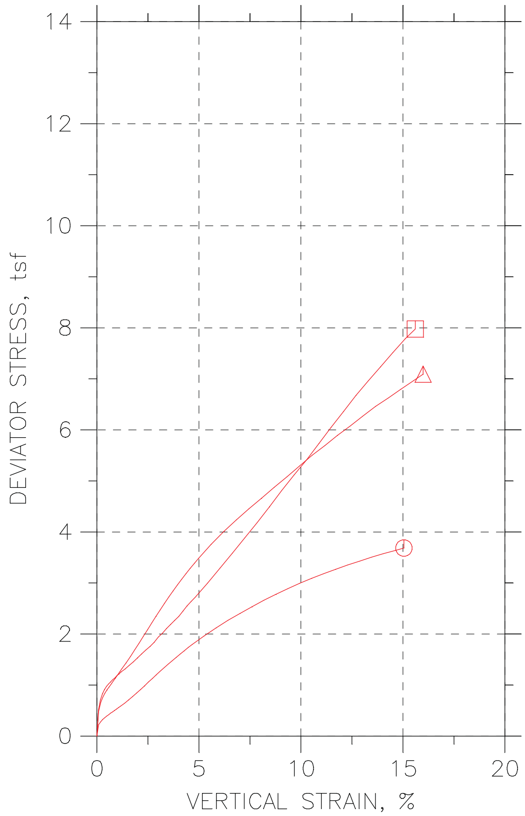
Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.8328 | 6.8328 | 0 | 0.000 | 1.7924 | 1.7924 | 1.000 | 1.7924 | 0 |
| 2 | 0.03 | 7.2441 | 6.8328 | 0.21566 | 0.524 | 1.9881 | 1.5767 | 1.261 | 1.7824 | 0.20567 |
| 3 | 0.08 | 7.3929 | 6.8328 | 0.35649 | 0.637 | 1.996 | 1.4359 | 1.390 | 1.7159 | 0.28004 |
| 4 | 0.13 | 7.4756 | 6.8328 | 0.45002 | 0.700 | 1.9852 | 1.3424 | 1.479 | 1.6638 | 0.32142 |
| 5 | 0.17 | 7.5334 | 6.8328 | 0.51768 | 0.739 | 1.9753 | 1.2747 | 1.550 | 1.625 | 0.35031 |
| 6 | 0.22 | 7.5828 | 6.8328 | 0.5705 | 0.761 | 1.9719 | 1.2219 | 1.614 | 1.5969 | 0.37502 |
| 7 | 0.27 | 7.6239 | 6.8328 | 0.61231 | 0.774 | 1.9712 | 1.1801 | 1.670 | 1.5757 | 0.39557 |
| 8 | 0.31 | 7.6609 | 6.8328 | 0.64697 | 0.781 | 1.9735 | 1.1454 | 1.723 | 1.5595 | 0.41404 |
| 9 | 0.36 | 7.6942 | 6.8328 | 0.67558 | 0.784 | 1.9782 | 1.1168 | 1.771 | 1.5475 | 0.4307 |
| 10 | 0.41 | 7.7275 | 6.8328 | 0.69978 | 0.782 | 1.9873 | 1.0926 | 1.819 | 1.54 | 0.44734 |
| 11 | 0.46 | 7.7566 | 6.8328 | 0.72014 | 0.780 | 1.9961 | 1.0723 | 1.862 | 1.5342 | 0.4619 |
| 12 | 0.50 | 7.7839 | 6.8328 | 0.73774 | 0.776 | 2.0058 | 1.0547 | 1.902 | 1.5302 | 0.47557 |
| 13 | 0.55 | 7.8118 | 6.8328 | 0.7526 | 0.769 | 2.0188 | 1.0398 | 1.942 | 1.5293 | 0.48951 |
| 14 | 0.65 | 7.8693 | 6.8328 | 0.7768 | 0.749 | 2.0521 | 1.0156 | 2.021 | 1.5338 | 0.51825 |
| 15 | 0.74 | 7.9237 | 6.8328 | 0.79496 | 0.729 | 2.0883 | 0.99744 | 2.094 | 1.5429 | 0.54543 |
| 16 | 0.84 | 7.9715 | 6.8328 | 0.69703 | 0.612 | 2.2341 | 1.0954 | 2.040 | 1.6647 | 0.56936 |
| 17 | 0.93 | 8.0287 | 6.8328 | 0.79881 | 0.668 | 2.1895 | 0.99359 | 2.204 | 1.5915 | 0.59796 |
| 18 | 1.02 | 8.0822 | 6.8328 | 0.79881 | 0.639 | 2.243 | 0.99359 | 2.258 | 1.6183 | 0.62472 |
| 19 | 1.12 | 8.1321 | 6.8328 | 0.80101 | 0.616 | 2.2907 | 0.99139 | 2.311 | 1.641 | 0.64966 |
| 20 | 1.21 | 8.1854 | 6.8328 | 0.80156 | 0.593 | 2.3435 | 0.99084 | 2.365 | 1.6672 | 0.67632 |
| 21 | 1.31 | 8.2369 | 6.8328 | 0.79936 | 0.569 | 2.3971 | 0.99304 | 2.414 | 1.6951 | 0.70204 |
| 22 | 1.40 | 8.287 | 6.8328 | 0.79771 | 0.549 | 2.4489 | 0.99469 | 2.462 | 1.7218 | 0.7271 |
| 23 | 1.49 | 8.3365 | 6.8328 | 0.79331 | 0.528 | 2.5028 | 0.99909 | 2.505 | 1.751 | 0.75187 |
| 24 | 1.59 | 8.3876 | 6.8328 | 0.7878 | 0.507 | 2.5594 | 1.0046 | 2.548 | 1.782 | 0.7774 |
| 25 | 1.69 | 8.4392 | 6.8328 | 0.779 | 0.485 | 2.6198 | 1.0134 | 2.585 | 1.8166 | 0.80319 |
| 26 | 1.79 | 8.4872 | 6.8328 | 0.76965 | 0.465 | 2.6772 | 1.0227 | 2.618 | 1.8499 | 0.82721 |
| 27 | 1.88 | 8.534 | 6.8328 | 0.75975 | 0.447 | 2.7338 | 1.0326 | 2.647 | 1.8832 | 0.85058 |
| 28 | 1.98 | 8.5806 | 6.8328 | 0.74874 | 0.428 | 2.7914 | 1.0436 | 2.675 | 1.9175 | 0.87389 |
| 29 | 2.08 | 8.6254 | 6.8328 | 0.73664 | 0.411 | 2.8483 | 1.0558 | 2.698 | 1.952 | 0.89628 |
| 30 | 2.17 | 8.6683 | 6.8328 | 0.72564 | 0.395 | 2.9023 | 1.0668 | 2.721 | 1.9845 | 0.91776 |
| 31 | 2.27 | 8.7135 | 6.8328 | 0.71188 | 0.379 | 2.9612 | 1.0805 | 2.741 | 2.0209 | 0.94034 |
| 32 | 2.56 | 8.8324 | 6.8328 | 0.66787 | 0.334 | 3.1241 | 1.1245 | 2.778 | 2.1243 | 0.99978 |
| 33 | 2.84 | 8.9494 | 6.8328 | 0.62331 | 0.294 | 3.2856 | 1.1691 | 2.810 | 2.2274 | 1.0583 |
| 34 | 3.12 | 9.0543 | 6.8328 | 0.58095 | 0.262 | 3.433 | 1.2114 | 2.834 | 2.3222 | 1.1108 |
| 35 | 3.41 | 9.1562 | 6.8328 | 0.5672 | 0.244 | 3.5486 | 1.2252 | 2.896 | 2.3869 | 1.1617 |
| 36 | 3.69 | 9.2545 | 6.8328 | 0.52209 | 0.216 | 3.692 | 1.2703 | 2.906 | 2.4811 | 1.2108 |
| 37 | 3.98 | 9.3487 | 6.8328 | 0.47862 | 0.190 | 3.8297 | 1.3138 | 2.915 | 2.5717 | 1.258 |
| 38 | 4.27 | 9.4383 | 6.8328 | 0.43571 | 0.167 | 3.9622 | 1.3567 | 2.921 | 2.6595 | 1.3028 |
| 39 | 4.56 | 9.5201 | 6.8328 | 0.3939 | 0.147 | 4.0858 | 1.3985 | 2.922 | 2.7421 | 1.3437 |
| 40 | 4.84 | 9.6003 | 6.8328 | 0.35429 | 0.128 | 4.2056 | 1.4381 | 2.924 | 2.8218 | 1.3837 |
| 41 | 5.13 | 9.672 | 6.8328 | 0.31358 | 0.110 | 4.318 | 1.4788 | 2.920 | 2.8984 | 1.4196 |
| 42 | 5.41 | 9.7494 | 6.8328 | 0.27562 | 0.095 | 4.4333 | 1.5168 | 2.923 | 2.9751 | 1.4583 |
| 43 | 5.70 | 9.8222 | 6.8328 | 0.23546 | 0.079 | 4.5463 | 1.5569 | 2.920 | 3.0516 | 1.4947 |
| 44 | 5.99 | 9.8912 | 6.8328 | 0.1997 | 0.065 | 4.6511 | 1.5927 | 2.920 | 3.1219 | 1.5292 |
| 45 | 6.28 | 9.9525 | 6.8328 | 0.16504 | 0.053 | 4.747 | 1.6274 | 2.917 | 3.1872 | 1.5598 |
| 46 | 6.57 | 10.016 | 6.8328 | 0.13093 | 0.041 | 4.8452 | 1.6615 | 2.916 | 3.2533 | 1.5918 |
| 47 | 6.86 | 10.078 | 6.8328 | 0.098476 | 0.030 | 4.9391 | 1.6939 | 2.916 | 3.3165 | 1.6226 |
| 48 | 7.14 | 10.134 | 6.8328 | 0.068218 | 0.021 | 5.0256 | 1.7242 | 2.915 | 3.3749 | 1.6507 |
| 49 | 7.43 | 10.19 | 6.8328 | 0.03796 | 0.011 | 5.1113 | 1.7544 | 2.913 | 3.4328 | 1.6784 |
| 50 | 7.71 | 10.22 | 6.8328 | 0.0088023 | 0.003 | 5.1707 | 1.7836 | 2.899 | 3.4771 | 1.6935 |
| 51 | 7.99 | 10.285 | 6.8328 | -0.019255 | -0.006 | 5.2642 | 1.8116 | 2.906 | 3.5379 | 1.7263 |
| 52 | 8.28 | 10.331 | 6.8328 | -0.046212 | -0.013 | 5.337 | 1.8386 | 2.903 | 3.5878 | 1.7492 |
| 53 | 8.57 | 10.382 | 6.8328 | -0.069868 | -0.020 | 5.4114 | 1.8623 | 2.906 | 3.6368 | 1.7746 |
| 54 | 8.87 | 10.425 | 6.8328 | -0.094625 | -0.026 | 5.4795 | 1.887 | 2.904 | 3.6832 | 1.7962 |
| 55 | 9.16 | 10.472 | 6.8328 | -0.11883 | -0.033 | 5.5509 | 1.9112 | 2.904 | 3.731 | 1.8198 |
| 56 | 9.45 | 10.5 | 6.8328 | -0.13919 | -0.038 | 5.599 | 1.9316 | 2.899 | 3.7653 | 1.8337 |
| 57 | 9.73 | 10.548 | 6.8328 | -0.15954 | -0.043 | 5.6673 | 1.9519 | 2.903 | 3.8096 | 1.8577 |
| 58 | 10.02 | 10.591 | 6.8328 | -0.18155 | -0.048 | 5.7324 | 1.9739 | 2.904 | 3.8532 | 1.8792 |
| 59 | 10.30 | 10.621 | 6.8328 | -0.20135 | -0.053 | 5.7816 | 1.9937 | 2.900 | 3.8877 | 1.8939 |
| 60 | 10.58 | 10.659 | 6.8328 | -0.22116 | -0.058 | 5.8393 | 2.0136 | 2.900 | 3.9264 | 1.9129 |
| 61 | 10.88 | 10.696 | 6.8328 | -0.23986 | -0.062 | 5.8958 | 2.0323 | 2.901 | 3.964 | 1.9318 |
| 62 | 11.17 | 10.728 | 6.8328 | -0.25912 | -0.067 | 5.9468 | 2.0515 | 2.899 | 3.9991 | 1.9476 |
| 63 | 11.46 | 10.763 | 6.8328 | -0.27782 | -0.071 | 6.0001 | 2.0702 | 2.898 | 4.0351 | 1.9649 |
| 64 | 11.74 | 10.793 | 6.8328 | -0.29323 | -0.074 | 6.0458 | 2.0856 | 2.899 | 4.0657 | 1.9801 |
| 65 | 12.03 | 10.834 | 6.8328 | -0.31248 | -0.078 | 6.1061 | 2.1049 | 2.901 | 4.1055 | 2.0006 |
| 66 | 12.31 | 10.849 | 6.8328 | -0.33064 | -0.082 | 6.1395 | 2.123 | 2.892 | 4.1313 | 2.0083 |
| 67 | 12.59 | 10.885 | 6.8328 | -0.34604 | -0.085 | 6.1903 | 2.1384 | 2.895 | 4.1643 | 2.0259 |
| 68 | 12.88 | 10.916 | 6.8328 | -0.36089 | -0.088 | 6.2362 | 2.1533 | 2.896 | 4.1948 | 2.0415 |
| 69 | 13.17 | 10.939 | 6.8328 | -0.3752 | -0.091 | 6.2739 | 2.1676 | 2.894 | 4.2208 | 2.0532 |
| 70 | 13.46 | 10.969 | 6.8328 | -0.38785 | -0.094 | 6.316 | 2.1802 | 2.897 | 4.2481 | 2.0679 |
| 71 | 13.76 | 10.992 | 6.8328 | -0.4016 | -0.097 | 6.3531 | 2.194 | 2.896 | 4.2735 | 2.0795 |
| 72 | 14.04 | 11.016 | 6.8328 | -0.41536 | -0.099 | 6.3914 | 2.2078 | 2.895 | 4.2996 | 2.0918 |
| 73 | 14.32 | 11.042 | 6.8328 | -0.43076 | -0.102 | 6.4328 | 2.2232 | 2.894 | 4.328 | 2.1048 |
| 74 | 14.61 | 11.053 | 6.8328 | -0.44507 | -0.105 | 6.4574 | 2.2375 | 2.886 | 4.3474 | 2.11 |
| 75 | 14.90 | 11.084 | 6.8328 | -0.45882 | -0.108 | 6.5029 | 2.2512 | 2.889 | 4.377 | 2.1258 |
| 76 | 15.19 | 11.108 | 6.8328 | -0.47422 | -0.111 | 6.5419 | 2.2666 | 2.886 | 4.4043 | 2.1376 |
| 77 | 15.43 | 11.122 | 6.8328 | -0.48523 | -0.113 | 6.5665 | 2.2776 | 2.883 | 4.4221 | 2.1444 |

# TRIAXIAL COMPRESSION TEST REPORT

AECOM



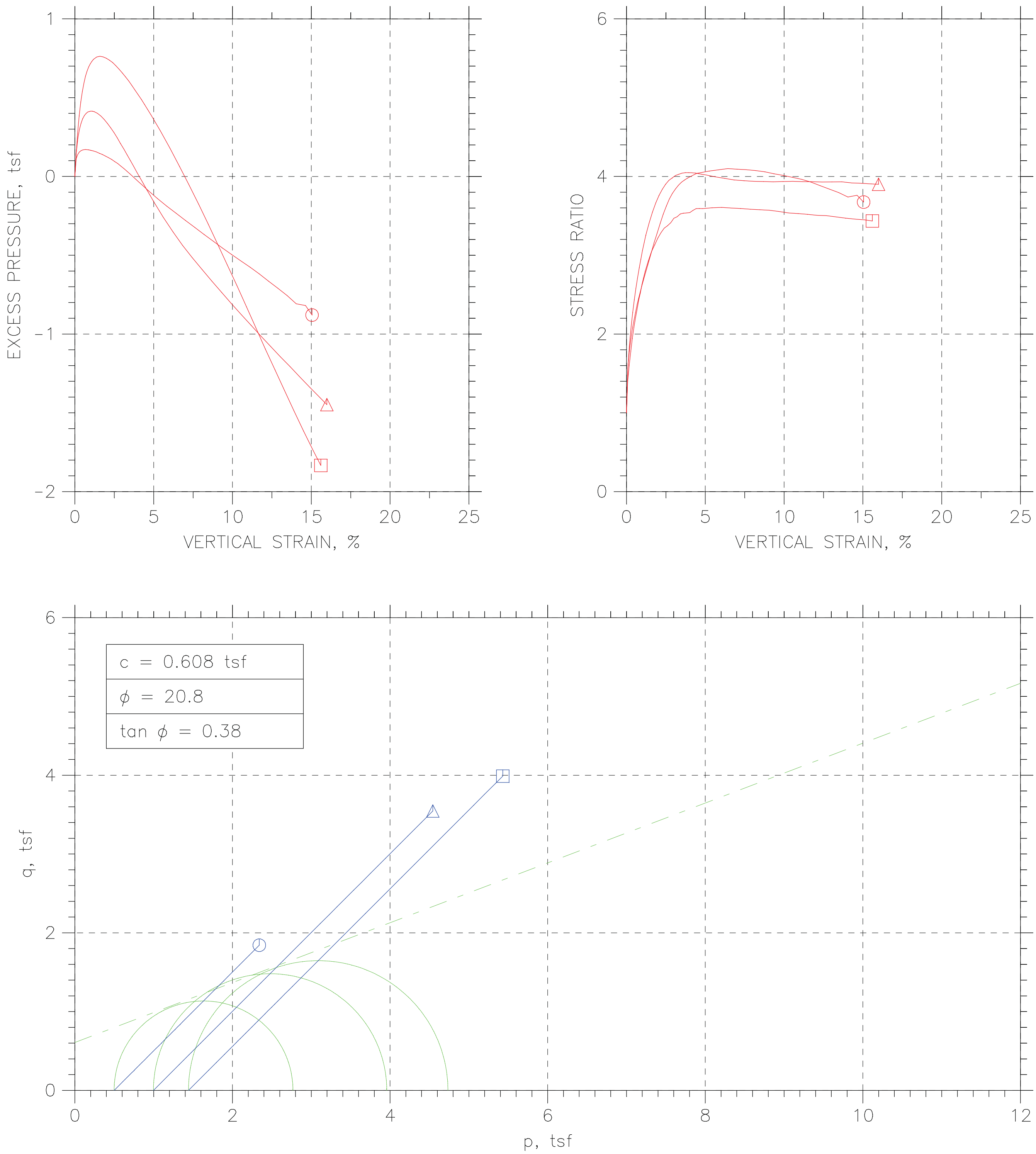

| | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|
| | Test No. | 7 PSI | 13.9 PSI | 20.8 PSI | |
| Initial | Diameter, in | 2.8457 | 2.8382 | 2.837 | |
| Initial | Height, in | 5.9839 | 5.9646 | 5.7075 | |
| Initial | Water Content, % | 13.01 | 13.76 | 17.65 | |
| Initial | Dry Density, pcf | 117.3 | 118. | 109.8 | |
| Initial | Saturation, % | 83.50 | 90.24 | 92.02 | |
| Initial | Void Ratio | 0.41352 | 0.40495 | 0.50912 | |
| Before Shear | Water Content, % | 15.40 | 14.54 | 18.60 | |
| Before Shear | Dry Density, pcf | 117.7 | 119.6 | 111. | |
| Before Shear | Saturation, % | 100.00 | 100.00 | 100.00 | |
| Before Shear | Void Ratio | 0.40877 | 0.3861 | 0.49381 | |
| Before Shear | Back Press., tsf | 5.046 | 5.0443 | 5.0958 | |
| | Minor Prin. Stress, tsf | 0.49798 | 0.99651 | 1.4418 | |
| | Max. Dev. Stress, tsf | 3.6849 | 7.0909 | 7.9769 | |
| | Time to Failure, min | 770.98 | 772.22 | 773.86 | |
| | Strain Rate, %/min | 0.02 | 0.02 | 0.02 | |
| | B-Value | .97 | .95 | .99 | |
| | Measured Specific Gravity | 2.65 | 2.65 | 2.65 | |
| | Liquid Limit | 27 | 27 | 27 | |
| | Plastic Limit | 11 | 11 | 11 | |
| | Plasticity Index | 16 | 16 | 16 | |
| | Failure Sketch |  |  |  | |

| | |
|---|---|
| Project: COLETO CREEK FACILITY | |
| Location: IPR-GDF SUEZ | |
| Project No.: 60225561 | |
| Boring No.: B-4-1 S-7 | |
| Sample Type: 3" ST | |
| Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767 | |

Mon, 12-DEC-2011 10:34:18

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-4-1 S-7 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-7 | Test Date: 12/1/11 | Depth: 12.0'-14.0' |
| Test No.: B-4-1 S-7 | Sample Type: 3" ST | Elevation: ---- |
| Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767 | | |
| | | |

Mon, 12-DEC-2011 10:34:58

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 7 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.06 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.36 | 0 | 0 | 5.046 | 5.544 | 5.544 |
| 2 | 5 | 0.086461 | 6.3655 | 19.795 | 0.2239 | 5.1593 | 5.544 | 5.7679 |
| 3 | 10 | 0.18589 | 6.3719 | 24.744 | 0.2796 | 5.1856 | 5.544 | 5.8236 |
| 4 | 15 | 0.28388 | 6.3781 | 28.64 | 0.3233 | 5.2008 | 5.544 | 5.8673 |
| 5 | 20 | 0.38187 | 6.3844 | 31.851 | 0.3592 | 5.209 | 5.544 | 5.9032 |
| 6 | 25 | 0.47842 | 6.3906 | 34.536 | 0.38911 | 5.2137 | 5.544 | 5.9331 |
| 7 | 30.001 | 0.57785 | 6.397 | 37.116 | 0.41775 | 5.216 | 5.544 | 5.9618 |
| 8 | 35.001 | 0.6744 | 6.4032 | 40.064 | 0.4505 | 5.2166 | 5.544 | 5.9945 |
| 9 | 40.001 | 0.77094 | 6.4094 | 42.433 | 0.47667 | 5.216 | 5.544 | 6.0207 |
| 10 | 45.001 | 0.86893 | 6.4158 | 44.961 | 0.50456 | 5.2148 | 5.544 | 6.0486 |
| 11 | 50.001 | 0.96692 | 6.4221 | 47.488 | 0.5324 | 5.2125 | 5.544 | 6.0764 |
| 12 | 55.001 | 1.0649 | 6.4285 | 50.015 | 0.56017 | 5.2102 | 5.544 | 6.1042 |
| 13 | 60.001 | 1.1629 | 6.4349 | 52.436 | 0.58671 | 5.2078 | 5.544 | 6.1307 |
| 14 | 70.001 | 1.3589 | 6.4476 | 57.701 | 0.64434 | 5.2014 | 5.544 | 6.1883 |
| 15 | 80.001 | 1.5549 | 6.4605 | 63.545 | 0.70819 | 5.1932 | 5.544 | 6.2522 |
| 16 | 90.002 | 1.7494 | 6.4733 | 69.652 | 0.77472 | 5.1851 | 5.544 | 6.3187 |
| 17 | 100 | 1.9454 | 6.4862 | 75.812 | 0.84155 | 5.1751 | 5.544 | 6.3855 |
| 18 | 110 | 2.1399 | 6.4991 | 82.287 | 0.91162 | 5.1652 | 5.544 | 6.4556 |
| 19 | 120 | 2.333 | 6.5119 | 89.026 | 0.98433 | 5.1535 | 5.544 | 6.5283 |
| 20 | 130 | 2.5261 | 6.5248 | 95.87 | 1.0579 | 5.1407 | 5.544 | 6.6019 |
| 21 | 140 | 2.7178 | 6.5377 | 102.5 | 1.1289 | 5.1278 | 5.544 | 6.6729 |
| 22 | 150 | 2.9109 | 6.5507 | 109.3 | 1.2013 | 5.1126 | 5.544 | 6.7453 |
| 23 | 160 | 3.1054 | 6.5639 | 115.93 | 1.2716 | 5.0963 | 5.544 | 6.8156 |
| 24 | 170 | 3.2999 | 6.5771 | 122.56 | 1.3417 | 5.0793 | 5.544 | 6.8857 |
| 25 | 180 | 3.4959 | 6.5904 | 129.2 | 1.4115 | 5.0618 | 5.544 | 6.9555 |
| 26 | 190 | 3.6904 | 6.6037 | 135.46 | 1.4769 | 5.0443 | 5.544 | 7.0209 |
| 27 | 200 | 3.8879 | 6.6173 | 141.83 | 1.5432 | 5.0262 | 5.544 | 7.0872 |
| 28 | 210 | 4.0838 | 6.6308 | 148.15 | 1.6087 | 5.0081 | 5.544 | 7.1527 |
| 29 | 220 | 4.2798 | 6.6444 | 154.31 | 1.6721 | 4.9905 | 5.544 | 7.2161 |
| 30 | 230 | 4.4744 | 6.6579 | 160.52 | 1.7359 | 4.973 | 5.544 | 7.2799 |
| 31 | 240 | 4.6675 | 6.6714 | 166.1 | 1.7926 | 4.9555 | 5.544 | 7.3366 |
| 32 | 270 | 5.2482 | 6.7123 | 182.69 | 1.9596 | 4.9052 | 5.544 | 7.5036 |
| 33 | 300 | 5.839 | 6.7544 | 198.8 | 2.1191 | 4.8568 | 5.544 | 7.6631 |
| 34 | 330 | 6.4298 | 6.7971 | 214.22 | 2.2692 | 4.8118 | 5.544 | 7.8132 |
| 35 | 360 | 7.012 | 6.8396 | 228.12 | 2.4014 | 4.7674 | 5.544 | 7.9454 |
| 36 | 390 | 7.597 | 6.8829 | 242.18 | 2.5333 | 4.723 | 5.544 | 8.0773 |
| 37 | 420 | 8.1879 | 6.9272 | 255.97 | 2.6605 | 4.6786 | 5.544 | 8.2045 |
| 38 | 450 | 8.7758 | 6.9719 | 269.13 | 2.7794 | 4.6354 | 5.544 | 8.3234 |
| 39 | 480 | 9.3565 | 7.0165 | 281.45 | 2.8881 | 4.5921 | 5.544 | 8.4321 |
| 40 | 510 | 9.943 | 7.0622 | 293.66 | 2.9939 | 4.5506 | 5.544 | 8.5379 |
| 41 | 540 | 10.532 | 7.1087 | 305.19 | 3.0911 | 4.5098 | 5.544 | 8.6351 |
| 42 | 570 | 11.116 | 7.1554 | 316.25 | 3.1822 | 4.47 | 5.544 | 8.7262 |
| 43 | 600 | 11.698 | 7.2026 | 326.89 | 3.2677 | 4.428 | 5.544 | 8.8117 |
| 44 | 630 | 12.285 | 7.2508 | 337.63 | 3.3526 | 4.3812 | 5.544 | 8.8966 |
| 45 | 660 | 12.874 | 7.2998 | 347.58 | 3.4282 | 4.3368 | 5.544 | 8.9722 |
| 46 | 690 | 13.463 | 7.3495 | 357.84 | 3.5056 | 4.2901 | 5.544 | 9.0496 |
| 47 | 720 | 14.047 | 7.3994 | 367.48 | 3.5757 | 4.2381 | 5.544 | 9.1197 |
| 48 | 750 | 14.632 | 7.4501 | 376.32 | 3.6369 | 4.2264 | 5.544 | 9.1809 |
| 49 | 770.98 | 15.049 | 7.4867 | 383.16 | 3.6849 | 4.1663 | 5.544 | 9.2289 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 7 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.06 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.544 | 5.544 | 0 | 0.000 | 0.49798 | 0.49798 | 1.000 | 0.49798 | 0 |
| 2 | 0.09 | 5.7679 | 5.544 | 0.11333 | 0.506 | 0.60855 | 0.38465 | 1.582 | 0.4966 | 0.11195 |
| 3 | 0.19 | 5.8236 | 5.544 | 0.13962 | 0.499 | 0.63796 | 0.35836 | 1.780 | 0.49816 | 0.1398 |
| 4 | 0.28 | 5.8673 | 5.544 | 0.1548 | 0.479 | 0.66648 | 0.34317 | 1.942 | 0.50483 | 0.16165 |
| 5 | 0.38 | 5.9032 | 5.544 | 0.16298 | 0.454 | 0.6942 | 0.335 | 2.072 | 0.5146 | 0.1796 |
| 6 | 0.48 | 5.9331 | 5.544 | 0.16766 | 0.431 | 0.71943 | 0.33032 | 2.178 | 0.52488 | 0.19455 |
| 7 | 0.58 | 5.9618 | 5.544 | 0.16999 | 0.407 | 0.74574 | 0.32799 | 2.274 | 0.53686 | 0.20888 |
| 8 | 0.67 | 5.9945 | 5.544 | 0.17058 | 0.379 | 0.7779 | 0.3274 | 2.376 | 0.55265 | 0.22525 |
| 9 | 0.77 | 6.0207 | 5.544 | 0.16999 | 0.357 | 0.80466 | 0.32799 | 2.453 | 0.56632 | 0.23834 |
| 10 | 0.87 | 6.0486 | 5.544 | 0.16882 | 0.335 | 0.83372 | 0.32915 | 2.533 | 0.58144 | 0.25228 |
| 11 | 0.97 | 6.0764 | 5.544 | 0.16649 | 0.313 | 0.86389 | 0.33149 | 2.606 | 0.59769 | 0.2662 |
| 12 | 1.06 | 6.1042 | 5.544 | 0.16415 | 0.293 | 0.894 | 0.33383 | 2.678 | 0.61391 | 0.28009 |
| 13 | 1.16 | 6.1307 | 5.544 | 0.16181 | 0.276 | 0.92288 | 0.33616 | 2.745 | 0.62952 | 0.29336 |
| 14 | 1.36 | 6.1883 | 5.544 | 0.15539 | 0.241 | 0.98693 | 0.34259 | 2.881 | 0.66476 | 0.32217 |
| 15 | 1.55 | 6.2522 | 5.544 | 0.14721 | 0.208 | 1.059 | 0.35077 | 3.019 | 0.70486 | 0.35409 |
| 16 | 1.75 | 6.3187 | 5.544 | 0.13903 | 0.179 | 1.1337 | 0.35895 | 3.158 | 0.7463 | 0.38736 |
| 17 | 1.95 | 6.3855 | 5.544 | 0.1291 | 0.153 | 1.2104 | 0.36888 | 3.281 | 0.78965 | 0.42077 |
| 18 | 2.14 | 6.4556 | 5.544 | 0.11917 | 0.131 | 1.2904 | 0.37881 | 3.407 | 0.83462 | 0.45581 |
| 19 | 2.33 | 6.5283 | 5.544 | 0.10749 | 0.109 | 1.3748 | 0.39049 | 3.521 | 0.88265 | 0.49216 |
| 20 | 2.53 | 6.6019 | 5.544 | 0.094635 | 0.089 | 1.4612 | 0.40334 | 3.623 | 0.93229 | 0.52895 |
| 21 | 2.72 | 6.6729 | 5.544 | 0.081783 | 0.072 | 1.5451 | 0.4162 | 3.712 | 0.98063 | 0.56444 |
| 22 | 2.91 | 6.7453 | 5.544 | 0.066595 | 0.055 | 1.6327 | 0.43138 | 3.785 | 1.032 | 0.60064 |
| 23 | 3.11 | 6.8156 | 5.544 | 0.050238 | 0.040 | 1.7194 | 0.44774 | 3.840 | 1.0836 | 0.63582 |
| 24 | 3.30 | 6.8857 | 5.544 | 0.033297 | 0.025 | 1.8064 | 0.46468 | 3.887 | 1.1355 | 0.67085 |
| 25 | 3.50 | 6.9555 | 5.544 | 0.015772 | 0.011 | 1.8937 | 0.48221 | 3.927 | 1.1879 | 0.70573 |
| 26 | 3.69 | 7.0209 | 5.544 | -0.0017525 | -0.001 | 1.9766 | 0.49973 | 3.955 | 1.2382 | 0.73846 |
| 27 | 3.89 | 7.0872 | 5.544 | -0.019862 | -0.013 | 2.061 | 0.51784 | 3.980 | 1.2894 | 0.7716 |
| 28 | 4.08 | 7.1527 | 5.544 | -0.037971 | -0.024 | 2.1446 | 0.53595 | 4.002 | 1.3403 | 0.80433 |
| 29 | 4.28 | 7.2161 | 5.544 | -0.055496 | -0.033 | 2.2256 | 0.55347 | 4.021 | 1.3895 | 0.83606 |
| 30 | 4.47 | 7.2799 | 5.544 | -0.073021 | -0.042 | 2.3069 | 0.571 | 4.040 | 1.4389 | 0.86795 |
| 31 | 4.67 | 7.3366 | 5.544 | -0.090546 | -0.051 | 2.3811 | 0.58852 | 4.046 | 1.4848 | 0.89631 |
| 32 | 5.25 | 7.5036 | 5.544 | -0.14078 | -0.072 | 2.5983 | 0.63876 | 4.068 | 1.6186 | 0.97979 |
| 33 | 5.84 | 7.6631 | 5.544 | -0.18927 | -0.089 | 2.8063 | 0.68725 | 4.083 | 1.7468 | 1.0595 |
| 34 | 6.43 | 7.8132 | 5.544 | -0.23425 | -0.103 | 3.0014 | 0.73223 | 4.099 | 1.8668 | 1.1346 |
| 35 | 7.01 | 7.9454 | 5.544 | -0.27865 | -0.116 | 3.178 | 0.77663 | 4.092 | 1.9773 | 1.2007 |
| 36 | 7.60 | 8.0773 | 5.544 | -0.32304 | -0.128 | 3.3543 | 0.82102 | 4.086 | 2.0877 | 1.2667 |
| 37 | 8.19 | 8.2045 | 5.544 | -0.36744 | -0.138 | 3.5259 | 0.86542 | 4.074 | 2.1957 | 1.3302 |
| 38 | 8.78 | 8.3234 | 5.544 | -0.41067 | -0.148 | 3.688 | 0.90865 | 4.059 | 2.2983 | 1.3897 |
| 39 | 9.36 | 8.4321 | 5.544 | -0.4539 | -0.157 | 3.84 | 0.95187 | 4.034 | 2.3959 | 1.4441 |
| 40 | 9.94 | 8.5379 | 5.544 | -0.49537 | -0.165 | 3.9873 | 0.99335 | 4.014 | 2.4903 | 1.497 |
| 41 | 10.53 | 8.6351 | 5.544 | -0.53626 | -0.173 | 4.1254 | 1.0342 | 3.989 | 2.5798 | 1.5456 |
| 42 | 11.12 | 8.7262 | 5.544 | -0.57599 | -0.181 | 4.2562 | 1.074 | 3.963 | 2.6651 | 1.5911 |
| 43 | 11.70 | 8.8117 | 5.544 | -0.61805 | -0.189 | 4.3837 | 1.116 | 3.928 | 2.7499 | 1.6338 |
| 44 | 12.28 | 8.8966 | 5.544 | -0.66478 | -0.198 | 4.5154 | 1.1628 | 3.883 | 2.8391 | 1.6763 |
| 45 | 12.87 | 8.9722 | 5.544 | -0.70918 | -0.207 | 4.6354 | 1.2072 | 3.840 | 2.9213 | 1.7141 |
| 46 | 13.46 | 9.0496 | 5.544 | -0.75591 | -0.216 | 4.7595 | 1.2539 | 3.796 | 3.0067 | 1.7528 |
| 47 | 14.05 | 9.1197 | 5.544 | -0.8079 | -0.226 | 4.8816 | 1.3059 | 3.738 | 3.0937 | 1.7879 |
| 48 | 14.63 | 9.1809 | 5.544 | -0.81958 | -0.225 | 4.9544 | 1.3176 | 3.760 | 3.136 | 1.8184 |
| 49 | 15.05 | 9.2289 | 5.544 | -0.87975 | -0.239 | 5.0627 | 1.3777 | 3.675 | 3.2202 | 1.8425 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 13.9 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.96 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.74 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3266 | 0 | 0 | 5.0443 | 6.0408 | 6.0408 |
| 2 | 5.0001 | 0.088226 | 6.3322 | 42.594 | 0.48432 | 5.1902 | 6.0408 | 6.5251 |
| 3 | 10 | 0.18929 | 6.3386 | 57.838 | 0.65698 | 5.2828 | 6.0408 | 6.6978 |
| 4 | 15 | 0.29035 | 6.3451 | 67.028 | 0.76059 | 5.3416 | 6.0408 | 6.8014 |
| 5 | 20 | 0.39301 | 6.3516 | 74.03 | 0.83918 | 5.381 | 6.0408 | 6.88 |
| 6 | 25 | 0.49407 | 6.358 | 79.864 | 0.9044 | 5.4104 | 6.0408 | 6.9452 |
| 7 | 30.001 | 0.59834 | 6.3647 | 85.335 | 0.96534 | 5.4304 | 6.0408 | 7.0061 |
| 8 | 35.001 | 0.7026 | 6.3714 | 90.44 | 1.022 | 5.4431 | 6.0408 | 7.0628 |
| 9 | 40.001 | 0.80687 | 6.3781 | 95.837 | 1.0819 | 5.4526 | 6.0408 | 7.1227 |
| 10 | 45.001 | 0.91274 | 6.3849 | 101.02 | 1.1391 | 5.4565 | 6.0408 | 7.1799 |
| 11 | 50.001 | 1.0154 | 6.3915 | 106.41 | 1.1987 | 5.4587 | 6.0408 | 7.2395 |
| 12 | 55.001 | 1.1213 | 6.3984 | 111.81 | 1.2582 | 5.4581 | 6.0408 | 7.299 |
| 13 | 60.001 | 1.2223 | 6.4049 | 117.43 | 1.32 | 5.4554 | 6.0408 | 7.3608 |
| 14 | 70.001 | 1.4357 | 6.4188 | 128 | 1.4358 | 5.4448 | 6.0408 | 7.4766 |
| 15 | 80.002 | 1.649 | 6.4327 | 139.67 | 1.5633 | 5.4271 | 6.0408 | 7.6041 |
| 16 | 90.002 | 1.8576 | 6.4464 | 151.49 | 1.692 | 5.406 | 6.0408 | 7.7328 |
| 17 | 100 | 2.0661 | 6.4601 | 163.52 | 1.8225 | 5.3805 | 6.0408 | 7.8633 |
| 18 | 110 | 2.273 | 6.4738 | 175.56 | 1.9525 | 5.3527 | 6.0408 | 7.9933 |
| 19 | 120 | 2.4816 | 6.4876 | 187.81 | 2.0843 | 5.3222 | 6.0408 | 8.1251 |
| 20 | 130 | 2.6885 | 6.5014 | 200.21 | 2.2172 | 5.2895 | 6.0408 | 8.258 |
| 21 | 140 | 2.8954 | 6.5153 | 212.32 | 2.3463 | 5.2534 | 6.0408 | 8.3871 |
| 22 | 150 | 3.1056 | 6.5294 | 224.42 | 2.4747 | 5.219 | 6.0408 | 8.5155 |
| 23 | 160 | 3.3157 | 6.5436 | 236.46 | 2.6018 | 5.1813 | 6.0408 | 8.6426 |
| 24 | 170 | 3.5242 | 6.5577 | 248.35 | 2.7267 | 5.1441 | 6.0408 | 8.7675 |
| 25 | 180 | 3.736 | 6.5722 | 259.8 | 2.8461 | 5.107 | 6.0408 | 8.8869 |
| 26 | 190 | 3.9461 | 6.5865 | 270.88 | 2.9611 | 5.0693 | 6.0408 | 9.0019 |
| 27 | 200 | 4.1563 | 6.601 | 281.75 | 3.0732 | 5.0321 | 6.0408 | 9.114 |
| 28 | 210 | 4.3648 | 6.6154 | 292.4 | 3.1824 | 4.9949 | 6.0408 | 9.2232 |
| 29 | 220 | 4.5717 | 6.6297 | 302.54 | 3.2856 | 4.9583 | 6.0408 | 9.3264 |
| 30 | 230 | 4.7787 | 6.6441 | 312.53 | 3.3868 | 4.9222 | 6.0408 | 9.4276 |
| 31 | 240 | 4.984 | 6.6585 | 322.3 | 3.4851 | 4.8873 | 6.0408 | 9.5259 |
| 32 | 270 | 5.6016 | 6.7021 | 349.8 | 3.7579 | 4.7863 | 6.0408 | 9.7987 |
| 33 | 300 | 6.224 | 6.7465 | 375.84 | 4.011 | 4.6926 | 6.0408 | 10.052 |
| 34 | 330 | 6.8335 | 6.7907 | 399.69 | 4.2378 | 4.6066 | 6.0408 | 10.279 |
| 35 | 360 | 7.4495 | 6.8359 | 422.95 | 4.4548 | 4.5289 | 6.0408 | 10.496 |
| 36 | 390 | 8.0687 | 6.8819 | 445.56 | 4.6616 | 4.454 | 6.0408 | 10.702 |
| 37 | 420 | 8.6911 | 6.9288 | 468.98 | 4.8733 | 4.3803 | 6.0408 | 10.914 |
| 38 | 450 | 9.3087 | 6.976 | 492.1 | 5.079 | 4.3087 | 6.0408 | 11.12 |
| 39 | 480 | 9.9279 | 7.024 | 516.31 | 5.2925 | 4.2377 | 6.0408 | 11.333 |
| 40 | 510 | 10.552 | 7.073 | 540.67 | 5.5038 | 4.1678 | 6.0408 | 11.545 |
| 41 | 540 | 11.176 | 7.1226 | 563.06 | 5.6918 | 4.1007 | 6.0408 | 11.733 |
| 42 | 570 | 11.797 | 7.1728 | 587.2 | 5.8943 | 4.0319 | 6.0408 | 11.935 |
| 43 | 600 | 12.416 | 7.2235 | 609.6 | 6.0761 | 3.9659 | 6.0408 | 12.117 |
| 44 | 630 | 13.033 | 7.2748 | 633.59 | 6.2708 | 3.9004 | 6.0408 | 12.312 |
| 45 | 660 | 13.659 | 7.3275 | 657.66 | 6.4622 | 3.8366 | 6.0408 | 12.503 |
| 46 | 690 | 14.283 | 7.3808 | 679.18 | 6.6254 | 3.7706 | 6.0408 | 12.666 |
| 47 | 720 | 14.902 | 7.4345 | 701.93 | 6.7979 | 3.7068 | 6.0408 | 12.839 |
| 48 | 750 | 15.525 | 7.4893 | 724.47 | 6.9648 | 3.643 | 6.0408 | 13.006 |
| 49 | 772.22 | 15.991 | 7.5309 | 741.68 | 7.0909 | 3.5959 | 6.0408 | 13.132 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 13.9 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.96 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.74 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.0408 | 6.0408 | 0 | 0.000 | 0.99651 | 0.99651 | 1.000 | 0.99651 | 0 |
| 2 | 0.09 | 6.5251 | 6.0408 | 0.1459 | 0.301 | 1.3349 | 0.85061 | 1.569 | 1.0928 | 0.24216 |
| 3 | 0.19 | 6.6978 | 6.0408 | 0.23854 | 0.363 | 1.4149 | 0.75797 | 1.867 | 1.0865 | 0.32849 |
| 4 | 0.29 | 6.8014 | 6.0408 | 0.29734 | 0.391 | 1.4598 | 0.69917 | 2.088 | 1.0795 | 0.3803 |
| 5 | 0.39 | 6.88 | 6.0408 | 0.33673 | 0.401 | 1.499 | 0.65978 | 2.272 | 1.0794 | 0.41959 |
| 6 | 0.49 | 6.9452 | 6.0408 | 0.36613 | 0.405 | 1.5348 | 0.63038 | 2.435 | 1.0826 | 0.4522 |
| 7 | 0.60 | 7.0061 | 6.0408 | 0.3861 | 0.400 | 1.5757 | 0.61041 | 2.581 | 1.0931 | 0.48267 |
| 8 | 0.70 | 7.0628 | 6.0408 | 0.39886 | 0.390 | 1.6197 | 0.59765 | 2.710 | 1.1087 | 0.51101 |
| 9 | 0.81 | 7.1227 | 6.0408 | 0.40829 | 0.377 | 1.6701 | 0.58822 | 2.839 | 1.1292 | 0.54094 |
| 10 | 0.91 | 7.1799 | 6.0408 | 0.41217 | 0.362 | 1.7235 | 0.58434 | 2.949 | 1.1539 | 0.56956 |
| 11 | 1.02 | 7.2395 | 6.0408 | 0.41439 | 0.346 | 1.7809 | 0.58212 | 3.059 | 1.1815 | 0.59937 |
| 12 | 1.12 | 7.299 | 6.0408 | 0.41384 | 0.329 | 1.8409 | 0.58267 | 3.159 | 1.2118 | 0.62909 |
| 13 | 1.22 | 7.3608 | 6.0408 | 0.41107 | 0.311 | 1.9055 | 0.58545 | 3.255 | 1.2455 | 0.66002 |
| 14 | 1.44 | 7.4766 | 6.0408 | 0.40053 | 0.279 | 2.0318 | 0.59599 | 3.409 | 1.3139 | 0.7179 |
| 15 | 1.65 | 7.6041 | 6.0408 | 0.38277 | 0.245 | 2.1771 | 0.61374 | 3.547 | 1.3954 | 0.78166 |
| 16 | 1.86 | 7.7328 | 6.0408 | 0.36169 | 0.214 | 2.3268 | 0.63482 | 3.665 | 1.4808 | 0.84599 |
| 17 | 2.07 | 7.8633 | 6.0408 | 0.33617 | 0.184 | 2.4828 | 0.66034 | 3.760 | 1.5716 | 0.91125 |
| 18 | 2.27 | 7.9933 | 6.0408 | 0.30844 | 0.158 | 2.6406 | 0.68807 | 3.838 | 1.6643 | 0.97625 |
| 19 | 2.48 | 8.1251 | 6.0408 | 0.27793 | 0.133 | 2.8029 | 0.71858 | 3.901 | 1.7607 | 1.0422 |
| 20 | 2.69 | 8.258 | 6.0408 | 0.2452 | 0.111 | 2.9685 | 0.75131 | 3.951 | 1.8599 | 1.1086 |
| 21 | 2.90 | 8.3871 | 6.0408 | 0.20914 | 0.089 | 3.1337 | 0.78737 | 3.980 | 1.9605 | 1.1731 |
| 22 | 3.11 | 8.5155 | 6.0408 | 0.17474 | 0.071 | 3.2965 | 0.82177 | 4.011 | 2.0591 | 1.2374 |
| 23 | 3.32 | 8.6426 | 6.0408 | 0.13702 | 0.053 | 3.4613 | 0.85949 | 4.027 | 2.1604 | 1.3009 |
| 24 | 3.52 | 8.7675 | 6.0408 | 0.099854 | 0.037 | 3.6233 | 0.89666 | 4.041 | 2.26 | 1.3633 |
| 25 | 3.74 | 8.8869 | 6.0408 | 0.062686 | 0.022 | 3.78 | 0.93383 | 4.048 | 2.3569 | 1.4231 |
| 26 | 3.95 | 9.0019 | 6.0408 | 0.024963 | 0.008 | 3.9327 | 0.97155 | 4.048 | 2.4521 | 1.4806 |
| 27 | 4.16 | 9.114 | 6.0408 | -0.012204 | -0.004 | 4.0819 | 1.0087 | 4.047 | 2.5453 | 1.5366 |
| 28 | 4.36 | 9.2232 | 6.0408 | -0.049372 | -0.016 | 4.2283 | 1.0459 | 4.043 | 2.6371 | 1.5912 |
| 29 | 4.57 | 9.3264 | 6.0408 | -0.085985 | -0.026 | 4.3681 | 1.0825 | 4.035 | 2.7253 | 1.6428 |
| 30 | 4.78 | 9.4276 | 6.0408 | -0.12204 | -0.036 | 4.5053 | 1.1186 | 4.028 | 2.8119 | 1.6934 |
| 31 | 4.98 | 9.5259 | 6.0408 | -0.15699 | -0.045 | 4.6386 | 1.1535 | 4.021 | 2.8961 | 1.7426 |
| 32 | 5.60 | 9.7987 | 6.0408 | -0.25796 | -0.069 | 5.0124 | 1.2545 | 3.996 | 3.1334 | 1.8789 |
| 33 | 6.22 | 10.052 | 6.0408 | -0.35171 | -0.088 | 5.3592 | 1.3482 | 3.975 | 3.3537 | 2.0055 |
| 34 | 6.83 | 10.279 | 6.0408 | -0.43769 | -0.103 | 5.672 | 1.4342 | 3.955 | 3.5531 | 2.1189 |
| 35 | 7.45 | 10.496 | 6.0408 | -0.51536 | -0.116 | 5.9667 | 1.5119 | 3.947 | 3.7393 | 2.2274 |
| 36 | 8.07 | 10.702 | 6.0408 | -0.59025 | -0.127 | 6.2483 | 1.5868 | 3.938 | 3.9175 | 2.3308 |
| 37 | 8.69 | 10.914 | 6.0408 | -0.66403 | -0.136 | 6.5338 | 1.6605 | 3.935 | 4.0972 | 2.4367 |
| 38 | 9.31 | 11.12 | 6.0408 | -0.73559 | -0.145 | 6.8111 | 1.7321 | 3.932 | 4.2716 | 2.5395 |
| 39 | 9.93 | 11.333 | 6.0408 | -0.8066 | -0.152 | 7.0956 | 1.8031 | 3.935 | 4.4494 | 2.6463 |
| 40 | 10.55 | 11.545 | 6.0408 | -0.8765 | -0.159 | 7.3768 | 1.873 | 3.938 | 4.6249 | 2.7519 |
| 41 | 11.18 | 11.733 | 6.0408 | -0.94362 | -0.166 | 7.6319 | 1.9401 | 3.934 | 4.786 | 2.8459 |
| 42 | 11.80 | 11.935 | 6.0408 | -1.0124 | -0.172 | 7.9032 | 2.0089 | 3.934 | 4.9561 | 2.9472 |
| 43 | 12.42 | 12.117 | 6.0408 | -1.0784 | -0.177 | 8.1511 | 2.0749 | 3.928 | 5.113 | 3.0381 |
| 44 | 13.03 | 12.312 | 6.0408 | -1.1439 | -0.182 | 8.4112 | 2.1404 | 3.930 | 5.2758 | 3.1354 |
| 45 | 13.66 | 12.503 | 6.0408 | -1.2077 | -0.187 | 8.6664 | 2.2042 | 3.932 | 5.4353 | 3.2311 |
| 46 | 14.28 | 12.666 | 6.0408 | -1.2737 | -0.192 | 8.8956 | 2.2702 | 3.918 | 5.5829 | 3.3127 |
| 47 | 14.90 | 12.839 | 6.0408 | -1.3375 | -0.197 | 9.1319 | 2.334 | 3.913 | 5.7329 | 3.3989 |
| 48 | 15.52 | 13.006 | 6.0408 | -1.4013 | -0.201 | 9.3626 | 2.3978 | 3.905 | 5.8802 | 3.4824 |
| 49 | 15.99 | 13.132 | 6.0408 | -1.4484 | -0.204 | 9.5358 | 2.4449 | 3.900 | 5.9904 | 3.5454 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 20.8 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.71 in
Specimen Area: 6.32 in^2
Specimen Volume: 36.08 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3214 | 0 | 0 | 5.0958 | 6.5376 | 6.5376 |
| 2 | 5.0038 | 0.074905 | 6.3261 | 45.054 | 0.51278 | 5.2246 | 6.5376 | 7.0504 |
| 3 | 10.004 | 0.17378 | 6.3324 | 62.257 | 0.70787 | 5.3665 | 6.5376 | 7.2455 |
| 4 | 15.004 | 0.27265 | 6.3386 | 72.957 | 0.82871 | 5.4806 | 6.5376 | 7.3663 |
| 5 | 20.004 | 0.37303 | 6.345 | 80.614 | 0.91477 | 5.5686 | 6.5376 | 7.4524 |
| 6 | 25.004 | 0.4749 | 6.3515 | 86.279 | 0.97804 | 5.636 | 6.5376 | 7.5156 |
| 7 | 30 | 0.57677 | 6.358 | 90.422 | 1.024 | 5.6898 | 6.5376 | 7.5616 |
| 8 | 35 | 0.67415 | 6.3643 | 93.779 | 1.0609 | 5.7316 | 6.5376 | 7.5985 |
| 9 | 40 | 0.77752 | 6.3709 | 97.975 | 1.1073 | 5.7648 | 6.5376 | 7.6449 |
| 10 | 45.002 | 0.87939 | 6.3774 | 100.65 | 1.1363 | 5.7909 | 6.5376 | 7.6739 |
| 11 | 50.003 | 0.97976 | 6.3839 | 104.95 | 1.1837 | 5.8104 | 6.5376 | 7.7213 |
| 12 | 55.003 | 1.0801 | 6.3904 | 107.84 | 1.215 | 5.8262 | 6.5376 | 7.7526 |
| 13 | 60.003 | 1.1835 | 6.3971 | 111.51 | 1.255 | 5.8387 | 6.5376 | 7.7926 |
| 14 | 70.003 | 1.3842 | 6.4101 | 117.22 | 1.3167 | 5.8539 | 6.5376 | 7.8543 |
| 15 | 80.004 | 1.5895 | 6.4235 | 123.99 | 1.3898 | 5.8583 | 6.5376 | 7.9274 |
| 16 | 90.004 | 1.7887 | 6.4365 | 130.13 | 1.4556 | 5.855 | 6.5376 | 7.9932 |
| 17 | 100 | 1.9925 | 6.4499 | 137.42 | 1.534 | 5.8463 | 6.5376 | 8.0716 |
| 18 | 110 | 2.1962 | 6.4633 | 144.6 | 1.6108 | 5.8338 | 6.5376 | 8.1484 |
| 19 | 120 | 2.3955 | 6.4765 | 151.58 | 1.6851 | 5.8186 | 6.5376 | 8.2227 |
| 20 | 130 | 2.5992 | 6.4901 | 158.24 | 1.7555 | 5.7979 | 6.5376 | 8.2931 |
| 21 | 140 | 2.8059 | 6.5039 | 165.9 | 1.8365 | 5.7762 | 6.5376 | 8.3741 |
| 22 | 150 | 3.0097 | 6.5175 | 175.55 | 1.9393 | 5.7523 | 6.5376 | 8.4769 |
| 23 | 160 | 3.2119 | 6.5311 | 182.73 | 2.0145 | 5.7278 | 6.5376 | 8.5521 |
| 24 | 170 | 3.4142 | 6.5448 | 191.81 | 2.1101 | 5.7018 | 6.5376 | 8.6477 |
| 25 | 180 | 3.6119 | 6.5582 | 199.36 | 2.1887 | 5.6735 | 6.5376 | 8.7263 |
| 26 | 190 | 3.8127 | 6.5719 | 206.81 | 2.2657 | 5.6442 | 6.5376 | 8.8033 |
| 27 | 200 | 4.0164 | 6.5859 | 214.52 | 2.3452 | 5.6148 | 6.5376 | 8.8828 |
| 28 | 210 | 4.2187 | 6.5998 | 224.32 | 2.4473 | 5.5849 | 6.5376 | 8.9849 |
| 29 | 220 | 4.4164 | 6.6134 | 234.24 | 2.5501 | 5.5534 | 6.5376 | 9.0877 |
| 30 | 230 | 4.6187 | 6.6275 | 242.73 | 2.637 | 5.5208 | 6.5376 | 9.1746 |
| 31 | 240 | 4.8209 | 6.6415 | 250.97 | 2.7207 | 5.4876 | 6.5376 | 9.2583 |
| 32 | 270 | 5.4291 | 6.6843 | 278.4 | 2.9988 | 5.3849 | 6.5376 | 9.5364 |
| 33 | 300 | 6.0389 | 6.7276 | 307.61 | 3.2921 | 5.2746 | 6.5376 | 9.8297 |
| 34 | 330 | 6.6411 | 6.771 | 336.99 | 3.5833 | 5.1589 | 6.5376 | 10.121 |
| 35 | 360 | 7.2433 | 6.815 | 367.41 | 3.8816 | 5.0409 | 6.5376 | 10.419 |
| 36 | 390 | 7.8605 | 6.8607 | 398.56 | 4.1827 | 4.9187 | 6.5376 | 10.72 |
| 37 | 420 | 8.4643 | 6.9059 | 431.13 | 4.4949 | 4.7937 | 6.5376 | 11.033 |
| 38 | 450 | 9.0605 | 6.9512 | 464.49 | 4.8112 | 4.6665 | 6.5376 | 11.349 |
| 39 | 480 | 9.6658 | 6.9978 | 497.43 | 5.118 | 4.535 | 6.5376 | 11.656 |
| 40 | 510 | 10.283 | 7.0459 | 529.79 | 5.4138 | 4.4035 | 6.5376 | 11.951 |
| 41 | 540 | 10.887 | 7.0936 | 564.88 | 5.7335 | 4.2698 | 6.5376 | 12.271 |
| 42 | 570 | 11.48 | 7.1412 | 599.97 | 6.0491 | 4.1361 | 6.5376 | 12.587 |
| 43 | 600 | 12.084 | 7.1902 | 634.95 | 6.3581 | 4.0008 | 6.5376 | 12.896 |
| 44 | 630 | 12.699 | 7.2409 | 671.35 | 6.6755 | 3.8687 | 6.5376 | 13.213 |
| 45 | 660 | 13.303 | 7.2913 | 704.92 | 6.9608 | 3.7378 | 6.5376 | 13.498 |
| 46 | 690 | 13.902 | 7.3421 | 738.01 | 7.2373 | 3.6073 | 6.5376 | 13.775 |
| 47 | 720 | 14.505 | 7.3938 | 771.63 | 7.514 | 3.4807 | 6.5376 | 14.052 |
| 48 | 750 | 15.119 | 7.4473 | 805.72 | 7.7897 | 3.3563 | 6.5376 | 14.327 |
| 49 | 773.86 | 15.606 | 7.4903 | 829.85 | 7.9769 | 3.2617 | 6.5376 | 14.514 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 20.8 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.71 in
Specimen Area: 6.32 in^2
Specimen Volume: 36.08 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

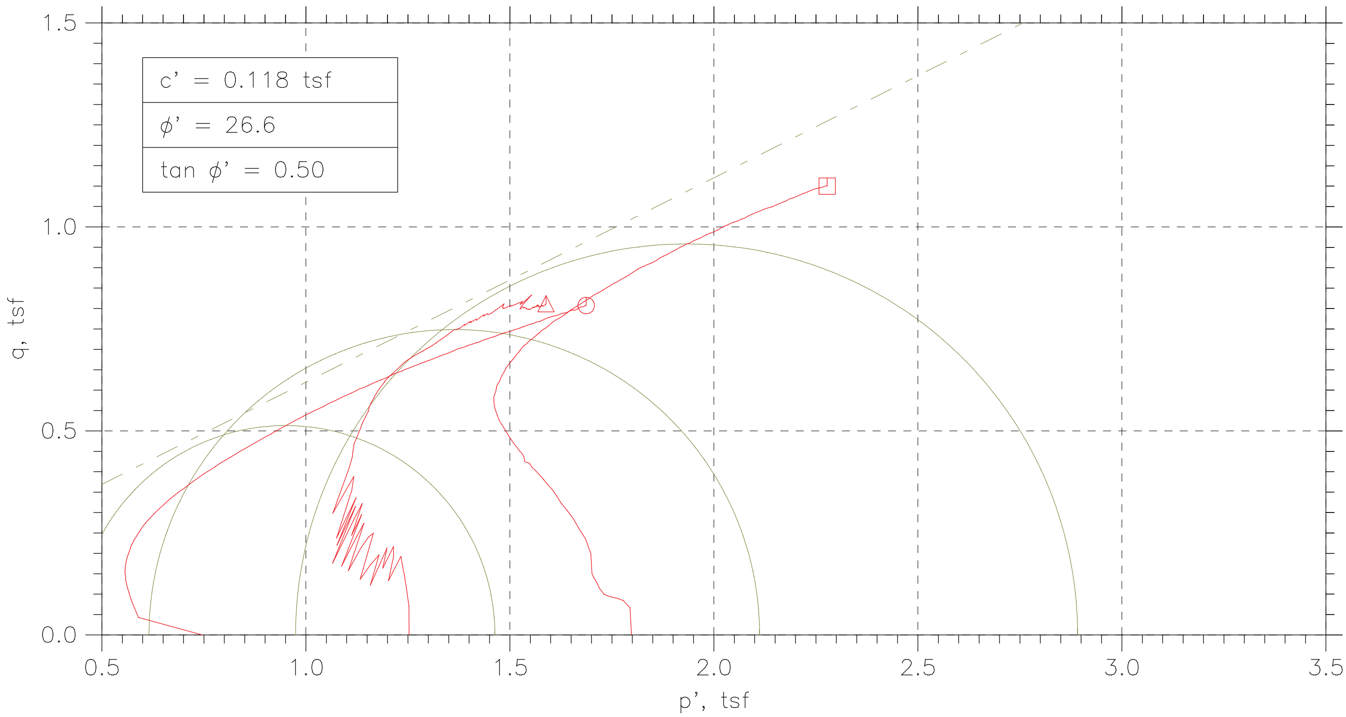
Plastic Limit: 11

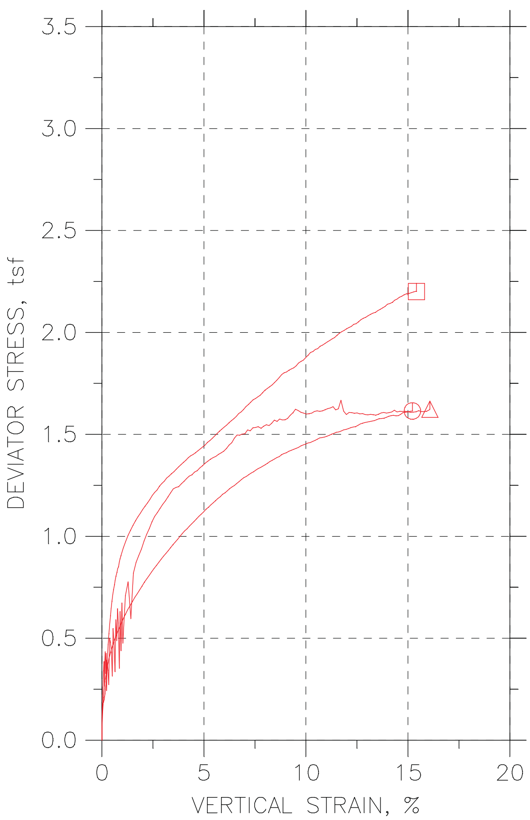
Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.5376 | 6.5376 | 0 | 0.000 | 1.4418 | 1.4418 | 1.000 | 1.4418 | 0 |
| 2 | 0.07 | 7.0504 | 6.5376 | 0.12879 | 0.251 | 1.8258 | 1.313 | 1.391 | 1.5694 | 0.25639 |
| 3 | 0.17 | 7.2455 | 6.5376 | 0.27063 | 0.382 | 1.879 | 1.1711 | 1.604 | 1.5251 | 0.35394 |
| 4 | 0.27 | 7.3663 | 6.5376 | 0.38475 | 0.464 | 1.8857 | 1.057 | 1.784 | 1.4714 | 0.41435 |
| 5 | 0.37 | 7.4524 | 6.5376 | 0.47279 | 0.517 | 1.8838 | 0.96898 | 1.944 | 1.4264 | 0.45738 |
| 6 | 0.47 | 7.5156 | 6.5376 | 0.54018 | 0.552 | 1.8796 | 0.9016 | 2.085 | 1.3906 | 0.48902 |
| 7 | 0.58 | 7.5616 | 6.5376 | 0.59398 | 0.580 | 1.8718 | 0.8478 | 2.208 | 1.3598 | 0.51198 |
| 8 | 0.67 | 7.5985 | 6.5376 | 0.63582 | 0.599 | 1.8669 | 0.80595 | 2.316 | 1.3364 | 0.53047 |
| 9 | 0.78 | 7.6449 | 6.5376 | 0.66897 | 0.604 | 1.8801 | 0.7728 | 2.433 | 1.3264 | 0.55363 |
| 10 | 0.88 | 7.6739 | 6.5376 | 0.69506 | 0.612 | 1.883 | 0.74672 | 2.522 | 1.3149 | 0.56816 |
| 11 | 0.98 | 7.7213 | 6.5376 | 0.71462 | 0.604 | 1.9108 | 0.72715 | 2.628 | 1.319 | 0.59183 |
| 12 | 1.08 | 7.7526 | 6.5376 | 0.73038 | 0.601 | 1.9264 | 0.71139 | 2.708 | 1.3189 | 0.60749 |
| 13 | 1.18 | 7.7926 | 6.5376 | 0.74288 | 0.592 | 1.9539 | 0.69889 | 2.796 | 1.3264 | 0.62751 |
| 14 | 1.38 | 7.8543 | 6.5376 | 0.7581 | 0.576 | 2.0004 | 0.68368 | 2.926 | 1.342 | 0.65834 |
| 15 | 1.59 | 7.9274 | 6.5376 | 0.76244 | 0.549 | 2.0691 | 0.67933 | 3.046 | 1.3742 | 0.69489 |
| 16 | 1.79 | 7.9932 | 6.5376 | 0.75918 | 0.522 | 2.1382 | 0.68259 | 3.132 | 1.4104 | 0.72781 |
| 17 | 1.99 | 8.0716 | 6.5376 | 0.75049 | 0.489 | 2.2253 | 0.69129 | 3.219 | 1.4583 | 0.76699 |
| 18 | 2.20 | 8.1484 | 6.5376 | 0.73799 | 0.458 | 2.3146 | 0.70379 | 3.289 | 1.5092 | 0.80542 |
| 19 | 2.40 | 8.2227 | 6.5376 | 0.72277 | 0.429 | 2.4041 | 0.719 | 3.344 | 1.5616 | 0.84255 |
| 20 | 2.60 | 8.2931 | 6.5376 | 0.70212 | 0.400 | 2.4951 | 0.73965 | 3.373 | 1.6174 | 0.87774 |
| 21 | 2.81 | 8.3741 | 6.5376 | 0.68039 | 0.370 | 2.5979 | 0.76139 | 3.412 | 1.6797 | 0.91827 |
| 22 | 3.01 | 8.4769 | 6.5376 | 0.65647 | 0.339 | 2.7246 | 0.7853 | 3.469 | 1.7549 | 0.96965 |
| 23 | 3.21 | 8.5521 | 6.5376 | 0.63202 | 0.314 | 2.8242 | 0.80976 | 3.488 | 1.817 | 1.0072 |
| 24 | 3.41 | 8.6477 | 6.5376 | 0.60593 | 0.287 | 2.9459 | 0.83584 | 3.524 | 1.8909 | 1.055 |
| 25 | 3.61 | 8.7263 | 6.5376 | 0.57768 | 0.264 | 3.0528 | 0.8641 | 3.533 | 1.9584 | 1.0943 |
| 26 | 3.81 | 8.8033 | 6.5376 | 0.54833 | 0.242 | 3.1592 | 0.89345 | 3.536 | 2.0263 | 1.1329 |
| 27 | 4.02 | 8.8828 | 6.5376 | 0.51898 | 0.221 | 3.268 | 0.92279 | 3.541 | 2.0954 | 1.1726 |
| 28 | 4.22 | 8.9849 | 6.5376 | 0.48909 | 0.200 | 3.3999 | 0.95268 | 3.569 | 2.1763 | 1.2236 |
| 29 | 4.42 | 9.0877 | 6.5376 | 0.45758 | 0.179 | 3.5343 | 0.9842 | 3.591 | 2.2593 | 1.2751 |
| 30 | 4.62 | 9.1746 | 6.5376 | 0.42497 | 0.161 | 3.6538 | 1.0168 | 3.593 | 2.3353 | 1.3185 |
| 31 | 4.82 | 9.2583 | 6.5376 | 0.39182 | 0.144 | 3.7707 | 1.05 | 3.591 | 2.4103 | 1.3604 |
| 32 | 5.43 | 9.5364 | 6.5376 | 0.28911 | 0.096 | 4.1515 | 1.1527 | 3.602 | 2.6521 | 1.4994 |
| 33 | 6.04 | 9.8297 | 6.5376 | 0.17879 | 0.054 | 4.5551 | 1.263 | 3.607 | 2.909 | 1.6461 |
| 34 | 6.64 | 10.121 | 6.5376 | 0.063039 | 0.018 | 4.9621 | 1.3787 | 3.599 | 3.1704 | 1.7917 |
| 35 | 7.24 | 10.419 | 6.5376 | -0.054887 | -0.014 | 5.3783 | 1.4967 | 3.594 | 3.4375 | 1.9408 |
| 36 | 7.86 | 10.72 | 6.5376 | -0.17716 | -0.042 | 5.8017 | 1.6189 | 3.584 | 3.7103 | 2.0914 |
| 37 | 8.46 | 11.033 | 6.5376 | -0.30215 | -0.067 | 6.2388 | 1.7439 | 3.577 | 3.9914 | 2.2475 |
| 38 | 9.06 | 11.349 | 6.5376 | -0.42932 | -0.089 | 6.6822 | 1.8711 | 3.571 | 4.2767 | 2.4056 |
| 39 | 9.67 | 11.656 | 6.5376 | -0.56083 | -0.110 | 7.1206 | 2.0026 | 3.556 | 4.5616 | 2.559 |
| 40 | 10.28 | 11.951 | 6.5376 | -0.69234 | -0.128 | 7.5479 | 2.1341 | 3.537 | 4.841 | 2.7069 |
| 41 | 10.89 | 12.271 | 6.5376 | -0.82603 | -0.144 | 8.0013 | 2.2678 | 3.528 | 5.1345 | 2.8667 |
| 42 | 11.48 | 12.587 | 6.5376 | -0.95971 | -0.159 | 8.4506 | 2.4015 | 3.519 | 5.426 | 3.0245 |
| 43 | 12.08 | 12.896 | 6.5376 | -1.095 | -0.172 | 8.8949 | 2.5368 | 3.506 | 5.7159 | 3.1791 |
| 44 | 12.70 | 13.213 | 6.5376 | -1.2271 | -0.184 | 9.3444 | 2.6689 | 3.501 | 6.0066 | 3.3378 |
| 45 | 13.30 | 13.498 | 6.5376 | -1.3581 | -0.195 | 9.7607 | 2.7998 | 3.486 | 6.2803 | 3.4804 |
| 46 | 13.90 | 13.775 | 6.5376 | -1.4885 | -0.206 | 10.168 | 2.9303 | 3.470 | 6.5489 | 3.6186 |
| 47 | 14.50 | 14.052 | 6.5376 | -1.6151 | -0.215 | 10.571 | 3.0569 | 3.458 | 6.8139 | 3.757 |
| 48 | 15.12 | 14.327 | 6.5376 | -1.7395 | -0.223 | 10.971 | 3.1813 | 3.449 | 7.0762 | 3.8948 |
| 49 | 15.61 | 14.514 | 6.5376 | -1.8341 | -0.230 | 11.253 | 3.2759 | 3.435 | 7.2643 | 3.9884 |

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|---|
| | | Test No. | 10.4 PSI | 17.4 PSI | 24.3 PSI | |
| Initial | | Diameter, in | 2.722 | 2.8299 | 2.6157 | |
| | | Height, in | 6.0571 | 5.4106 | 5.9323 | |
| | | Water Content, % | 5.02 | 7.46 | 5.91 | |
| | | Dry Density, pcf | 121.2 | 121.3 | 120.9 | |
| | | Saturation, % | 36.18 | 53.82 | 42.11 | |
| | | Void Ratio | 0.36923 | 0.3684 | 0.37292 | |
| Before Shear | | Water Content, % | 13.55 | 13.79 | 12.58 | |
| | | Dry Density, pcf | 122. | 121.5 | 124.4 | |
| | | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | | Void Ratio | 0.36021 | 0.36668 | 0.33456 | |
| | | Back Press., tsf | 5.0425 | 5.0399 | 5.042 | |
| Minor Prin. Stress, tsf | | | 0.74626 | 1.2529 | 1.798 | |
| Max. Dev. Stress, tsf | | | 1.6147 | 1.6669 | 2.202 | |
| Time to Failure, min | | | 3930 | 2700 | 3930 | |
| Strain Rate, %/min | | | 0.006 | 0.006 | 0.006 | |
| B-Value | | | .95 | .95 | .97 | |
| Measured Specific Gravity | | | 2.66 | 2.66 | 2.66 | |
| Liquid Limit | | | 40 | 40 | 40 | |
| Plastic Limit | | | 24 | 24 | 24 | |
| Plasticity Index | | | 16 | 16 | 16 | |

| | |
|---|---|
| Project: COLETO CREEK FACILITY | Failure Sketch |
| Location: IPR-GDF SUEZ |  |
| Project No.: 60225561 | |
| Boring No.: B-4-1 S-13 | |
| Sample Type: 3" ST | |
| Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | |

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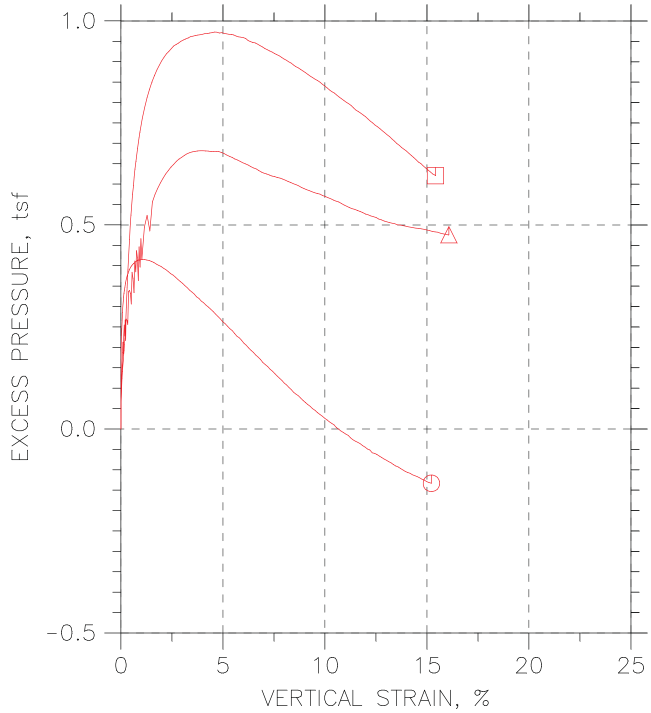
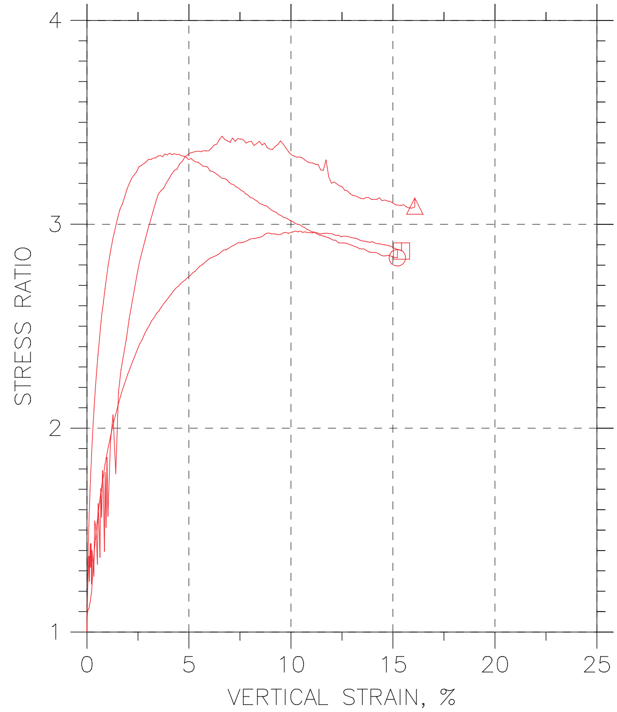
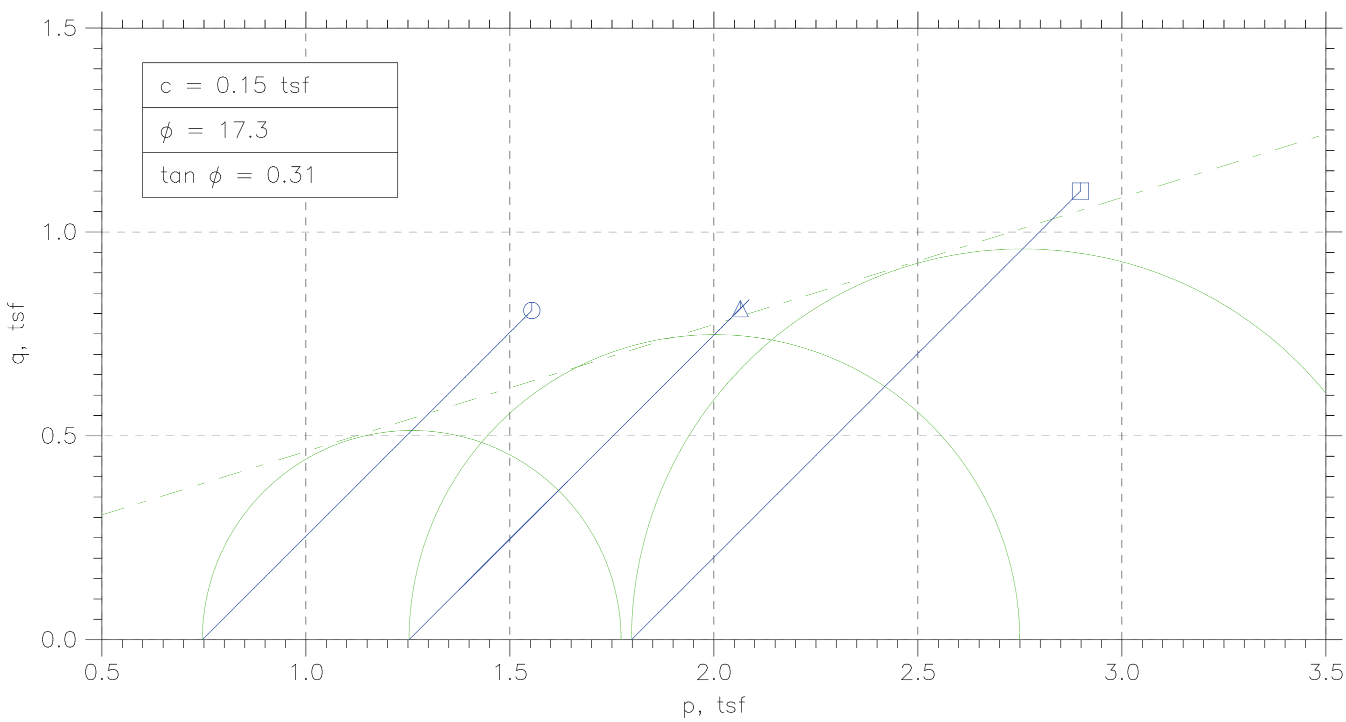
# TRIAXIAL COMPRESSION TEST REPORT




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-4-1 S-13 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-13 | Test Date: 12/2/11 | Depth: 24.0'-26.0' |
| Test No.: B-4-1 S-13 | Sample Type: 3" ST | Elevation: ----- |
| Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | | |
| | | |

Mon, 12-DEC-2011 10:58:11

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: -----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.06 in
Specimen Area: 5.82 in^2
Specimen Volume: 35.25 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5.8194 | 0 | 0 | 5.0425 | 5.7888 | 5.7888 |
| 2 | 5.0041 | 0.017083 | 5.8204 | 6.8968 | 0.085314 | 5.2419 | 5.7888 | 5.8741 |
| 3 | 10 | 0.037013 | 5.8216 | 11.372 | 0.14064 | 5.2811 | 5.7888 | 5.9294 |
| 4 | 15 | 0.056944 | 5.8228 | 14.478 | 0.17902 | 5.308 | 5.7888 | 5.9678 |
| 5 | 20 | 0.075451 | 5.8238 | 16.9 | 0.20893 | 5.3273 | 5.7888 | 5.9977 |
| 6 | 25 | 0.093957 | 5.8249 | 18.795 | 0.23232 | 5.3425 | 5.7888 | 6.0211 |
| 7 | 30 | 0.11389 | 5.8261 | 20.48 | 0.25309 | 5.3553 | 5.7888 | 6.0419 |
| 8 | 35.001 | 0.13239 | 5.8272 | 21.901 | 0.27061 | 5.3658 | 5.7888 | 6.0594 |
| 9 | 40.001 | 0.1509 | 5.8282 | 23.27 | 0.28747 | 5.3746 | 5.7888 | 6.0763 |
| 10 | 45.001 | 0.17083 | 5.8294 | 24.428 | 0.30172 | 5.3828 | 5.7888 | 6.0905 |
| 11 | 50.001 | 0.19076 | 5.8306 | 25.481 | 0.31466 | 5.3892 | 5.7888 | 6.1035 |
| 12 | 55.001 | 0.21069 | 5.8317 | 26.481 | 0.32695 | 5.3951 | 5.7888 | 6.1157 |
| 13 | 60.001 | 0.2292 | 5.8328 | 27.482 | 0.33923 | 5.4003 | 5.7888 | 6.128 |
| 14 | 70.001 | 0.26764 | 5.8351 | 29.272 | 0.36119 | 5.4097 | 5.7888 | 6.15 |
| 15 | 80.001 | 0.3075 | 5.8374 | 30.904 | 0.38118 | 5.4173 | 5.7888 | 6.17 |
| 16 | 90.002 | 0.34593 | 5.8396 | 32.325 | 0.39856 | 5.4231 | 5.7888 | 6.1874 |
| 17 | 100 | 0.38579 | 5.842 | 33.694 | 0.41527 | 5.4284 | 5.7888 | 6.2041 |
| 18 | 110 | 0.42281 | 5.8441 | 34.905 | 0.43003 | 5.4337 | 5.7888 | 6.2188 |
| 19 | 120 | 0.46124 | 5.8464 | 36.063 | 0.44413 | 5.4372 | 5.7888 | 6.2329 |
| 20 | 130 | 0.50111 | 5.8487 | 37.116 | 0.45691 | 5.4407 | 5.7888 | 6.2457 |
| 21 | 140 | 0.54097 | 5.8511 | 38.169 | 0.46969 | 5.4436 | 5.7888 | 6.2585 |
| 22 | 150 | 0.5794 | 5.8534 | 39.117 | 0.48116 | 5.4454 | 5.7888 | 6.27 |
| 23 | 160 | 0.61784 | 5.8556 | 40.012 | 0.49198 | 5.4477 | 5.7888 | 6.2808 |
| 24 | 170 | 0.65628 | 5.8579 | 40.907 | 0.50279 | 5.4494 | 5.7888 | 6.2916 |
| 25 | 180 | 0.69471 | 5.8602 | 41.802 | 0.51359 | 5.4512 | 5.7888 | 6.3024 |
| 26 | 190 | 0.73457 | 5.8625 | 42.644 | 0.52373 | 5.453 | 5.7888 | 6.3125 |
| 27 | 200 | 0.77159 | 5.8647 | 43.276 | 0.53129 | 5.4541 | 5.7888 | 6.3201 |
| 28 | 210 | 0.81145 | 5.867 | 44.013 | 0.54012 | 5.4553 | 5.7888 | 6.3289 |
| 29 | 220 | 0.84846 | 5.8692 | 44.75 | 0.54896 | 5.4565 | 5.7888 | 6.3378 |
| 30 | 230 | 0.8869 | 5.8715 | 45.645 | 0.55973 | 5.4565 | 5.7888 | 6.3485 |
| 31 | 270 | 1.0406 | 5.8806 | 48.593 | 0.59495 | 5.4576 | 5.7888 | 6.3838 |
| 32 | 300 | 1.156 | 5.8875 | 50.541 | 0.61808 | 5.4576 | 5.7888 | 6.4069 |
| 33 | 330 | 1.2713 | 5.8944 | 52.489 | 0.64116 | 5.4565 | 5.7888 | 6.43 |
| 34 | 360 | 1.3866 | 5.9013 | 54.174 | 0.66096 | 5.4553 | 5.7888 | 6.4498 |
| 35 | 390 | 1.5005 | 5.9081 | 55.911 | 0.68137 | 5.453 | 5.7888 | 6.4702 |
| 36 | 420 | 1.6172 | 5.9151 | 57.596 | 0.70107 | 5.4506 | 5.7888 | 6.4899 |
| 37 | 450 | 1.7325 | 5.922 | 59.07 | 0.71817 | 5.4465 | 5.7888 | 6.507 |
| 38 | 480 | 1.8492 | 5.9291 | 60.702 | 0.73714 | 5.4436 | 5.7888 | 6.5259 |
| 39 | 510 | 1.966 | 5.9361 | 62.334 | 0.75606 | 5.4407 | 5.7888 | 6.5449 |
| 40 | 540 | 2.0841 | 5.9433 | 63.966 | 0.77492 | 5.4366 | 5.7888 | 6.5637 |
| 41 | 570 | 2.2009 | 5.9504 | 65.44 | 0.79183 | 5.4331 | 5.7888 | 6.5806 |
| 42 | 600 | 2.3176 | 5.9575 | 66.862 | 0.80806 | 5.4284 | 5.7888 | 6.5969 |
| 43 | 630 | 2.4358 | 5.9647 | 68.388 | 0.82551 | 5.4231 | 5.7888 | 6.6143 |
| 44 | 660 | 2.5539 | 5.972 | 69.863 | 0.84229 | 5.4196 | 5.7888 | 6.6311 |
| 45 | 690 | 2.6721 | 5.9792 | 71.179 | 0.85711 | 5.4144 | 5.7888 | 6.6459 |
| 46 | 720 | 2.7902 | 5.9865 | 72.548 | 0.87254 | 5.4091 | 5.7888 | 6.6613 |
| 47 | 750 | 2.9056 | 5.9936 | 73.916 | 0.88795 | 5.4038 | 5.7888 | 6.6767 |
| 48 | 780 | 3.0223 | 6.0008 | 75.285 | 0.9033 | 5.3992 | 5.7888 | 6.6921 |
| 49 | 810 | 3.1376 | 6.0079 | 76.391 | 0.91548 | 5.3939 | 5.7888 | 6.7043 |
| 50 | 840 | 3.2515 | 6.015 | 77.707 | 0.93016 | 5.3886 | 5.7888 | 6.719 |
| 51 | 870 | 3.3654 | 6.0221 | 78.971 | 0.94417 | 5.3828 | 5.7888 | 6.733 |
| 52 | 900 | 3.4807 | 6.0293 | 80.287 | 0.95876 | 5.3781 | 5.7888 | 6.7476 |
| 53 | 930 | 3.5946 | 6.0364 | 81.498 | 0.97207 | 5.3729 | 5.7888 | 6.7609 |
| 54 | 960 | 3.7085 | 6.0436 | 82.656 | 0.98472 | 5.3664 | 5.7888 | 6.7735 |
| 55 | 990 | 3.8238 | 6.0508 | 84.025 | 0.99983 | 5.3623 | 5.7888 | 6.7886 |
| 56 | 1020 | 3.9377 | 6.058 | 85.235 | 1.013 | 5.3559 | 5.7888 | 6.8018 |
| 57 | 1050 | 4.053 | 6.0653 | 86.446 | 1.0262 | 5.3518 | 5.7888 | 6.815 |
| 58 | 1080 | 4.1683 | 6.0726 | 87.447 | 1.0368 | 5.346 | 5.7888 | 6.8256 |
| 59 | 1110 | 4.285 | 6.08 | 88.658 | 1.0499 | 5.3413 | 5.7888 | 6.8387 |
| 60 | 1140 | 4.4018 | 6.0874 | 89.658 | 1.0604 | 5.336 | 5.7888 | 6.8492 |
| 61 | 1170 | 4.5185 | 6.0948 | 90.816 | 1.0728 | 5.3308 | 5.7888 | 6.8616 |
| 62 | 1200 | 4.6352 | 6.1023 | 91.974 | 1.0852 | 5.3243 | 5.7888 | 6.874 |
| 63 | 1230 | 4.752 | 6.1098 | 93.133 | 1.0975 | 5.3185 | 5.7888 | 6.8863 |
| 64 | 1260 | 4.8701 | 6.1174 | 94.185 | 1.1085 | 5.3126 | 5.7888 | 6.8973 |
| 65 | 1290 | 4.9883 | 6.125 | 95.238 | 1.1195 | 5.3056 | 5.7888 | 6.9083 |
| 66 | 1320 | 5.1064 | 6.1326 | 96.502 | 1.133 | 5.301 | 5.7888 | 6.9218 |
| 67 | 1350 | 5.2232 | 6.1402 | 97.45 | 1.1427 | 5.2945 | 5.7888 | 6.9315 |
| 68 | 1380 | 5.3385 | 6.1476 | 98.555 | 1.1543 | 5.2881 | 5.7888 | 6.9431 |
| 69 | 1410 | 5.4552 | 6.1552 | 99.555 | 1.1645 | 5.2834 | 5.7888 | 6.9533 |
| 70 | 1440 | 5.5705 | 6.1627 | 100.56 | 1.1748 | 5.277 | 5.7888 | 6.9636 |
| 71 | 1470 | 5.683 | 6.1701 | 101.61 | 1.1857 | 5.27 | 5.7888 | 6.9745 |
| 72 | 1500 | 5.7983 | 6.1776 | 102.45 | 1.1941 | 5.2659 | 5.7888 | 6.9829 |
| 73 | 1530 | 5.9136 | 6.1852 | 103.61 | 1.2061 | 5.26 | 5.7888 | 6.9949 |
| 74 | 1560 | 6.0275 | 6.1927 | 104.35 | 1.2132 | 5.2524 | 5.7888 | 7.002 |
| 75 | 1590 | 6.1428 | 6.2003 | 105.29 | 1.2227 | 5.2477 | 5.7888 | 7.0115 |
| 76 | 1620 | 6.2581 | 6.2079 | 106.35 | 1.2334 | 5.2413 | 5.7888 | 7.0222 |
| 77 | 1650 | 6.372 | 6.2155 | 107.24 | 1.2423 | 5.2355 | 5.7888 | 7.0311 |
| 78 | 1680 | 6.4887 | 6.2233 | 107.98 | 1.2493 | 5.2302 | 5.7888 | 7.0381 |
| 79 | 1710 | 6.6041 | 6.2309 | 108.87 | 1.2581 | 5.2238 | 5.7888 | 7.0469 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1740 | 6.7236 | 6.2389 | 109.93 | 1.2686 | 5.2185 | 5.7888 | 7.0574 |
| 81 | 1770 | 6.8418 | 6.2468 | 110.98 | 1.2791 | 5.2127 | 5.7888 | 7.0679 |
| 82 | 1800 | 6.9585 | 6.2547 | 111.82 | 1.2872 | 5.2057 | 5.7888 | 7.076 |
| 83 | 1830 | 7.0767 | 6.2626 | 112.56 | 1.2941 | 5.1998 | 5.7888 | 7.0829 |
| 84 | 1860 | 7.1948 | 6.2706 | 113.45 | 1.3027 | 5.1951 | 5.7888 | 7.0915 |
| 85 | 1890 | 7.3144 | 6.2787 | 114.24 | 1.3101 | 5.1887 | 5.7888 | 7.0989 |
| 86 | 1920 | 7.4326 | 6.2867 | 114.98 | 1.3168 | 5.184 | 5.7888 | 7.1056 |
| 87 | 1950 | 7.5493 | 6.2946 | 115.82 | 1.3248 | 5.1776 | 5.7888 | 7.1136 |
| 88 | 1980 | 7.6646 | 6.3025 | 116.61 | 1.3322 | 5.1723 | 5.7888 | 7.121 |
| 89 | 2010 | 7.7814 | 6.3105 | 117.24 | 1.3377 | 5.1665 | 5.7888 | 7.1265 |
| 90 | 2040 | 7.8953 | 6.3183 | 118.03 | 1.3451 | 5.1612 | 5.7888 | 7.1339 |
| 91 | 2070 | 8.0077 | 6.326 | 118.72 | 1.3512 | 5.1548 | 5.7888 | 7.14 |
| 92 | 2100 | 8.1216 | 6.3339 | 119.56 | 1.3591 | 5.1501 | 5.7888 | 7.1479 |
| 93 | 2130 | 8.2369 | 6.3418 | 120.35 | 1.3664 | 5.1443 | 5.7888 | 7.1552 |
| 94 | 2160 | 8.3522 | 6.3498 | 121.09 | 1.373 | 5.139 | 5.7888 | 7.1618 |
| 95 | 2190 | 8.4647 | 6.3576 | 121.77 | 1.3791 | 5.1326 | 5.7888 | 7.1679 |
| 96 | 2220 | 8.58 | 6.3656 | 122.56 | 1.3863 | 5.1279 | 5.7888 | 7.1751 |
| 97 | 2250 | 8.6939 | 6.3735 | 123.14 | 1.3911 | 5.1238 | 5.7888 | 7.1799 |
| 98 | 2280 | 8.8092 | 6.3816 | 124.14 | 1.4006 | 5.1185 | 5.7888 | 7.1894 |
| 99 | 2310 | 8.9259 | 6.3898 | 124.77 | 1.4059 | 5.1127 | 5.7888 | 7.1947 |
| 100 | 2340 | 9.0441 | 6.3981 | 125.3 | 1.41 | 5.1074 | 5.7888 | 7.1988 |
| 101 | 2370 | 9.1608 | 6.4063 | 126.04 | 1.4165 | 5.1022 | 5.7888 | 7.2053 |
| 102 | 2400 | 9.279 | 6.4147 | 126.67 | 1.4218 | 5.0981 | 5.7888 | 7.2106 |
| 103 | 2430 | 9.3957 | 6.4229 | 127.25 | 1.4264 | 5.0922 | 5.7888 | 7.2152 |
| 104 | 2460 | 9.5139 | 6.4313 | 127.83 | 1.4311 | 5.0881 | 5.7888 | 7.2199 |
| 105 | 2490 | 9.632 | 6.4397 | 128.41 | 1.4357 | 5.0829 | 5.7888 | 7.2245 |
| 106 | 2520 | 9.7516 | 6.4482 | 129.25 | 1.4432 | 5.0782 | 5.7888 | 7.232 |
| 107 | 2550 | 9.8698 | 6.4567 | 129.88 | 1.4483 | 5.0735 | 5.7888 | 7.2371 |
| 108 | 2580 | 9.9837 | 6.4649 | 130.35 | 1.4518 | 5.0688 | 5.7888 | 7.2406 |
| 109 | 2610 | 10.102 | 6.4734 | 131.04 | 1.4575 | 5.0648 | 5.7888 | 7.2463 |
| 110 | 2640 | 10.219 | 6.4818 | 131.46 | 1.4603 | 5.0601 | 5.7888 | 7.2491 |
| 111 | 2670 | 10.332 | 6.49 | 132.09 | 1.4654 | 5.056 | 5.7888 | 7.2542 |
| 112 | 2700 | 10.448 | 6.4984 | 132.72 | 1.4705 | 5.0525 | 5.7888 | 7.2593 |
| 113 | 2730 | 10.562 | 6.5066 | 133.46 | 1.4768 | 5.046 | 5.7888 | 7.2656 |
| 114 | 2760 | 10.677 | 6.515 | 134.2 | 1.4831 | 5.0414 | 5.7888 | 7.2719 |
| 115 | 2790 | 10.792 | 6.5235 | 134.46 | 1.484 | 5.0373 | 5.7888 | 7.2728 |
| 116 | 2820 | 10.909 | 6.532 | 134.88 | 1.4867 | 5.0338 | 5.7888 | 7.2755 |
| 117 | 2850 | 11.024 | 6.5405 | 135.41 | 1.4906 | 5.0297 | 5.7888 | 7.2794 |
| 118 | 2880 | 11.14 | 6.549 | 135.99 | 1.4951 | 5.0268 | 5.7888 | 7.2839 |
| 119 | 2910 | 11.256 | 6.5576 | 136.67 | 1.5006 | 5.0209 | 5.7888 | 7.2894 |
| 120 | 2940 | 11.373 | 6.5662 | 137.2 | 1.5044 | 5.0162 | 5.7888 | 7.2932 |
| 121 | 2970 | 11.491 | 6.575 | 137.88 | 1.5099 | 5.0127 | 5.7888 | 7.2987 |
| 122 | 3000 | 11.609 | 6.5838 | 138.25 | 1.5119 | 5.0098 | 5.7888 | 7.3007 |
| 123 | 3030 | 11.73 | 6.5928 | 138.83 | 1.5162 | 5.0063 | 5.7888 | 7.305 |
| 124 | 3060 | 11.847 | 6.6015 | 139.57 | 1.5222 | 5.0016 | 5.7888 | 7.311 |
| 125 | 3090 | 11.965 | 6.6104 | 139.94 | 1.5242 | 4.9981 | 5.7888 | 7.313 |
| 126 | 3120 | 12.083 | 6.6193 | 140.51 | 1.5284 | 4.9934 | 5.7888 | 7.3172 |
| 127 | 3150 | 12.2 | 6.6281 | 141.15 | 1.5333 | 4.9911 | 5.7888 | 7.3221 |
| 128 | 3180 | 12.317 | 6.6369 | 141.62 | 1.5364 | 4.9841 | 5.7888 | 7.3252 |
| 129 | 3210 | 12.432 | 6.6456 | 141.94 | 1.5378 | 4.9829 | 5.7888 | 7.3266 |
| 130 | 3240 | 12.55 | 6.6546 | 142.67 | 1.5437 | 4.98 | 5.7888 | 7.3325 |
| 131 | 3270 | 12.666 | 6.6634 | 143.52 | 1.5507 | 4.9759 | 5.7888 | 7.3395 |
| 132 | 3300 | 12.78 | 6.6721 | 144.09 | 1.555 | 4.9724 | 5.7888 | 7.3438 |
| 133 | 3330 | 12.893 | 6.6808 | 144.57 | 1.558 | 4.9689 | 5.7888 | 7.3468 |
| 134 | 3360 | 13.009 | 6.6897 | 144.99 | 1.5605 | 4.966 | 5.7888 | 7.3493 |
| 135 | 3390 | 13.124 | 6.6986 | 145.36 | 1.5624 | 4.9624 | 5.7888 | 7.3512 |
| 136 | 3420 | 13.238 | 6.7074 | 145.83 | 1.5654 | 4.9595 | 5.7888 | 7.3542 |
| 137 | 3450 | 13.355 | 6.7164 | 146.2 | 1.5673 | 4.9554 | 5.7888 | 7.3561 |
| 138 | 3480 | 13.471 | 6.7255 | 146.89 | 1.5725 | 4.9519 | 5.7888 | 7.3613 |
| 139 | 3510 | 13.588 | 6.7345 | 147.46 | 1.5766 | 4.9496 | 5.7888 | 7.3654 |
| 140 | 3540 | 13.706 | 6.7438 | 147.78 | 1.5778 | 4.9455 | 5.7888 | 7.3666 |
| 141 | 3570 | 13.823 | 6.7529 | 148.1 | 1.579 | 4.942 | 5.7888 | 7.3678 |
| 142 | 3600 | 13.938 | 6.7619 | 148.68 | 1.5831 | 4.9385 | 5.7888 | 7.3719 |
| 143 | 3630 | 14.058 | 6.7714 | 149.41 | 1.5887 | 4.9355 | 5.7888 | 7.3775 |
| 144 | 3660 | 14.175 | 6.7806 | 149.89 | 1.5916 | 4.9338 | 5.7888 | 7.3804 |
| 145 | 3690 | 14.291 | 6.7898 | 150.25 | 1.5933 | 4.9303 | 5.7888 | 7.3821 |
| 146 | 3720 | 14.411 | 6.7993 | 150.25 | 1.5911 | 4.9279 | 5.7888 | 7.3799 |
| 147 | 3750 | 14.529 | 6.8087 | 150.52 | 1.5917 | 4.9256 | 5.7888 | 7.3805 |
| 148 | 3780 | 14.645 | 6.8179 | 151.31 | 1.5979 | 4.9227 | 5.7888 | 7.3867 |
| 149 | 3810 | 14.76 | 6.8271 | 152.36 | 1.6068 | 4.9192 | 5.7888 | 7.3956 |
| 150 | 3840 | 14.875 | 6.8364 | 152.73 | 1.6085 | 4.9168 | 5.7888 | 7.3973 |
| 151 | 3870 | 14.99 | 6.8456 | 153.04 | 1.6097 | 4.9133 | 5.7888 | 7.3985 |
| 152 | 3900 | 15.104 | 6.8548 | 153.57 | 1.613 | 4.911 | 5.7888 | 7.4018 |
| 153 | 3930 | 15.218 | 6.864 | 153.94 | 1.6147 | 4.9092 | 5.7888 | 7.4035 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: -----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.06 in
Specimen Area: 5.82 in^2
Specimen Volume: 35.25 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.7888 | 5.7888 | 0 | 0.000 | 0.74626 | 0.74626 | 1.000 | 0.74626 | 0 |
| 2 | 0.02 | 5.8741 | 5.7888 | 0.19936 | 2.337 | 0.63221 | 0.5469 | 1.156 | 0.58956 | 0.042657 |
| 3 | 0.04 | 5.9294 | 5.7888 | 0.23853 | 1.696 | 0.64837 | 0.50773 | 1.277 | 0.57805 | 0.070321 |
| 4 | 0.06 | 5.9678 | 5.7888 | 0.26543 | 1.483 | 0.65986 | 0.48083 | 1.372 | 0.57035 | 0.089512 |
| 5 | 0.08 | 5.9977 | 5.7888 | 0.28472 | 1.363 | 0.67047 | 0.46154 | 1.453 | 0.56601 | 0.10447 |
| 6 | 0.09 | 6.0211 | 5.7888 | 0.29992 | 1.291 | 0.67866 | 0.44634 | 1.520 | 0.5625 | 0.11616 |
| 7 | 0.11 | 6.0419 | 5.7888 | 0.31278 | 1.236 | 0.68657 | 0.43348 | 1.584 | 0.56002 | 0.12655 |
| 8 | 0.13 | 6.0594 | 5.7888 | 0.32331 | 1.195 | 0.69356 | 0.42295 | 1.640 | 0.55826 | 0.1353 |
| 9 | 0.15 | 6.0763 | 5.7888 | 0.33208 | 1.155 | 0.70165 | 0.41418 | 1.694 | 0.55792 | 0.14373 |
| 10 | 0.17 | 6.0905 | 5.7888 | 0.34026 | 1.128 | 0.70772 | 0.406 | 1.743 | 0.55686 | 0.15086 |
| 11 | 0.19 | 6.1035 | 5.7888 | 0.34669 | 1.102 | 0.71423 | 0.39957 | 1.787 | 0.5569 | 0.15733 |
| 12 | 0.21 | 6.1157 | 5.7888 | 0.35254 | 1.078 | 0.72067 | 0.39372 | 1.830 | 0.5572 | 0.16347 |
| 13 | 0.23 | 6.128 | 5.7888 | 0.3578 | 1.055 | 0.72769 | 0.38846 | 1.873 | 0.55808 | 0.16962 |
| 14 | 0.27 | 6.15 | 5.7888 | 0.36716 | 1.017 | 0.7403 | 0.37911 | 1.953 | 0.5597 | 0.1806 |
| 15 | 0.31 | 6.17 | 5.7888 | 0.37476 | 0.983 | 0.75268 | 0.37151 | 2.026 | 0.56209 | 0.19059 |
| 16 | 0.35 | 6.1874 | 5.7888 | 0.3806 | 0.955 | 0.76421 | 0.36566 | 2.090 | 0.56494 | 0.19928 |
| 17 | 0.39 | 6.2041 | 5.7888 | 0.38586 | 0.929 | 0.77566 | 0.3604 | 2.152 | 0.56803 | 0.20763 |
| 18 | 0.42 | 6.2188 | 5.7888 | 0.39113 | 0.910 | 0.78517 | 0.35514 | 2.211 | 0.57015 | 0.21501 |
| 19 | 0.46 | 6.2329 | 5.7888 | 0.39463 | 0.889 | 0.79576 | 0.35163 | 2.263 | 0.57369 | 0.22206 |
| 20 | 0.50 | 6.2457 | 5.7888 | 0.39814 | 0.871 | 0.80503 | 0.34812 | 2.313 | 0.57658 | 0.22846 |
| 21 | 0.54 | 6.2585 | 5.7888 | 0.40106 | 0.854 | 0.81488 | 0.3452 | 2.361 | 0.58004 | 0.23484 |
| 22 | 0.58 | 6.27 | 5.7888 | 0.40282 | 0.837 | 0.8246 | 0.34344 | 2.401 | 0.58402 | 0.24058 |
| 23 | 0.62 | 6.2808 | 5.7888 | 0.40516 | 0.824 | 0.83308 | 0.3411 | 2.442 | 0.58709 | 0.24599 |
| 24 | 0.66 | 6.2916 | 5.7888 | 0.40691 | 0.809 | 0.84214 | 0.33935 | 2.482 | 0.59075 | 0.25139 |
| 25 | 0.69 | 6.3024 | 5.7888 | 0.40866 | 0.796 | 0.85119 | 0.3376 | 2.521 | 0.59439 | 0.2568 |
| 26 | 0.73 | 6.3125 | 5.7888 | 0.41042 | 0.784 | 0.85957 | 0.33584 | 2.559 | 0.59771 | 0.26187 |
| 27 | 0.77 | 6.3201 | 5.7888 | 0.41159 | 0.775 | 0.86596 | 0.33467 | 2.587 | 0.60032 | 0.26565 |
| 28 | 0.81 | 6.3289 | 5.7888 | 0.41276 | 0.764 | 0.87363 | 0.3335 | 2.620 | 0.60357 | 0.27006 |
| 29 | 0.85 | 6.3378 | 5.7888 | 0.41393 | 0.754 | 0.8813 | 0.33233 | 2.652 | 0.60682 | 0.27448 |
| 30 | 0.89 | 6.3485 | 5.7888 | 0.41393 | 0.740 | 0.89206 | 0.33233 | 2.684 | 0.6122 | 0.27986 |
| 31 | 1.04 | 6.3838 | 5.7888 | 0.4151 | 0.698 | 0.92612 | 0.33117 | 2.797 | 0.62864 | 0.29748 |
| 32 | 1.16 | 6.4069 | 5.7888 | 0.4151 | 0.672 | 0.94925 | 0.33117 | 2.866 | 0.64021 | 0.30904 |
| 33 | 1.27 | 6.43 | 5.7888 | 0.41393 | 0.646 | 0.97349 | 0.33233 | 2.929 | 0.65291 | 0.32058 |
| 34 | 1.39 | 6.4498 | 5.7888 | 0.41276 | 0.624 | 0.99447 | 0.3335 | 2.982 | 0.66398 | 0.33048 |
| 35 | 1.50 | 6.4702 | 5.7888 | 0.41042 | 0.602 | 1.0172 | 0.33584 | 3.029 | 0.67653 | 0.34069 |
| 36 | 1.62 | 6.4899 | 5.7888 | 0.40808 | 0.582 | 1.0393 | 0.33818 | 3.073 | 0.68872 | 0.35054 |
| 37 | 1.73 | 6.507 | 5.7888 | 0.40399 | 0.563 | 1.0604 | 0.34227 | 3.098 | 0.70136 | 0.35909 |
| 38 | 1.85 | 6.5259 | 5.7888 | 0.40106 | 0.544 | 1.0823 | 0.3452 | 3.135 | 0.71377 | 0.36857 |
| 39 | 1.97 | 6.5449 | 5.7888 | 0.39814 | 0.527 | 1.1042 | 0.34812 | 3.172 | 0.72615 | 0.37803 |
| 40 | 2.08 | 6.5637 | 5.7888 | 0.39405 | 0.509 | 1.1271 | 0.35221 | 3.200 | 0.73967 | 0.38746 |
| 41 | 2.20 | 6.5806 | 5.7888 | 0.39054 | 0.493 | 1.1475 | 0.35572 | 3.226 | 0.75163 | 0.39591 |
| 42 | 2.32 | 6.5969 | 5.7888 | 0.38586 | 0.478 | 1.1685 | 0.3604 | 3.242 | 0.76443 | 0.40403 |
| 43 | 2.44 | 6.6143 | 5.7888 | 0.3806 | 0.461 | 1.1912 | 0.36566 | 3.258 | 0.77842 | 0.41276 |
| 44 | 2.55 | 6.6311 | 5.7888 | 0.37709 | 0.448 | 1.2115 | 0.36917 | 3.282 | 0.79031 | 0.42114 |
| 45 | 2.67 | 6.6459 | 5.7888 | 0.37183 | 0.434 | 1.2315 | 0.37443 | 3.289 | 0.80299 | 0.42856 |
| 46 | 2.79 | 6.6613 | 5.7888 | 0.36657 | 0.420 | 1.2522 | 0.37969 | 3.298 | 0.81596 | 0.43627 |
| 47 | 2.91 | 6.6767 | 5.7888 | 0.36131 | 0.407 | 1.2729 | 0.38495 | 3.307 | 0.82893 | 0.44397 |
| 48 | 3.02 | 6.6921 | 5.7888 | 0.35663 | 0.395 | 1.2929 | 0.38963 | 3.318 | 0.84128 | 0.45165 |
| 49 | 3.14 | 6.7043 | 5.7888 | 0.35137 | 0.384 | 1.3104 | 0.39489 | 3.318 | 0.85263 | 0.45774 |
| 50 | 3.25 | 6.719 | 5.7888 | 0.34611 | 0.372 | 1.3303 | 0.40015 | 3.324 | 0.86523 | 0.46508 |
| 51 | 3.37 | 6.733 | 5.7888 | 0.34026 | 0.360 | 1.3502 | 0.406 | 3.326 | 0.87808 | 0.47208 |
| 52 | 3.48 | 6.7476 | 5.7888 | 0.33558 | 0.350 | 1.3694 | 0.41068 | 3.335 | 0.89006 | 0.47938 |
| 53 | 3.59 | 6.7609 | 5.7888 | 0.33032 | 0.340 | 1.388 | 0.41594 | 3.337 | 0.90197 | 0.48603 |
| 54 | 3.71 | 6.7735 | 5.7888 | 0.32389 | 0.329 | 1.4071 | 0.42237 | 3.331 | 0.91473 | 0.49236 |
| 55 | 3.82 | 6.7886 | 5.7888 | 0.3198 | 0.320 | 1.4263 | 0.42646 | 3.344 | 0.92638 | 0.49991 |
| 56 | 3.94 | 6.8018 | 5.7888 | 0.31337 | 0.309 | 1.4459 | 0.43289 | 3.340 | 0.93941 | 0.50652 |
| 57 | 4.05 | 6.815 | 5.7888 | 0.30928 | 0.301 | 1.4632 | 0.43699 | 3.348 | 0.95008 | 0.5131 |
| 58 | 4.17 | 6.8256 | 5.7888 | 0.30343 | 0.293 | 1.4797 | 0.44283 | 3.341 | 0.96124 | 0.51841 |
| 59 | 4.29 | 6.8387 | 5.7888 | 0.29875 | 0.285 | 1.4974 | 0.44751 | 3.346 | 0.97246 | 0.52495 |
| 60 | 4.40 | 6.8492 | 5.7888 | 0.29349 | 0.277 | 1.5132 | 0.45277 | 3.342 | 0.983 | 0.53022 |
| 61 | 4.52 | 6.8616 | 5.7888 | 0.28823 | 0.269 | 1.5309 | 0.45803 | 3.342 | 0.99445 | 0.53642 |
| 62 | 4.64 | 6.874 | 5.7888 | 0.2818 | 0.260 | 1.5497 | 0.46446 | 3.336 | 1.0071 | 0.5426 |
| 63 | 4.75 | 6.8863 | 5.7888 | 0.27595 | 0.251 | 1.5678 | 0.47031 | 3.334 | 1.0191 | 0.54876 |
| 64 | 4.87 | 6.8973 | 5.7888 | 0.2701 | 0.244 | 1.5847 | 0.47616 | 3.328 | 1.0304 | 0.55427 |
| 65 | 4.99 | 6.9083 | 5.7888 | 0.26309 | 0.235 | 1.6027 | 0.48317 | 3.317 | 1.0429 | 0.55977 |
| 66 | 5.11 | 6.9218 | 5.7888 | 0.25841 | 0.228 | 1.6208 | 0.48785 | 3.322 | 1.0543 | 0.56649 |
| 67 | 5.22 | 6.9315 | 5.7888 | 0.25198 | 0.221 | 1.637 | 0.49428 | 3.312 | 1.0656 | 0.57135 |
| 68 | 5.34 | 6.9431 | 5.7888 | 0.24555 | 0.213 | 1.655 | 0.50071 | 3.305 | 1.0778 | 0.57713 |
| 69 | 5.46 | 6.9533 | 5.7888 | 0.24087 | 0.207 | 1.6699 | 0.50539 | 3.304 | 1.0877 | 0.58227 |
| 70 | 5.57 | 6.9636 | 5.7888 | 0.23444 | 0.200 | 1.6866 | 0.51182 | 3.295 | 1.0992 | 0.5874 |
| 71 | 5.68 | 6.9745 | 5.7888 | 0.22743 | 0.192 | 1.7045 | 0.51884 | 3.285 | 1.1117 | 0.59285 |
| 72 | 5.80 | 6.9829 | 5.7888 | 0.22333 | 0.187 | 1.717 | 0.52293 | 3.283 | 1.12 | 0.59703 |
| 73 | 5.91 | 6.9949 | 5.7888 | 0.21749 | 0.180 | 1.7349 | 0.52877 | 3.281 | 1.1318 | 0.60304 |
| 74 | 6.03 | 7.002 | 5.7888 | 0.20989 | 0.173 | 1.7496 | 0.53637 | 3.262 | 1.143 | 0.6066 |
| 75 | 6.14 | 7.0115 | 5.7888 | 0.20521 | 0.168 | 1.7638 | 0.54105 | 3.260 | 1.1524 | 0.61135 |
| 76 | 6.26 | 7.0222 | 5.7888 | 0.19878 | 0.161 | 1.7809 | 0.54748 | 3.253 | 1.1642 | 0.61671 |
| 77 | 6.37 | 7.0311 | 5.7888 | 0.19293 | 0.155 | 1.7956 | 0.55333 | 3.245 | 1.1745 | 0.62114 |
| 78 | 6.49 | 7.0381 | 5.7888 | 0.18767 | 0.150 | 1.8079 | 0.55859 | 3.236 | 1.1832 | 0.62463 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 6.60 | 7.0469 | 5.7888 | 0.18124 | 0.144 | 1.8231 | 0.56502 | 3.227 | 1.1941 | 0.62903 |
| 80 | 6.72 | 7.0574 | 5.7888 | 0.17598 | 0.139 | 1.8389 | 0.57028 | 3.225 | 1.2046 | 0.6343 |
| 81 | 6.84 | 7.0679 | 5.7888 | 0.17013 | 0.133 | 1.8553 | 0.57613 | 3.220 | 1.2157 | 0.63957 |
| 82 | 6.96 | 7.076 | 5.7888 | 0.16312 | 0.127 | 1.8704 | 0.58315 | 3.207 | 1.2268 | 0.64361 |
| 83 | 7.08 | 7.0829 | 5.7888 | 0.15727 | 0.122 | 1.8831 | 0.58899 | 3.197 | 1.236 | 0.64703 |
| 84 | 7.19 | 7.0915 | 5.7888 | 0.15259 | 0.117 | 1.8964 | 0.59367 | 3.194 | 1.245 | 0.65135 |
| 85 | 7.31 | 7.0989 | 5.7888 | 0.14616 | 0.112 | 1.9102 | 0.6001 | 3.183 | 1.2551 | 0.65504 |
| 86 | 7.43 | 7.1056 | 5.7888 | 0.14148 | 0.107 | 1.9216 | 0.60478 | 3.177 | 1.2632 | 0.65842 |
| 87 | 7.55 | 7.1136 | 5.7888 | 0.13505 | 0.102 | 1.936 | 0.61121 | 3.168 | 1.2736 | 0.66241 |
| 88 | 7.66 | 7.121 | 5.7888 | 0.12979 | 0.097 | 1.9487 | 0.61647 | 3.161 | 1.2826 | 0.6661 |
| 89 | 7.78 | 7.1265 | 5.7888 | 0.12394 | 0.093 | 1.96 | 0.62232 | 3.150 | 1.2912 | 0.66886 |
| 90 | 7.90 | 7.1339 | 5.7888 | 0.11868 | 0.088 | 1.9726 | 0.62758 | 3.143 | 1.3001 | 0.67253 |
| 91 | 8.01 | 7.14 | 5.7888 | 0.11225 | 0.083 | 1.9852 | 0.63401 | 3.131 | 1.3096 | 0.67561 |
| 92 | 8.12 | 7.1479 | 5.7888 | 0.10757 | 0.079 | 1.9978 | 0.63869 | 3.128 | 1.3182 | 0.67956 |
| 93 | 8.24 | 7.1552 | 5.7888 | 0.10173 | 0.074 | 2.0109 | 0.64453 | 3.120 | 1.3277 | 0.68319 |
| 94 | 8.35 | 7.1618 | 5.7888 | 0.096466 | 0.070 | 2.0228 | 0.6498 | 3.113 | 1.3363 | 0.68651 |
| 95 | 8.46 | 7.1679 | 5.7888 | 0.090035 | 0.065 | 2.0353 | 0.65623 | 3.102 | 1.3458 | 0.68954 |
| 96 | 8.58 | 7.1751 | 5.7888 | 0.085358 | 0.062 | 2.0472 | 0.6609 | 3.098 | 1.354 | 0.69314 |
| 97 | 8.69 | 7.1799 | 5.7888 | 0.081265 | 0.058 | 2.0561 | 0.665 | 3.092 | 1.3605 | 0.69554 |
| 98 | 8.81 | 7.1894 | 5.7888 | 0.076003 | 0.054 | 2.0709 | 0.67026 | 3.090 | 1.3706 | 0.70031 |
| 99 | 8.93 | 7.1947 | 5.7888 | 0.070157 | 0.050 | 2.082 | 0.6761 | 3.079 | 1.3791 | 0.70297 |
| 100 | 9.04 | 7.1988 | 5.7888 | 0.064895 | 0.046 | 2.0914 | 0.68137 | 3.069 | 1.3864 | 0.70502 |
| 101 | 9.16 | 7.2053 | 5.7888 | 0.059634 | 0.042 | 2.1031 | 0.68663 | 3.063 | 1.3949 | 0.70826 |
| 102 | 9.28 | 7.2106 | 5.7888 | 0.055541 | 0.039 | 2.1125 | 0.69072 | 3.058 | 1.4016 | 0.71088 |
| 103 | 9.40 | 7.2152 | 5.7888 | 0.049695 | 0.035 | 2.123 | 0.69657 | 3.048 | 1.4098 | 0.71321 |
| 104 | 9.51 | 7.2199 | 5.7888 | 0.045602 | 0.032 | 2.1317 | 0.70066 | 3.042 | 1.4162 | 0.71553 |
| 105 | 9.63 | 7.2245 | 5.7888 | 0.04034 | 0.028 | 2.1416 | 0.70592 | 3.034 | 1.4238 | 0.71783 |
| 106 | 9.75 | 7.232 | 5.7888 | 0.035663 | 0.025 | 2.1538 | 0.7106 | 3.031 | 1.4322 | 0.72158 |
| 107 | 9.87 | 7.2371 | 5.7888 | 0.030986 | 0.021 | 2.1636 | 0.71528 | 3.025 | 1.4394 | 0.72416 |
| 108 | 9.98 | 7.2406 | 5.7888 | 0.026309 | 0.018 | 2.1717 | 0.71995 | 3.016 | 1.4458 | 0.72588 |
| 109 | 10.10 | 7.2463 | 5.7888 | 0.022216 | 0.015 | 2.1815 | 0.72404 | 3.013 | 1.4528 | 0.72874 |
| 110 | 10.22 | 7.2491 | 5.7888 | 0.017539 | 0.012 | 2.189 | 0.72872 | 3.004 | 1.4589 | 0.73013 |
| 111 | 10.33 | 7.2542 | 5.7888 | 0.013447 | 0.009 | 2.1982 | 0.73281 | 3.000 | 1.4655 | 0.73271 |
| 112 | 10.45 | 7.2593 | 5.7888 | 0.0099389 | 0.007 | 2.2069 | 0.73632 | 2.997 | 1.4716 | 0.73527 |
| 113 | 10.56 | 7.2656 | 5.7888 | 0.0035079 | 0.002 | 2.2196 | 0.74275 | 2.988 | 1.4812 | 0.73841 |
| 114 | 10.68 | 7.2719 | 5.7888 | -0.0011693 | -0.001 | 2.2305 | 0.74743 | 2.984 | 1.489 | 0.74153 |
| 115 | 10.79 | 7.2728 | 5.7888 | -0.0052618 | -0.004 | 2.2356 | 0.75152 | 2.975 | 1.4935 | 0.74202 |
| 116 | 10.91 | 7.2755 | 5.7888 | -0.0087696 | -0.006 | 2.2418 | 0.75503 | 2.969 | 1.4984 | 0.74337 |
| 117 | 11.02 | 7.2794 | 5.7888 | -0.012862 | -0.009 | 2.2497 | 0.75912 | 2.964 | 1.5044 | 0.74531 |
| 118 | 11.14 | 7.2839 | 5.7888 | -0.015785 | -0.011 | 2.2571 | 0.76205 | 2.962 | 1.5096 | 0.74753 |
| 119 | 11.26 | 7.2894 | 5.7888 | -0.021632 | -0.014 | 2.2685 | 0.76789 | 2.954 | 1.5182 | 0.7503 |
| 120 | 11.37 | 7.2932 | 5.7888 | -0.026309 | -0.017 | 2.277 | 0.77257 | 2.947 | 1.5248 | 0.7522 |
| 121 | 11.49 | 7.2987 | 5.7888 | -0.029817 | -0.020 | 2.286 | 0.77608 | 2.946 | 1.531 | 0.75495 |
| 122 | 11.61 | 7.3007 | 5.7888 | -0.03274 | -0.022 | 2.2909 | 0.779 | 2.941 | 1.535 | 0.75595 |
| 123 | 11.73 | 7.305 | 5.7888 | -0.036248 | -0.024 | 2.2987 | 0.78251 | 2.938 | 1.5406 | 0.75808 |
| 124 | 11.85 | 7.311 | 5.7888 | -0.040925 | -0.027 | 2.3094 | 0.78719 | 2.934 | 1.5483 | 0.7611 |
| 125 | 11.97 | 7.313 | 5.7888 | -0.044433 | -0.029 | 2.3149 | 0.79069 | 2.928 | 1.5528 | 0.76209 |
| 126 | 12.08 | 7.3172 | 5.7888 | -0.04911 | -0.032 | 2.3238 | 0.79537 | 2.922 | 1.5596 | 0.76421 |
| 127 | 12.20 | 7.3221 | 5.7888 | -0.051449 | -0.034 | 2.331 | 0.79771 | 2.922 | 1.5643 | 0.76663 |
| 128 | 12.32 | 7.3252 | 5.7888 | -0.058464 | -0.038 | 2.3411 | 0.80473 | 2.909 | 1.5729 | 0.76818 |
| 129 | 12.43 | 7.3266 | 5.7888 | -0.059634 | -0.039 | 2.3437 | 0.80589 | 2.908 | 1.5748 | 0.76888 |
| 130 | 12.55 | 7.3325 | 5.7888 | -0.062557 | -0.041 | 2.3525 | 0.80882 | 2.909 | 1.5806 | 0.77183 |
| 131 | 12.67 | 7.3395 | 5.7888 | -0.066649 | -0.043 | 2.3636 | 0.81291 | 2.908 | 1.5883 | 0.77536 |
| 132 | 12.78 | 7.3438 | 5.7888 | -0.070157 | -0.045 | 2.3714 | 0.81642 | 2.905 | 1.5939 | 0.77748 |
| 133 | 12.89 | 7.3468 | 5.7888 | -0.073665 | -0.047 | 2.378 | 0.81993 | 2.900 | 1.5989 | 0.77902 |
| 134 | 13.01 | 7.3493 | 5.7888 | -0.076588 | -0.049 | 2.3834 | 0.82285 | 2.896 | 1.6031 | 0.78025 |
| 135 | 13.12 | 7.3512 | 5.7888 | -0.080096 | -0.051 | 2.3888 | 0.82636 | 2.891 | 1.6076 | 0.7812 |
| 136 | 13.24 | 7.3542 | 5.7888 | -0.083019 | -0.053 | 2.3947 | 0.82928 | 2.888 | 1.612 | 0.78272 |
| 137 | 13.35 | 7.3561 | 5.7888 | -0.087112 | -0.056 | 2.4006 | 0.83337 | 2.881 | 1.617 | 0.78364 |
| 138 | 13.47 | 7.3613 | 5.7888 | -0.09062 | -0.058 | 2.4094 | 0.83688 | 2.879 | 1.6231 | 0.78625 |
| 139 | 13.59 | 7.3654 | 5.7888 | -0.092958 | -0.059 | 2.4158 | 0.83922 | 2.879 | 1.6275 | 0.78828 |
| 140 | 13.71 | 7.3666 | 5.7888 | -0.097051 | -0.062 | 2.4211 | 0.84331 | 2.871 | 1.6322 | 0.78889 |
| 141 | 13.82 | 7.3678 | 5.7888 | -0.10056 | -0.064 | 2.4258 | 0.84682 | 2.865 | 1.6363 | 0.78951 |
| 142 | 13.94 | 7.3719 | 5.7888 | -0.10407 | -0.066 | 2.4334 | 0.85033 | 2.862 | 1.6419 | 0.79153 |
| 143 | 14.06 | 7.3775 | 5.7888 | -0.10699 | -0.067 | 2.442 | 0.85325 | 2.862 | 1.6476 | 0.79435 |
| 144 | 14.17 | 7.3804 | 5.7888 | -0.10874 | -0.068 | 2.4466 | 0.855 | 2.861 | 1.6508 | 0.79579 |
| 145 | 14.29 | 7.3821 | 5.7888 | -0.11225 | -0.070 | 2.4518 | 0.85851 | 2.856 | 1.6552 | 0.79666 |
| 146 | 14.41 | 7.3799 | 5.7888 | -0.11459 | -0.072 | 2.4519 | 0.86085 | 2.848 | 1.6564 | 0.79555 |
| 147 | 14.53 | 7.3805 | 5.7888 | -0.11693 | -0.073 | 2.4549 | 0.86319 | 2.844 | 1.659 | 0.79584 |
| 148 | 14.64 | 7.3867 | 5.7888 | -0.11985 | -0.075 | 2.464 | 0.86611 | 2.845 | 1.6651 | 0.79894 |
| 149 | 14.76 | 7.3956 | 5.7888 | -0.12336 | -0.077 | 2.4764 | 0.86962 | 2.848 | 1.673 | 0.80341 |
| 150 | 14.88 | 7.3973 | 5.7888 | -0.1257 | -0.078 | 2.4805 | 0.87196 | 2.845 | 1.6762 | 0.80426 |
| 151 | 14.99 | 7.3985 | 5.7888 | -0.12921 | -0.080 | 2.4851 | 0.87547 | 2.839 | 1.6803 | 0.80484 |
| 152 | 15.10 | 7.4018 | 5.7888 | -0.13154 | -0.082 | 2.4909 | 0.87781 | 2.838 | 1.6843 | 0.80652 |
| 153 | 15.22 | 7.4035 | 5.7888 | -0.1333 | -0.083 | 2.4943 | 0.87956 | 2.836 | 1.6869 | 0.80737 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3 " ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.41 in
Specimen Area: 6.29 in^2
Specimen Volume: 34.03 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.2898 | 0 | 0 | 5.0399 | 6.2928 | 6.2928 |
| 2 | 5.0042 | 0.0151 | 6.2908 | 12.364 | 0.14151 | 5.111 | 6.2928 | 6.4343 |
| 3 | 10 | 0.035234 | 6.292 | 19.701 | 0.22544 | 5.1588 | 6.2928 | 6.5182 |
| 4 | 15 | 0.057045 | 6.2934 | 25.408 | 0.29068 | 5.1965 | 6.2928 | 6.5835 |
| 5 | 20 | 0.078856 | 6.2948 | 29.756 | 0.34035 | 5.2265 | 6.2928 | 6.6331 |
| 6 | 25 | 0.10067 | 6.2962 | 33.696 | 0.38533 | 5.2526 | 6.2928 | 6.6781 |
| 7 | 30 | 0.12248 | 6.2975 | 23.234 | 0.26563 | 5.2232 | 6.2928 | 6.5584 |
| 8 | 35.001 | 0.14261 | 6.2988 | 33.628 | 0.38439 | 5.2704 | 6.2928 | 6.6772 |
| 9 | 40.001 | 0.16442 | 6.3002 | 37.976 | 0.434 | 5.2948 | 6.2928 | 6.7268 |
| 10 | 45.001 | 0.18623 | 6.3016 | 28.533 | 0.32601 | 5.2676 | 6.2928 | 6.6188 |
| 11 | 50.001 | 0.20637 | 6.3028 | 37.297 | 0.42606 | 5.307 | 6.2928 | 6.7189 |
| 12 | 55.001 | 0.23154 | 6.3044 | 21.332 | 0.24362 | 5.2565 | 6.2928 | 6.5364 |
| 13 | 60.001 | 0.24999 | 6.3056 | 34.375 | 0.39251 | 5.3098 | 6.2928 | 6.6853 |
| 14 | 70.001 | 0.29529 | 6.3085 | 30.163 | 0.34426 | 5.3065 | 6.2928 | 6.6371 |
| 15 | 80.001 | 0.33724 | 6.3111 | 23.845 | 0.27204 | 5.2959 | 6.2928 | 6.5648 |
| 16 | 90.002 | 0.37583 | 6.3136 | 43.751 | 0.49893 | 5.377 | 6.2928 | 6.7917 |
| 17 | 100 | 0.42113 | 6.3164 | 42.12 | 0.48012 | 5.3792 | 6.2928 | 6.7729 |
| 18 | 110 | 0.46475 | 6.3192 | 37.636 | 0.42882 | 5.3715 | 6.2928 | 6.7216 |
| 19 | 120 | 0.51005 | 6.3221 | 27.582 | 0.31412 | 5.3459 | 6.2928 | 6.6069 |
| 20 | 130 | 0.55032 | 6.3246 | 48.098 | 0.54756 | 5.4242 | 6.2928 | 6.8404 |
| 21 | 140 | 0.59394 | 6.3274 | 42.052 | 0.47851 | 5.4087 | 6.2928 | 6.7713 |
| 22 | 150 | 0.64092 | 6.3304 | 29.552 | 0.33612 | 5.3737 | 6.2928 | 6.6289 |
| 23 | 160 | 0.67951 | 6.3329 | 51.971 | 0.59087 | 5.4514 | 6.2928 | 6.8837 |
| 24 | 170 | 0.72481 | 6.3357 | 42.935 | 0.48792 | 5.4248 | 6.2928 | 6.7807 |
| 25 | 180 | 0.76507 | 6.3383 | 56.794 | 0.64515 | 5.477 | 6.2928 | 6.938 |
| 26 | 190 | 0.8087 | 6.3411 | 50.612 | 0.57467 | 5.4603 | 6.2928 | 6.8675 |
| 27 | 200 | 0.85567 | 6.3441 | 30.979 | 0.35158 | 5.4031 | 6.2928 | 6.6444 |
| 28 | 210 | 0.89594 | 6.3467 | 55.639 | 0.6312 | 5.4864 | 6.2928 | 6.924 |
| 29 | 220 | 0.94124 | 6.3496 | 38.723 | 0.4391 | 5.4364 | 6.2928 | 6.7319 |
| 30 | 230 | 0.98151 | 6.3522 | 59.376 | 0.67301 | 5.5064 | 6.2928 | 6.9658 |
| 31 | 240 | 1.0268 | 6.3551 | 41.984 | 0.47566 | 5.4553 | 6.2928 | 6.7685 |
| 32 | 270 | 1.1543 | 6.3633 | 62.637 | 0.70873 | 5.5347 | 6.2928 | 7.0015 |
| 33 | 300 | 1.2835 | 6.3716 | 68.751 | 0.77689 | 5.5636 | 6.2928 | 7.0697 |
| 34 | 330 | 1.4161 | 6.3802 | 52.854 | 0.59645 | 5.5253 | 6.2928 | 6.8893 |
| 35 | 360 | 1.5436 | 6.3884 | 72.691 | 0.81926 | 5.5963 | 6.2928 | 7.1121 |
| 36 | 390 | 1.6728 | 6.3968 | 77.515 | 0.87247 | 5.6152 | 6.2928 | 7.1653 |
| 37 | 420 | 1.8053 | 6.4055 | 80.504 | 0.90489 | 5.6297 | 6.2928 | 7.1977 |
| 38 | 450 | 1.9362 | 6.414 | 83.425 | 0.93648 | 5.643 | 6.2928 | 7.2293 |
| 39 | 480 | 2.0654 | 6.4225 | 87.229 | 0.9779 | 5.6547 | 6.2928 | 7.2707 |
| 40 | 510 | 2.1962 | 6.4311 | 90.218 | 1.0101 | 5.6647 | 6.2928 | 7.3029 |
| 41 | 540 | 2.3254 | 6.4396 | 92.936 | 1.0391 | 5.6735 | 6.2928 | 7.3319 |
| 42 | 570 | 2.4563 | 6.4482 | 95.925 | 1.0711 | 5.6819 | 6.2928 | 7.3639 |
| 43 | 600 | 2.5855 | 6.4568 | 98.439 | 1.0977 | 5.6885 | 6.2928 | 7.3905 |
| 44 | 630 | 2.7163 | 6.4654 | 100.27 | 1.1167 | 5.6957 | 6.2928 | 7.4095 |
| 45 | 660 | 2.8489 | 6.4743 | 102.18 | 1.1363 | 5.7013 | 6.2928 | 7.4291 |
| 46 | 690 | 2.9781 | 6.4829 | 104.15 | 1.1567 | 5.7057 | 6.2928 | 7.4495 |
| 47 | 720 | 3.1089 | 6.4916 | 105.84 | 1.1739 | 5.7102 | 6.2928 | 7.4667 |
| 48 | 750 | 3.2381 | 6.5003 | 107.75 | 1.1934 | 5.7141 | 6.2928 | 7.4862 |
| 49 | 780 | 3.369 | 6.5091 | 109.72 | 1.2136 | 5.7169 | 6.2928 | 7.5064 |
| 50 | 810 | 3.4982 | 6.5178 | 111.55 | 1.2323 | 5.7191 | 6.2928 | 7.5251 |
| 51 | 840 | 3.6307 | 6.5268 | 112.37 | 1.2396 | 5.7202 | 6.2928 | 7.5324 |
| 52 | 870 | 3.7616 | 6.5357 | 112.91 | 1.2439 | 5.7213 | 6.2928 | 7.5367 |
| 53 | 900 | 3.8925 | 6.5446 | 114.34 | 1.2579 | 5.7218 | 6.2928 | 7.5507 |
| 54 | 930 | 4.0233 | 6.5535 | 115.56 | 1.2696 | 5.7218 | 6.2928 | 7.5624 |
| 55 | 960 | 4.1525 | 6.5623 | 116.99 | 1.2835 | 5.7213 | 6.2928 | 7.5763 |
| 56 | 990 | 4.2817 | 6.5712 | 118.21 | 1.2952 | 5.7207 | 6.2928 | 7.588 |
| 57 | 1020 | 4.4143 | 6.5803 | 118.96 | 1.3016 | 5.7196 | 6.2928 | 7.5944 |
| 58 | 1050 | 4.5418 | 6.5891 | 120.31 | 1.3147 | 5.7202 | 6.2928 | 7.6075 |
| 59 | 1080 | 4.6726 | 6.5981 | 121.13 | 1.3218 | 5.7202 | 6.2928 | 7.6146 |
| 60 | 1110 | 4.8018 | 6.6071 | 122.56 | 1.3355 | 5.7196 | 6.2928 | 7.6283 |
| 61 | 1140 | 4.931 | 6.6161 | 123.71 | 1.3463 | 5.7174 | 6.2928 | 7.6391 |
| 62 | 1170 | 5.0619 | 6.6252 | 125 | 1.3585 | 5.7146 | 6.2928 | 7.6513 |
| 63 | 1200 | 5.1928 | 6.6343 | 126.09 | 1.3684 | 5.7113 | 6.2928 | 7.6612 |
| 64 | 1230 | 5.322 | 6.6434 | 127.18 | 1.3783 | 5.708 | 6.2928 | 7.6711 |
| 65 | 1260 | 5.4545 | 6.6527 | 128.06 | 1.3859 | 5.7052 | 6.2928 | 7.6787 |
| 66 | 1290 | 5.5837 | 6.6618 | 128.81 | 1.3921 | 5.7019 | 6.2928 | 7.6849 |
| 67 | 1320 | 5.7129 | 6.6709 | 129.89 | 1.4019 | 5.6991 | 6.2928 | 7.6947 |
| 68 | 1350 | 5.8437 | 6.6802 | 130.71 | 1.4088 | 5.6957 | 6.2928 | 7.7016 |
| 69 | 1380 | 5.9746 | 6.6895 | 131.73 | 1.4178 | 5.6924 | 6.2928 | 7.7106 |
| 70 | 1410 | 6.1055 | 6.6988 | 133.15 | 1.4312 | 5.6896 | 6.2928 | 7.724 |
| 71 | 1440 | 6.2363 | 6.7082 | 134.85 | 1.4474 | 5.6869 | 6.2928 | 7.7402 |
| 72 | 1470 | 6.3655 | 6.7174 | 136.14 | 1.4592 | 5.683 | 6.2928 | 7.752 |
| 73 | 1500 | 6.4947 | 6.7267 | 138.38 | 1.4812 | 5.6796 | 6.2928 | 7.774 |
| 74 | 1530 | 6.6239 | 6.736 | 140.02 | 1.4966 | 5.6774 | 6.2928 | 7.7894 |
| 75 | 1560 | 6.7531 | 6.7453 | 140.15 | 1.496 | 5.6735 | 6.2928 | 7.7888 |
| 76 | 1590 | 6.884 | 6.7548 | 140.9 | 1.5018 | 5.6696 | 6.2928 | 7.7946 |
| 77 | 1620 | 7.0132 | 6.7642 | 141.24 | 1.5034 | 5.6669 | 6.2928 | 7.7962 |
| 78 | 1650 | 7.1407 | 6.7735 | 143.21 | 1.5223 | 5.6647 | 6.2928 | 7.8151 |
| 79 | 1680 | 7.2682 | 6.7828 | 142.94 | 1.5173 | 5.6624 | 6.2928 | 7.8101 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1710 | 7.3991 | 6.7924 | 144.57 | 1.5324 | 5.6597 | 6.2928 | 7.8252 |
| 81 | 1740 | 7.5299 | 6.802 | 144.91 | 1.5339 | 5.6585 | 6.2928 | 7.8267 |
| 82 | 1770 | 7.6641 | 6.8119 | 145.45 | 1.5374 | 5.6563 | 6.2928 | 7.8302 |
| 83 | 1800 | 7.7984 | 6.8218 | 144.97 | 1.5301 | 5.6547 | 6.2928 | 7.8229 |
| 84 | 1830 | 7.9292 | 6.8315 | 146.13 | 1.5401 | 5.6524 | 6.2928 | 7.8329 |
| 85 | 1860 | 8.0618 | 6.8414 | 147.01 | 1.5472 | 5.6497 | 6.2928 | 7.84 |
| 86 | 1890 | 8.1927 | 6.8511 | 146.81 | 1.5428 | 5.6463 | 6.2928 | 7.8356 |
| 87 | 1920 | 8.3235 | 6.8609 | 148.1 | 1.5542 | 5.6441 | 6.2928 | 7.847 |
| 88 | 1950 | 8.4527 | 6.8706 | 149.8 | 1.5698 | 5.6408 | 6.2928 | 7.8626 |
| 89 | 1980 | 8.5836 | 6.8804 | 149.39 | 1.5633 | 5.6386 | 6.2928 | 7.8561 |
| 90 | 2010 | 8.7128 | 6.8901 | 150.75 | 1.5753 | 5.6358 | 6.2928 | 7.8681 |
| 91 | 2040 | 8.842 | 6.8999 | 150.48 | 1.5702 | 5.6319 | 6.2928 | 7.863 |
| 92 | 2070 | 8.9695 | 6.9096 | 150.82 | 1.5716 | 5.6291 | 6.2928 | 7.8644 |
| 93 | 2100 | 9.0987 | 6.9194 | 151.63 | 1.5778 | 5.6263 | 6.2928 | 7.8706 |
| 94 | 2130 | 9.2295 | 6.9294 | 153.33 | 1.5932 | 5.6241 | 6.2928 | 7.886 |
| 95 | 2160 | 9.3604 | 6.9394 | 154.76 | 1.6057 | 5.6213 | 6.2928 | 7.8985 |
| 96 | 2190 | 9.4913 | 6.9494 | 156.66 | 1.6231 | 5.6191 | 6.2928 | 7.9159 |
| 97 | 2220 | 9.6238 | 6.9596 | 156.32 | 1.6172 | 5.6169 | 6.2928 | 7.91 |
| 98 | 2250 | 9.7547 | 6.9697 | 155.71 | 1.6085 | 5.6152 | 6.2928 | 7.9013 |
| 99 | 2280 | 9.8872 | 6.9799 | 155.5 | 1.6041 | 5.6119 | 6.2928 | 7.8969 |
| 100 | 2310 | 10.02 | 6.9902 | 155.3 | 1.5996 | 5.6097 | 6.2928 | 7.8924 |
| 101 | 2340 | 10.151 | 7.0004 | 155.71 | 1.6015 | 5.6069 | 6.2928 | 7.8943 |
| 102 | 2370 | 10.285 | 7.0109 | 156.18 | 1.604 | 5.6041 | 6.2928 | 7.8968 |
| 103 | 2400 | 10.417 | 7.0213 | 157.2 | 1.612 | 5.6008 | 6.2928 | 7.9048 |
| 104 | 2430 | 10.548 | 7.0315 | 157.75 | 1.6153 | 5.598 | 6.2928 | 7.9081 |
| 105 | 2460 | 10.681 | 7.042 | 157.75 | 1.6129 | 5.5963 | 6.2928 | 7.9057 |
| 106 | 2490 | 10.81 | 7.0522 | 158.22 | 1.6154 | 5.5925 | 6.2928 | 7.9082 |
| 107 | 2520 | 10.939 | 7.0624 | 158.97 | 1.6207 | 5.5886 | 6.2928 | 7.9135 |
| 108 | 2550 | 11.07 | 7.0728 | 159.78 | 1.6266 | 5.5858 | 6.2928 | 7.9194 |
| 109 | 2580 | 11.199 | 7.0831 | 160.26 | 1.6291 | 5.5825 | 6.2928 | 7.9219 |
| 110 | 2610 | 11.328 | 7.0934 | 161.14 | 1.6356 | 5.5797 | 6.2928 | 7.9284 |
| 111 | 2640 | 11.459 | 7.1039 | 159.85 | 1.6202 | 5.578 | 6.2928 | 7.913 |
| 112 | 2670 | 11.59 | 7.1144 | 160.6 | 1.6253 | 5.5752 | 6.2928 | 7.9181 |
| 113 | 2700 | 11.718 | 7.1247 | 164.95 | 1.6669 | 5.573 | 6.2928 | 7.9597 |
| 114 | 2730 | 11.852 | 7.1355 | 159.92 | 1.6137 | 5.5703 | 6.2928 | 7.9065 |
| 115 | 2760 | 11.983 | 7.1461 | 158.56 | 1.5976 | 5.5669 | 6.2928 | 7.8904 |
| 116 | 2790 | 12.112 | 7.1566 | 159.78 | 1.6075 | 5.5647 | 6.2928 | 7.9003 |
| 117 | 2820 | 12.243 | 7.1673 | 159.92 | 1.6065 | 5.5619 | 6.2928 | 7.8993 |
| 118 | 2850 | 12.375 | 7.1781 | 159.85 | 1.6034 | 5.5603 | 6.2928 | 7.8962 |
| 119 | 2880 | 12.506 | 7.1889 | 160.26 | 1.6051 | 5.558 | 6.2928 | 7.8979 |
| 120 | 2910 | 12.639 | 7.1998 | 160.06 | 1.6006 | 5.5541 | 6.2928 | 7.8934 |
| 121 | 2940 | 12.771 | 7.2107 | 160.4 | 1.6016 | 5.5525 | 6.2928 | 7.8944 |
| 122 | 2970 | 12.904 | 7.2217 | 160.19 | 1.5971 | 5.5497 | 6.2928 | 7.8899 |
| 123 | 3000 | 13.035 | 7.2326 | 160.33 | 1.5961 | 5.5475 | 6.2928 | 7.8889 |
| 124 | 3030 | 13.169 | 7.2438 | 160.74 | 1.5976 | 5.5458 | 6.2928 | 7.8904 |
| 125 | 3060 | 13.298 | 7.2545 | 160.87 | 1.5966 | 5.5442 | 6.2928 | 7.8894 |
| 126 | 3090 | 13.427 | 7.2654 | 160.87 | 1.5942 | 5.543 | 6.2928 | 7.887 |
| 127 | 3120 | 13.56 | 7.2765 | 161.62 | 1.5992 | 5.5403 | 6.2928 | 7.892 |
| 128 | 3150 | 13.689 | 7.2874 | 162.43 | 1.6049 | 5.5397 | 6.2928 | 7.8977 |
| 129 | 3180 | 13.818 | 7.2983 | 162.98 | 1.6078 | 5.538 | 6.2928 | 7.9006 |
| 130 | 3210 | 13.947 | 7.3093 | 162.84 | 1.6041 | 5.5369 | 6.2928 | 7.8969 |
| 131 | 3240 | 14.078 | 7.3204 | 163.39 | 1.607 | 5.5353 | 6.2928 | 7.8998 |
| 132 | 3270 | 14.208 | 7.3314 | 163.93 | 1.6099 | 5.5342 | 6.2928 | 7.9027 |
| 133 | 3300 | 14.338 | 7.3426 | 165.02 | 1.6181 | 5.533 | 6.2928 | 7.9109 |
| 134 | 3330 | 14.468 | 7.3537 | 164.4 | 1.6097 | 5.5319 | 6.2928 | 7.9025 |
| 135 | 3360 | 14.598 | 7.365 | 165.02 | 1.6132 | 5.5314 | 6.2928 | 7.906 |
| 136 | 3390 | 14.731 | 7.3765 | 165.15 | 1.612 | 5.5303 | 6.2928 | 7.9048 |
| 137 | 3420 | 14.864 | 7.3879 | 165.49 | 1.6128 | 5.5292 | 6.2928 | 7.9056 |
| 138 | 3450 | 14.994 | 7.3993 | 165.56 | 1.611 | 5.5275 | 6.2928 | 7.9038 |
| 139 | 3480 | 15.127 | 7.4109 | 165.42 | 1.6072 | 5.5258 | 6.2928 | 7.9 |
| 140 | 3510 | 15.261 | 7.4226 | 165.9 | 1.6092 | 5.5242 | 6.2928 | 7.902 |
| 141 | 3540 | 15.394 | 7.4342 | 166.31 | 1.6107 | 5.523 | 6.2928 | 7.9035 |
| 142 | 3570 | 15.525 | 7.4457 | 167.12 | 1.6161 | 5.5219 | 6.2928 | 7.9089 |
| 143 | 3600 | 15.655 | 7.4573 | 166.99 | 1.6122 | 5.5197 | 6.2928 | 7.905 |
| 144 | 3630 | 15.788 | 7.469 | 167.19 | 1.6117 | 5.5181 | 6.2928 | 7.9045 |
| 145 | 3660 | 15.916 | 7.4804 | 167.6 | 1.6132 | 5.5169 | 6.2928 | 7.906 |
| 146 | 3690 | 16.048 | 7.4922 | 168.55 | 1.6198 | 5.5153 | 6.2928 | 7.9126 |
| 147 | 3695.9 | 16.073 | 7.4944 | 168.96 | 1.6232 | 5.5158 | 6.2928 | 7.916 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3 " ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.41 in
Specimen Area: 6.29 in^2
Specimen Volume: 34.03 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.2928 | 6.2928 | 0 | 0.000 | 1.2529 | 1.2529 | 1.000 | 1.2529 | 0 |
| 2 | 0.02 | 6.4343 | 6.2928 | 0.071079 | 0.502 | 1.3233 | 1.1818 | 1.120 | 1.2525 | 0.070757 |
| 3 | 0.04 | 6.5182 | 6.2928 | 0.11883 | 0.527 | 1.3595 | 1.134 | 1.199 | 1.2468 | 0.11272 |
| 4 | 0.06 | 6.5835 | 6.2928 | 0.1566 | 0.539 | 1.3869 | 1.0963 | 1.265 | 1.2416 | 0.14534 |
| 5 | 0.08 | 6.6331 | 6.2928 | 0.18658 | 0.548 | 1.4066 | 1.0663 | 1.319 | 1.2365 | 0.17017 |
| 6 | 0.10 | 6.6781 | 6.2928 | 0.21268 | 0.552 | 1.4255 | 1.0402 | 1.370 | 1.2328 | 0.19267 |
| 7 | 0.12 | 6.5584 | 6.2928 | 0.18325 | 0.690 | 1.3352 | 1.0696 | 1.248 | 1.2024 | 0.13282 |
| 8 | 0.14 | 6.6772 | 6.2928 | 0.23045 | 0.600 | 1.4068 | 1.0224 | 1.376 | 1.2146 | 0.1922 |
| 9 | 0.16 | 6.7268 | 6.2928 | 0.25488 | 0.587 | 1.432 | 0.99798 | 1.435 | 1.215 | 0.217 |
| 10 | 0.19 | 6.6188 | 6.2928 | 0.22767 | 0.698 | 1.3512 | 1.0252 | 1.318 | 1.1882 | 0.16301 |
| 11 | 0.21 | 6.7189 | 6.2928 | 0.2671 | 0.627 | 1.4118 | 0.98576 | 1.432 | 1.1988 | 0.21303 |
| 12 | 0.23 | 6.5364 | 6.2928 | 0.21657 | 0.889 | 1.2799 | 1.0363 | 1.235 | 1.1581 | 0.12181 |
| 13 | 0.25 | 6.6853 | 6.2928 | 0.26988 | 0.688 | 1.3755 | 0.98299 | 1.399 | 1.1792 | 0.19626 |
| 14 | 0.30 | 6.6371 | 6.2928 | 0.26655 | 0.774 | 1.3306 | 0.98632 | 1.349 | 1.1585 | 0.17213 |
| 15 | 0.34 | 6.5648 | 6.2928 | 0.25599 | 0.941 | 1.2689 | 0.99687 | 1.273 | 1.1329 | 0.13602 |
| 16 | 0.38 | 6.7917 | 6.2928 | 0.33707 | 0.676 | 1.4147 | 0.9158 | 1.545 | 1.1653 | 0.24947 |
| 17 | 0.42 | 6.7729 | 6.2928 | 0.33929 | 0.707 | 1.3937 | 0.91357 | 1.526 | 1.1536 | 0.24006 |
| 18 | 0.46 | 6.7216 | 6.2928 | 0.33152 | 0.773 | 1.3502 | 0.92135 | 1.465 | 1.1358 | 0.21441 |
| 19 | 0.51 | 6.6069 | 6.2928 | 0.30597 | 0.974 | 1.261 | 0.94689 | 1.332 | 1.104 | 0.15706 |
| 20 | 0.55 | 6.8404 | 6.2928 | 0.38427 | 0.702 | 1.4161 | 0.86859 | 1.630 | 1.1424 | 0.27378 |
| 21 | 0.59 | 6.7713 | 6.2928 | 0.36872 | 0.771 | 1.3627 | 0.88414 | 1.541 | 1.1234 | 0.23926 |
| 22 | 0.64 | 6.6289 | 6.2928 | 0.33374 | 0.993 | 1.2552 | 0.91913 | 1.366 | 1.0872 | 0.16806 |
| 23 | 0.68 | 6.8837 | 6.2928 | 0.41148 | 0.696 | 1.4323 | 0.84138 | 1.702 | 1.1368 | 0.29543 |
| 24 | 0.72 | 6.7807 | 6.2928 | 0.38483 | 0.789 | 1.356 | 0.86804 | 1.562 | 1.112 | 0.24396 |
| 25 | 0.77 | 6.938 | 6.2928 | 0.43702 | 0.677 | 1.461 | 0.81584 | 1.791 | 1.1384 | 0.32258 |
| 26 | 0.81 | 6.8675 | 6.2928 | 0.42036 | 0.731 | 1.4072 | 0.8325 | 1.690 | 1.1198 | 0.28734 |
| 27 | 0.86 | 6.6444 | 6.2928 | 0.36317 | 1.033 | 1.2413 | 0.8897 | 1.395 | 1.0655 | 0.17579 |
| 28 | 0.90 | 6.924 | 6.2928 | 0.44646 | 0.707 | 1.4376 | 0.8064 | 1.783 | 1.122 | 0.3156 |
| 29 | 0.94 | 6.7319 | 6.2928 | 0.39649 | 0.903 | 1.2955 | 0.85638 | 1.513 | 1.0759 | 0.21955 |
| 30 | 0.98 | 6.9658 | 6.2928 | 0.46646 | 0.693 | 1.4594 | 0.78641 | 1.856 | 1.1229 | 0.3365 |
| 31 | 1.03 | 6.7685 | 6.2928 | 0.41537 | 0.873 | 1.3132 | 0.8375 | 1.568 | 1.0753 | 0.23783 |
| 32 | 1.15 | 7.0015 | 6.2928 | 0.49478 | 0.698 | 1.4668 | 0.75809 | 1.935 | 1.1125 | 0.35436 |
| 33 | 1.28 | 7.0697 | 6.2928 | 0.52365 | 0.674 | 1.5061 | 0.72921 | 2.065 | 1.1177 | 0.38845 |
| 34 | 1.42 | 6.8893 | 6.2928 | 0.48534 | 0.814 | 1.364 | 0.76753 | 1.777 | 1.0658 | 0.29823 |
| 35 | 1.54 | 7.1121 | 6.2928 | 0.55641 | 0.679 | 1.5157 | 0.69645 | 2.176 | 1.1061 | 0.40963 |
| 36 | 1.67 | 7.1653 | 6.2928 | 0.57529 | 0.659 | 1.55 | 0.67757 | 2.288 | 1.1138 | 0.43624 |
| 37 | 1.81 | 7.1977 | 6.2928 | 0.58973 | 0.652 | 1.568 | 0.66313 | 2.365 | 1.1156 | 0.45245 |
| 38 | 1.94 | 7.2293 | 6.2928 | 0.60306 | 0.644 | 1.5863 | 0.6498 | 2.441 | 1.118 | 0.46824 |
| 39 | 2.07 | 7.2707 | 6.2928 | 0.61472 | 0.629 | 1.616 | 0.63814 | 2.532 | 1.1271 | 0.48895 |
| 40 | 2.20 | 7.3029 | 6.2928 | 0.62472 | 0.618 | 1.6382 | 0.62815 | 2.608 | 1.1332 | 0.50503 |
| 41 | 2.33 | 7.3319 | 6.2928 | 0.6336 | 0.610 | 1.6584 | 0.61926 | 2.678 | 1.1388 | 0.51955 |
| 42 | 2.46 | 7.3639 | 6.2928 | 0.64193 | 0.599 | 1.682 | 0.61093 | 2.753 | 1.1465 | 0.53554 |
| 43 | 2.59 | 7.3905 | 6.2928 | 0.64859 | 0.591 | 1.702 | 0.60427 | 2.817 | 1.1531 | 0.54885 |
| 44 | 2.72 | 7.4095 | 6.2928 | 0.65581 | 0.587 | 1.7137 | 0.59705 | 2.870 | 1.1554 | 0.55833 |
| 45 | 2.85 | 7.4291 | 6.2928 | 0.66137 | 0.582 | 1.7278 | 0.5915 | 2.921 | 1.1596 | 0.56814 |
| 46 | 2.98 | 7.4495 | 6.2928 | 0.66581 | 0.576 | 1.7437 | 0.58706 | 2.970 | 1.1654 | 0.57833 |
| 47 | 3.11 | 7.4667 | 6.2928 | 0.67025 | 0.571 | 1.7565 | 0.58261 | 3.015 | 1.1696 | 0.58697 |
| 48 | 3.24 | 7.4862 | 6.2928 | 0.67414 | 0.565 | 1.7722 | 0.57873 | 3.062 | 1.1754 | 0.59672 |
| 49 | 3.37 | 7.5064 | 6.2928 | 0.67692 | 0.558 | 1.7896 | 0.57595 | 3.107 | 1.1828 | 0.60681 |
| 50 | 3.50 | 7.5251 | 6.2928 | 0.67914 | 0.551 | 1.806 | 0.57373 | 3.148 | 1.1899 | 0.61613 |
| 51 | 3.63 | 7.5324 | 6.2928 | 0.68025 | 0.549 | 1.8122 | 0.57262 | 3.165 | 1.1924 | 0.61978 |
| 52 | 3.76 | 7.5367 | 6.2928 | 0.68136 | 0.548 | 1.8154 | 0.57151 | 3.176 | 1.1934 | 0.62193 |
| 53 | 3.89 | 7.5507 | 6.2928 | 0.68191 | 0.542 | 1.8288 | 0.57095 | 3.203 | 1.1999 | 0.62893 |
| 54 | 4.02 | 7.5624 | 6.2928 | 0.68191 | 0.537 | 1.8405 | 0.57095 | 3.224 | 1.2057 | 0.63479 |
| 55 | 4.15 | 7.5763 | 6.2928 | 0.68136 | 0.531 | 1.855 | 0.57151 | 3.246 | 1.2133 | 0.64176 |
| 56 | 4.28 | 7.588 | 6.2928 | 0.6808 | 0.526 | 1.8673 | 0.57206 | 3.264 | 1.2197 | 0.6476 |
| 57 | 4.41 | 7.5944 | 6.2928 | 0.67969 | 0.522 | 1.8748 | 0.57317 | 3.271 | 1.224 | 0.65079 |
| 58 | 4.54 | 7.6075 | 6.2928 | 0.68025 | 0.517 | 1.8873 | 0.57262 | 3.296 | 1.23 | 0.65734 |
| 59 | 4.67 | 7.6146 | 6.2928 | 0.68025 | 0.515 | 1.8944 | 0.57262 | 3.308 | 1.2335 | 0.66089 |
| 60 | 4.80 | 7.6283 | 6.2928 | 0.67969 | 0.509 | 1.9087 | 0.57317 | 3.330 | 1.2409 | 0.66777 |
| 61 | 4.93 | 7.6391 | 6.2928 | 0.67747 | 0.503 | 1.9217 | 0.57539 | 3.340 | 1.2485 | 0.67315 |
| 62 | 5.06 | 7.6513 | 6.2928 | 0.67469 | 0.497 | 1.9366 | 0.57817 | 3.350 | 1.2574 | 0.67923 |
| 63 | 5.19 | 7.6612 | 6.2928 | 0.67136 | 0.491 | 1.9499 | 0.5815 | 3.353 | 1.2657 | 0.6842 |
| 64 | 5.32 | 7.6711 | 6.2928 | 0.66803 | 0.485 | 1.9631 | 0.58483 | 3.357 | 1.274 | 0.68915 |
| 65 | 5.45 | 7.6787 | 6.2928 | 0.66525 | 0.480 | 1.9735 | 0.58761 | 3.359 | 1.2806 | 0.69297 |
| 66 | 5.58 | 7.6849 | 6.2928 | 0.66192 | 0.475 | 1.9831 | 0.59094 | 3.356 | 1.287 | 0.69606 |
| 67 | 5.71 | 7.6947 | 6.2928 | 0.65915 | 0.470 | 1.9957 | 0.59372 | 3.361 | 1.2947 | 0.70097 |
| 68 | 5.84 | 7.7016 | 6.2928 | 0.65581 | 0.466 | 2.0058 | 0.59705 | 3.360 | 1.3014 | 0.70439 |
| 69 | 5.97 | 7.7106 | 6.2928 | 0.65248 | 0.460 | 2.0182 | 0.60038 | 3.361 | 1.3093 | 0.7089 |
| 70 | 6.11 | 7.724 | 6.2928 | 0.64971 | 0.454 | 2.0343 | 0.60316 | 3.373 | 1.3187 | 0.71558 |
| 71 | 6.24 | 7.7402 | 6.2928 | 0.64693 | 0.447 | 2.0533 | 0.60594 | 3.389 | 1.3296 | 0.7237 |
| 72 | 6.37 | 7.752 | 6.2928 | 0.64304 | 0.441 | 2.0691 | 0.60982 | 3.393 | 1.3394 | 0.72962 |
| 73 | 6.49 | 7.774 | 6.2928 | 0.63971 | 0.432 | 2.0944 | 0.61315 | 3.416 | 1.3538 | 0.74061 |
| 74 | 6.62 | 7.7894 | 6.2928 | 0.63749 | 0.426 | 2.112 | 0.61538 | 3.432 | 1.3637 | 0.7483 |
| 75 | 6.75 | 7.7888 | 6.2928 | 0.6336 | 0.424 | 2.1152 | 0.61926 | 3.416 | 1.3673 | 0.74799 |
| 76 | 6.88 | 7.7946 | 6.2928 | 0.62971 | 0.419 | 2.125 | 0.62315 | 3.410 | 1.3741 | 0.75092 |
| 77 | 7.01 | 7.7962 | 6.2928 | 0.62694 | 0.417 | 2.1293 | 0.62593 | 3.402 | 1.3776 | 0.75169 |
| 78 | 7.14 | 7.8151 | 6.2928 | 0.62472 | 0.410 | 2.1504 | 0.62815 | 3.423 | 1.3893 | 0.76113 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 7.27 | 7.8101 | 6.2928 | 0.6225 | 0.410 | 2.1476 | 0.63037 | 3.407 | 1.389 | 0.75864 |
| 80 | 7.40 | 7.8252 | 6.2928 | 0.61972 | 0.404 | 2.1656 | 0.63315 | 3.420 | 1.3994 | 0.76621 |
| 81 | 7.53 | 7.8267 | 6.2928 | 0.61861 | 0.403 | 2.1681 | 0.63426 | 3.418 | 1.4012 | 0.76693 |
| 82 | 7.66 | 7.8302 | 6.2928 | 0.61639 | 0.401 | 2.1738 | 0.63648 | 3.415 | 1.4052 | 0.76868 |
| 83 | 7.80 | 7.8229 | 6.2928 | 0.61472 | 0.402 | 2.1683 | 0.63814 | 3.398 | 1.4032 | 0.76506 |
| 84 | 7.93 | 7.8329 | 6.2928 | 0.6125 | 0.398 | 2.1805 | 0.64036 | 3.405 | 1.4104 | 0.77006 |
| 85 | 8.06 | 7.84 | 6.2928 | 0.60972 | 0.394 | 2.1903 | 0.64314 | 3.406 | 1.4167 | 0.7736 |
| 86 | 8.19 | 7.8356 | 6.2928 | 0.60639 | 0.393 | 2.1893 | 0.64647 | 3.387 | 1.4179 | 0.77142 |
| 87 | 8.32 | 7.847 | 6.2928 | 0.60417 | 0.389 | 2.2029 | 0.64869 | 3.396 | 1.4258 | 0.7771 |
| 88 | 8.45 | 7.8626 | 6.2928 | 0.60084 | 0.383 | 2.2218 | 0.65203 | 3.408 | 1.4369 | 0.7849 |
| 89 | 8.58 | 7.8561 | 6.2928 | 0.59862 | 0.383 | 2.2175 | 0.65425 | 3.389 | 1.4359 | 0.78165 |
| 90 | 8.71 | 7.8681 | 6.2928 | 0.59584 | 0.378 | 2.2323 | 0.65702 | 3.398 | 1.4447 | 0.78764 |
| 91 | 8.84 | 7.863 | 6.2928 | 0.59195 | 0.377 | 2.2311 | 0.66091 | 3.376 | 1.446 | 0.78511 |
| 92 | 8.97 | 7.8644 | 6.2928 | 0.58918 | 0.375 | 2.2352 | 0.66369 | 3.368 | 1.4495 | 0.78578 |
| 93 | 9.10 | 7.8706 | 6.2928 | 0.5864 | 0.372 | 2.2443 | 0.66646 | 3.367 | 1.4554 | 0.78891 |
| 94 | 9.23 | 7.886 | 6.2928 | 0.58418 | 0.367 | 2.2619 | 0.66869 | 3.383 | 1.4653 | 0.79659 |
| 95 | 9.36 | 7.8985 | 6.2928 | 0.5814 | 0.362 | 2.2772 | 0.67146 | 3.391 | 1.4743 | 0.80285 |
| 96 | 9.49 | 7.9159 | 6.2928 | 0.57918 | 0.357 | 2.2968 | 0.67368 | 3.409 | 1.4852 | 0.81154 |
| 97 | 9.62 | 7.91 | 6.2928 | 0.57696 | 0.357 | 2.2931 | 0.6759 | 3.393 | 1.4845 | 0.8086 |
| 98 | 9.75 | 7.9013 | 6.2928 | 0.57529 | 0.358 | 2.2861 | 0.67757 | 3.374 | 1.4818 | 0.80427 |
| 99 | 9.89 | 7.8969 | 6.2928 | 0.57196 | 0.357 | 2.285 | 0.6809 | 3.356 | 1.4829 | 0.80204 |
| 100 | 10.02 | 7.8924 | 6.2928 | 0.56974 | 0.356 | 2.2827 | 0.68312 | 3.342 | 1.4829 | 0.79981 |
| 101 | 10.15 | 7.8943 | 6.2928 | 0.56696 | 0.354 | 2.2874 | 0.6859 | 3.335 | 1.4866 | 0.80074 |
| 102 | 10.28 | 7.8968 | 6.2928 | 0.56419 | 0.352 | 2.2926 | 0.68868 | 3.329 | 1.4907 | 0.80198 |
| 103 | 10.42 | 7.9048 | 6.2928 | 0.56086 | 0.348 | 2.3041 | 0.69201 | 3.330 | 1.498 | 0.80602 |
| 104 | 10.55 | 7.9081 | 6.2928 | 0.55808 | 0.346 | 2.31 | 0.69478 | 3.325 | 1.5024 | 0.80763 |
| 105 | 10.68 | 7.9057 | 6.2928 | 0.55641 | 0.345 | 2.3093 | 0.69645 | 3.316 | 1.5029 | 0.80643 |
| 106 | 10.81 | 7.9082 | 6.2928 | 0.55253 | 0.342 | 2.3157 | 0.70034 | 3.307 | 1.508 | 0.80769 |
| 107 | 10.94 | 7.9135 | 6.2928 | 0.54864 | 0.339 | 2.3249 | 0.70422 | 3.301 | 1.5146 | 0.81033 |
| 108 | 11.07 | 7.9194 | 6.2928 | 0.54586 | 0.336 | 2.3336 | 0.707 | 3.301 | 1.5203 | 0.81329 |
| 109 | 11.20 | 7.9219 | 6.2928 | 0.54253 | 0.333 | 2.3394 | 0.71033 | 3.293 | 1.5249 | 0.81453 |
| 110 | 11.33 | 7.9284 | 6.2928 | 0.53976 | 0.330 | 2.3488 | 0.71311 | 3.294 | 1.5309 | 0.81782 |
| 111 | 11.46 | 7.913 | 6.2928 | 0.53809 | 0.332 | 2.3349 | 0.71478 | 3.267 | 1.5249 | 0.81008 |
| 112 | 11.59 | 7.9181 | 6.2928 | 0.53531 | 0.329 | 2.3429 | 0.71755 | 3.265 | 1.5302 | 0.81266 |
| 113 | 11.72 | 7.9597 | 6.2928 | 0.53309 | 0.320 | 2.3867 | 0.71977 | 3.316 | 1.5532 | 0.83346 |
| 114 | 11.85 | 7.9065 | 6.2928 | 0.53031 | 0.329 | 2.3362 | 0.72255 | 3.233 | 1.5294 | 0.80683 |
| 115 | 11.98 | 7.8904 | 6.2928 | 0.52698 | 0.330 | 2.3235 | 0.72588 | 3.201 | 1.5247 | 0.79878 |
| 116 | 12.11 | 7.9003 | 6.2928 | 0.52476 | 0.326 | 2.3356 | 0.7281 | 3.208 | 1.5319 | 0.80376 |
| 117 | 12.24 | 7.8993 | 6.2928 | 0.52199 | 0.325 | 2.3374 | 0.73088 | 3.198 | 1.5341 | 0.80325 |
| 118 | 12.38 | 7.8962 | 6.2928 | 0.52032 | 0.325 | 2.3359 | 0.73255 | 3.189 | 1.5342 | 0.8017 |
| 119 | 12.51 | 7.8979 | 6.2928 | 0.5181 | 0.323 | 2.3398 | 0.73477 | 3.184 | 1.5373 | 0.80254 |
| 120 | 12.64 | 7.8934 | 6.2928 | 0.51421 | 0.321 | 2.3393 | 0.73865 | 3.167 | 1.539 | 0.8003 |
| 121 | 12.77 | 7.8944 | 6.2928 | 0.51255 | 0.320 | 2.3419 | 0.74032 | 3.163 | 1.5411 | 0.80079 |
| 122 | 12.90 | 7.8899 | 6.2928 | 0.50977 | 0.319 | 2.3402 | 0.7431 | 3.149 | 1.5416 | 0.79855 |
| 123 | 13.03 | 7.8889 | 6.2928 | 0.50755 | 0.318 | 2.3414 | 0.74532 | 3.141 | 1.5433 | 0.79803 |
| 124 | 13.17 | 7.8904 | 6.2928 | 0.50588 | 0.317 | 2.3446 | 0.74698 | 3.139 | 1.5458 | 0.79882 |
| 125 | 13.30 | 7.8894 | 6.2928 | 0.50422 | 0.316 | 2.3453 | 0.74865 | 3.133 | 1.547 | 0.79831 |
| 126 | 13.43 | 7.887 | 6.2928 | 0.50311 | 0.316 | 2.344 | 0.74976 | 3.126 | 1.5469 | 0.79712 |
| 127 | 13.56 | 7.892 | 6.2928 | 0.50033 | 0.313 | 2.3517 | 0.75254 | 3.125 | 1.5521 | 0.7996 |
| 128 | 13.69 | 7.8977 | 6.2928 | 0.49977 | 0.311 | 2.3579 | 0.75309 | 3.131 | 1.5555 | 0.80243 |
| 129 | 13.82 | 7.9006 | 6.2928 | 0.49811 | 0.310 | 2.3626 | 0.75476 | 3.130 | 1.5587 | 0.80391 |
| 130 | 13.95 | 7.8969 | 6.2928 | 0.497 | 0.310 | 2.3599 | 0.75587 | 3.122 | 1.5579 | 0.80203 |
| 131 | 14.08 | 7.8998 | 6.2928 | 0.49533 | 0.308 | 2.3645 | 0.75753 | 3.121 | 1.561 | 0.80349 |
| 132 | 14.21 | 7.9027 | 6.2928 | 0.49422 | 0.307 | 2.3685 | 0.75864 | 3.122 | 1.5636 | 0.80495 |
| 133 | 14.34 | 7.9109 | 6.2928 | 0.49311 | 0.305 | 2.3779 | 0.75975 | 3.130 | 1.5688 | 0.80905 |
| 134 | 14.47 | 7.9025 | 6.2928 | 0.492 | 0.306 | 2.3705 | 0.76087 | 3.116 | 1.5657 | 0.80484 |
| 135 | 14.60 | 7.906 | 6.2928 | 0.49144 | 0.305 | 2.3746 | 0.76142 | 3.119 | 1.568 | 0.80659 |
| 136 | 14.73 | 7.9048 | 6.2928 | 0.49033 | 0.304 | 2.3745 | 0.76253 | 3.114 | 1.5685 | 0.806 |
| 137 | 14.86 | 7.9056 | 6.2928 | 0.48922 | 0.303 | 2.3765 | 0.76364 | 3.112 | 1.57 | 0.80641 |
| 138 | 14.99 | 7.9038 | 6.2928 | 0.48756 | 0.303 | 2.3763 | 0.76531 | 3.105 | 1.5708 | 0.8055 |
| 139 | 15.13 | 7.9 | 6.2928 | 0.48589 | 0.302 | 2.3741 | 0.76697 | 3.095 | 1.5706 | 0.80358 |
| 140 | 15.26 | 7.902 | 6.2928 | 0.48422 | 0.301 | 2.3779 | 0.76864 | 3.094 | 1.5733 | 0.80462 |
| 141 | 15.39 | 7.9035 | 6.2928 | 0.48311 | 0.300 | 2.3804 | 0.76975 | 3.092 | 1.5751 | 0.80533 |
| 142 | 15.52 | 7.9089 | 6.2928 | 0.482 | 0.298 | 2.3869 | 0.77086 | 3.096 | 1.5789 | 0.80803 |
| 143 | 15.66 | 7.905 | 6.2928 | 0.47978 | 0.298 | 2.3853 | 0.77308 | 3.085 | 1.5792 | 0.80612 |
| 144 | 15.79 | 7.9045 | 6.2928 | 0.47812 | 0.297 | 2.3864 | 0.77475 | 3.080 | 1.5806 | 0.80584 |
| 145 | 15.92 | 7.906 | 6.2928 | 0.47701 | 0.296 | 2.389 | 0.77586 | 3.079 | 1.5824 | 0.80658 |
| 146 | 16.05 | 7.9126 | 6.2928 | 0.47534 | 0.293 | 2.3973 | 0.77752 | 3.083 | 1.5874 | 0.80988 |
| 147 | 16.07 | 7.916 | 6.2928 | 0.4759 | 0.293 | 2.4002 | 0.77697 | 3.089 | 1.5886 | 0.81159 |

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.93 in
Specimen Area: 5.37 in^2
Specimen Volume: 31.88 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5.3738 | 0 | 0 | 5.042 | 6.84 | 6.84 |
| 2 | 5 | 0.017296 | 5.3747 | 9.9129 | 0.13279 | 5.1121 | 6.84 | 6.9728 |
| 3 | 10 | 0.036033 | 5.3757 | 12.588 | 0.16859 | 5.1464 | 6.84 | 7.0086 |
| 4 | 15 | 0.054771 | 5.3767 | 13.427 | 0.1798 | 5.167 | 6.84 | 7.0198 |
| 5 | 20 | 0.073508 | 5.3778 | 13.847 | 0.18538 | 5.1822 | 6.84 | 7.0254 |
| 6 | 25 | 0.092245 | 5.3788 | 14.319 | 0.19167 | 5.1958 | 6.84 | 7.0317 |
| 7 | 30.001 | 0.11242 | 5.3799 | 14.843 | 0.19865 | 5.2083 | 6.84 | 7.0386 |
| 8 | 35.001 | 0.13116 | 5.3809 | 15.945 | 0.21335 | 5.2214 | 6.84 | 7.0533 |
| 9 | 40.001 | 0.15134 | 5.3819 | 17.046 | 0.22804 | 5.2344 | 6.84 | 7.068 |
| 10 | 45.001 | 0.17152 | 5.383 | 18.515 | 0.24764 | 5.2485 | 6.84 | 7.0876 |
| 11 | 50.001 | 0.19026 | 5.384 | 19.931 | 0.26653 | 5.2632 | 6.84 | 7.1065 |
| 12 | 55.001 | 0.20899 | 5.3851 | 21.189 | 0.28331 | 5.2768 | 6.84 | 7.1233 |
| 13 | 60.001 | 0.22773 | 5.3861 | 22.553 | 0.30149 | 5.2898 | 6.84 | 7.1415 |
| 14 | 70.001 | 0.26521 | 5.3881 | 29.739 | 0.39739 | 5.3404 | 6.84 | 7.2374 |
| 15 | 80.001 | 0.30124 | 5.39 | 35.088 | 0.46871 | 5.3887 | 6.84 | 7.3087 |
| 16 | 90.002 | 0.34015 | 5.3921 | 39.127 | 0.52245 | 5.4322 | 6.84 | 7.3625 |
| 17 | 100 | 0.37907 | 5.3943 | 42.746 | 0.57055 | 5.4703 | 6.84 | 7.4106 |
| 18 | 110 | 0.41799 | 5.3964 | 45.788 | 0.61092 | 5.5056 | 6.84 | 7.4509 |
| 19 | 120 | 0.45546 | 5.3984 | 48.463 | 0.64637 | 5.5376 | 6.84 | 7.4864 |
| 20 | 130 | 0.49582 | 5.4006 | 51.138 | 0.68177 | 5.5664 | 6.84 | 7.5218 |
| 21 | 140 | 0.53473 | 5.4027 | 53.498 | 0.71295 | 5.5925 | 6.84 | 7.553 |
| 22 | 150 | 0.57365 | 5.4048 | 55.439 | 0.73853 | 5.6175 | 6.84 | 7.5785 |
| 23 | 160 | 0.61401 | 5.407 | 57.274 | 0.76267 | 5.6393 | 6.84 | 7.6027 |
| 24 | 170 | 0.65292 | 5.4091 | 58.9 | 0.78401 | 5.6594 | 6.84 | 7.624 |
| 25 | 180 | 0.69184 | 5.4112 | 60.474 | 0.80464 | 5.6789 | 6.84 | 7.6446 |
| 26 | 190 | 0.7322 | 5.4134 | 61.837 | 0.82245 | 5.6974 | 6.84 | 7.6625 |
| 27 | 200 | 0.77111 | 5.4156 | 63.306 | 0.84166 | 5.7132 | 6.84 | 7.6817 |
| 28 | 210 | 0.81147 | 5.4178 | 63.935 | 0.84968 | 5.7284 | 6.84 | 7.6897 |
| 29 | 220 | 0.85039 | 5.4199 | 65.824 | 0.87443 | 5.7431 | 6.84 | 7.7144 |
| 30 | 230 | 0.8893 | 5.422 | 67.082 | 0.8908 | 5.7566 | 6.84 | 7.7308 |
| 31 | 240 | 0.92966 | 5.4242 | 68.131 | 0.90436 | 5.7697 | 6.84 | 7.7444 |
| 32 | 270 | 1.0493 | 5.4308 | 71.121 | 0.9429 | 5.8034 | 6.84 | 7.7829 |
| 33 | 300 | 1.1689 | 5.4374 | 73.639 | 0.9751 | 5.8306 | 6.84 | 7.8151 |
| 34 | 330 | 1.2871 | 5.4439 | 75.999 | 1.0052 | 5.8545 | 6.84 | 7.8452 |
| 35 | 360 | 1.4053 | 5.4504 | 77.939 | 1.0296 | 5.8746 | 6.84 | 7.8696 |
| 36 | 390 | 1.5235 | 5.4569 | 79.775 | 1.0526 | 5.8925 | 6.84 | 7.8926 |
| 37 | 420 | 1.6417 | 5.4635 | 81.611 | 1.0755 | 5.9083 | 6.84 | 7.9155 |
| 38 | 450 | 1.7599 | 5.4701 | 83.184 | 1.0949 | 5.9219 | 6.84 | 7.9349 |
| 39 | 480 | 1.8781 | 5.4767 | 84.653 | 1.1129 | 5.9333 | 6.84 | 7.9529 |
| 40 | 510 | 1.9977 | 5.4833 | 86.174 | 1.1315 | 5.9441 | 6.84 | 7.9715 |
| 41 | 540 | 2.1159 | 5.49 | 87.538 | 1.148 | 5.9534 | 6.84 | 7.988 |
| 42 | 570 | 2.2326 | 5.4965 | 88.849 | 1.1638 | 5.9615 | 6.84 | 8.0038 |
| 43 | 600 | 2.3494 | 5.5031 | 90.265 | 1.181 | 5.9675 | 6.84 | 8.021 |
| 44 | 630 | 2.4704 | 5.5099 | 91.838 | 1.2001 | 5.974 | 6.84 | 8.0401 |
| 45 | 660 | 2.5872 | 5.5165 | 93.097 | 1.2151 | 5.9805 | 6.84 | 8.0551 |
| 46 | 690 | 2.7068 | 5.5233 | 94.146 | 1.2273 | 5.9843 | 6.84 | 8.0673 |
| 47 | 720 | 2.8236 | 5.5299 | 95.667 | 1.2456 | 5.9876 | 6.84 | 8.0856 |
| 48 | 750 | 2.9418 | 5.5367 | 96.821 | 1.2591 | 5.992 | 6.84 | 8.0991 |
| 49 | 780 | 3.0599 | 5.5434 | 97.818 | 1.2705 | 5.9952 | 6.84 | 8.1105 |
| 50 | 810 | 3.1781 | 5.5502 | 99.129 | 1.2859 | 5.9979 | 6.84 | 8.1259 |
| 51 | 840 | 3.2934 | 5.5568 | 99.968 | 1.2953 | 6.0001 | 6.84 | 8.1353 |
| 52 | 870 | 3.4102 | 5.5635 | 101.02 | 1.3073 | 6.0034 | 6.84 | 8.1473 |
| 53 | 900 | 3.5284 | 5.5703 | 101.86 | 1.3166 | 6.0045 | 6.84 | 8.1566 |
| 54 | 930 | 3.6451 | 5.5771 | 102.96 | 1.3292 | 6.0061 | 6.84 | 8.1692 |
| 55 | 960 | 3.7633 | 5.5839 | 104.01 | 1.3411 | 6.0072 | 6.84 | 8.1811 |
| 56 | 990 | 3.883 | 5.5909 | 104.95 | 1.3516 | 6.0083 | 6.84 | 8.1916 |
| 57 | 1020 | 3.9997 | 5.5977 | 105.95 | 1.3627 | 6.0093 | 6.84 | 8.2027 |
| 58 | 1050 | 4.1179 | 5.6046 | 106.89 | 1.3732 | 6.011 | 6.84 | 8.2132 |
| 59 | 1080 | 4.2346 | 5.6114 | 107.99 | 1.3857 | 6.011 | 6.84 | 8.2257 |
| 60 | 1110 | 4.3514 | 5.6183 | 108.83 | 1.3947 | 6.0126 | 6.84 | 8.2347 |
| 61 | 1140 | 4.4681 | 5.6251 | 109.46 | 1.4011 | 6.0131 | 6.84 | 8.2411 |
| 62 | 1170 | 4.5849 | 5.632 | 110.25 | 1.4094 | 6.0148 | 6.84 | 8.2494 |
| 63 | 1200 | 4.7045 | 5.6391 | 111.14 | 1.419 | 6.0142 | 6.84 | 8.259 |
| 64 | 1230 | 4.8213 | 5.646 | 112.03 | 1.4287 | 6.0126 | 6.84 | 8.2687 |
| 65 | 1260 | 4.9438 | 5.6533 | 112.98 | 1.4388 | 6.0131 | 6.84 | 8.2788 |
| 66 | 1290 | 5.0576 | 5.6601 | 113.81 | 1.4478 | 6.0115 | 6.84 | 8.2878 |
| 67 | 1320 | 5.1744 | 5.667 | 114.97 | 1.4607 | 6.0104 | 6.84 | 8.3007 |
| 68 | 1350 | 5.294 | 5.6742 | 115.81 | 1.4695 | 6.0093 | 6.84 | 8.3095 |
| 69 | 1380 | 5.4093 | 5.6811 | 116.8 | 1.4803 | 6.0088 | 6.84 | 8.3203 |
| 70 | 1410 | 5.5261 | 5.6881 | 117.91 | 1.4924 | 6.0077 | 6.84 | 8.3324 |
| 71 | 1440 | 5.6443 | 5.6953 | 118.95 | 1.5038 | 6.005 | 6.84 | 8.3438 |
| 72 | 1470 | 5.7596 | 5.7022 | 120.06 | 1.5159 | 6.0028 | 6.84 | 8.3559 |
| 73 | 1500 | 5.8763 | 5.7093 | 120.95 | 1.5253 | 6.0023 | 6.84 | 8.3653 |
| 74 | 1530 | 5.9945 | 5.7165 | 121.94 | 1.5359 | 6.0012 | 6.84 | 8.3759 |
| 75 | 1560 | 6.1141 | 5.7238 | 122.84 | 1.5452 | 5.999 | 6.84 | 8.3852 |
| 76 | 1590 | 6.2309 | 5.7309 | 123.94 | 1.5571 | 5.9941 | 6.84 | 8.3971 |
| 77 | 1620 | 6.3491 | 5.7381 | 124.93 | 1.5676 | 5.9914 | 6.84 | 8.4076 |
| 78 | 1650 | 6.4673 | 5.7454 | 125.83 | 1.5768 | 5.9892 | 6.84 | 8.4168 |
| 79 | 1680 | 6.5854 | 5.7526 | 126.87 | 1.588 | 5.9882 | 6.84 | 8.428 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1710 | 6.7036 | 5.7599 | 128.13 | 1.6017 | 5.9849 | 6.84 | 8.4417 |
| 81 | 1740 | 6.8204 | 5.7671 | 128.92 | 1.6095 | 5.9816 | 6.84 | 8.4495 |
| 82 | 1770 | 6.9386 | 5.7745 | 130.02 | 1.6212 | 5.9784 | 6.84 | 8.4612 |
| 83 | 1800 | 7.0582 | 5.7819 | 131.33 | 1.6354 | 5.9746 | 6.84 | 8.4754 |
| 84 | 1830 | 7.1793 | 5.7894 | 132.43 | 1.647 | 5.9713 | 6.84 | 8.487 |
| 85 | 1860 | 7.2946 | 5.7966 | 133.48 | 1.658 | 5.9686 | 6.84 | 8.498 |
| 86 | 1890 | 7.4099 | 5.8039 | 134.58 | 1.6696 | 5.9659 | 6.84 | 8.5096 |
| 87 | 1920 | 7.5252 | 5.8111 | 135.27 | 1.676 | 5.9621 | 6.84 | 8.516 |
| 88 | 1950 | 7.6405 | 5.8184 | 136.05 | 1.6836 | 5.9593 | 6.84 | 8.5236 |
| 89 | 1980 | 7.7558 | 5.8256 | 136.84 | 1.6912 | 5.9566 | 6.84 | 8.5312 |
| 90 | 2010 | 7.8726 | 5.833 | 138.05 | 1.704 | 5.9528 | 6.84 | 8.544 |
| 91 | 2040 | 7.9893 | 5.8404 | 139.25 | 1.7167 | 5.949 | 6.84 | 8.5567 |
| 92 | 2070 | 8.1075 | 5.8479 | 140.14 | 1.7255 | 5.9458 | 6.84 | 8.5655 |
| 93 | 2100 | 8.2228 | 5.8553 | 140.98 | 1.7336 | 5.942 | 6.84 | 8.5736 |
| 94 | 2130 | 8.3396 | 5.8627 | 141.87 | 1.7424 | 5.9387 | 6.84 | 8.5824 |
| 95 | 2160 | 8.4577 | 5.8703 | 143.03 | 1.7543 | 5.9338 | 6.84 | 8.5943 |
| 96 | 2190 | 8.5745 | 5.8778 | 144.08 | 1.7649 | 5.93 | 6.84 | 8.6049 |
| 97 | 2220 | 8.6956 | 5.8856 | 145.44 | 1.7792 | 5.9267 | 6.84 | 8.6192 |
| 98 | 2250 | 8.8123 | 5.8931 | 146.81 | 1.7936 | 5.9229 | 6.84 | 8.6336 |
| 99 | 2280 | 8.9305 | 5.9008 | 147.7 | 1.8022 | 5.9191 | 6.84 | 8.6422 |
| 100 | 2310 | 9.0516 | 5.9086 | 148.17 | 1.8055 | 5.9153 | 6.84 | 8.6455 |
| 101 | 2340 | 9.1683 | 5.9162 | 149.11 | 1.8147 | 5.911 | 6.84 | 8.6547 |
| 102 | 2370 | 9.2865 | 5.9239 | 149.79 | 1.8206 | 5.9066 | 6.84 | 8.6606 |
| 103 | 2400 | 9.4033 | 5.9316 | 150.42 | 1.8259 | 5.9028 | 6.84 | 8.6659 |
| 104 | 2430 | 9.5214 | 5.9393 | 151.42 | 1.8356 | 5.899 | 6.84 | 8.6756 |
| 105 | 2460 | 9.6382 | 5.947 | 152.78 | 1.8498 | 5.8958 | 6.84 | 8.6898 |
| 106 | 2490 | 9.7549 | 5.9547 | 153.62 | 1.8575 | 5.892 | 6.84 | 8.6975 |
| 107 | 2520 | 9.8731 | 5.9625 | 154.36 | 1.8639 | 5.8871 | 6.84 | 8.7039 |
| 108 | 2550 | 9.9884 | 5.9701 | 155.56 | 1.8761 | 5.8827 | 6.84 | 8.7161 |
| 109 | 2580 | 10.107 | 5.978 | 156.77 | 1.8882 | 5.8778 | 6.84 | 8.7282 |
| 110 | 2610 | 10.222 | 5.9857 | 158.08 | 1.9015 | 5.8729 | 6.84 | 8.7415 |
| 111 | 2640 | 10.343 | 5.9937 | 158.71 | 1.9065 | 5.8686 | 6.84 | 8.7465 |
| 112 | 2670 | 10.46 | 6.0015 | 159.76 | 1.9166 | 5.8653 | 6.84 | 8.7566 |
| 113 | 2700 | 10.578 | 6.0095 | 160.28 | 1.9204 | 5.8604 | 6.84 | 8.7604 |
| 114 | 2730 | 10.695 | 6.0173 | 161.49 | 1.9323 | 5.8556 | 6.84 | 8.7723 |
| 115 | 2760 | 10.813 | 6.0253 | 162.17 | 1.9379 | 5.8512 | 6.84 | 8.7779 |
| 116 | 2790 | 10.931 | 6.0333 | 163.01 | 1.9453 | 5.8469 | 6.84 | 8.7853 |
| 117 | 2820 | 11.049 | 6.0413 | 163.9 | 1.9534 | 5.8425 | 6.84 | 8.7934 |
| 118 | 2850 | 11.167 | 6.0494 | 164.74 | 1.9608 | 5.8392 | 6.84 | 8.8008 |
| 119 | 2880 | 11.284 | 6.0573 | 165.58 | 1.9682 | 5.8349 | 6.84 | 8.8082 |
| 120 | 2910 | 11.404 | 6.0655 | 166.37 | 1.9749 | 5.8289 | 6.84 | 8.8149 |
| 121 | 2940 | 11.519 | 6.0734 | 167.47 | 1.9854 | 5.8235 | 6.84 | 8.8254 |
| 122 | 2970 | 11.637 | 6.0815 | 168.57 | 1.9957 | 5.8197 | 6.84 | 8.8357 |
| 123 | 3000 | 11.754 | 6.0896 | 169.46 | 2.0036 | 5.8159 | 6.84 | 8.8436 |
| 124 | 3030 | 11.872 | 6.0977 | 170.2 | 2.0096 | 5.8115 | 6.84 | 8.8496 |
| 125 | 3060 | 11.992 | 6.106 | 171.14 | 2.018 | 5.8072 | 6.84 | 8.858 |
| 126 | 3090 | 12.107 | 6.114 | 171.88 | 2.024 | 5.8018 | 6.84 | 8.864 |
| 127 | 3120 | 12.224 | 6.1222 | 172.56 | 2.0294 | 5.7963 | 6.84 | 8.8694 |
| 128 | 3150 | 12.344 | 6.1305 | 173.66 | 2.0395 | 5.792 | 6.84 | 8.8795 |
| 129 | 3180 | 12.46 | 6.1387 | 174.13 | 2.0424 | 5.7865 | 6.84 | 8.8824 |
| 130 | 3210 | 12.577 | 6.1469 | 175.23 | 2.0525 | 5.7827 | 6.84 | 8.8925 |
| 131 | 3240 | 12.694 | 6.1551 | 176.28 | 2.0621 | 5.7778 | 6.84 | 8.9021 |
| 132 | 3270 | 12.813 | 6.1636 | 177.17 | 2.0697 | 5.7729 | 6.84 | 8.9097 |
| 133 | 3300 | 12.932 | 6.1719 | 177.8 | 2.0742 | 5.7681 | 6.84 | 8.9142 |
| 134 | 3330 | 13.05 | 6.1803 | 178.69 | 2.0818 | 5.7632 | 6.84 | 8.9218 |
| 135 | 3360 | 13.172 | 6.189 | 179.59 | 2.0892 | 5.7583 | 6.84 | 8.9292 |
| 136 | 3390 | 13.288 | 6.1973 | 180.27 | 2.0944 | 5.7528 | 6.84 | 8.9344 |
| 137 | 3420 | 13.412 | 6.2061 | 180.84 | 2.098 | 5.7474 | 6.84 | 8.938 |
| 138 | 3450 | 13.527 | 6.2144 | 181.89 | 2.1074 | 5.7414 | 6.84 | 8.9474 |
| 139 | 3480 | 13.644 | 6.2228 | 182.68 | 2.1137 | 5.7371 | 6.84 | 8.9537 |
| 140 | 3510 | 13.763 | 6.2315 | 183.52 | 2.1204 | 5.7316 | 6.84 | 8.9604 |
| 141 | 3540 | 13.88 | 6.2399 | 184.36 | 2.1272 | 5.7273 | 6.84 | 8.9672 |
| 142 | 3570 | 13.998 | 6.2485 | 185.56 | 2.1382 | 5.723 | 6.84 | 8.9782 |
| 143 | 3600 | 14.118 | 6.2572 | 186.14 | 2.1419 | 5.7175 | 6.84 | 8.9819 |
| 144 | 3630 | 14.237 | 6.2659 | 186.93 | 2.1479 | 5.7121 | 6.84 | 8.9879 |
| 145 | 3660 | 14.348 | 6.274 | 188.03 | 2.1578 | 5.7072 | 6.84 | 8.9978 |
| 146 | 3690 | 14.465 | 6.2826 | 188.82 | 2.1639 | 5.7018 | 6.84 | 9.0039 |
| 147 | 3720 | 14.581 | 6.2911 | 189.76 | 2.1718 | 5.6963 | 6.84 | 9.0118 |
| 148 | 3750 | 14.702 | 6.3 | 190.55 | 2.1777 | 5.6925 | 6.84 | 9.0177 |
| 149 | 3780 | 14.814 | 6.3083 | 191.39 | 2.1844 | 5.6871 | 6.84 | 9.0244 |
| 150 | 3810 | 14.934 | 6.3172 | 192.12 | 2.1897 | 5.6817 | 6.84 | 9.0297 |
| 151 | 3840 | 15.046 | 6.3255 | 192.49 | 2.191 | 5.6768 | 6.84 | 9.031 |
| 152 | 3870 | 15.164 | 6.3344 | 193.12 | 2.1951 | 5.6719 | 6.84 | 9.0351 |
| 153 | 3900 | 15.281 | 6.3431 | 193.75 | 2.1992 | 5.667 | 6.84 | 9.0392 |
| 154 | 3930 | 15.402 | 6.3522 | 194.27 | 2.202 | 5.6637 | 6.84 | 9.042 |
| 155 | 3934.9 | 15.419 | 6.3535 | 194.17 | 2.2004 | 5.6626 | 6.84 | 9.0404 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.93 in
Specimen Area: 5.37 in^2
Specimen Volume: 31.88 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

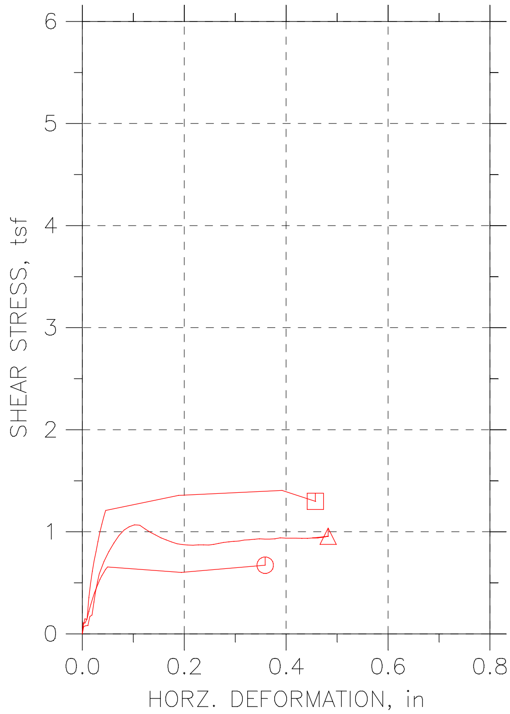
Measured Specific Gravity: 2.66

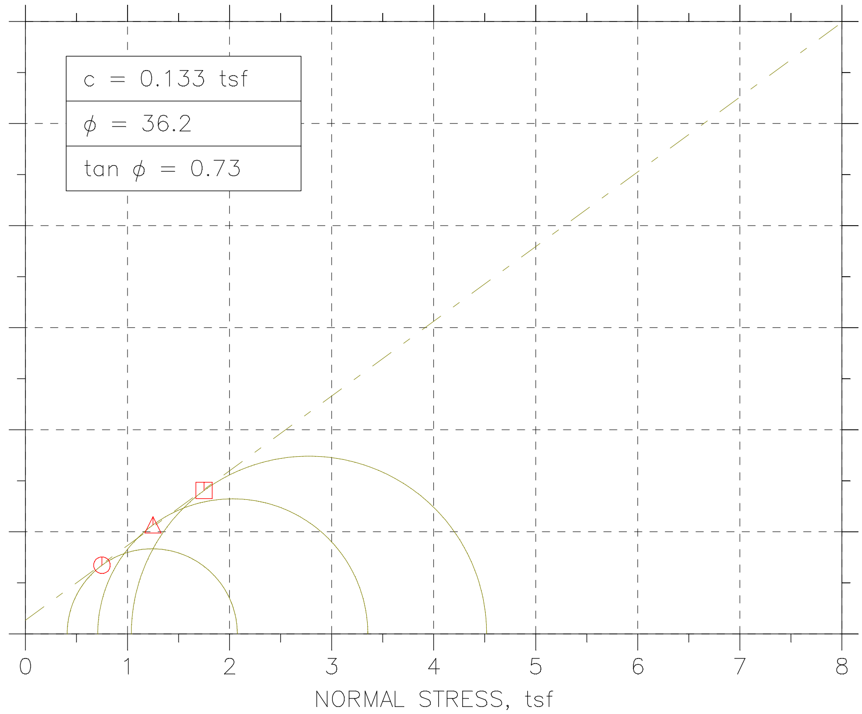
| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.84 | 6.84 | 0 | 0.000 | 1.798 | 1.798 | 1.000 | 1.798 | 0 |
| 2 | 0.02 | 6.9728 | 6.84 | 0.070104 | 0.528 | 1.8607 | 1.7279 | 1.077 | 1.7943 | 0.066397 |
| 3 | 0.04 | 7.0086 | 6.84 | 0.10434 | 0.619 | 1.8622 | 1.6936 | 1.100 | 1.7779 | 0.084297 |
| 4 | 0.05 | 7.0198 | 6.84 | 0.12499 | 0.695 | 1.8528 | 1.673 | 1.107 | 1.7629 | 0.0899 |
| 5 | 0.07 | 7.0254 | 6.84 | 0.14021 | 0.756 | 1.8432 | 1.6578 | 1.112 | 1.7505 | 0.092692 |
| 6 | 0.09 | 7.0317 | 6.84 | 0.15379 | 0.802 | 1.8359 | 1.6442 | 1.117 | 1.74 | 0.095834 |
| 7 | 0.11 | 7.0386 | 6.84 | 0.16629 | 0.837 | 1.8303 | 1.6317 | 1.122 | 1.731 | 0.099325 |
| 8 | 0.13 | 7.0533 | 6.84 | 0.17933 | 0.841 | 1.832 | 1.6186 | 1.132 | 1.7253 | 0.10667 |
| 9 | 0.15 | 7.068 | 6.84 | 0.19238 | 0.844 | 1.8336 | 1.6056 | 1.142 | 1.7196 | 0.11402 |
| 10 | 0.17 | 7.0876 | 6.84 | 0.20651 | 0.834 | 1.8391 | 1.5915 | 1.156 | 1.7153 | 0.12382 |
| 11 | 0.19 | 7.1065 | 6.84 | 0.22118 | 0.830 | 1.8433 | 1.5768 | 1.169 | 1.7101 | 0.13326 |
| 12 | 0.21 | 7.1233 | 6.84 | 0.23477 | 0.829 | 1.8465 | 1.5632 | 1.181 | 1.7049 | 0.14165 |
| 13 | 0.23 | 7.1415 | 6.84 | 0.24781 | 0.822 | 1.8517 | 1.5502 | 1.194 | 1.7009 | 0.15074 |
| 14 | 0.27 | 7.2374 | 6.84 | 0.29835 | 0.751 | 1.897 | 1.4996 | 1.265 | 1.6983 | 0.1987 |
| 15 | 0.30 | 7.3087 | 6.84 | 0.34671 | 0.740 | 1.92 | 1.4513 | 1.323 | 1.6856 | 0.23436 |
| 16 | 0.34 | 7.3625 | 6.84 | 0.39019 | 0.747 | 1.9302 | 1.4078 | 1.371 | 1.669 | 0.26123 |
| 17 | 0.38 | 7.4106 | 6.84 | 0.42823 | 0.751 | 1.9403 | 1.3697 | 1.417 | 1.655 | 0.28528 |
| 18 | 0.42 | 7.4509 | 6.84 | 0.46355 | 0.759 | 1.9453 | 1.3344 | 1.458 | 1.6399 | 0.30546 |
| 19 | 0.46 | 7.4864 | 6.84 | 0.49562 | 0.767 | 1.9487 | 1.3024 | 1.496 | 1.6255 | 0.32318 |
| 20 | 0.50 | 7.5218 | 6.84 | 0.52442 | 0.769 | 1.9553 | 1.2736 | 1.535 | 1.6144 | 0.34088 |
| 21 | 0.53 | 7.553 | 6.84 | 0.5505 | 0.772 | 1.9604 | 1.2475 | 1.572 | 1.6039 | 0.35648 |
| 22 | 0.57 | 7.5785 | 6.84 | 0.5755 | 0.779 | 1.961 | 1.2225 | 1.604 | 1.5917 | 0.36926 |
| 23 | 0.61 | 7.6027 | 6.84 | 0.59724 | 0.783 | 1.9634 | 1.2007 | 1.635 | 1.5821 | 0.38133 |
| 24 | 0.65 | 7.624 | 6.84 | 0.61735 | 0.787 | 1.9646 | 1.1806 | 1.664 | 1.5726 | 0.39201 |
| 25 | 0.69 | 7.6446 | 6.84 | 0.63691 | 0.792 | 1.9657 | 1.1611 | 1.693 | 1.5634 | 0.40232 |
| 26 | 0.73 | 7.6625 | 6.84 | 0.65539 | 0.797 | 1.965 | 1.1426 | 1.720 | 1.5538 | 0.41123 |
| 27 | 0.77 | 7.6817 | 6.84 | 0.67115 | 0.797 | 1.9685 | 1.1268 | 1.747 | 1.5477 | 0.42083 |
| 28 | 0.81 | 7.6897 | 6.84 | 0.68636 | 0.808 | 1.9613 | 1.1116 | 1.764 | 1.5365 | 0.42484 |
| 29 | 0.85 | 7.7144 | 6.84 | 0.70104 | 0.802 | 1.9714 | 1.0969 | 1.797 | 1.5342 | 0.43721 |
| 30 | 0.89 | 7.7308 | 6.84 | 0.71462 | 0.802 | 1.9742 | 1.0834 | 1.822 | 1.5288 | 0.4454 |
| 31 | 0.93 | 7.7444 | 6.84 | 0.72766 | 0.805 | 1.9747 | 1.0703 | 1.845 | 1.5225 | 0.45218 |
| 32 | 1.05 | 7.7829 | 6.84 | 0.76136 | 0.807 | 1.9795 | 1.0366 | 1.910 | 1.5081 | 0.47145 |
| 33 | 1.17 | 7.8151 | 6.84 | 0.78853 | 0.809 | 1.9845 | 1.0094 | 1.966 | 1.497 | 0.48755 |
| 34 | 1.29 | 7.8452 | 6.84 | 0.81244 | 0.808 | 1.9907 | 0.98553 | 2.020 | 1.4881 | 0.50258 |
| 35 | 1.41 | 7.8696 | 6.84 | 0.83255 | 0.809 | 1.995 | 0.96543 | 2.066 | 1.4802 | 0.51479 |
| 36 | 1.52 | 7.8926 | 6.84 | 0.85048 | 0.808 | 2.0001 | 0.94749 | 2.111 | 1.4738 | 0.52628 |
| 37 | 1.64 | 7.9155 | 6.84 | 0.86624 | 0.805 | 2.0072 | 0.93173 | 2.154 | 1.4695 | 0.53775 |
| 38 | 1.76 | 7.9349 | 6.84 | 0.87983 | 0.804 | 2.0131 | 0.91815 | 2.193 | 1.4656 | 0.54746 |
| 39 | 1.88 | 7.9529 | 6.84 | 0.89124 | 0.801 | 2.0196 | 0.90674 | 2.227 | 1.4632 | 0.55645 |
| 40 | 2.00 | 7.9715 | 6.84 | 0.90211 | 0.797 | 2.0274 | 0.89587 | 2.263 | 1.4616 | 0.56576 |
| 41 | 2.12 | 7.988 | 6.84 | 0.91135 | 0.794 | 2.0347 | 0.88663 | 2.295 | 1.4606 | 0.57402 |
| 42 | 2.23 | 8.0038 | 6.84 | 0.9195 | 0.790 | 2.0423 | 0.87848 | 2.325 | 1.4604 | 0.58192 |
| 43 | 2.35 | 8.021 | 6.84 | 0.92548 | 0.784 | 2.0535 | 0.8725 | 2.354 | 1.463 | 0.59049 |
| 44 | 2.47 | 8.0401 | 6.84 | 0.932 | 0.777 | 2.0661 | 0.86598 | 2.386 | 1.466 | 0.60004 |
| 45 | 2.59 | 8.0551 | 6.84 | 0.93852 | 0.772 | 2.0745 | 0.85946 | 2.414 | 1.467 | 0.60754 |
| 46 | 2.71 | 8.0673 | 6.84 | 0.94232 | 0.768 | 2.0829 | 0.85565 | 2.434 | 1.4693 | 0.61363 |
| 47 | 2.82 | 8.0856 | 6.84 | 0.94558 | 0.759 | 2.098 | 0.85239 | 2.461 | 1.4752 | 0.62279 |
| 48 | 2.94 | 8.0991 | 6.84 | 0.94993 | 0.754 | 2.1071 | 0.84804 | 2.485 | 1.4776 | 0.62954 |
| 49 | 3.06 | 8.1105 | 6.84 | 0.95319 | 0.750 | 2.1153 | 0.84478 | 2.504 | 1.48 | 0.63524 |
| 50 | 3.18 | 8.1259 | 6.84 | 0.95591 | 0.743 | 2.128 | 0.84207 | 2.527 | 1.485 | 0.64297 |
| 51 | 3.29 | 8.1353 | 6.84 | 0.95808 | 0.740 | 2.1352 | 0.83989 | 2.542 | 1.4875 | 0.64765 |
| 52 | 3.41 | 8.1473 | 6.84 | 0.96134 | 0.735 | 2.1439 | 0.83663 | 2.563 | 1.4903 | 0.65365 |
| 53 | 3.53 | 8.1566 | 6.84 | 0.96243 | 0.731 | 2.1521 | 0.83555 | 2.576 | 1.4938 | 0.65828 |
| 54 | 3.65 | 8.1692 | 6.84 | 0.96406 | 0.725 | 2.1631 | 0.83392 | 2.594 | 1.4985 | 0.66459 |
| 55 | 3.76 | 8.1811 | 6.84 | 0.96515 | 0.720 | 2.1739 | 0.83283 | 2.610 | 1.5034 | 0.67054 |
| 56 | 3.88 | 8.1916 | 6.84 | 0.96623 | 0.715 | 2.1833 | 0.83174 | 2.625 | 1.5075 | 0.67578 |
| 57 | 4.00 | 8.2027 | 6.84 | 0.96732 | 0.710 | 2.1934 | 0.83065 | 2.641 | 1.512 | 0.68137 |
| 58 | 4.12 | 8.2132 | 6.84 | 0.96895 | 0.706 | 2.2022 | 0.82902 | 2.656 | 1.5156 | 0.68659 |
| 59 | 4.23 | 8.2257 | 6.84 | 0.96895 | 0.699 | 2.2147 | 0.82902 | 2.671 | 1.5218 | 0.69283 |
| 60 | 4.35 | 8.2347 | 6.84 | 0.97058 | 0.696 | 2.2221 | 0.82739 | 2.686 | 1.5248 | 0.69736 |
| 61 | 4.47 | 8.2411 | 6.84 | 0.97112 | 0.693 | 2.2279 | 0.82685 | 2.694 | 1.5274 | 0.70053 |
| 62 | 4.58 | 8.2494 | 6.84 | 0.97276 | 0.690 | 2.2346 | 0.82522 | 2.708 | 1.5299 | 0.70471 |
| 63 | 4.70 | 8.259 | 6.84 | 0.97221 | 0.685 | 2.2448 | 0.82576 | 2.718 | 1.5353 | 0.70952 |
| 64 | 4.82 | 8.2687 | 6.84 | 0.97058 | 0.679 | 2.2561 | 0.82739 | 2.727 | 1.5417 | 0.71433 |
| 65 | 4.94 | 8.2788 | 6.84 | 0.97112 | 0.675 | 2.2657 | 0.82685 | 2.740 | 1.5463 | 0.71942 |
| 66 | 5.06 | 8.2878 | 6.84 | 0.96949 | 0.670 | 2.2763 | 0.82848 | 2.748 | 1.5524 | 0.7239 |
| 67 | 5.17 | 8.3007 | 6.84 | 0.96841 | 0.663 | 2.2902 | 0.82957 | 2.761 | 1.5599 | 0.73034 |
| 68 | 5.29 | 8.3095 | 6.84 | 0.96732 | 0.658 | 2.3001 | 0.83065 | 2.769 | 1.5654 | 0.73474 |
| 69 | 5.41 | 8.3203 | 6.84 | 0.96678 | 0.653 | 2.3115 | 0.8312 | 2.781 | 1.5714 | 0.74016 |
| 70 | 5.53 | 8.3324 | 6.84 | 0.96569 | 0.647 | 2.3247 | 0.83228 | 2.793 | 1.5785 | 0.74622 |
| 71 | 5.64 | 8.3438 | 6.84 | 0.96297 | 0.640 | 2.3388 | 0.835 | 2.801 | 1.5869 | 0.75192 |
| 72 | 5.76 | 8.3559 | 6.84 | 0.9608 | 0.634 | 2.3531 | 0.83718 | 2.811 | 1.5951 | 0.75795 |
| 73 | 5.88 | 8.3653 | 6.84 | 0.96026 | 0.630 | 2.363 | 0.83772 | 2.821 | 1.6004 | 0.76264 |
| 74 | 5.99 | 8.3759 | 6.84 | 0.95917 | 0.624 | 2.3747 | 0.83881 | 2.831 | 1.6068 | 0.76795 |
| 75 | 6.11 | 8.3852 | 6.84 | 0.957 | 0.619 | 2.3861 | 0.84098 | 2.837 | 1.6136 | 0.77258 |
| 76 | 6.23 | 8.3971 | 6.84 | 0.9521 | 0.611 | 2.403 | 0.84587 | 2.841 | 1.6244 | 0.77854 |
| 77 | 6.35 | 8.4076 | 6.84 | 0.94939 | 0.606 | 2.4162 | 0.84859 | 2.847 | 1.6324 | 0.78381 |
| 78 | 6.47 | 8.4168 | 6.84 | 0.94721 | 0.601 | 2.4276 | 0.85076 | 2.853 | 1.6392 | 0.78841 |

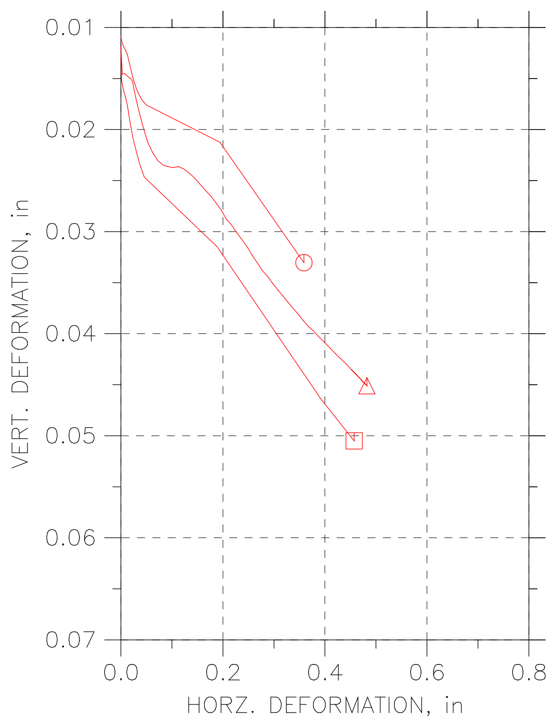
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 6.59 | 8.428 | 6.84 | 0.94613 | 0.596 | 2.4398 | 0.85185 | 2.864 | 1.6458 | 0.79398 |
| 80 | 6.70 | 8.4417 | 6.84 | 0.94287 | 0.589 | 2.4568 | 0.85511 | 2.873 | 1.656 | 0.80084 |
| 81 | 6.82 | 8.4495 | 6.84 | 0.93961 | 0.584 | 2.4679 | 0.85837 | 2.875 | 1.6631 | 0.80475 |
| 82 | 6.94 | 8.4612 | 6.84 | 0.93634 | 0.578 | 2.4828 | 0.86163 | 2.882 | 1.6722 | 0.8106 |
| 83 | 7.06 | 8.4754 | 6.84 | 0.93254 | 0.570 | 2.5009 | 0.86543 | 2.890 | 1.6832 | 0.81772 |
| 84 | 7.18 | 8.487 | 6.84 | 0.92928 | 0.564 | 2.5157 | 0.8687 | 2.896 | 1.6922 | 0.8235 |
| 85 | 7.29 | 8.498 | 6.84 | 0.92656 | 0.559 | 2.5294 | 0.87141 | 2.903 | 1.7004 | 0.82899 |
| 86 | 7.41 | 8.5096 | 6.84 | 0.92385 | 0.553 | 2.5437 | 0.87413 | 2.910 | 1.7089 | 0.8348 |
| 87 | 7.53 | 8.516 | 6.84 | 0.92004 | 0.549 | 2.5539 | 0.87793 | 2.909 | 1.7159 | 0.83798 |
| 88 | 7.64 | 8.5236 | 6.84 | 0.91732 | 0.545 | 2.5643 | 0.88065 | 2.912 | 1.7225 | 0.8418 |
| 89 | 7.76 | 8.5312 | 6.84 | 0.91461 | 0.541 | 2.5746 | 0.88337 | 2.915 | 1.729 | 0.84561 |
| 90 | 7.87 | 8.544 | 6.84 | 0.9108 | 0.535 | 2.5911 | 0.88717 | 2.921 | 1.7392 | 0.85199 |
| 91 | 7.99 | 8.5567 | 6.84 | 0.907 | 0.528 | 2.6077 | 0.89098 | 2.927 | 1.7493 | 0.85834 |
| 92 | 8.11 | 8.5655 | 6.84 | 0.90374 | 0.524 | 2.6197 | 0.89424 | 2.930 | 1.757 | 0.86273 |
| 93 | 8.22 | 8.5736 | 6.84 | 0.89993 | 0.519 | 2.6317 | 0.89804 | 2.930 | 1.7648 | 0.86681 |
| 94 | 8.34 | 8.5824 | 6.84 | 0.89667 | 0.515 | 2.6437 | 0.9013 | 2.933 | 1.7725 | 0.87118 |
| 95 | 8.46 | 8.5943 | 6.84 | 0.89178 | 0.508 | 2.6605 | 0.90619 | 2.936 | 1.7833 | 0.87713 |
| 96 | 8.57 | 8.6049 | 6.84 | 0.88798 | 0.503 | 2.6749 | 0.91 | 2.939 | 1.7924 | 0.88244 |
| 97 | 8.70 | 8.6192 | 6.84 | 0.88472 | 0.497 | 2.6925 | 0.91326 | 2.948 | 1.8029 | 0.88961 |
| 98 | 8.81 | 8.6336 | 6.84 | 0.88091 | 0.491 | 2.7107 | 0.91706 | 2.956 | 1.8139 | 0.8968 |
| 99 | 8.93 | 8.6422 | 6.84 | 0.87711 | 0.487 | 2.723 | 0.92087 | 2.957 | 1.8219 | 0.90108 |
| 100 | 9.05 | 8.6455 | 6.84 | 0.87331 | 0.484 | 2.7302 | 0.92467 | 2.953 | 1.8274 | 0.90276 |
| 101 | 9.17 | 8.6547 | 6.84 | 0.86896 | 0.479 | 2.7437 | 0.92902 | 2.953 | 1.8364 | 0.90735 |
| 102 | 9.29 | 8.6606 | 6.84 | 0.86461 | 0.475 | 2.754 | 0.93336 | 2.951 | 1.8437 | 0.91031 |
| 103 | 9.40 | 8.6659 | 6.84 | 0.86081 | 0.471 | 2.7631 | 0.93717 | 2.948 | 1.8501 | 0.91296 |
| 104 | 9.52 | 8.6756 | 6.84 | 0.857 | 0.467 | 2.7766 | 0.94097 | 2.951 | 1.8588 | 0.91781 |
| 105 | 9.64 | 8.6898 | 6.84 | 0.85374 | 0.462 | 2.794 | 0.94423 | 2.959 | 1.8691 | 0.92488 |
| 106 | 9.75 | 8.6975 | 6.84 | 0.84994 | 0.458 | 2.8055 | 0.94804 | 2.959 | 1.8768 | 0.92876 |
| 107 | 9.87 | 8.7039 | 6.84 | 0.84505 | 0.453 | 2.8169 | 0.95293 | 2.956 | 1.8849 | 0.93197 |
| 108 | 9.99 | 8.7161 | 6.84 | 0.8407 | 0.448 | 2.8334 | 0.95728 | 2.960 | 1.8953 | 0.93806 |
| 109 | 10.11 | 8.7282 | 6.84 | 0.83581 | 0.443 | 2.8503 | 0.96217 | 2.962 | 1.9063 | 0.94409 |
| 110 | 10.22 | 8.7415 | 6.84 | 0.83092 | 0.437 | 2.8686 | 0.96706 | 2.966 | 1.9178 | 0.95076 |
| 111 | 10.34 | 8.7465 | 6.84 | 0.82657 | 0.434 | 2.8779 | 0.97141 | 2.963 | 1.9247 | 0.95326 |
| 112 | 10.46 | 8.7566 | 6.84 | 0.82331 | 0.430 | 2.8913 | 0.97467 | 2.966 | 1.933 | 0.95831 |
| 113 | 10.58 | 8.7604 | 6.84 | 0.81842 | 0.426 | 2.8999 | 0.97956 | 2.960 | 1.9397 | 0.96019 |
| 114 | 10.69 | 8.7723 | 6.84 | 0.81353 | 0.421 | 2.9168 | 0.98445 | 2.963 | 1.9506 | 0.96615 |
| 115 | 10.81 | 8.7779 | 6.84 | 0.80918 | 0.418 | 2.9267 | 0.9888 | 2.960 | 1.9577 | 0.96895 |
| 116 | 10.93 | 8.7853 | 6.84 | 0.80483 | 0.414 | 2.9385 | 0.99314 | 2.959 | 1.9658 | 0.97267 |
| 117 | 11.05 | 8.7934 | 6.84 | 0.80049 | 0.410 | 2.9509 | 0.99749 | 2.958 | 1.9742 | 0.97669 |
| 118 | 11.17 | 8.8008 | 6.84 | 0.79722 | 0.407 | 2.9615 | 1.0008 | 2.959 | 1.9811 | 0.98039 |
| 119 | 11.28 | 8.8082 | 6.84 | 0.79288 | 0.403 | 2.9733 | 1.0051 | 2.958 | 1.9892 | 0.98409 |
| 120 | 11.40 | 8.8149 | 6.84 | 0.7869 | 0.398 | 2.9859 | 1.0111 | 2.953 | 1.9985 | 0.98743 |
| 121 | 11.52 | 8.8254 | 6.84 | 0.78146 | 0.394 | 3.0019 | 1.0165 | 2.953 | 2.0092 | 0.99268 |
| 122 | 11.64 | 8.8357 | 6.84 | 0.77766 | 0.390 | 3.0161 | 1.0203 | 2.956 | 2.0182 | 0.99787 |
| 123 | 11.75 | 8.8436 | 6.84 | 0.77386 | 0.386 | 3.0278 | 1.0241 | 2.956 | 2.0259 | 1.0018 |
| 124 | 11.87 | 8.8496 | 6.84 | 0.76951 | 0.383 | 3.0381 | 1.0285 | 2.954 | 2.0333 | 1.0048 |
| 125 | 11.99 | 8.858 | 6.84 | 0.76516 | 0.379 | 3.0508 | 1.0328 | 2.954 | 2.0418 | 1.009 |
| 126 | 12.11 | 8.864 | 6.84 | 0.75973 | 0.375 | 3.0623 | 1.0382 | 2.949 | 2.0503 | 1.012 |
| 127 | 12.22 | 8.8694 | 6.84 | 0.75429 | 0.372 | 3.0731 | 1.0437 | 2.944 | 2.0584 | 1.0147 |
| 128 | 12.34 | 8.8795 | 6.84 | 0.74995 | 0.368 | 3.0876 | 1.048 | 2.946 | 2.0678 | 1.0198 |
| 129 | 12.46 | 8.8824 | 6.84 | 0.74451 | 0.365 | 3.0958 | 1.0535 | 2.939 | 2.0746 | 1.0212 |
| 130 | 12.58 | 8.8925 | 6.84 | 0.74071 | 0.361 | 3.1098 | 1.0573 | 2.941 | 2.0835 | 1.0263 |
| 131 | 12.69 | 8.9021 | 6.84 | 0.73582 | 0.357 | 3.1242 | 1.0622 | 2.941 | 2.0932 | 1.031 |
| 132 | 12.81 | 8.9097 | 6.84 | 0.73093 | 0.353 | 3.1367 | 1.0671 | 2.940 | 2.1019 | 1.0348 |
| 133 | 12.93 | 8.9142 | 6.84 | 0.72603 | 0.350 | 3.1461 | 1.0719 | 2.935 | 2.109 | 1.0371 |
| 134 | 13.05 | 8.9218 | 6.84 | 0.72114 | 0.346 | 3.1586 | 1.0768 | 2.933 | 2.1177 | 1.0409 |
| 135 | 13.17 | 8.9292 | 6.84 | 0.71625 | 0.343 | 3.1709 | 1.0817 | 2.931 | 2.1263 | 1.0446 |
| 136 | 13.29 | 8.9344 | 6.84 | 0.71082 | 0.339 | 3.1815 | 1.0872 | 2.926 | 2.1343 | 1.0472 |
| 137 | 13.41 | 8.938 | 6.84 | 0.70538 | 0.336 | 3.1906 | 1.0926 | 2.920 | 2.1416 | 1.049 |
| 138 | 13.53 | 8.9474 | 6.84 | 0.69941 | 0.332 | 3.206 | 1.0986 | 2.918 | 2.1523 | 1.0537 |
| 139 | 13.64 | 8.9537 | 6.84 | 0.69506 | 0.329 | 3.2166 | 1.1029 | 2.916 | 2.1598 | 1.0568 |
| 140 | 13.76 | 8.9604 | 6.84 | 0.68962 | 0.325 | 3.2288 | 1.1084 | 2.913 | 2.1686 | 1.0602 |
| 141 | 13.88 | 8.9672 | 6.84 | 0.68528 | 0.322 | 3.2399 | 1.1127 | 2.912 | 2.1763 | 1.0636 |
| 142 | 14.00 | 8.9782 | 6.84 | 0.68093 | 0.318 | 3.2553 | 1.117 | 2.914 | 2.1862 | 1.0691 |
| 143 | 14.12 | 8.9819 | 6.84 | 0.67549 | 0.315 | 3.2644 | 1.1225 | 2.908 | 2.1934 | 1.0709 |
| 144 | 14.24 | 8.9879 | 6.84 | 0.67006 | 0.312 | 3.2759 | 1.1279 | 2.904 | 2.2019 | 1.074 |
| 145 | 14.35 | 8.9978 | 6.84 | 0.66517 | 0.308 | 3.2906 | 1.1328 | 2.905 | 2.2117 | 1.0789 |
| 146 | 14.47 | 9.0039 | 6.84 | 0.65973 | 0.305 | 3.3021 | 1.1382 | 2.901 | 2.2202 | 1.0819 |
| 147 | 14.58 | 9.0118 | 6.84 | 0.6543 | 0.301 | 3.3154 | 1.1437 | 2.899 | 2.2296 | 1.0859 |
| 148 | 14.70 | 9.0177 | 6.84 | 0.6505 | 0.299 | 3.3252 | 1.1475 | 2.898 | 2.2363 | 1.0888 |
| 149 | 14.81 | 9.0244 | 6.84 | 0.64506 | 0.295 | 3.3373 | 1.1529 | 2.895 | 2.2451 | 1.0922 |
| 150 | 14.93 | 9.0297 | 6.84 | 0.63963 | 0.292 | 3.348 | 1.1583 | 2.890 | 2.2532 | 1.0948 |
| 151 | 15.05 | 9.031 | 6.84 | 0.63474 | 0.290 | 3.3542 | 1.1632 | 2.884 | 2.2587 | 1.0955 |
| 152 | 15.16 | 9.0351 | 6.84 | 0.62985 | 0.287 | 3.3632 | 1.1681 | 2.879 | 2.2657 | 1.0975 |
| 153 | 15.28 | 9.0392 | 6.84 | 0.62495 | 0.284 | 3.3722 | 1.173 | 2.875 | 2.2726 | 1.0996 |
| 154 | 15.40 | 9.042 | 6.84 | 0.62169 | 0.282 | 3.3783 | 1.1763 | 2.872 | 2.2773 | 1.101 |
| 155 | 15.42 | 9.0404 | 6.84 | 0.62061 | 0.282 | 3.3777 | 1.1774 | 2.869 | 2.2776 | 1.1002 |

# DIRECT SHEAR TEST REPORT

AECOM




| | | | | | |
|---|---|---|---|---|---|
| Symbol | | ○ | △ | □ | |
| Test No. | | .75 TSF | 1.25 TSF | 1.75 TSF | |
| Sample No. | | S-16-18 | S-16-18 | S-16-18 | |
| Shape | | Circular | Circular | Circular | |
| Initial | Dimension, in | 2.3504 | 2.3504 | 2.3504 | |
| | Area, in^2 | 4.3388 | 4.3388 | 4.3388 | |
| | Height, in | 1 | 1 | 1 | |
| | Water Content, % | 16.12 | 16.62 | 16.15 | |
| | Dry Density, pcf | 117.9 | 117.1 | 117.9 | |
| | Saturation, % | 99.55 | 100.36 | 99.77 | |
| | Void Ratio | 0.44047 | 0.45053 | 0.44026 | |
| Consol. Height, in | | 0.98989 | 0.9897 | 0.98947 | |
| Consol. Void Ratio | | 0.42591 | 0.43558 | 0.4251 | |
| Final | Water Content, % | 14.02 | 14.02 | 12.51 | |
| | Dry Density, pcf | 121.9 | 122.6 | 124.2 | |
| | Saturation, % | 97.07 | 99.04 | 92.56 | |
| | Void Ratio | 0.39288 | 0.38509 | 0.36752 | |
| Normal Stress, tsf | | 0.75 | 1.25 | 1.75 | |
| Max. Shear Stress, tsf | | 0.67243 | 1.0674 | 1.4045 | |
| Ult. Shear Stress, tsf | | 0.67243 | 0.95657 | 1.2984 | |
| Time to Failure, min | | 180.15 | 62.996 | 198 | |
| Disp. Rate, in/min | | 0.001417 | 0.001417 | 0.001417 | |
| Estimated Specific Gravity | | 2.72 | 2.72 | 2.72 | |
| Liquid Limit | | --- | --- | --- | |
| Plastic Limit | | --- | --- | --- | |
| Plasticity Index | | --- | --- | --- | |

Project: COLETO CREEK FACILITY

Location: IPR-GDF SUEZ

Project No.: 60225561

Boring No.: B-1-1

Sample Type: TRIMMED

Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE

Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Thu, 22-DEC-2011 13:30:56

DIRECT SHEAR TEST DATA

AECOM

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: .75 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.75 | 0.01082 | 0 | 0 | 0 |
| 2 | 2.00 | 0.75 | 0.01127 | 0.06009 | 0.001129 | 0.001129 |
| 3 | 4.00 | 0.75 | 0.01182 | 0.1469 | 0.004796 | 0.004796 |
| 4 | 6.00 | 0.75 | 0.01225 | 0.143 | 0.008888 | 0.008888 |
| 5 | 8.00 | 0.75 | 0.01266 | 0.2189 | 0.0127 | 0.0127 |
| 6 | 10.00 | 0.75 | 0.0135 | 0.2873 | 0.01651 | 0.01651 |
| 7 | 12.00 | 0.75 | 0.01429 | 0.3483 | 0.02031 | 0.02031 |
| 8 | 14.00 | 0.75 | 0.01498 | 0.4009 | 0.02384 | 0.02384 |
| 9 | 16.00 | 0.75 | 0.01557 | 0.4496 | 0.02751 | 0.02751 |
| 10 | 18.00 | 0.75 | 0.01607 | 0.4908 | 0.03104 | 0.03104 |
| 11 | 20.00 | 0.75 | 0.01648 | 0.5329 | 0.03456 | 0.03456 |
| 12 | 22.00 | 0.75 | 0.01683 | 0.5689 | 0.03809 | 0.03809 |
| 13 | 24.00 | 0.75 | 0.01715 | 0.6005 | 0.0419 | 0.0419 |
| 14 | 26.00 | 0.75 | 0.01735 | 0.6294 | 0.04543 | 0.04543 |
| 15 | 28.00 | 0.75 | 0.01757 | 0.6558 | 0.04938 | 0.04938 |
| 16 | 98.00 | 0.75 | 0.02125 | 0.6014 | 0.1943 | 0.1943 |
| 17 | 180.15 | 0.75 | 0.03304 | 0.6724 | 0.3589 | 0.3589 |

DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Location: IPR-GDF SUEZ
Project No.: 60225561
Boring No.: B-1-1
Tested By: BCM
Checked By: WPQ
Sample No.: S-16-18
Test Date: 12/17/11
Depth: ----
Test No.: 1.25 TSF
Sample Type: TRIMMED
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.25 | 0.01189 | 0 | 0 | 0 |
| 2 | 12.00 | 1.25 | 0.01458 | 0.07233 | 0.002821 | 0.002821 |
| 3 | 14.00 | 1.25 | 0.01451 | 0.07971 | 0.006913 | 0.006913 |
| 4 | 16.00 | 1.25 | 0.01467 | 0.08127 | 0.011 | 0.011 |
| 5 | 18.00 | 1.25 | 0.01488 | 0.1684 | 0.01481 | 0.01481 |
| 6 | 20.00 | 1.25 | 0.01499 | 0.1843 | 0.0189 | 0.0189 |
| 7 | 22.00 | 1.25 | 0.0153 | 0.313 | 0.02271 | 0.02271 |
| 8 | 24.00 | 1.25 | 0.01616 | 0.413 | 0.0261 | 0.0261 |
| 9 | 26.00 | 1.25 | 0.01703 | 0.5094 | 0.02963 | 0.02963 |
| 10 | 28.00 | 1.25 | 0.01777 | 0.5879 | 0.03315 | 0.03315 |
| 11 | 33.00 | 1.25 | 0.01959 | 0.7097 | 0.04246 | 0.04246 |
| 12 | 38.00 | 1.25 | 0.02117 | 0.8061 | 0.05206 | 0.05206 |
| 13 | 43.00 | 1.25 | 0.02223 | 0.8912 | 0.06193 | 0.06193 |
| 14 | 48.00 | 1.25 | 0.02302 | 0.9647 | 0.07209 | 0.07209 |
| 15 | 53.00 | 1.25 | 0.02348 | 1.018 | 0.08196 | 0.08196 |
| 16 | 58.00 | 1.25 | 0.02364 | 1.05 | 0.09198 | 0.09198 |
| 17 | 63.00 | 1.25 | 0.02373 | 1.067 | 0.1021 | 0.1021 |
| 18 | 68.00 | 1.25 | 0.02364 | 1.064 | 0.1126 | 0.1126 |
| 19 | 73.00 | 1.25 | 0.02385 | 1.029 | 0.123 | 0.123 |
| 20 | 78.00 | 1.25 | 0.02424 | 0.9962 | 0.1333 | 0.1333 |
| 21 | 83.00 | 1.25 | 0.0247 | 0.969 | 0.1436 | 0.1436 |
| 22 | 88.00 | 1.25 | 0.02532 | 0.941 | 0.1542 | 0.1542 |
| 23 | 93.00 | 1.25 | 0.02591 | 0.9196 | 0.1648 | 0.1648 |
| 24 | 98.00 | 1.25 | 0.02646 | 0.9006 | 0.1754 | 0.1754 |
| 25 | 103.00 | 1.25 | 0.02715 | 0.8831 | 0.1859 | 0.1859 |
| 26 | 108.00 | 1.25 | 0.02788 | 0.8749 | 0.1964 | 0.1964 |
| 27 | 113.00 | 1.25 | 0.02879 | 0.8695 | 0.2068 | 0.2068 |
| 28 | 118.00 | 1.25 | 0.02939 | 0.8679 | 0.2174 | 0.2174 |
| 29 | 123.00 | 1.25 | 0.03015 | 0.871 | 0.2277 | 0.2277 |
| 30 | 128.00 | 1.25 | 0.03082 | 0.8718 | 0.2378 | 0.2378 |
| 31 | 133.00 | 1.25 | 0.03154 | 0.8706 | 0.248 | 0.248 |
| 32 | 138.00 | 1.25 | 0.03235 | 0.8772 | 0.2577 | 0.2577 |
| 33 | 143.00 | 1.25 | 0.03304 | 0.8858 | 0.2673 | 0.2673 |
| 34 | 148.00 | 1.25 | 0.0338 | 0.8955 | 0.2769 | 0.2769 |
| 35 | 153.00 | 1.25 | 0.03439 | 0.9017 | 0.2872 | 0.2872 |
| 36 | 158.00 | 1.25 | 0.03505 | 0.9064 | 0.2972 | 0.2972 |
| 37 | 163.00 | 1.25 | 0.03568 | 0.9091 | 0.3074 | 0.3074 |
| 38 | 168.00 | 1.25 | 0.0363 | 0.9185 | 0.3176 | 0.3176 |
| 39 | 173.00 | 1.25 | 0.03691 | 0.922 | 0.3276 | 0.3276 |
| 40 | 178.00 | 1.25 | 0.03753 | 0.9262 | 0.3377 | 0.3377 |
| 41 | 183.00 | 1.25 | 0.03808 | 0.9321 | 0.3476 | 0.3476 |
| 42 | 188.00 | 1.25 | 0.03874 | 0.9282 | 0.3578 | 0.3578 |
| 43 | 193.00 | 1.25 | 0.0393 | 0.929 | 0.3678 | 0.3678 |
| 44 | 198.00 | 1.25 | 0.03976 | 0.9309 | 0.3779 | 0.3779 |
| 45 | 203.00 | 1.25 | 0.04033 | 0.941 | 0.3884 | 0.3884 |
| 46 | 208.00 | 1.25 | 0.04084 | 0.9383 | 0.399 | 0.399 |
| 47 | 213.00 | 1.25 | 0.04139 | 0.9371 | 0.4095 | 0.4095 |
| 48 | 218.00 | 1.25 | 0.04193 | 0.9379 | 0.42 | 0.42 |
| 49 | 223.00 | 1.25 | 0.04244 | 0.9356 | 0.4307 | 0.4307 |
| 50 | 228.00 | 1.25 | 0.04296 | 0.936 | 0.4413 | 0.4413 |
| 51 | 233.00 | 1.25 | 0.04351 | 0.9391 | 0.4517 | 0.4517 |
| 52 | 238.00 | 1.25 | 0.04403 | 0.9406 | 0.462 | 0.462 |
| 53 | 243.00 | 1.25 | 0.04459 | 0.9476 | 0.4723 | 0.4723 |
| 54 | 248.00 | 1.25 | 0.04511 | 0.9566 | 0.4823 | 0.4823 |

AECOM

# DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: 1.75 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

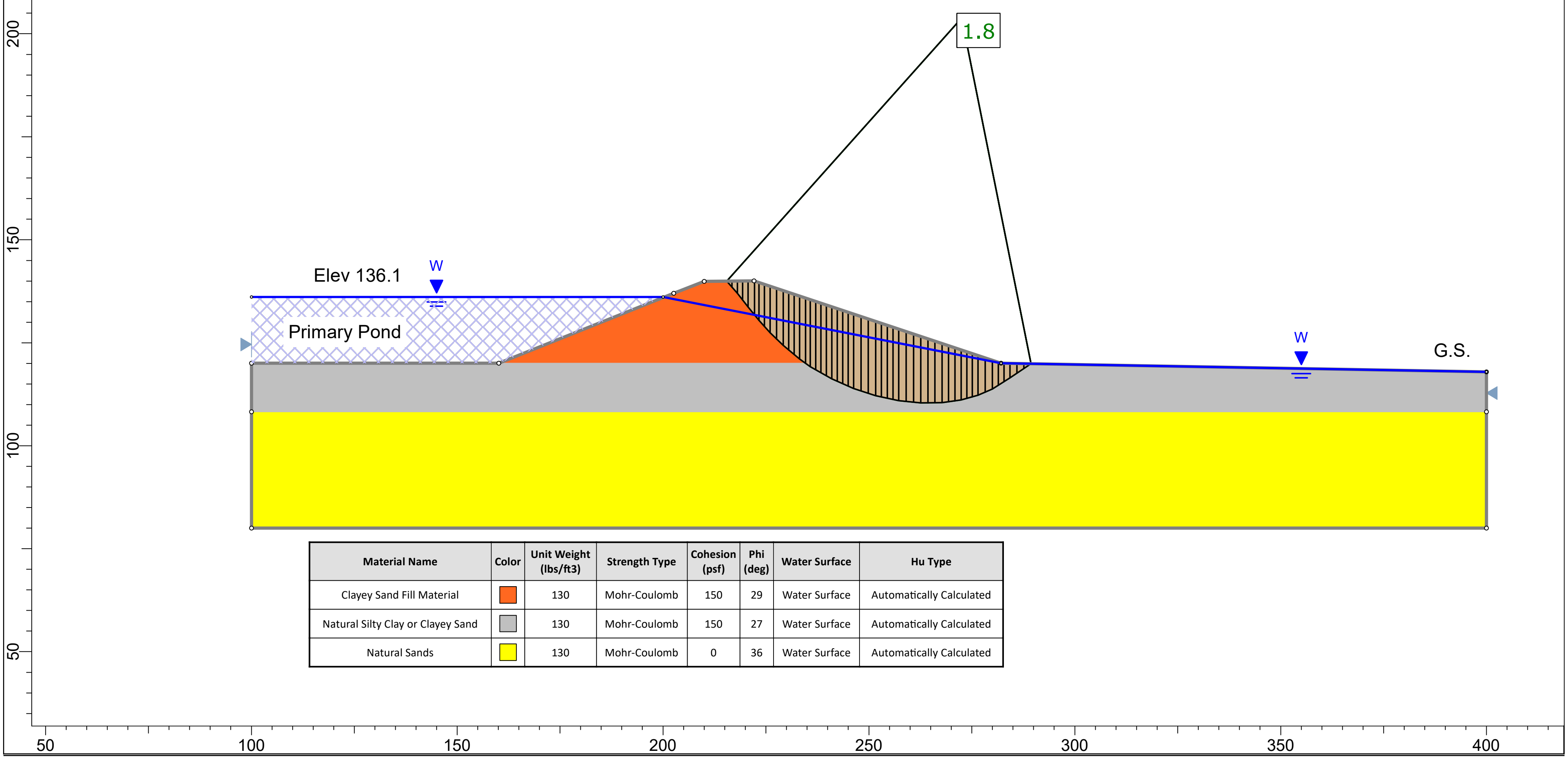
Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.75 | 0.01256 | 0 | 0 | 0 |
| 2 | 4.00 | 1.75 | 0.01529 | 0.1083 | 0.001552 | 0.001552 |
| 3 | 6.00 | 1.75 | 0.0162 | 0.107 | 0.00522 | 0.00522 |
| 4 | 8.00 | 1.75 | 0.01687 | 0.1474 | 0.009311 | 0.009311 |
| 5 | 10.00 | 1.75 | 0.01767 | 0.3553 | 0.0127 | 0.0127 |
| 6 | 12.00 | 1.75 | 0.01877 | 0.497 | 0.01622 | 0.01622 |
| 7 | 14.00 | 1.75 | 0.01979 | 0.615 | 0.01961 | 0.01961 |
| 8 | 16.00 | 1.75 | 0.0207 | 0.7159 | 0.02328 | 0.02328 |
| 9 | 18.00 | 1.75 | 0.02152 | 0.8062 | 0.02694 | 0.02694 |
| 10 | 20.00 | 1.75 | 0.02223 | 0.904 | 0.03061 | 0.03061 |
| 11 | 22.00 | 1.75 | 0.02289 | 0.9887 | 0.03414 | 0.03414 |
| 12 | 24.00 | 1.75 | 0.02361 | 1.072 | 0.03809 | 0.03809 |
| 13 | 26.00 | 1.75 | 0.02409 | 1.144 | 0.0419 | 0.0419 |
| 14 | 28.00 | 1.75 | 0.02466 | 1.209 | 0.04585 | 0.04585 |
| 15 | 98.00 | 1.75 | 0.0315 | 1.356 | 0.1888 | 0.1888 |
| 16 | 198.00 | 1.75 | 0.04639 | 1.405 | 0.392 | 0.392 |
| 17 | 243.36 | 1.75 | 0.0505 | 1.298 | 0.4572 | 0.4572 |

# APPENDIX C: SLIDE 7.0 STABILITY ANALYSIS MODELS

Case 1

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Effective Stress Analysis, Non-circular



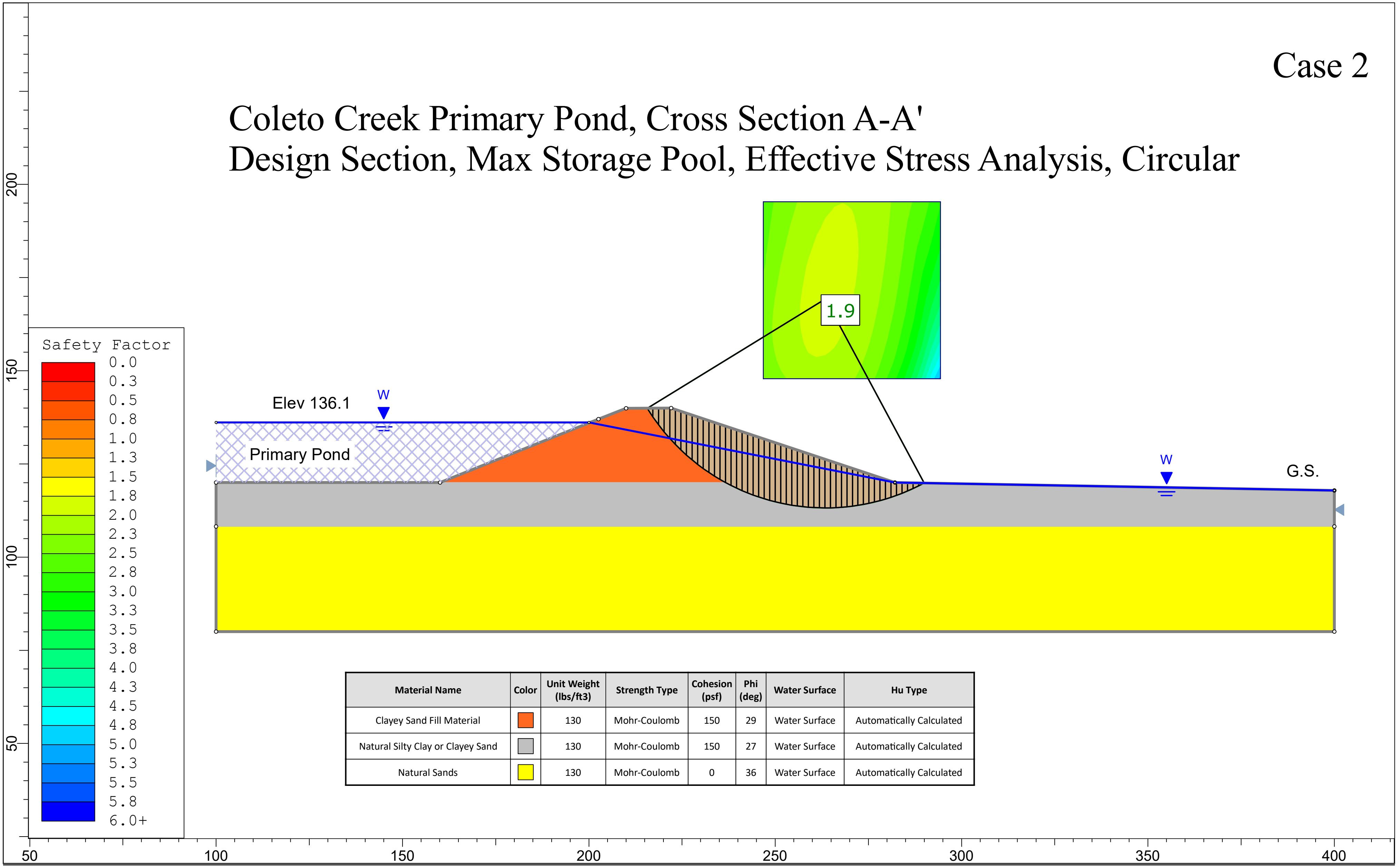

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 1_A-A_design_maxstor_eff_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 2

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Effective Stress Analysis, Circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

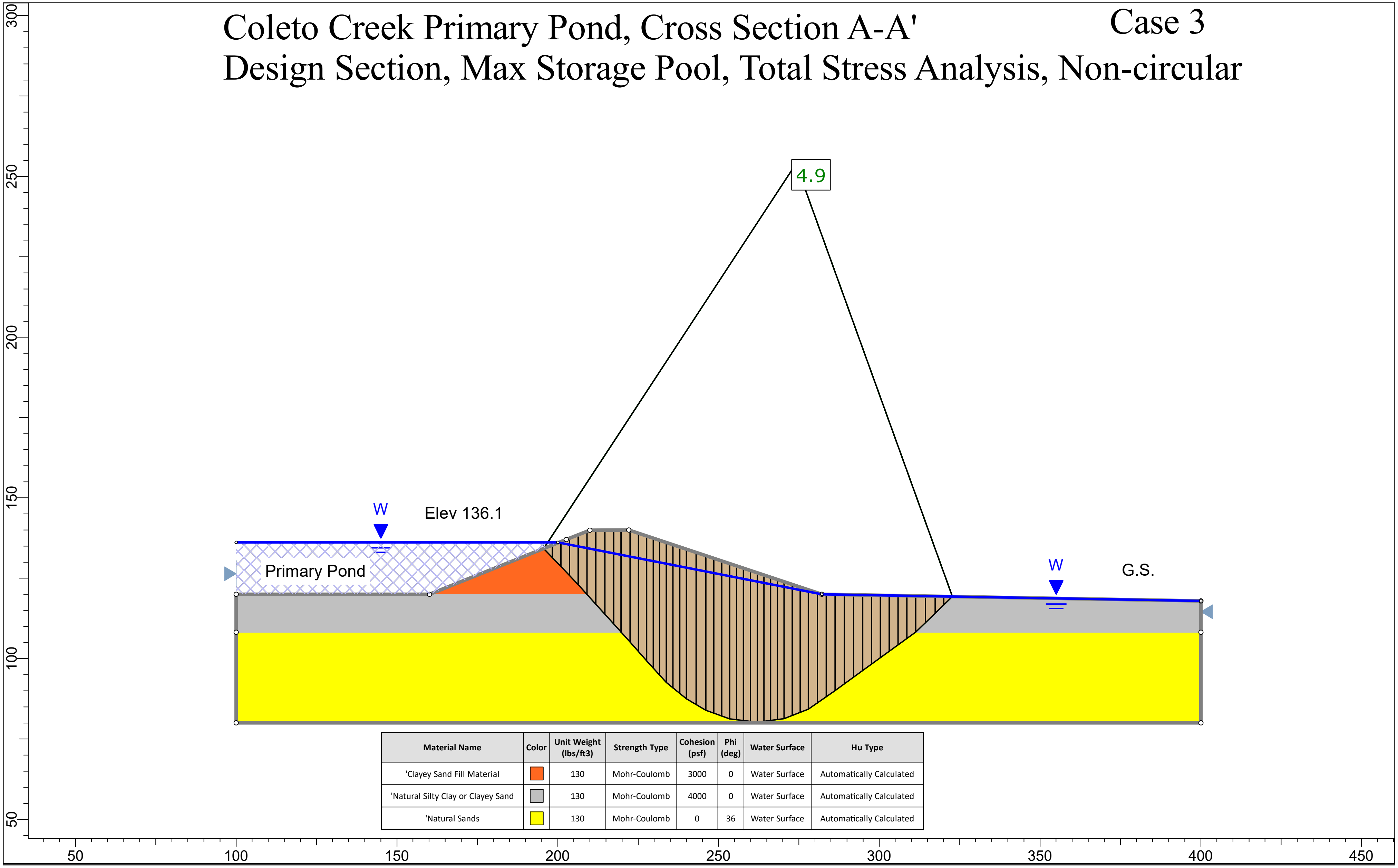
Coleto 2_A-A_design_maxstor_eff_cir.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary Pond, Cross Section A-A'

Case 3

## Design Section, Max Storage Pool, Total Stress Analysis, Non-circular



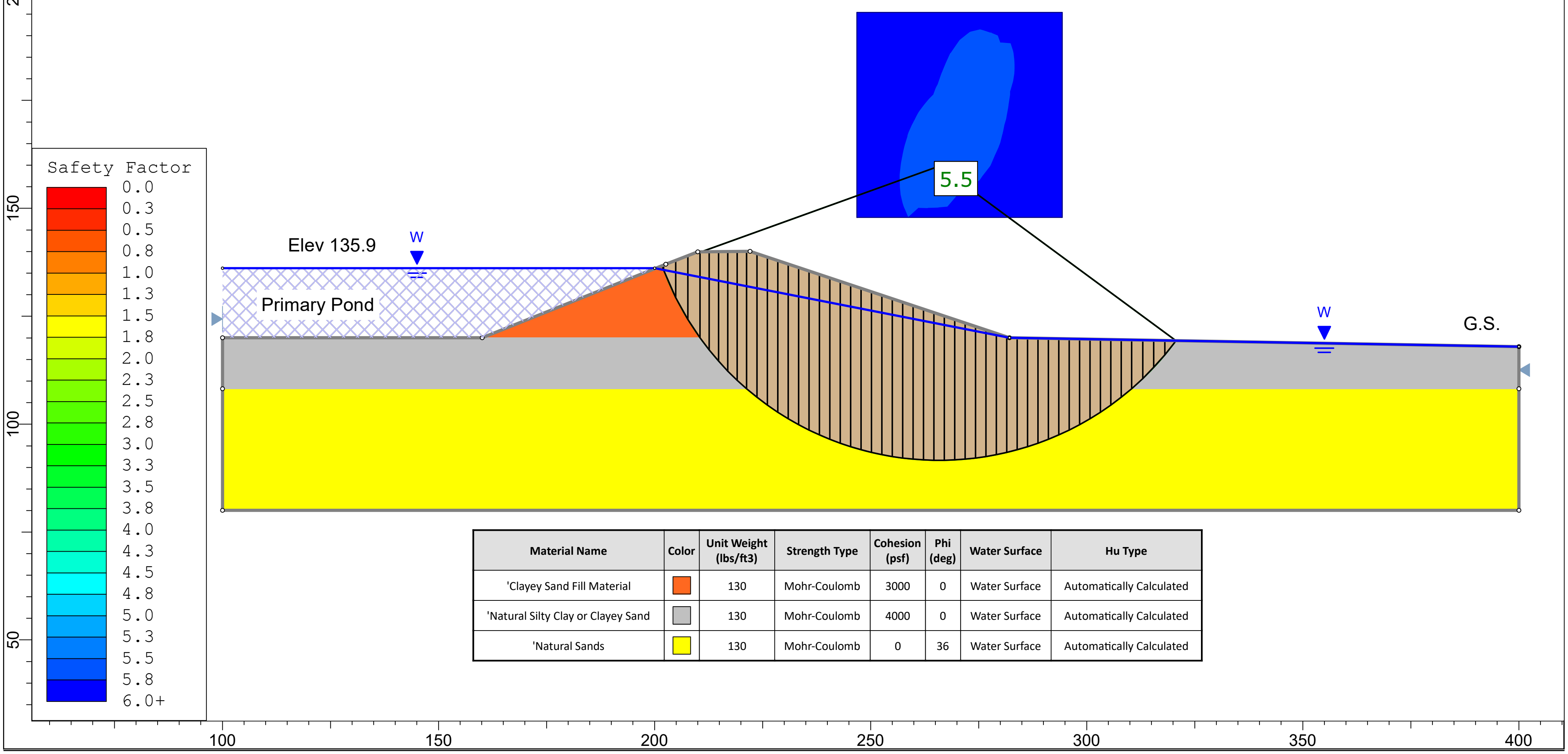

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 3_A-A_design_maxstor_tot_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 4

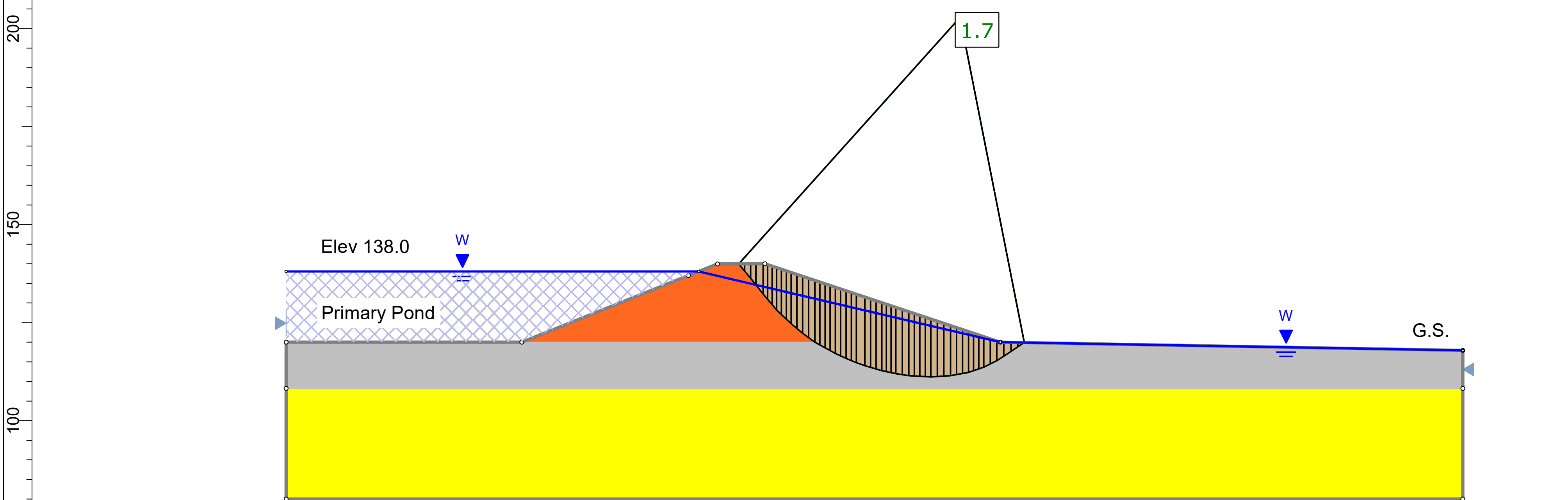
# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Total Stress Analysis, Circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Case 5

# Coleto Creek Primary Pond, Cross Section A-A'
## Design Section, Max Surcharge Pool, Effective Stress Analysis, Non-circular



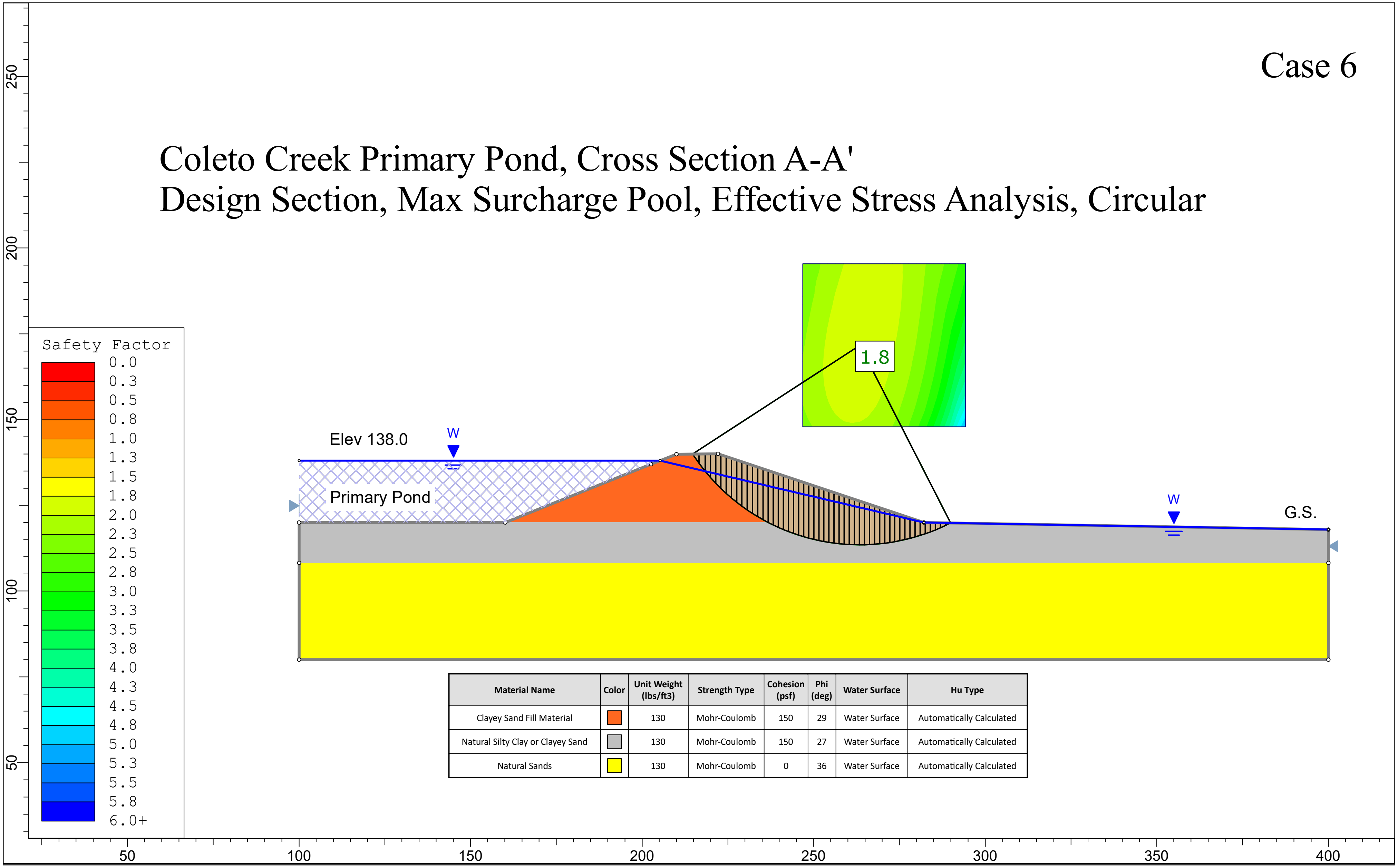

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 5_A-A_design_maxsur_eff_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 6

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Surcharge Pool, Effective Stress Analysis, Circular

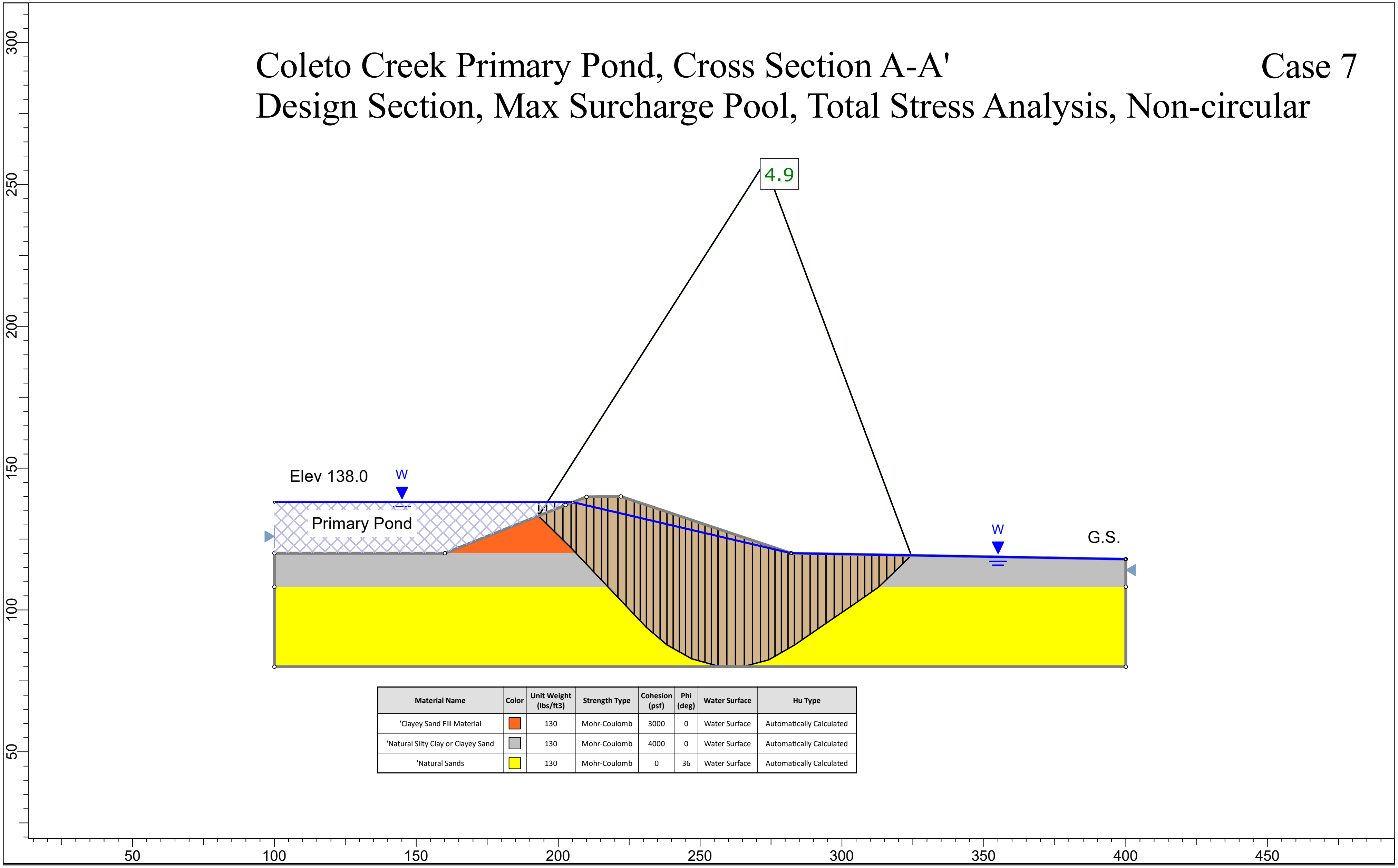



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 6_A-A_design_maxsur_eff_cir.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary Pond, Cross Section A-A' Case 7
## Design Section, Max Surcharge Pool, Total Stress Analysis, Non-circular



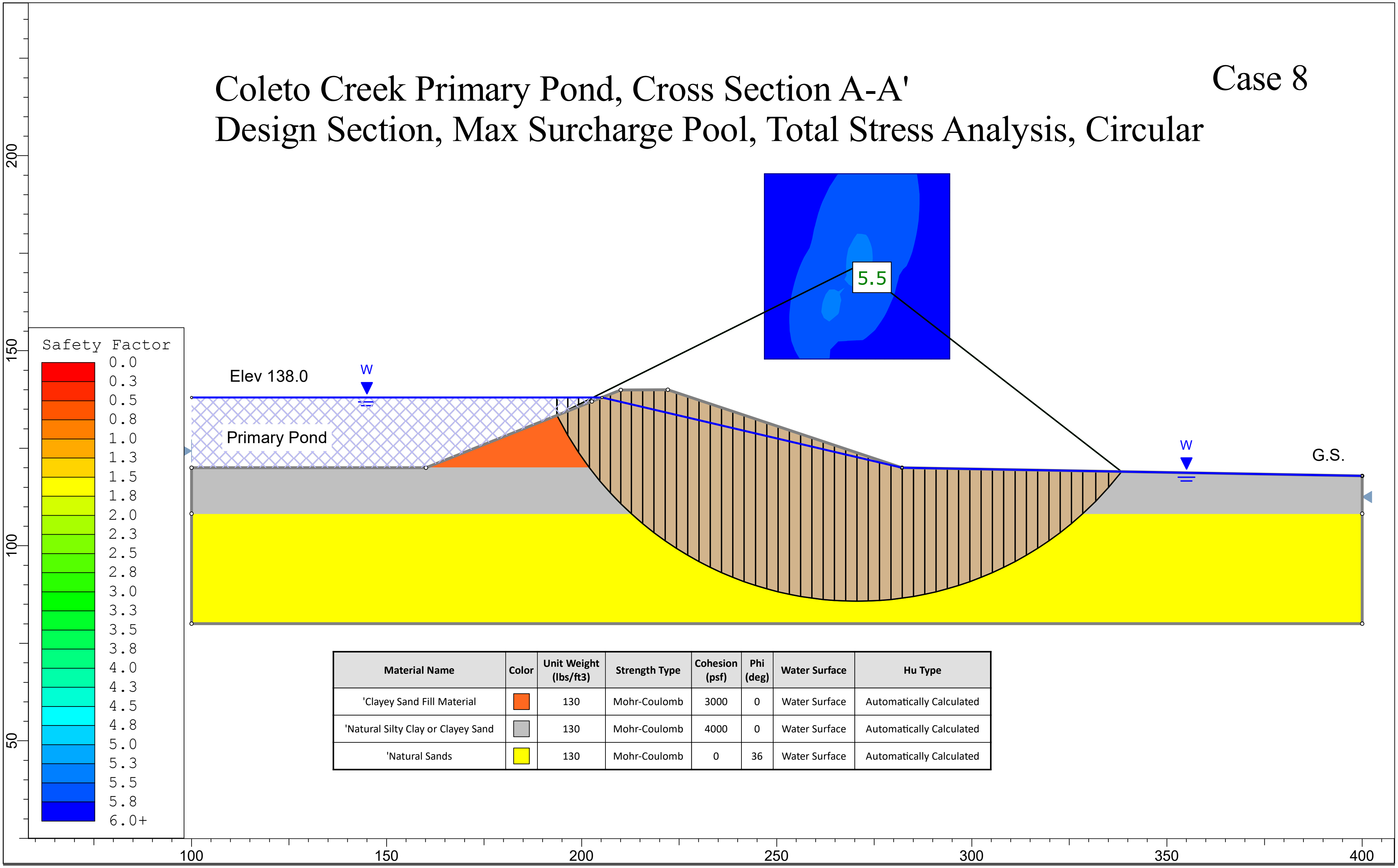

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 7_A-A_design_maxsur_tot_noncir.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Surcharge Pool, Total Stress Analysis, Circular

Case 8



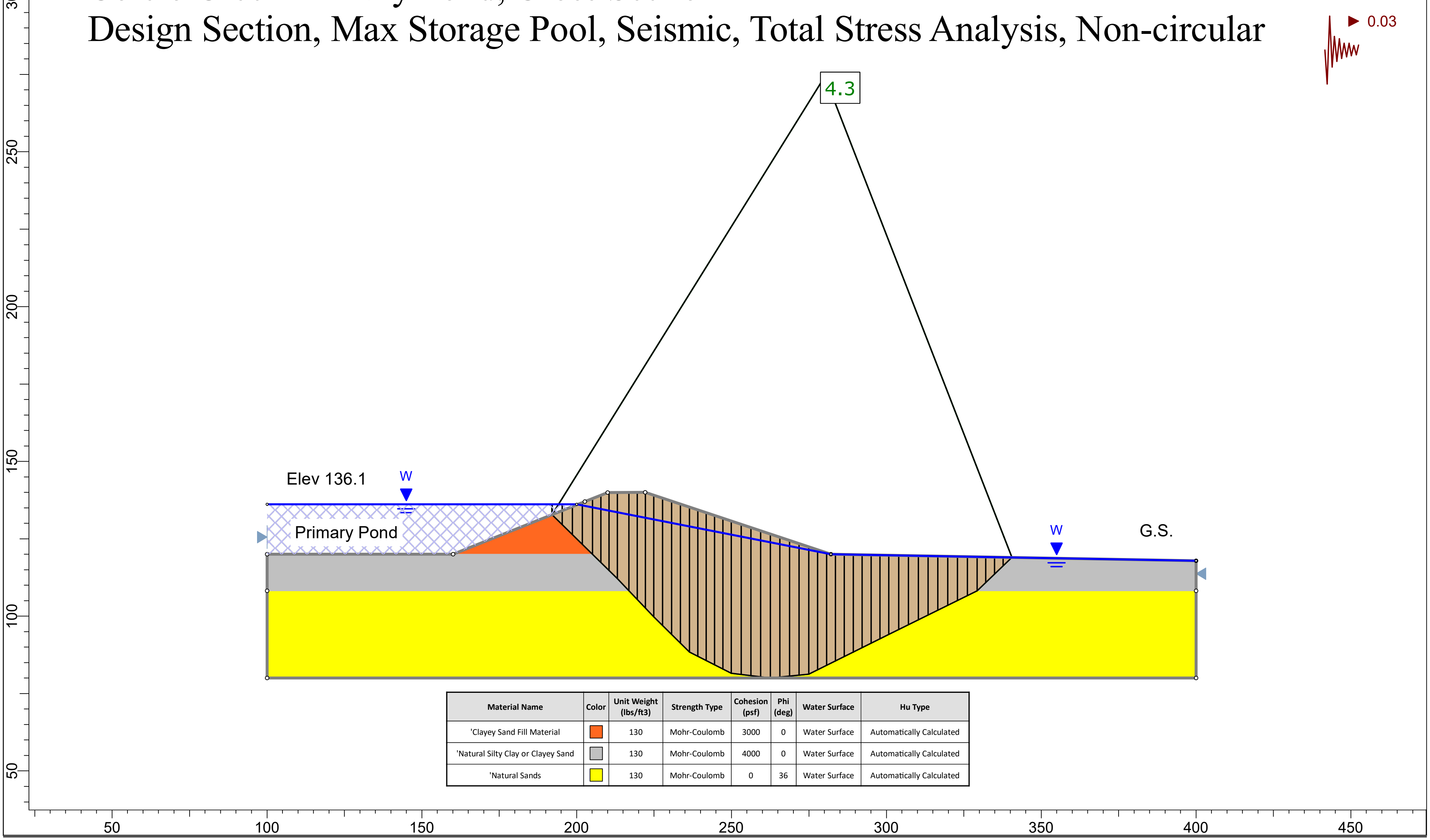

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 8_A-A_design_maxsur_tot_cir.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Seismic, Total Stress Analysis, Non-circular

Case 9



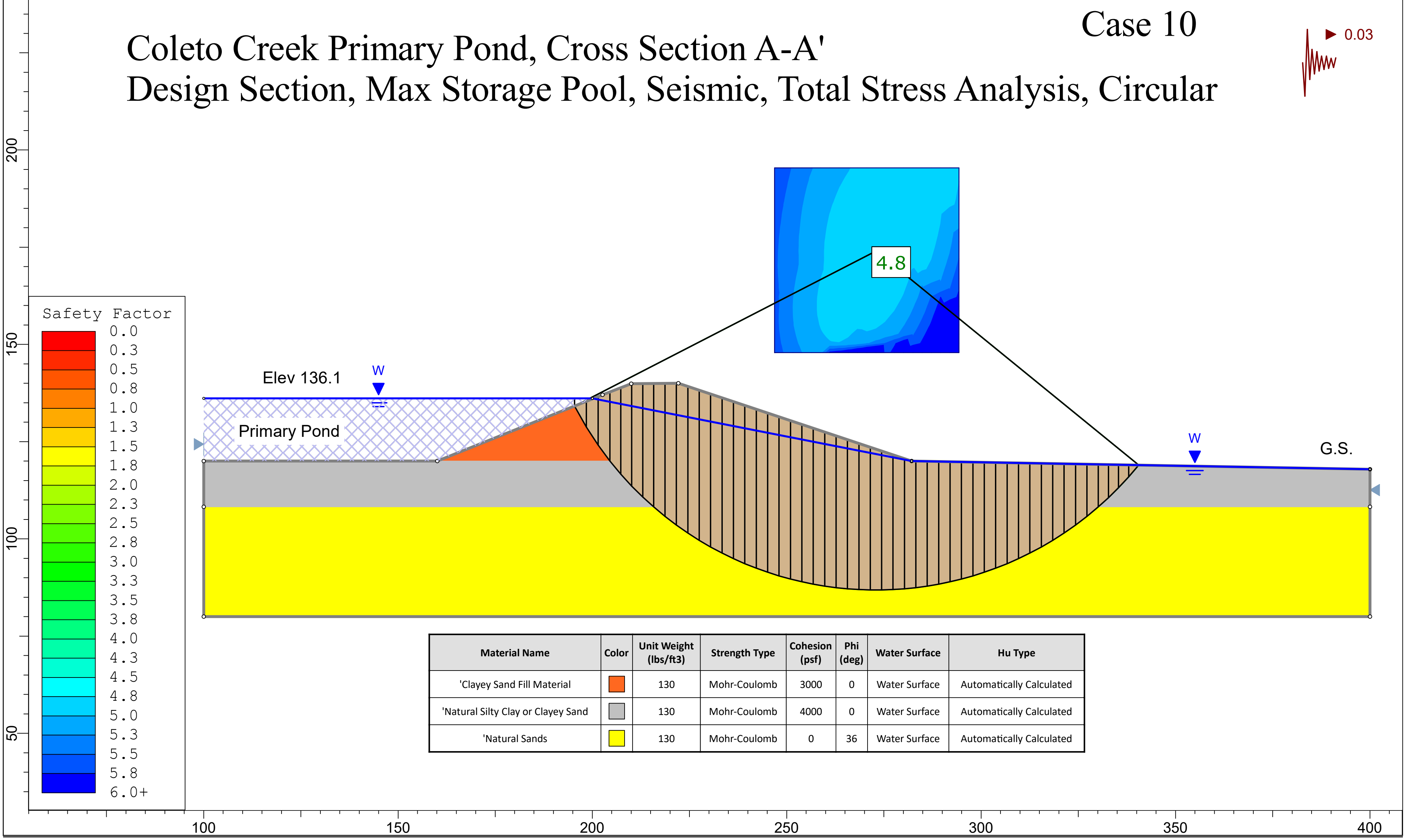

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 9_A-A_design_maxstor_seis_tot_noncir.slmd

Bullock, Bennett & Associates, LLC

Case 10

# Coleto Creek Primary Pond, Cross Section A-A'
# Design Section, Max Storage Pool, Seismic, Total Stress Analysis, Circular



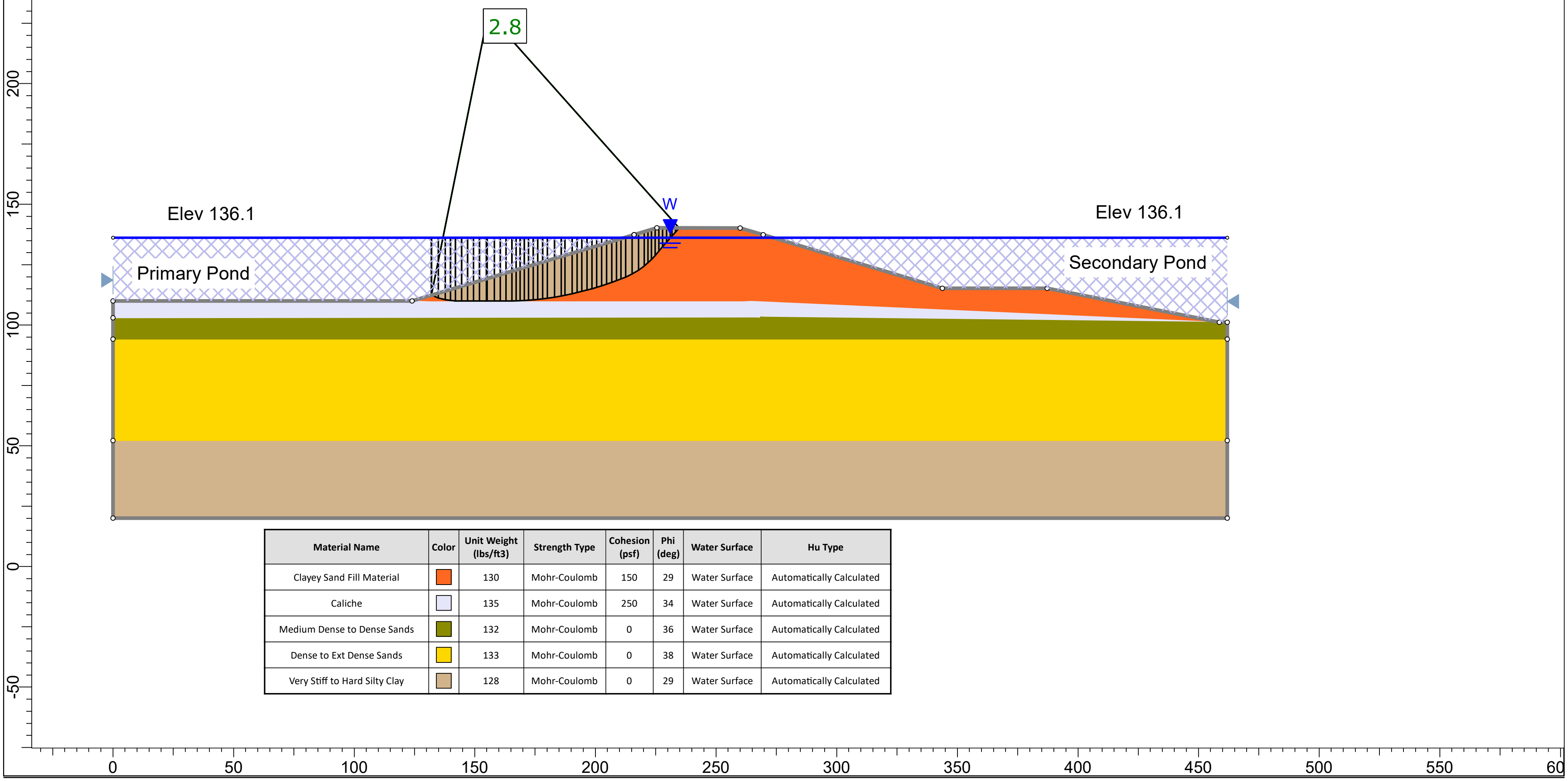

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| 'Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto 10_A-A_design_maxstor_seis_tot_cir.slmd

Bullock, Bennett & Associates, LLC

# Case 11

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Effective Stress Analysis, Non-circular



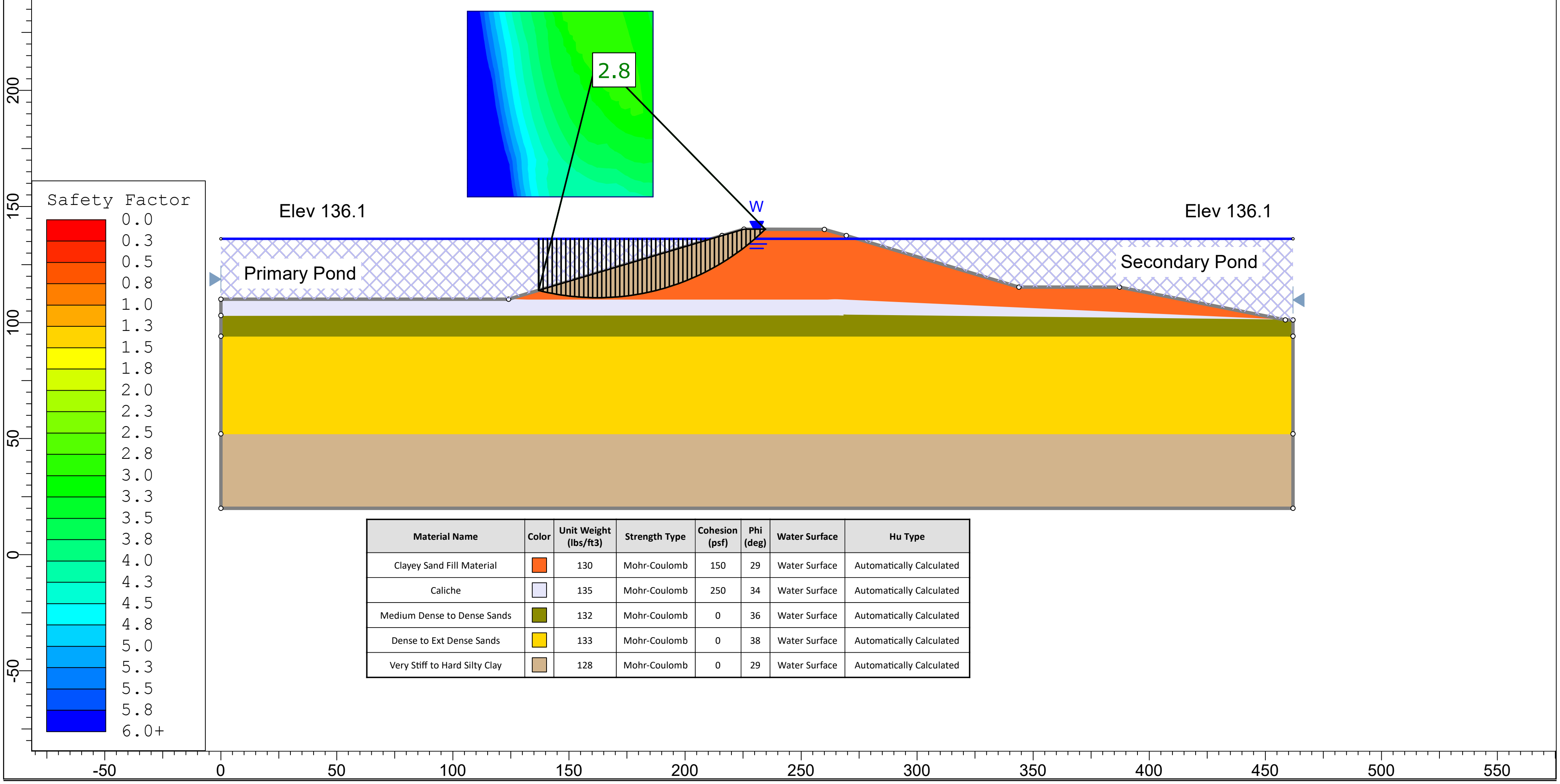

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 34 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 0 | 29 | Water Surface | Automatically Calculated |

Coleto 11_B-B Design_maxstor_effective_noncirc.slmd

Bullock, Bennett & Associates, LLC

Case 12

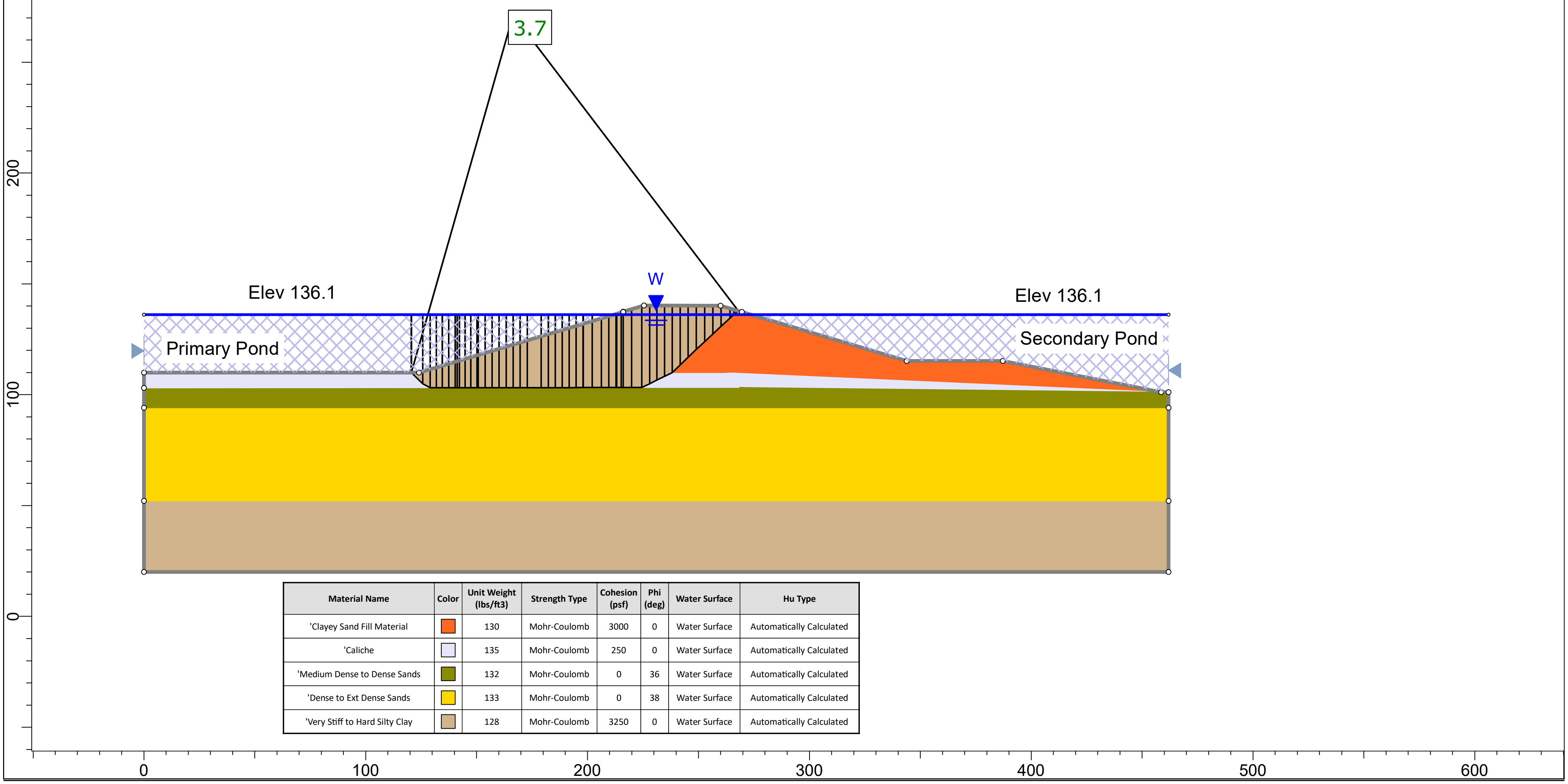
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Effective Stress Analysis, Circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 34 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 0 | 29 | Water Surface | Automatically Calculated |

Case 13

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Non-circular



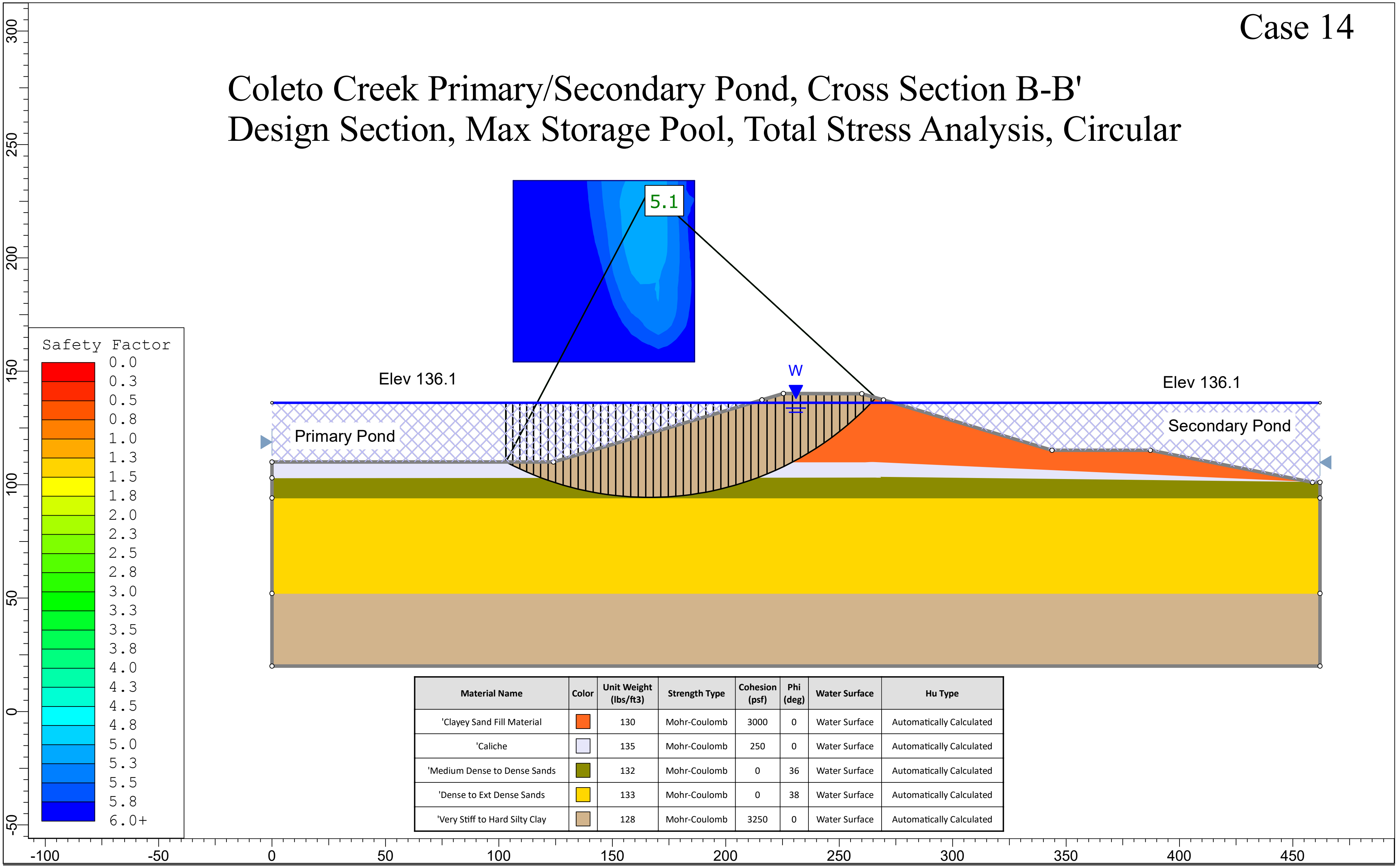

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 13_B-B Design_maxstor_total_noncirc.slmd

Bullock, Bennett & Associates, LLC

Case 14

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Circular



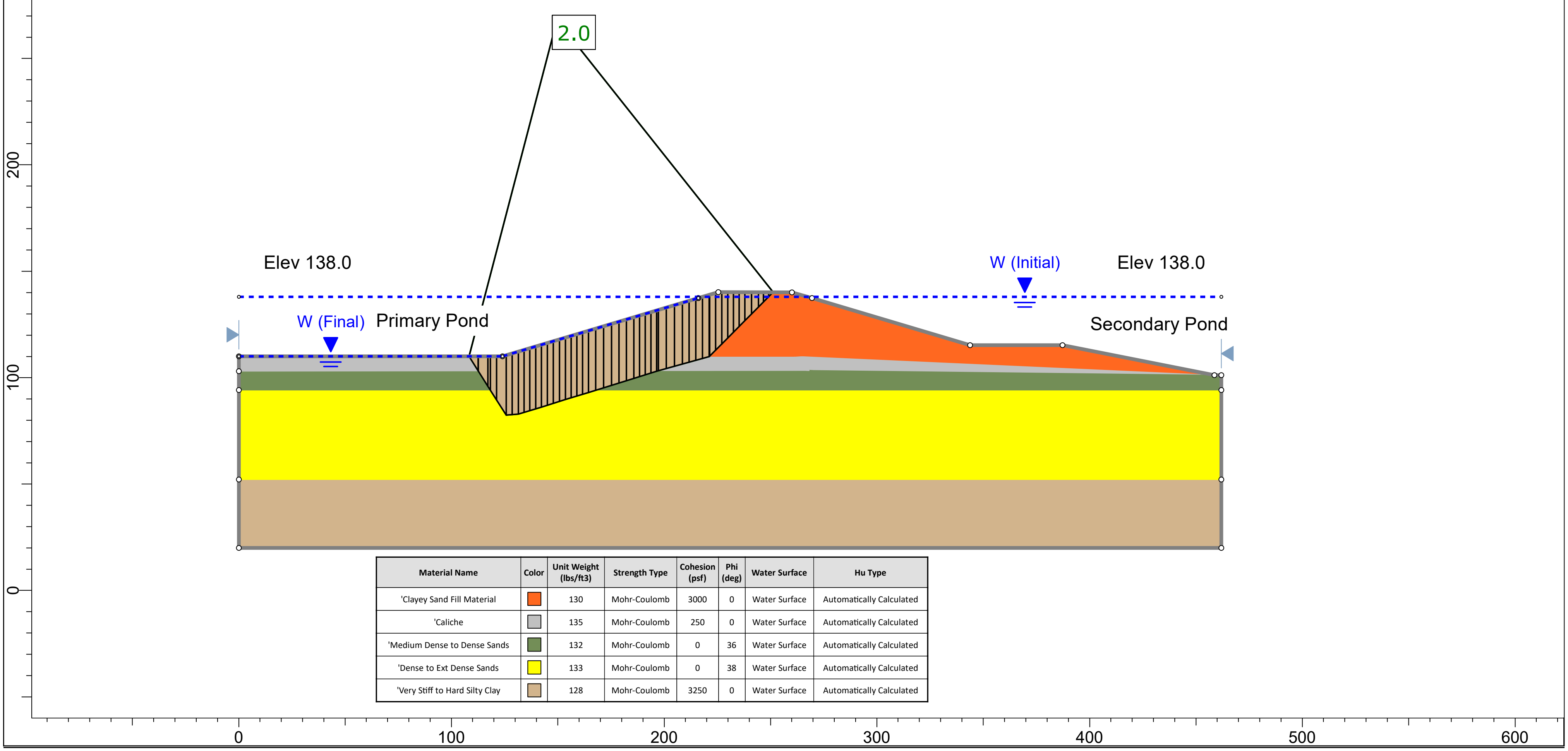

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 14_B-B Design_maxstor_total_circ.slmd

Bullock, Bennett & Associates, LLC

Case 15

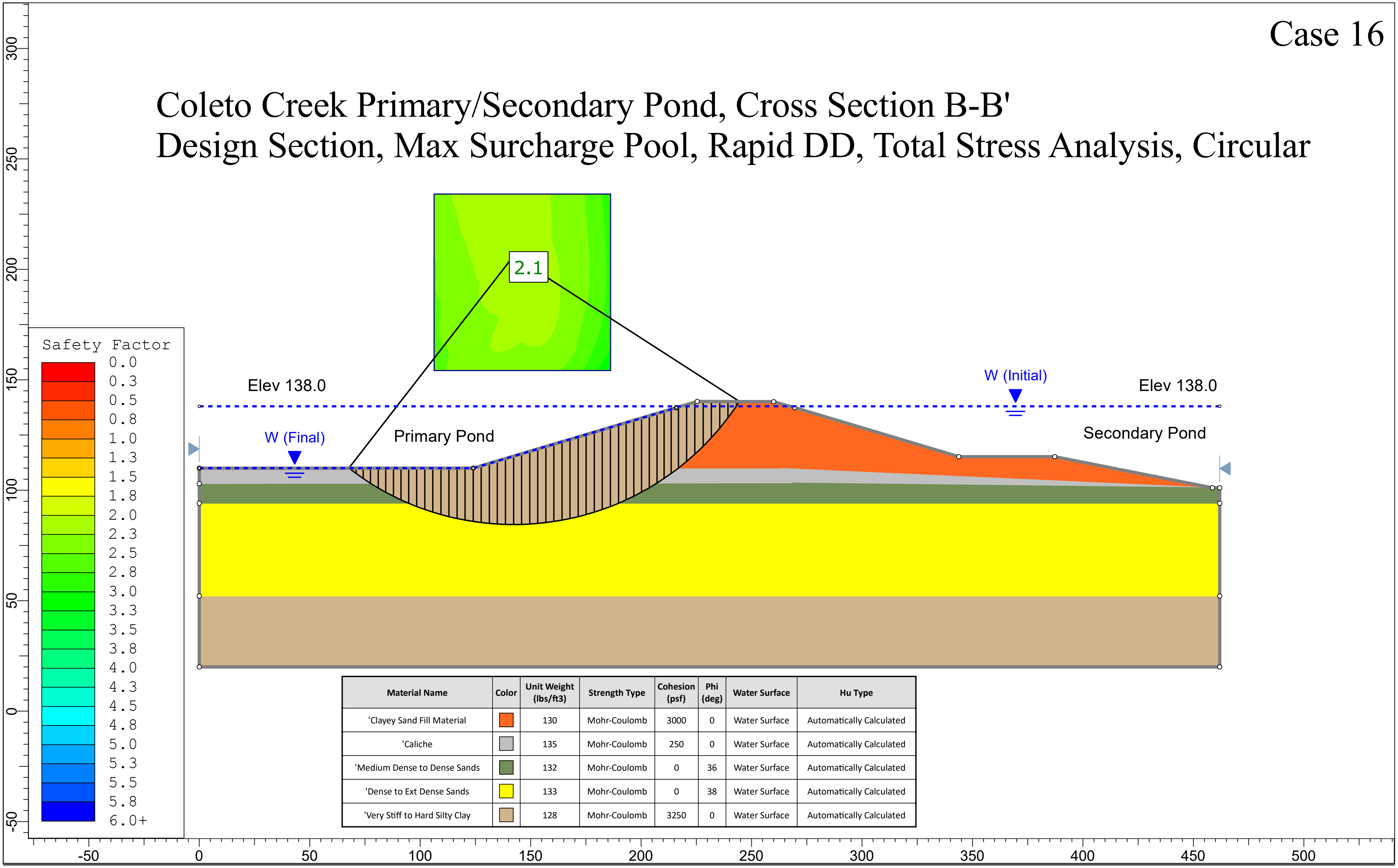
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Surcharge Pool, Rapid DD, Total Stress Analysis, Non-circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Case 16

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Surcharge Pool, Rapid DD, Total Stress Analysis, Circular

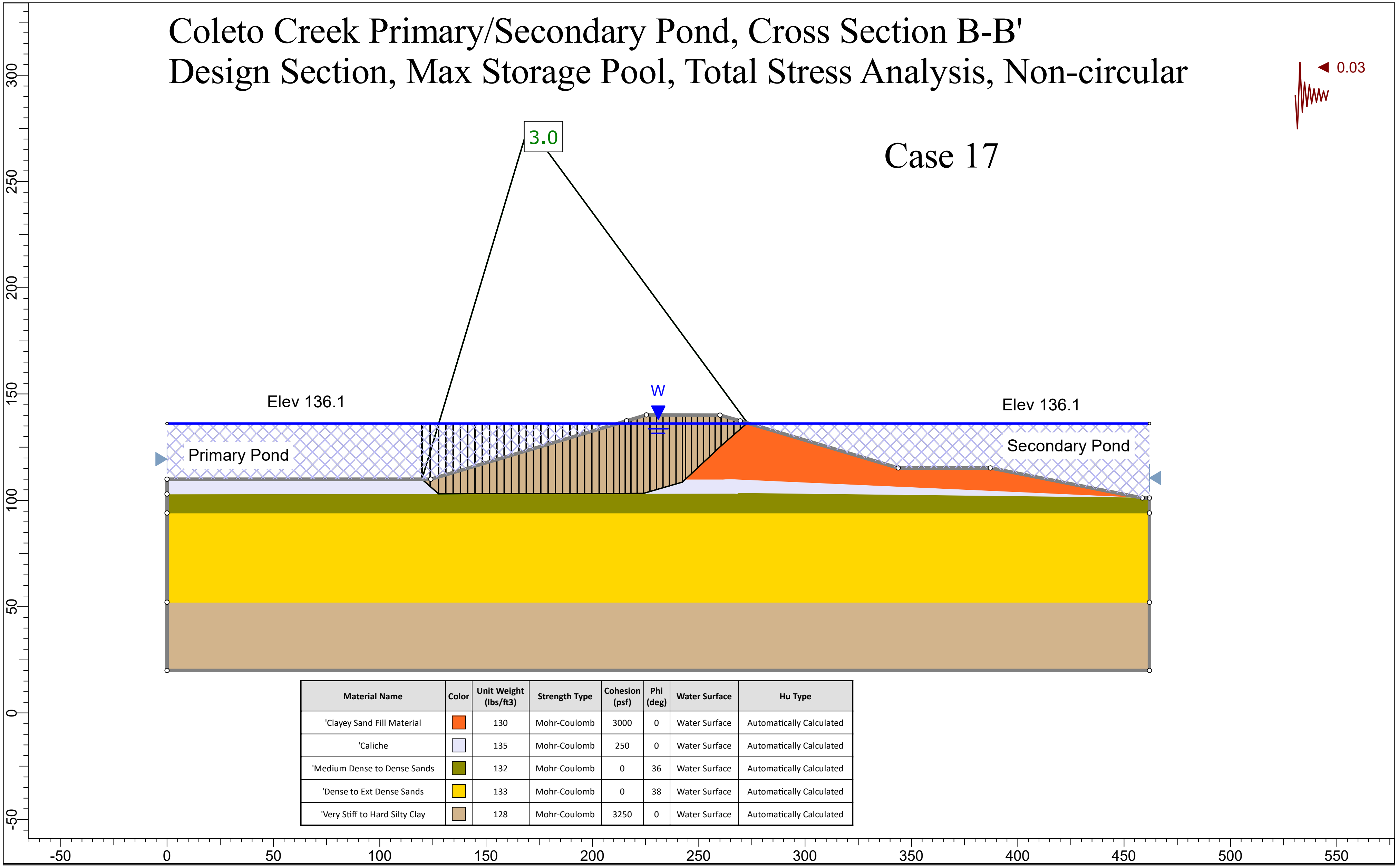



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 16_B-B Model_Maxsur_Rapid DD_total_circ.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Non-circular



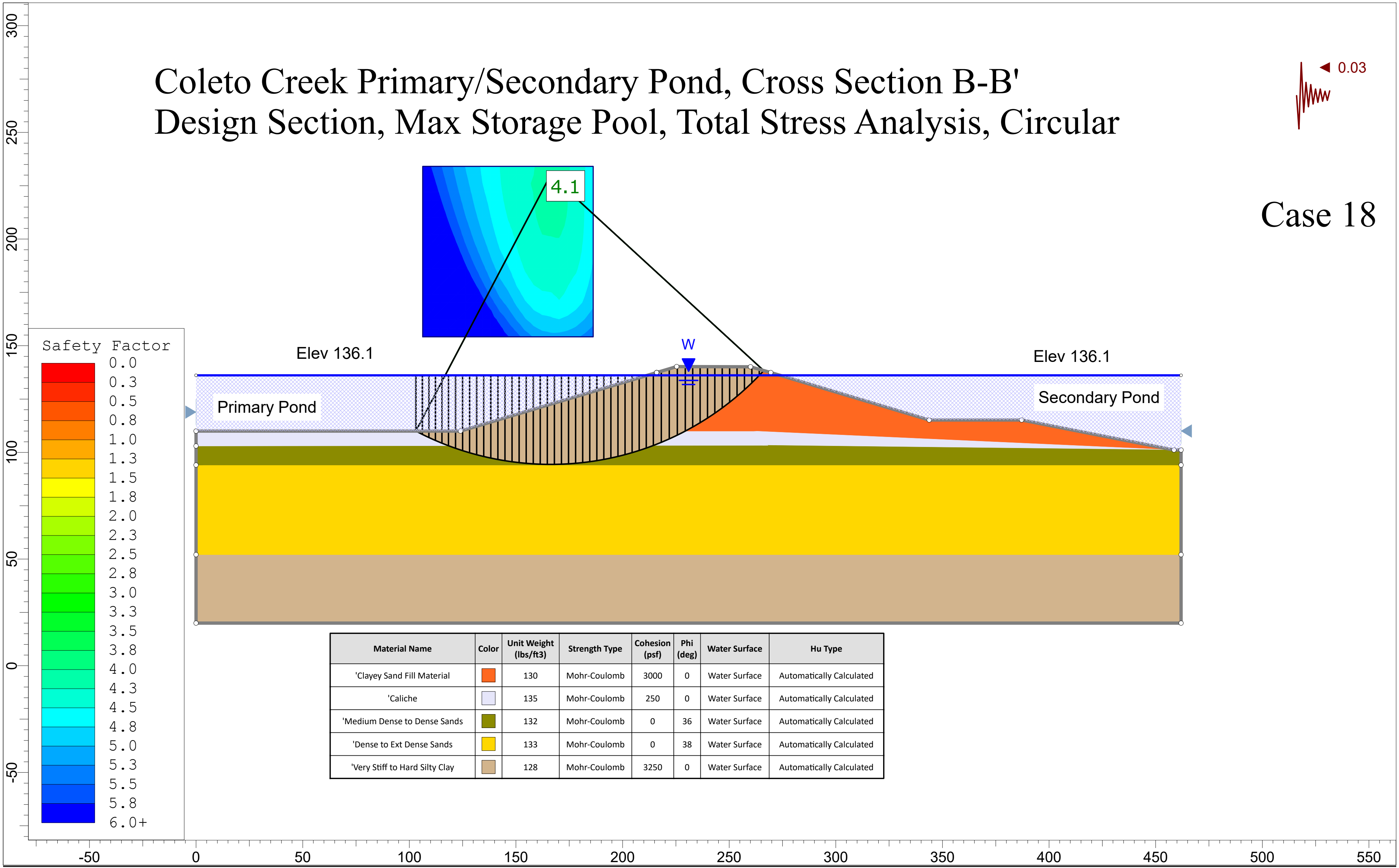

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto 17_B-B Design_maxstor_total__seismic_noncirc.slmd

Bullock, Bennett & Associates, LLC

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
# Design Section, Max Storage Pool, Total Stress Analysis, Circular

Case 18




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| 'Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| 'Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| 'Medium Dense to Dense Sands | | 132 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| 'Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| 'Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

# APPENDIX D:  LIQUEFACTION ASSESSMENT CALCULATIONS

**APPENDIX D**
**LIQUEFACTION FACTOR OF SAFETY**
**ASSESSMENT METHODOLOGY**
**Coleto Creek Power Station**

Sources: Coduto, Donald P., Geotechnical Engineering Principles and Practices. Prentice-Hall.

Rauch, Alan F., May 1997. EPOLLS: *An Empiracle Method for Predicting Surface Displacements Due to Liquefaction-Induced Lateral Spreading in Earthquakes.* Dissertation Submitted to Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for degree of Doctor of Philosophy in Civil Engineering.

United States Environmental Protection Agency (USEPA), April 1995. RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities. Office of Research and Development. Washington, DC. EPA/600/R-95/051

Methodology: Standard Penetration Test (SPT)

*Step 1: Compute the standardized value of number of blow counts per foot normalized for overburden stress at the depth of the test*

$$(N_1)_{60} = NSPT \cdot C_N \cdot CE \cdot CB \cdot CS \cdot C_R$$

where:
$(N_1)_{60}$ = Measured blowcount normalized for overburden stress at the depth of the test
$C_N$ = Correction factor to normalize the measured blowcount to an equivalent value under one atmosphere of effective overburden stress

$$C_N = \sqrt{\frac{Pa}{\sigma'_{vo}}} \leq 2.0$$

where:
Pa = one atmosphere of pressure (101.325kPa) in the same units as $\sigma'_{vo}$
$\sigma'_{vo}$ = vertical efffective stress at depth of $N_{SPT}$

$C_E$ =Correction factor of the measured SPT blowcount for level of energy delivered by the SPT hammer, 1.0 for safety hammer type with rope and pulley hammer release
$C_B$ = Correction factor for borehole diameters outside the recommended range of 2.5 to 4.5 inch, 1.0 for borehole inside range
$C_S$ = Correction factor for SPT samplers used without a sample liner, 1.0 for standard sampler
$C_R$ = Correction factor for loss of energy through reflection in short lengths of drill rod:

where:
For $z < 3$ m; $C_R = 0.75$
For $3 < z < 9$ m; $C_R = (15+z)/24$
For $z > 9$ m; $C_R = 1.0$
where: z = length of drill rod in meters (approximately equal to depth of $N_{SPT}$)

Step 2: Compute a clean-sand equivalent value of $(N_1)_{60}$

$$(N_1)_{60} - cs = (N_1)_{60} + \Delta(N_1)$$

where:

$\Delta(N_1)_{60}$ = correction factor computed as follows:

For FC < 5%, $\Delta(N_1)_{60}$ = 0.0

For 5 < FC < 35%, $\Delta(N_1)_{60}$ = 7*(FC - 5)/30

For FC > 35%, $\Delta(N_1)_{60}$ = 7.0

where:

FC = Fines content (percent finer than 0.075 mm)

Note: Where data was available, those FC were used. Otherwise, representative values from the USGS standard soil classification were used for the soil type observed during drilling.

*Step 3: Compute the cyclic resistance ratio for a standardized magnitude 7.5 earthquake (CRR $_{M7.5}$)*

$$100 \cdot CRR_{M7.5} = \frac{95}{34 - (N_1)_{60} - cs} + \frac{(N_1)_{60} - cs}{1.3} - \frac{1}{2}$$

Note: A value of $(N_1)_{60}$-cs > 30 indicates an unliquefiable soil with an infinite CRR. Designated as UL in the calculation tables.

*Step 4: Adjust the standardized cyclic resistance ratio for the worst-case magnitude of earthquake for the area*

$$CRR = CRRM_{7.5} \cdot MSF \cdot K\sigma \cdot K\alpha$$

where:

MSF = magnitude scaling factor computed as follows:

For $M_w$ < 7.0; MSF = $10^{3.00}$ * $M_w^{-3.46}$

where:

$M_w$ = estimated worst-case magnitude eartquake, 6.1 taken from Figure 3.3 Seismic Source Zones in the Contiguous United States (USGS, 1982) and Table 3.1 Parameters for Seismic Source Zones (USGS, 2982) (USEPA, 1995)

Note: Two additional correction factors are potentially applicable for liquefiable soil deposits subject to significant overburden with a stress factor greater than 1 tsf (2000 psf) (Kσ) or static shear stresses such as significant slopes (Kα). Kσ values were interpolated using Figure 5.7 Curves for Estimation of Correction Factor (Harder 1988, and Hynes 1988, as Quoted in Marcuson, et.al., 1990) (USEPA, 1998). No Kα factor was applied due to the relatively flat ground surface in the area.

*Step 5: Estimate the average cyclic shear stress (CSR)*

$$CSR = 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_{vo}}{\sigma'_{vo}} \cdot rd$$

where:

$a_{max}/g$ = peak horizonal acceleration that would occur at the ground surface in the absence of excess pore pressures or liquefaction, 0.03 g taken from the 2014 United States Geological Survey National Seismic Hazard Maps found at http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014pga2pct.pdf).

$\sigma_{vo}$ = total vertical overburden stress

g = acceleration due to gravity, 9.81 m/s$^2$

$r_d$ = stress reduction factor calculated as follows for depths up to 30 m:

$r_d = 1.0 + 1.6 * 10^{-6}(z^4 - 42z^3 + 105z^2 - 4200z)$

Step 6: Calculate the Factor of Safety against liquefaction ($FS_{liq}$)

$$FS_{liq} = \frac{CRR}{CSR}$$

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**

**TEST BORING B-1-1[1]**

**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 12 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 50' bgs<br>3", 50' to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | Kσ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0.61 | Unsaturated | 40 | SC | 250 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 60.0 | 35 | 7.0 | 67.0 | UL | 1.92 | NA | UL | 0.03 | 250 | 1.00 | UL | UL |
| 2 | 4 | 1.22 | Unsaturated | 13 | SC | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 19.5 | 35 | 7.0 | 26.5 | 0.33 | 1.92 | NA | 0.62 | 0.03 | 500 | 0.99 | 0.019 | 32 |
| 3 | 6 | 1.83 | Unsaturated | 14 | SC | 750 | 1.68 | 1.0 | 1.00 | 1.0 | 0.75 | 17.6 | 35 | 7.0 | 24.6 | 0.29 | 1.92 | NA | 0.55 | 0.03 | 750 | 0.99 | 0.019 | 28 |
| 4 | 8 | 2.44 | Unsaturated | 15 | SC | 1000 | 1.45 | 1.0 | 1.00 | 1.0 | 0.75 | 16.4 | 90.6 | 7.0 | 23.4 | 0.26 | 1.92 | NA | 0.51 | 0.03 | 1000 | 0.98 | 0.019 | 26 |
| 7 | 14 | 4.27 | Saturated | 10 | SC | 1635.4 | 1.14 | 1.0 | 1.00 | 1.0 | 0.80 | 9.1 | 35 | 7.0 | 16.1 | 0.17 | 1.92 | NA | 0.33 | 0.03 | 1760 | 0.97 | 0.020 | 16 |
| 8 | 16 | 4.88 | Saturated | 13 | SC | 1770.8 | 1.09 | 1.0 | 1.00 | 1.0 | 0.83 | 11.8 | 35 | 7.0 | 18.8 | 0.20 | 1.92 | NA | 0.39 | 0.03 | 2020 | 0.96 | 0.021 | 18 |
| 9 | 18 | 5.49 | Saturated | 9 | SC | 1906.2 | 1.05 | 1.0 | 1.00 | 1.0 | 0.85 | 8.1 | 35 | 7.0 | 15.1 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 2280 | 0.96 | 0.022 | 14 |
| 10 | 20 | 6.10 | Saturated | 15 | SC | 2041.6 | 1.02 | 1.0 | 1.00 | 1.0 | 0.88 | 13.4 | 39.5 | 7.0 | 20.4 | 0.22 | 1.92 | 0.93 | 0.40 | 0.03 | 2540 | 0.95 | 0.023 | 17 |
| 12 | 24 | 7.32 | Saturated | 13 | SC | 2312.4 | 0.96 | 1.0 | 1.00 | 1.0 | 0.93 | 11.6 | 35 | 7.0 | 18.6 | 0.20 | 1.92 | 0.92 | 0.35 | 0.03 | 3060 | 0.94 | 0.024 | 15 |
| 13 | 26 | 7.92 | Saturated | 21 | SC | 2447.8 | 0.93 | 1.0 | 1.00 | 1.0 | 0.96 | 18.7 | 35 | 7.0 | 25.7 | 0.31 | 1.92 | 0.92 | 0.54 | 0.03 | 3320 | 0.93 | 0.025 | 22 |
| 14 | 28 | 8.53 | Saturated | 15 | SC | 2583.2 | 0.91 | 1.0 | 1.00 | 1.0 | 0.98 | 13.3 | 35 | 7.0 | 20.3 | 0.22 | 1.92 | 0.91 | 0.39 | 0.03 | 3580 | 0.92 | 0.025 | 16 |
| 15 | 30 | 9.14 | Saturated | 28 | SC | 2718.6 | 0.88 | 1.0 | 1.00 | 1.0 | 1.0 | 24.7 | 35 | 7.0 | 31.7 | UL | 1.92 | 0.91 | UL | 0.03 | 3840 | 0.91 | UL | UL |
| 16 | 32 | 9.75 | Saturated | 12 | SC | 2854 | 0.86 | 1.0 | 1.00 | 1.0 | 1.0 | 10.3 | 35 | 7.0 | 17.3 | 0.19 | 1.92 | 0.90 | 0.32 | 0.03 | 4100 | 0.90 | 0.025 | 13 |
| 18 | 34.7 | 10.58 | Saturated | 6 | SM | 3036.79 | 0.83 | 1.0 | 1.00 | 1.0 | 1.0 | 5.0 | 15 | 2.3 | 7.3 | 0.09 | 1.92 | 0.90 | 0.15 | 0.03 | 4451 | 0.89 | 0.025 | 6 |
| 18A | 36 | 10.97 | Saturated | 15 | SM | 3124.8 | 0.82 | 1.0 | 1.00 | 1.0 | 1.0 | 12.3 | 15 | 2.3 | 14.7 | 0.16 | 1.92 | 0.90 | 0.27 | 0.03 | 4620 | 0.88 | 0.025 | 11 |
| 19 | 36.7 | 11.19 | Saturated | 24 | SP | 3172.19 | 0.82 | 1.0 | 1.00 | 1.0 | 1.0 | 19.6 | 1 | 0.0 | 19.6 | 0.21 | 1.92 | 0.89 | 0.36 | 0.03 | 4711 | 0.88 | 0.025 | 14 |
| 19A | 38 | 11.58 | Saturated | 26 | SP | 3260.2 | 0.81 | 1.0 | 1.00 | 1.0 | 1.0 | 20.9 | 1 | 0.0 | 20.9 | 0.23 | 1.92 | 0.89 | 0.39 | 0.03 | 4880 | 0.87 | 0.025 | 15 |
| 20 | 40 | 12.19 | Saturated | 39 | SP | 3395.6 | 0.79 | 1.0 | 1.00 | 1.0 | 1.0 | 30.8 | 1 | 0.0 | 30.8 | UL | 1.92 | 0.89 | UL | 0.03 | 5140 | 0.86 | UL | UL |
| 21 | 42 | 12.80 | Saturated | 27 | SP | 3531 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 20.9 | 1 | 0.0 | 20.9 | 0.23 | 1.92 | 0.88 | 0.39 | 0.03 | 5400 | 0.84 | 0.025 | 15 |
| 22 | 44 | 13.41 | Saturated | 35 | SM | 3666.4 | 0.76 | 1.0 | 1.00 | 1.0 | 1.0 | 26.6 | 15 | 2.3 | 28.9 | 0.40 | 1.92 | 0.88 | 0.68 | 0.03 | 5660 | 0.83 | UL | UL |
| 23 | 46 | 14.02 | Saturated | 34 | SP | 3801.8 | 0.75 | 1.0 | 1.00 | 1.0 | 1.0 | 25.4 | 1 | 0.0 | 25.4 | 0.30 | 1.92 | 0.87 | 0.50 | 0.03 | 5920 | 0.82 | UL | UL |
| 24 | 48 | 14.63 | Saturated | 66 | SP | 3937.2 | 0.73 | 1.0 | 1.00 | 1.0 | 1.0 | 48.4 | 1 | 0.0 | 48.4 | UL | 1.92 | 0.87 | UL | 0.03 | 6180 | 0.80 | UL | UL |
| 25 | 50 | 15.24 | Saturated | 56 | SP | 4072.6 | 0.72 | 1.0 | 1.00 | 1.0 | 1.0 | 40.4 | 1 | 0.0 | 40.4 | UL | 1.92 | 0.86 | UL | 0.03 | 6440 | 0.79 | UL | UL |
| 26 | 52 | 15.85 | Saturated | 50 | SP | 4208 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 35.5 | 1 | 0.0 | 35.5 | UL | 1.92 | 0.86 | UL | 0.03 | 6700 | 0.77 | UL | UL |
| 27 | 57 | 17.37 | Saturated | 50 | SP | 4546.5 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 34.1 | 1 | 0.0 | 34.1 | UL | 1.92 | 0.85 | UL | 0.03 | 7350 | 0.73 | UL | UL |
| 28 | 62 | 18.90 | Saturated | 66 | SP | 4885 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 43.4 | 1 | 0.0 | 43.4 | UL | 1.92 | 0.84 | UL | 0.03 | 8000 | 0.68 | UL | UL |
| 29 | 67 | 20.42 | Saturated | 50 | SC | 5223.5 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 31.8 | 35 | 7.0 | 38.8 | UL | 1.92 | 0.83 | UL | 0.03 | 8650 | 0.64 | UL | UL |
| 30 | 72 | 21.95 | Saturated | 92 | SC | 5562 | 0.62 | 1.0 | 1.00 | 1.0 | 1.0 | 56.7 | 35 | 7.0 | 63.7 | UL | 1.92 | 0.81 | UL | 0.03 | 9300 | 0.59 | UL | UL |
| 31 | 75 | 22.86 | Saturated | 50 | SC | 5765.1 | 0.61 | 1.0 | 1.00 | 1.0 | 1.0 | 30.3 | 35 | 7.0 | 37.3 | UL | 1.92 | 0.81 | UL | 0.03 | 9690 | 0.57 | UL | UL |
| 32 | 81 | 24.69 | Saturated | 50 | SP | 6171.3 | 0.59 | 1.0 | 1.00 | 1.0 | 1.0 | 29.3 | 1 | 0.0 | 29.3 | UL | 1.92 | 0.79 | UL | 0.03 | 10470 | 0.52 | UL | UL |
| 33 | 86 | 26.21 | Saturated | 50 | SM | 6509.8 | 0.57 | 1.0 | 1.00 | 1.0 | 1.0 | 28.5 | 15 | 2.3 | 30.8 | UL | 1.92 | 0.78 | UL | 0.03 | 11120 | 0.48 | UL | UL |
| 34 | 91 | 27.74 | Saturated | 50 | CL | 6848.3 | 0.56 | 1.0 | 1.00 | 1.0 | 1.0 | 27.8 | 77.9 | 7.0 | 34.8 | UL | 1.92 | 0.77 | UL | 0.03 | 11770 | 0.46 | UL | UL |
| 35 | 96 | 29.26 | Saturated | 50 | CL | 7186.8 | 0.54 | 1.0 | 1.00 | 1.0 | 1.0 | 27.1 | 90 | 7.0 | 34.1 | UL | 1.92 | 0.76 | UL | 0.03 | 12420 | 0.44 | UL | UL |
| 36 | 100 | 30.48 | Saturated | 50 | SC | 7457.6 | 0.53 | 1.0 | 1.00 | 1.0 | 1.0 | 26.6 | 35 | 7.0 | 33.6 | UL | 1.92 | 0.75 | UL | 0.03 | 12940 | 0.43 | UL | UL |
| 37 | 107 | 32.61 | Saturated | 93 | CH | 7931.5 | 0.52 | 1.0 | 1.00 | 1.0 | 1.0 | 48.0 | 90 | 7.0 | 55.0 | UL | 1.92 | 0.74 | UL | 0.03 | 13850 | 0.44 | UL | UL |
| 38 | 112 | 34.14 | Saturated | 51 | CH | 9516 | 0.47 | 1.0 | 1.00 | 1.0 | 1.0 | 24.1 | 90 | 7.0 | 31.1 | UL | 1.92 | 0.68 | UL | 0.03 | 14500 | 0.47 | UL | UL |
| 39 | 117 | 35.66 | Saturated | 38 | CH | 9854.5 | 0.46 | 1.0 | 1.00 | 1.0 | 1.0 | 17.6 | 90 | 7.0 | 24.6 | 0.29 | 1.92 | 0.67 | 0.37 | 0.03 | 15150 | 0.51 | 0.015 | 24 |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

# LIQUEFACTION FACTOR OF SAFETY ASSESSMENT
## TEST BORING B-2-1[1]
## Coleto Creek Power Plant

| | | |
|---|---|---|
| Depth to Water = | 32 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 50' bgs<br>3", 50' to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0.61 | Unsaturated | 17 | SC | 250 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 35 | 7.0 | 32.5 | UL | 1.92 | NA | UL | 0.03 | 250 | 1.00 | UL | UL |
| 2 | 4 | 1.22 | Unsaturated | 21 | SC | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 31.5 | 35 | 7.0 | 38.5 | UL | 1.92 | NA | UL | 0.03 | 500 | 0.99 | UL | UL |
| 3 | 6 | 1.83 | Unsaturated | 15 | SC | 750 | 1.68 | 1.0 | 1.00 | 1.0 | 0.75 | 18.9 | 35 | 7.0 | 25.9 | 0.31 | 1.92 | NA | 0.60 | 0.03 | 750 | 0.99 | 0.019 | 31 |
| 4 | 8 | 2.44 | Unsaturated | 13 | SC | 1000 | 1.45 | 1.0 | 1.00 | 1.0 | 0.75 | 14.2 | 35 | 7.0 | 21.2 | 0.23 | 1.92 | NA | 0.45 | 0.03 | 1000 | 0.98 | 0.019 | 23 |
| 5 | 10 | 3.05 | Unsaturated | 15 | SC | 1250 | 1.30 | 1.0 | 1.00 | 1.0 | 0.75 | 14.6 | 37.3 | 7.0 | 21.6 | 0.24 | 1.92 | NA | 0.46 | 0.03 | 1250 | 0.98 | 0.019 | 24 |
| 7 | 14 | 4.27 | Unsaturated | 12 | SC | 1750 | 1.10 | 1.0 | 1.00 | 1.0 | 0.80 | 10.6 | 35 | 7.0 | 17.6 | 0.19 | 1.92 | NA | 0.36 | 0.03 | 1750 | 0.97 | 0.019 | 19 |
| 8 | 16 | 4.88 | Unsaturated | 21 | SC | 2000 | 1.03 | 1.0 | 1.00 | 1.0 | 0.83 | 17.9 | 35 | 7.0 | 24.9 | 0.29 | 1.92 | NA | 0.56 | 0.03 | 2000 | 0.96 | 0.019 | 30 |
| 9 | 18 | 5.49 | Unsaturated | 9 | SC | 2250 | 0.97 | 1.0 | 1.00 | 1.0 | 0.85 | 7.4 | 42.3 | 7.0 | 14.4 | 0.15 | 1.92 | NA | 0.30 | 0.03 | 2250 | 0.96 | 0.019 | 16 |
| 11 | 22 | 6.71 | Unsaturated | 14 | SC | 2750 | 0.88 | 1.0 | 1.00 | 1.0 | 0.90 | 11.1 | 35 | 7.0 | 18.1 | 0.19 | 1.92 | 0.91 | 0.34 | 0.03 | 2750 | 0.95 | 0.018 | 18 |
| 12 | 24 | 7.32 | Unsaturated | 17 | SC | 3000 | 0.84 | 1.0 | 1.00 | 1.0 | 0.93 | 13.3 | 35 | 7.0 | 20.3 | 0.22 | 1.92 | 0.90 | 0.38 | 0.03 | 3000 | 0.94 | 0.018 | 21 |
| 13 | 26 | 7.92 | Unsaturated | 18 | SC | 3250 | 0.81 | 1.0 | 1.00 | 1.0 | 0.96 | 13.9 | 35.2 | 7.0 | 20.9 | 0.23 | 1.92 | 0.89 | 0.39 | 0.03 | 3250 | 0.93 | 0.018 | 22 |
| 15 | 30 | 9.14 | Unsaturated | 16 | SC | 3750 | 0.75 | 1.0 | 1.00 | 1.0 | 1.0 | 12.0 | 35 | 7.0 | 19.0 | 0.20 | 1.92 | 0.88 | 0.34 | 0.03 | 3750 | 0.91 | 0.018 | 19 |
| 16 | 32 | 9.75 | Saturated | 22 | SC | 4000 | 0.73 | 1.0 | 1.00 | 1.0 | 1.0 | 16.0 | 38.4 | 7.0 | 23.0 | 0.26 | 1.92 | 0.87 | 0.43 | 0.03 | 4000 | 0.90 | 0.018 | 24 |
| 18 | 36 | 10.97 | Saturated | 15 | SC | 4270.8 | 0.70 | 1.0 | 1.00 | 1.0 | 1.0 | 10.6 | 35 | 7.0 | 17.6 | 0.19 | 1.92 | 0.86 | 0.31 | 0.03 | 4520 | 0.88 | 0.018 | 17 |
| 19 | 38 | 11.58 | Saturated | 8 | SC | 4406.2 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 5.5 | 35 | 7.0 | 12.5 | 0.14 | 1.92 | 0.85 | 0.22 | 0.03 | 4780 | 0.87 | 0.018 | 12 |
| 20 | 40 | 12.19 | Saturated | 16 | SC | 4541.6 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 10.9 | 35 | 7.0 | 17.9 | 0.19 | 1.92 | 0.85 | 0.31 | 0.03 | 5040 | 0.86 | 0.019 | 17 |
| 21A | 42 | 12.80 | Saturated | 14 | SP | 4677 | 0.67 | 1.0 | 1.00 | 1.0 | 1.0 | 9.4 | 1 | 0.0 | 9.4 | 0.11 | 1.92 | 0.84 | 0.17 | 0.03 | 5300 | 0.84 | 0.019 | 9 |
| 22 | 44 | 13.41 | Saturated | 27 | SP | 4812.4 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 17.9 | 1 | 0.0 | 17.9 | 0.19 | 1.92 | 0.84 | 0.31 | 0.03 | 5560 | 0.83 | 0.019 | 17 |
| 23 | 46 | 14.02 | Saturated | 25 | SP | 4947.8 | 0.65 | 1.0 | 1.00 | 1.0 | 1.0 | 5.0 | 1 | 0.0 | 5.0 | 0.07 | 1.92 | 0.84 | 0.11 | 0.03 | 5820 | 0.82 | 0.019 | 6 |
| 24 | 48 | 14.63 | Saturated | 37 | SP | 5083.2 | 0.65 | 1.0 | 1.00 | 1.0 | 1.0 | 23.9 | 1 | 0.0 | 23.9 | 0.27 | 1.92 | 0.83 | 0.43 | 0.03 | 6080 | 0.80 | 0.019 | 23 |
| 25 | 50 | 15.24 | Saturated | 35 | SP | 5218.6 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 22.3 | 1 | 0.0 | 22.3 | 0.25 | 1.92 | 0.83 | 0.39 | 0.03 | 6340 | 0.79 | 0.019 | 21 |
| 26 | 52 | 15.85 | Saturated | 33 | SM | 5354 | 0.63 | 1.0 | 1.00 | 1.0 | 1.0 | 20.7 | 35 | 7.0 | 27.7 | 0.36 | 1.92 | 0.82 | 0.57 | 0.03 | 6600 | 0.77 | 0.018 | 31 |
| 27 | 56 | 17.07 | Saturated | 39 | SC | 5624.8 | 0.61 | 1.0 | 1.00 | 1.0 | 1.0 | 23.9 | 45.7 | 7.0 | 30.9 | UL | 1.92 | 0.81 | UL | 0.03 | 7120 | 0.74 | UL | UL |
| 28 | 61 | 18.59 | Saturated | 43 | SC | 5963.3 | 0.60 | 1.0 | 1.00 | 1.0 | 1.0 | 25.6 | 35 | 7.0 | 32.6 | UL | 1.92 | 0.80 | UL | 0.03 | 7770 | 0.69 | UL | UL |
| 29 | 66 | 20.12 | Saturated | 40 | SP-SM | 6301.8 | 0.58 | 1.0 | 1.00 | 1.0 | 1.0 | 23.2 | 10 | 1.2 | 24.3 | 0.28 | 1.92 | 0.79 | 0.43 | 0.03 | 8420 | 0.65 | 0.017 | 25 |
| 30 | 71 | 21.64 | Saturated | 39 | SP | 6640.3 | 0.56 | 1.0 | 1.00 | 1.0 | 1.0 | 22.0 | 1 | 0.0 | 22.0 | 0.24 | 1.92 | 0.78 | 0.36 | 0.03 | 9070 | 0.60 | 0.016 | 23 |
| 31 | 76 | 23.16 | Saturated | 50 | SM | 6978.8 | 0.55 | 1.0 | 1.00 | 1.0 | 1.0 | 27.5 | 35 | 7.0 | 34.5 | UL | 1.92 | 0.77 | UL | 0.03 | 9720 | 0.56 | UL | UL |
| 32 | 81 | 24.69 | Saturated | 60 | CL-ML-S | 7317.3 | 0.54 | 1.0 | 1.00 | 1.0 | 1.0 | 32.3 | 50 | 0.0 | 32.3 | UL | 1.92 | 0.76 | UL | 0.03 | 10370 | 0.52 | UL | UL |
| 33 | 86 | 26.21 | Saturated | 34 | CH | 7655.8 | 0.53 | 1.0 | 1.00 | 1.0 | 1.0 | 17.9 | 92.4 | 7.0 | 24.9 | 0.29 | 1.92 | 0.74 | 0.41 | 0.03 | 11020 | 0.48 | 0.014 | 31 |
| 34 | 91 | 27.74 | Saturated | 41 | CH | 7994.3 | 0.51 | 1.0 | 1.00 | 1.0 | 1.0 | 21.1 | 90 | 7.0 | 28.1 | 0.37 | 1.92 | 0.73 | 0.52 | 0.03 | 11670 | 0.46 | 0.013 | 40 |
| 36 | 101 | 30.78 | Saturated | 50 | SC | 8671.3 | 0.49 | 1.0 | 1.00 | 1.0 | 1.0 | 24.7 | 35 | 7.0 | 31.7 | UL | 1.92 | 0.71 | UL | 0.03 | 12970 | 0.43 | UL | UL |
| 37 | 107 | 32.61 | Saturated | 70 | CH | 9077.5 | 0.48 | 1.0 | 1.00 | 1.0 | 1.0 | 33.8 | 90 | 7.0 | 40.8 | UL | 1.92 | 0.70 | UL | 0.03 | 13750 | 0.44 | UL | UL |
| 38 | 111 | 33.83 | Saturated | 68 | CH | 9348.3 | 0.48 | 1.0 | 1.00 | 1.0 | 1.0 | 32.4 | 90 | 7.0 | 39.4 | UL | 1.92 | 0.69 | UL | 0.03 | 14270 | 0.46 | UL | UL |
| 39 | 116 | 35.36 | Saturated | 58 | CH | 9686.8 | 0.47 | 1.0 | 1.00 | 1.0 | 1.0 | 27.1 | 90 | 7.0 | 34.1 | UL | 1.92 | 0.68 | UL | 0.03 | 14920 | 0.50 | UL | UL |
| 40 | 119 | 36.27 | Saturated | 77 | CH | 9889.9 | 0.46 | 1.0 | 1.00 | 1.0 | 1.0 | 35.6 | 90 | 7.0 | 42.6 | UL | 1.92 | 0.67 | UL | 0.03 | 15310 | 0.54 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**

**TEST BORING B-2-2[1]**

**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 3.5 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 5 | OL | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 7.5 | 50 | 7.0 | 14.5 | 0.16 | 1.92 | NA | 0.30 | 0.03 | 125 | 1.00 | 0.019 | UL |
| 2 | 3 | 0.91 | Unsaturated | 16 | OL | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 24.0 | 50 | 7.0 | 31.0 | 0.55 | 1.92 | NA | 1.05 | 0.03 | 375 | 0.99 | 0.019 | UL |
| 3 | 5 | 1.52 | Saturated | 15 | SC | 510.4 | 2.04 | 1.0 | 1.00 | 1.0 | 0.75 | 22.9 | 35 | 7.0 | 29.9 | 0.46 | 1.92 | NA | 0.88 | 0.03 | 635 | 0.99 | 0.024 | 37 |
| 4 | 7 | 2.13 | Saturated | 16 | SP | 645.8 | 1.81 | 1.0 | 1.00 | 1.0 | 0.75 | 21.7 | 1 | 0.0 | 21.7 | 0.24 | 1.92 | NA | 0.46 | 0.03 | 895 | 0.99 | 0.027 | 17 |
| 5 | 9 | 2.74 | Saturated | 15 | SP | 781.2 | 1.65 | 1.0 | 1.00 | 1.0 | 0.75 | 18.5 | 1 | 0.0 | 18.5 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1155 | 0.98 | 0.028 | 13 |
| 6 | 10 | 3.05 | Saturated | 18 | SP | 848.9 | 1.58 | 1.0 | 1.00 | 1.0 | 0.75 | 21.3 | 1 | 0.0 | 21.3 | 0.23 | 1.92 | NA | 0.45 | 0.03 | 1285 | 0.98 | 0.029 | 16 |
| 6A | 11 | 3.35 | Saturated | 15 | SP | 916.6 | 1.52 | 1.0 | 1.00 | 1.0 | 0.75 | 17.1 | 1 | 0.0 | 17.1 | 0.18 | 1.92 | NA | 0.35 | 0.03 | 1415 | 0.98 | 0.029 | 12 |
| 7 | 14 | 4.27 | Saturated | 26 | ML | 1119.7 | 1.37 | 1.0 | 1.00 | 1.0 | 0.80 | 28.6 | 50 | 7.0 | 35.6 | UL | 1.92 | NA | UL | 0.03 | 1805 | 0.97 | UL | UL |
| 7A | 15 | 4.57 | Saturated | 32 | CL | 1187.4 | 1.34 | 1.0 | 1.00 | 1.0 | 0.75 | 32.0 | 50 | 7.0 | 39.0 | UL | 1.92 | NA | UL | 0.03 | 1935 | 0.97 | UL | UL |
| 8 | 20 | 6.10 | Saturated | 21 | ML | 1525.9 | 1.18 | 1.0 | 1.00 | 1.0 | 0.88 | 21.8 | 50 | 7.0 | 28.8 | 0.40 | 1.92 | NA | 0.76 | 0.03 | 2585 | 0.95 | 0.031 | 24 |
| 9 | 25 | 7.62 | Saturated | 35 | SP | 1864.4 | 1.07 | 1.0 | 1.00 | 1.0 | 0.94 | 35.1 | 1 | 0.0 | 35.1 | UL | 1.92 | NA | UL | 0.03 | 3235 | 0.93 | UL | UL |
| 10 | 31 | 9.45 | Saturated | 41 | SP | 2270.6 | 0.97 | 1.0 | 1.00 | 1.0 | 1.02 | 40.4 | 1 | 0.0 | 40.4 | UL | 1.92 | 0.92 | UL | 0.03 | 4015 | 0.91 | UL | UL |
| 11 | 35 | 10.67 | Saturated | 45 | SC | 2541.4 | 0.91 | 1.0 | 1.00 | 1.0 | 1.07 | 43.9 | 35 | 7.0 | 50.9 | UL | 1.92 | 0.92 | UL | 0.03 | 4535 | 0.89 | UL | UL |
| 12 | 39 | 11.89 | Saturated | 50 | SC | 2812.2 | 0.87 | 1.0 | 1.00 | 1.0 | 1.12 | 48.6 | 35 | 7.0 | 55.6 | UL | 1.92 | 0.91 | UL | 0.03 | 5055 | 0.86 | UL | UL |
| 13 | 45 | 13.72 | Saturated | 42 | SP | 3218.4 | 0.81 | 1.0 | 1.00 | 1.0 | 1.20 | 40.9 | 1 | 0.0 | 40.9 | UL | 1.92 | 0.89 | UL | 0.03 | 5835 | 0.82 | UL | UL |
| 14 | 50 | 15.24 | Saturated | 26 | CL | 3556.9 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 20.1 | 50 | 7.0 | 27.1 | 0.34 | 1.92 | 0.88 | 0.57 | 0.03 | 6485 | 0.79 | 0.028 | 21 |
| 15 | 54 | 16.46 | Saturated | 56 | SP | 3827.7 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 41.6 | 1 | 0.0 | 41.6 | UL | 1.92 | 0.87 | UL | 0.03 | 7005 | 0.75 | UL | UL |
| 15A | 55 | 16.76 | Saturated | 120 | SP | 3895.4 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 88.4 | 1 | 0.0 | 88.4 | UL | 1.92 | 0.87 | UL | 0.03 | 7135 | 0.74 | UL | UL |
| 16 | 59 | 17.98 | Saturated | 83 | CL | 4166.2 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 59.2 | 50 | 7.0 | 66.2 | UL | 1.92 | 0.86 | UL | 0.03 | 7655 | 0.71 | UL | UL |
| 17 | 65 | 19.81 | Saturated | 50 | SM | 4572.4 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 34.0 | 35 | 7.0 | 41.0 | UL | 1.92 | 0.85 | UL | 0.03 | 8435 | 0.66 | UL | UL |
| 18 | 70 | 21.34 | Saturated | 56 | CH | 4910.9 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 36.8 | 90 | 7.0 | 43.8 | UL | 1.92 | 0.84 | UL | 0.03 | 9085 | 0.61 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-3-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 28 | ft (Only saturated strata was found between 28.0 and 28.5 ft bgs) |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 30'<br>3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 19 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 28.5 | 35 | 7.0 | 35.5 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 17 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 35 | 7.0 | 32.5 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 26 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 35.9 | 35 | 7.0 | 42.9 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 26 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 30.3 | 35 | 7.0 | 37.3 | UL | 1.92 | NA | UL | 0.03 | 875 | 0.99 | UL | UL |
| 5 | 9 | 2.74 | Unsaturated | 9 | SC | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 9.3 | 35 | 7.0 | 16.3 | 0.17 | 1.92 | NA | 0.33 | 0.03 | 1125 | 0.98 | 0.019 | 17 |
| 6 | 11 | 3.35 | Unsaturated | 15 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.75 | 14.0 | 35 | 7.0 | 21.0 | 0.23 | 1.92 | NA | 0.44 | 0.03 | 1375 | 0.98 | 0.019 | 23 |
| 7 | 13 | 3.96 | Unsaturated | 12 | SC | 1625 | 1.14 | 1.0 | 1.00 | 1.0 | 0.79 | 10.8 | 35 | 7.0 | 17.8 | 0.19 | 1.92 | NA | 0.37 | 0.03 | 1625 | 0.97 | 0.019 | 19 |
| 8 | 15 | 4.57 | Unsaturated | 11 | SC | 1875 | 1.06 | 1.0 | 1.00 | 1.0 | 0.75 | 8.8 | 35 | 7.0 | 15.8 | 0.17 | 1.92 | NA | 0.32 | 0.03 | 1875 | 0.97 | 0.019 | 17 |
| 8A | 16 | 4.88 | Unsaturated | 24 | SC | 2000 | 1.03 | 1.0 | 1.00 | 1.0 | 0.83 | 20.5 | 40 | 7.0 | 27.5 | 0.35 | 1.92 | NA | 0.68 | 0.03 | 2000 | 0.96 | 0.019 | 36 |
| 11 | 21 | 6.40 | Unsaturated | 18 | SC | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.89 | 14.4 | 34.8 | 7.0 | 21.4 | 0.23 | 1.92 | 0.91 | 0.41 | 0.03 | 2625 | 0.95 | 0.019 | 22 |
| 12 | 23 | 7.01 | Unsaturated | 21 | CL | 2875 | 0.86 | 1.0 | 1.00 | 1.0 | 0.92 | 16.6 | 50 | 7.0 | 23.6 | 0.27 | 1.92 | 0.90 | 0.46 | 0.03 | 2875 | 0.94 | 0.018 | 25 |
| 14 | 27 | 8.23 | Unsaturated | 19 | SC | 3375 | 0.79 | 1.0 | 1.00 | 1.0 | 1.0 | 15.0 | 35 | 7.0 | 22.0 | 0.24 | 1.92 | 0.89 | 0.42 | 0.03 | 3375 | 0.93 | 0.018 | 23 |
| 15 | 28.5 | 8.69 | Saturated | 16 | SC | 3533.85 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 12.4 | 35 | 7.0 | 19.4 | 0.21 | 1.92 | 0.88 | 0.35 | 0.03 | 3565 | 0.92 | 0.018 | 20 |
| 15A | 29 | 8.84 | Unsaturated | 20 | SM | 3627.5 | 0.76 | 1.0 | 1.00 | 1.0 | 1.0 | 15.3 | 35 | 7.0 | 22.3 | 0.25 | 1.92 | 0.88 | 0.42 | 0.03 | 3627.5 | 0.92 | 0.018 | 23 |
| 16 | 31 | 9.45 | Unsaturated | 17 | SM | 3877.5 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 12.6 | 35 | 7.0 | 19.6 | 0.21 | 1.92 | 0.87 | 0.35 | 0.03 | 3877.5 | 0.91 | 0.018 | 20 |
| 17 | 36 | 10.97 | Unsaturated | 65 | SM | 4502.5 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 44.6 | 35 | 7.0 | 51.6 | UL | 1.92 | 0.85 | UL | 0.03 | 4502.5 | 0.88 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**

**TEST BORING B-3-2[1]**

**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 14 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 12 | SM | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 18.0 | 35 | 7.0 | 25.0 | 0.29 | 1.92 | NA | 0.56 | 0.03 | 125 | 1.00 | 0.019 | 29 |
| 2 | 3 | 0.91 | Unsaturated | 14 | CL | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 21.0 | 50 | 7.0 | 28.0 | 0.37 | 1.92 | NA | 0.71 | 0.03 | 375 | 0.99 | 0.019 | 36 |
| 2A | 4 | 1.22 | Unsaturated | 18 | CL | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 27.0 | 50 | 7.0 | 34.0 | UL | 1.92 | NA | UL | 0.03 | 500 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 18 | CL | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 24.8 | 50 | 7.0 | 31.8 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 18 | CL | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 21.0 | 50 | 7.0 | 28.0 | 0.37 | 1.92 | NA | 0.71 | 0.03 | 875 | 0.99 | 0.019 | 37 |
| 5 | 9 | 2.74 | Unsaturated | 19 | CL | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 19.5 | 50 | 7.0 | 26.5 | 0.33 | 1.92 | NA | 0.63 | 0.03 | 1125 | 0.98 | 0.019 | 33 |
| 6 | 11 | 3.35 | Unsaturated | 47 | SM | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 44.3 | 35 | 7.0 | 51.3 | UL | 1.92 | NA | UL | 0.03 | 1375 | 0.98 | UL | UL |
| 7 | 15 | 4.57 | Saturated | 23 | SP | 1817.7 | 1.08 | 1.0 | 1.00 | 1.0 | 0.82 | 20.3 | 1 | 0.0 | 20.3 | 0.22 | 1.92 | NA | 0.42 | 0.03 | 1880 | 0.97 | 0.020 | 22 |
| 8 | 20 | 6.10 | Saturated | 42 | SM | 2156.2 | 0.99 | 1.0 | 1.00 | 1.0 | 0.75 | 31.2 | 35 | 7.0 | 38.2 | UL | 1.92 | NA | UL | 0.03 | 2530 | 0.95 | UL | UL |
| 9 | 24 | 7.32 | Saturated | 50 | SP | 2427 | 0.93 | 1.0 | 1.00 | 1.0 | 0.93 | 43.4 | 1 | 0.0 | 43.4 | UL | 1.92 | 0.92 | UL | 0.03 | 3050 | 0.94 | UL | UL |
| 10 | 29 | 8.84 | Saturated | 52 | SP | 2765.5 | 0.87 | 1.0 | 1.00 | 1.0 | 0.99 | 45.0 | 1 | 0.0 | 45.0 | UL | 1.92 | 0.91 | UL | 0.03 | 3700 | 0.92 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

# LIQUEFACTION FACTOR OF SAFETY ASSESSMENT
## TEST BORING B-4-1[1]
## Coleto Creek Power Plant

| | | |
|---|---|---|
| Depth to Water = | 35.6 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | Kσ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 17 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 12.8 | 1.8 | 27.3 | 0.35 | 1.92 | NA | 0.67 | 0.03 | 125 | 1.00 | 0.019 | 34 |
| 2 | 3 | 0.91 | Unsaturated | 12 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 18.0 | 12.8 | 1.8 | 19.8 | 0.21 | 1.92 | NA | 0.41 | 0.03 | 375 | 0.99 | 0.019 | 21 |
| 3 | 5 | 1.52 | Unsaturated | 12 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 16.6 | 12.8 | 1.8 | 18.4 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 625 | 0.99 | 0.019 | 20 |
| 6 | 11 | 3.35 | Unsaturated | 14 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 13.2 | 12.8 | 1.8 | 15.0 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 1375 | 0.98 | 0.019 | 16 |
| 8 | 14 | 4.27 | Unsaturated | 21 | SC | 1750 | 1.10 | 1.0 | 1.00 | 1.0 | 0.80 | 18.5 | 12.8 | 1.8 | 20.3 | 0.22 | 1.92 | NA | 0.42 | 0.03 | 1750 | 0.97 | 0.019 | 22 |
| 9 | 17 | 5.18 | Unsaturated | 20 | SC | 2125 | 1.00 | 1.0 | 1.00 | 1.0 | 0.84 | 16.8 | 12.8 | 1.8 | 18.6 | 0.20 | 1.92 | 0.93 | 0.38 | 0.03 | 2125 | 0.96 | 0.019 | 20 |
| 10 | 19 | 5.79 | Unsaturated | 29 | SC | 2375 | 0.94 | 1.0 | 1.00 | 1.0 | 0.87 | 23.8 | 12.8 | 1.8 | 25.6 | 0.31 | 1.92 | 0.92 | 0.59 | 0.03 | 2375 | 0.96 | 0.019 | 31 |
| 11 | 20 | 6.10 | Unsaturated | 16 | CL | 2500 | 0.92 | 1.0 | 1.00 | 1.0 | 0.88 | 13.0 | 50 | 7.0 | 20.0 | 0.22 | 1.92 | 0.92 | 0.41 | 0.03 | 2500 | 0.95 | 0.019 | 22 |
| 11A | 21 | 6.40 | Unsaturated | 23 | CL | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.89 | 18.4 | 50 | 7.0 | 25.4 | 0.30 | 1.92 | 0.91 | 0.58 | 0.03 | 2625 | 0.95 | 0.019 | 31 |
| 12 | 22 | 6.71 | Unsaturated | 24 | CL | 2750 | 0.88 | 1.0 | 1.00 | 1.0 | 0.90 | 18.9 | 50 | 7.0 | 25.9 | 0.31 | 1.92 | 0.91 | 0.60 | 0.03 | 2750 | 0.95 | 0.018 | 33 |
| 12A | 23 | 7.01 | Unsaturated | 22 | CL | 2875 | 0.86 | 1.0 | 1.00 | 1.0 | 0.92 | 17.4 | 50 | 7.0 | 24.4 | 0.28 | 1.92 | 0.90 | 0.54 | 0.03 | 2875 | 0.94 | 0.018 | 29 |
| 14 | 27 | 8.23 | Unsaturated | 25 | SC | 3375 | 0.79 | 1.0 | 1.00 | 1.0 | 0.97 | 19.2 | 35 | 7.0 | 26.2 | 0.32 | 1.92 | 0.89 | 0.61 | 0.03 | 3375 | 0.93 | 0.018 | 34 |
| 15 | 29 | 8.84 | Unsaturated | 23 | SC | 3625 | 0.76 | 1.0 | 1.00 | 1.0 | 0.99 | 17.4 | 35 | 7.0 | 24.4 | 0.28 | 1.92 | 0.88 | 0.54 | 0.03 | 3625 | 0.92 | 0.018 | 30 |
| 16 | 31 | 9.45 | Unsaturated | 26 | SM | 3875 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 19.2 | 35 | 7.0 | 26.2 | 0.32 | 1.92 | 0.87 | 0.61 | 0.03 | 3875 | 0.91 | 0.018 | 35 |
| 17 | 34 | 10.36 | Unsaturated | 22 | CL | 4242 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 15.5 | 50 | 7.0 | 22.5 | 0.25 | 1.92 | 0.86 | 0.48 | 0.03 | 4242 | 0.89 | 0.017 | 28 |
| 17A | 36 | 10.97 | Saturated | 28 | SP | 4477.08 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 19.3 | 1 | 0.0 | 19.3 | 0.21 | 1.92 | 0.85 | 0.40 | 0.03 | 4502 | 0.88 | 0.017 | 23 |
| 18 | 41 | 12.50 | Saturated | 35 | SP | 4815.58 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 23.2 | 1 | 0.0 | 23.2 | 0.26 | 1.92 | 0.84 | 0.50 | 0.03 | 5152 | 0.85 | 0.018 | 28 |
| 19 | 46 | 14.02 | Saturated | 35 | SP | 5154.08 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 22.4 | 1 | 0.0 | 22.4 | 0.25 | 1.92 | 0.83 | 0.48 | 0.03 | 5802 | 0.82 | 0.018 | 27 |
| 20 | 51 | 15.54 | Unsaturated | 60 | SP | 6427 | 0.57 | 1.0 | 1.00 | 1.0 | 1.0 | 34.4 | 1 | 0.0 | 34.4 | UL | 1.92 | 0.79 | UL | 0.03 | 6427 | 0.78 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-4-2[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 14 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 23 | SM | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 34.5 | 35 | 7.0 | 41.5 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 33 | SM | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 49.5 | 35 | 7.0 | 56.5 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 28 | OL | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 38.6 | 50 | 7.0 | 45.6 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 22 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 25.7 | 35 | 7.0 | 32.7 | UL | 1.92 | NA | UL | 0.03 | 875 | 0.99 | UL | UL |
| 6 | 11 | 3.35 | Unsaturated | 12 | SM | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 11.3 | 35 | 7.0 | 18.3 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1375 | 0.98 | 0.019 | 20 |
| 7 | 15 | 4.57 | Saturated | 13 | SP | 1817.7 | 1.08 | 1.0 | 1.00 | 1.0 | 0.82 | 11.5 | 1 | 0.0 | 11.5 | 0.13 | 1.92 | NA | 0.24 | 0.03 | 1880 | 0.97 | 0.020 | 12 |
| 8 | 20 | 6.10 | Saturated | 16 | SP | 2156.2 | 0.99 | 1.0 | 1.00 | 1.0 | 0.75 | 11.9 | 1 | 0.0 | 11.9 | 0.13 | 1.92 | 0.93 | 0.25 | 0.03 | 2530 | 0.95 | 0.022 | 11 |
| 9 | 25 | 7.62 | Saturated | 29 | SP | 2494.7 | 0.92 | 1.0 | 1.00 | 1.0 | 0.94 | 25.1 | 1 | 0.0 | 25.1 | 0.29 | 1.92 | 0.92 | 0.57 | 0.03 | 3180 | 0.93 | 0.023 | 24 |
| 10 | 29 | 8.84 | Saturated | 12 | SM | 2765.5 | 0.87 | 1.0 | 1.00 | 1.0 | 0.99 | 10.4 | 35 | 7.0 | 17.4 | 0.19 | 1.92 | 0.91 | 0.36 | 0.03 | 3700 | 0.92 | 0.024 | 15 |
| 10A | 29.5 | 8.99 | Saturated | 43 | SP | 2799.35 | 0.87 | 1.0 | 1.00 | 1.0 | 1.00 | 37.4 | 1 | 0.0 | 37.4 | UL | 1.92 | 0.91 | UL | 0.03 | 3765 | 0.91 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**

**TEST BORING B-5-1[1]**

**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 32 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 34 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 51.0 | 35 | 7.0 | 58.0 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 26 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 39.0 | 35 | 7.0 | 46.0 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 23 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 31.7 | 35 | 7.0 | 38.7 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 17 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 19.8 | 35 | 7.0 | 26.8 | 0.33 | 1.92 | NA | 0.64 | 0.03 | 875 | 0.99 | 0.019 | 33 |
| 5 | 9 | 2.74 | Unsaturated | 11 | SC | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 11.3 | 35 | 7.0 | 18.3 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1125 | 0.98 | 0.019 | 20 |
| 6 | 11 | 3.35 | Unsaturated | 17 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.75 | 15.8 | 35 | 7.0 | 22.8 | 0.26 | 1.92 | NA | 0.49 | 0.03 | 1375 | 0.98 | 0.019 | 26 |
| 7 | 12 | 3.66 | Unsaturated | 12 | SC | 1500 | 1.19 | 1.0 | 1.00 | 1.0 | 0.75 | 10.7 | 35 | 7.0 | 17.7 | 0.19 | 1.92 | NA | 0.36 | 0.03 | 1500 | 0.97 | 0.019 | 19 |
| 7A | 13 | 3.96 | Unsaturated | 18 | SC | 1625 | 1.14 | 1.0 | 1.00 | 1.0 | 0.75 | 15.4 | 35 | 7.0 | 22.4 | 0.25 | 1.92 | NA | 0.48 | 0.03 | 1625 | 0.97 | 0.019 | 25 |
| 8 | 15 | 4.57 | Unsaturated | 10 | SC | 1875 | 1.06 | 1.0 | 1.00 | 1.0 | 0.75 | 8.0 | 35 | 7.0 | 15.0 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 1875 | 0.97 | 0.019 | 16 |
| 9 | 17 | 5.18 | Unsaturated | 15 | SC | 2125 | 1.00 | 1.0 | 1.00 | 1.0 | 0.75 | 11.2 | 35 | 7.0 | 18.2 | 0.20 | 1.92 | 0.93 | 0.37 | 0.03 | 2125 | 0.96 | 0.019 | 20 |
| 10 | 19 | 5.79 | Unsaturated | 32 | SC | 2375 | 0.94 | 1.0 | 1.00 | 1.0 | 0.75 | 22.7 | 35 | 7.0 | 29.7 | 0.44 | 1.92 | 0.92 | 0.85 | 0.03 | 2375 | 0.96 | 0.019 | 45 |
| 11 | 20 | 6.10 | Unsaturated | 20 | SC | 2500 | 0.92 | 1.0 | 1.00 | 1.0 | 0.75 | 13.8 | 35 | 7.0 | 20.8 | 0.23 | 1.92 | 0.92 | 0.44 | 0.03 | 2500 | 0.95 | 0.019 | 23 |
| 11A | 21 | 6.40 | Unsaturated | 28 | CL | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.75 | 18.9 | 83.9 | 7.0 | 25.9 | 0.31 | 1.92 | 0.91 | 0.60 | 0.03 | 2625 | 0.95 | 0.019 | 32 |
| 16 | 31 | 9.45 | Unsaturated | 35 | CL | 3875 | 0.74 | 1.0 | 1.00 | 1.0 | 0.75 | 19.4 | 50 | 7.0 | 26.4 | 0.32 | 1.92 | 0.87 | 0.62 | 0.03 | 3875 | 0.91 | 0.018 | 35 |
| 17 | 33 | 10.06 | Saturated | 33 | SM | 4067.7 | 0.72 | 1.0 | 1.00 | 1.0 | 0.75 | 17.9 | 35 | 7.0 | 24.9 | 0.29 | 1.92 | 0.86 | 0.56 | 0.03 | 4130 | 0.90 | 0.018 | 31 |
| 18 | 36 | 10.97 | Saturated | 80 | SP | 4270.8 | 0.70 | 1.0 | 1.00 | 1.0 | 0.75 | 42.2 | 1 | 0.0 | 42.2 | UL | 1.92 | 0.86 | UL | 0.03 | 4520 | 0.88 | UL | UL |
| 19 | 41 | 12.50 | Saturated | 77 | SP | 4609.3 | 0.68 | 1.0 | 1.00 | 1.0 | 0.75 | 39.1 | 1 | 0.0 | 39.1 | UL | 1.92 | 0.85 | UL | 0.03 | 5170 | 0.85 | UL | UL |
| 20 | 46 | 14.02 | Saturated | 42 | SM | 4947.8 | 0.65 | 1.0 | 1.00 | 1.0 | 0.75 | 20.6 | 35 | 7.0 | 27.6 | 0.36 | 1.92 | 0.84 | 0.68 | 0.03 | 5820 | 0.82 | 0.019 | 36 |
| 21 | 50 | 15.24 | Saturated | 50 | SM | 5218.6 | 0.64 | 1.0 | 1.00 | 1.0 | 0.75 | 23.9 | 35 | 7.0 | 30.9 | UL | 1.92 | 0.83 | UL | 0.03 | 6340 | 0.79 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

APPENDIX E:  GUADALUPE-BLANCO RIVER AUTHORITY LAKE AREA-CAPACITY CURVES

ATTACHMENT 3-1

TABLE 1

COLETO CREEK RESERVOIR
AREAS AND CAPACITIES
INITIAL CONDITIONS*

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AREA IN ACRES | | | | | |
| 50 | | | | | | | | | 0 | 9 |
| 60 | 18 | 26 | 34 | 42 | 50 | 60 | 80 | 100 | 120 | 145 |
| 70 | 170 | 200 | 239 | 277 | 314 | 351 | 397 | 442 | 495 | 547 |
| 80 | 599 | 679 | 758 | 835 | 910 | 984 | 1087 | 1189 | 1299 | 1408 |
| 90 | 1504 | 1650 | 1796 | 1940 | 2084 | 2230 | 2369 | 2514 | 2652 | 2787 |
| 100 | 2918 | 3077 | 3255 | 3461 | 3698 | 3954 | 4207 | 4458 | 4706 | 4949 |
| 110 | 5190 | 5531 | 5910 | 6324 | 6763 | 7234 | 7734 | 8229 | 8725 | 9223 |
| 120 | 9723 | | | | | | | | | |
| | | | | | CAPACITY IN ACRE-FEET | | | | | |
| 50 | | | | | | | | | 0 | 4 |
| 60 | 18 | 40 | 70 | 108 | 154 | 209 | 279 | 369 | 479 | 611 |
| 70 | 769 | 954 | 1174 | 1432 | 1727 | 2060 | 2434 | 2853 | 3322 | 3843 |
| 80 | 4416 | 5055 | 5774 | 6570 | 7442 | 8389 | 9425 | 10,563 | 11,807 | 13,160 |
| 90 | 14,617 | 16,194 | 17,917 | 19,786 | 21,798 | 23,955 | 26,254 | 28,695 | 31,277 | 33,996 |
| 100 | 36,849 | 39,846 | 43,012 | 46,370 | 49,949 | 53,744 | 57,855 | 62,187 | 66,769 | 71,597 |
| 110 | 76,667 | 82,027 | 87,747 | 93,863 | 100,406 | 107,409 | 114,807 | 122,878 | 131,354 | 140,328 |
| 120 | 149,800 | | | | | | | | | |

*Areas and capacities of impoundments behind Dike Nos. 1 and 2 are not included in this tabulation.

ATTACHMENT 3-2

TABLE 2

COLETO CREEK PROJECT
AREAS AND CAPACITIES
SULPHUR CREEK BEHIND DIKE NO. 1
INCLUDING FLUME NO. 1

AREA IN ACRES

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | | | | | | | 0 | 1 | 2 |
| 80 | 3 | 5 | 7 | 10 | 14 | 18 | 22 | 26 | 31 | 36 |
| 90 | 49 | 56 | 64 | 73 | 82 | 90 | 101 | 113 | 126 | 138 |
| 100 | 151 | 164 | 178 | 193 | 207 | 223 | 240 | 259 | 279 | 303 |
| 110 | 329 | 358 | 388 | 419 | 455 | 499 | 540 | 590 | 641 | 699 |
| 120 | 770 | | | | | | | | | |

CAPACITY IN ACRE-FEET

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | | | | | | | | 0 | 2 |
| 80 | 4 | 8 | 14 | 23 | 35 | 51 | 71 | 95 | 123 | 157 |
| 90 | 199 | 251 | 311 | 379 | 456 | 542 | 638 | 745 | 865 | 997 |
| 100 | 1141 | 1299 | 1470 | 1656 | 1856 | 2071 | 2303 | 2553 | 2822 | 3113 |
| 110 | 3429 | 3773 | 4146 | 4550 | 4987 | 5464 | 5984 | 6549 | 7165 | 7835 |
| 120 | 8570 | | | | | | | | | |

ATTACHMENT 3-3

TABLE 3

COLETO CREEK PROJECT
AREAS AND CAPACITIES
TURKEY CREEK BEHIND DIKE NO. 2
INCLUDING FLUME NO. 2

AREA IN ACRES

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | 0 | 1 | 3 | 6 | 9 | 13 | 18 | 24 | 31 |
| 80 | 38 | 46 | 55 | 65 | 76 | 88 | 101 | 115 | 130 | 146 |
| 90 | 167 | 184 | 200 | 217 | 234 | 250 | 270 | 293 | 322 | 355 |
| 100 | 391 | 429 | 467 | 506 | 545 | 583 | 623 | 663 | 705 | 748 |
| 110 | 791 | 831 | 882 | 947 | 1032 | 1118 | 1206 | 1291 | 1374 | 1458 |
| 120 | 1537 | | | | | | | | | |

CAPACITY IN ACRE-FEET

| Elev. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | | 0 | 0 | 2 | 7 | 14 | 25 | 41 | 62 | 89 |
| 80 | 124 | 166 | 216 | 276 | 347 | 429 | 523 | 631 | 754 | 892 |
| 90 | 1048 | 1224 | 1416 | 1624 | 1850 | 2092 | 2352 | 2634 | 2942 | 3281 |
| 100 | 3654 | 4064 | 4512 | 4998 | 5524 | 6089 | 6691 | 7334 | 8018 | 8744 |
| 110 | 9513 | 10,324 | 11,181 | 12,096 | 13,086 | 14,161 | 15,323 | 16,572 | 17,905 | 19,321 |
| 120 | 20,819 | | | | | | | | | |

**COLETO CREEK POWER, LLC**
**Fannin, Texas**

# COAL COMBUSTION RESIDUALS
# PRIMARY ASH POND
# STRUCTURAL STABILITY ASSESSMENT
# 5-Year Periodic Update

## COLETO CREEK POWER PLANT
## FANNIN, TEXAS

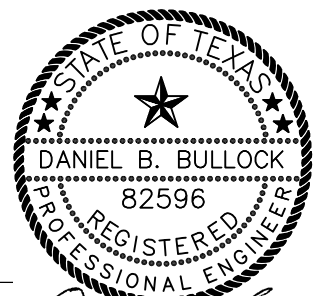
October 11, 2021

**Bullock, Bennett & Associates, LLC**
**Engineering and Geoscience**
**Registrations: Engineering F-8542, Geoscience 50127**
**www.bbaengineering.com**

**Certification Statement 40 *CFR* § 257.73(d) and 30 T.A.C. § 352.731 - Structural Integrity Criteria for Existing CCR Surface Impoundments, 5-Year Periodic Structural Stability Assessment**

**CCR Unit: Coleto Creek Power, LLC; Coleto Creek Power Plant; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Structural Stability Assessment, dated October 11, 2021, meets the requirements of 40 *CFR* § 257.73(d) and 30 T.A.C. § 352.731.




Daniel B. Bullock, P.E. (TX 82596)

10-11-2021

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## 1.0 INTRODUCTION

Coleto Creek Power Plant is located at 45 FM 2987 just outside the city of Fannin in Goliad County, Texas. The power plant consists of one coal-fired boiler. Bottom ash and fly ash, or coal combustion residuals (CCR), generated in the boiler are either shipped off-site for beneficial re-use or managed in an on-site CCR surface impoundment (Coleto Creek Primary Ash Pond). Figures 1 and 2 provide site location maps showing the Primary Ash Pond configuration.

In April 2015, the Environmental Protection Agency (EPA) promulgated rules (40 C.F.R. Part 257, Subpart D) to address potential risks associated with operating CCR surface impoundments at coal-fired power plants. The State of Texas subsequently codified 30 T.A.C. Chapter 352 to address CCR management in surface impoundments and landfills in the state of Texas. This report has been prepared to specifically address the requirements identified in 40 CFR §257.73(d) and 30 T.A.C. § 352.731 regarding periodic Structural Stability Assessments to be performed every 5 years.

## 2.0 5-YEAR PERIODIC STRUCTURAL STABILITY ASSESSMENT

According to §257.73(d) and codified in §352.731 by reference, the owner or operator of a CCR non-incised surface impoundment "must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein." Requirements for the Structural Stability Assessment are addressed below.

*§257.73(d)(1)(i) Stable foundations and abutments.* The Primary Ash Pond was constructed on a foundation of in-place cohesive soils whose geotechnical characteristics either met or exceeded Texas Department of Water Resources technical guidelines for the design and construction of wastewater ponds that were in force at the time of construction (S&L, 1978). The Primary Ash Pond and Secondary Pond dikes are continuous, with no abutments constructed against other structures. A review of the geotechnical data collected at the time of construction confirms that the foundation for the pond should continue to be stable over its operational life.

*§257.73(d)(1)(ii) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.* The Primary Ash Pond dikes were constructed with 2.5 to 3 horizontal to 1 vertical side slopes. Outer slopes were seeded for slope protection, but interior dike surfaces were not. Vegetation does naturally occur on these surfaces thus assisting in the control of erosion. The interior dike sections in areas impounding water are armored with rock riprap. The dikes are regularly inspected in accordance with §257.83(a) and (b) and repaired as necessary to maintain their integrity. An engineering site inspection was performed in November 2020 in accordance with the requirements defined in §257.83(b) which included an evaluation of the surface impoundment dikes. No additional slope protection was deemed to be necessary at that time (BBA, 2021a).

*§257.73(d)(1)(iii) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.* The dike system was engineered by S&L and constructed in approximately 1978 (S&L, 1978). Dike fill material was placed in controlled, mechanically compacted lifts, averaging approximately 98% maximum dry density as determined by ASTM D698. Full time field inspection was performed during construction, with approximately 420 field density tests performed on the dikes.

*§257.73(d)(1)(iv) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection.* The slopes of the dikes and surrounding areas are vegetated as required. The slopes are reportedly mowed as necessary to comply with height of grass requirements.

*§257.73(d)(1)(v) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of the section of the rule*. As is common with surface impoundments of this type, the Primary Ash Pond was not constructed with a spillway. The results of the hydraulic analysis completed in support of the Periodic Inflow Design Flood Control System evaluation (BBA, 2021b) showed that the Primary Ash Pond, as configured without a spillway and when operated at a maximum storage operating elevation of 136.1 feet NAVD88, has sufficient capacity to manage the design flood. The design flood is designated by rule for a Low Hazard Potential surface impoundment to equal the 100-year rainfall event. It is therefore not necessary for the surface impoundment to have a spillway.

*§257.73(d)(1)(vi) Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.* The weir system and pipe penetrations were visually inspected by a professional engineer in November of 2020 (BBA, 2021a). There were no observations of conditions that would negatively impact operation of the structures

*§257.73(d)(1)(vii) For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.* The dike that separates the Primary Ash Pond from the Secondary Pond was evaluated for stability in the event of rapid drawdown of the Secondary Pond, as further discussed in the periodic Safety Factor Assessment report (BBA, 2021c). The modeled slope stability results indicate this divider dike exceeds the required safety factors under the max surcharge pool/rapid drawdown scenario.

## 3.0 CONCLUSION

No structural stability deficiencies were identified in this 5-year periodic Structural Stability Assessment that would require corrective measures.

## 4.0 REFERENCES

BBA. (2021a). *2020 Annual CCR Unit Inspection Report Coleto Creek Power, LLC Primary Ash Pond.* Bullock, Bennett & Associates, LLC.

BBA. (2021b). *Coal Combustion Residuals CCR Primary Ash Pond Inflow Design Flood Control System Plan 5-Year Periodic Update.* Bullock, Bennett & Associates, LLC.

BBA. (2021c). *Coal Combustion Residuals CCR Primary Ash Pond Hazard Potential Classification 5-Year Periodic Update.* Bullock, Bennett & Associates, LLC.

S&L. (December 1978). *Design and Construction Summary for Coal Pile and Wastewater Pond Facilities, Coleto Creek Power Station Unit 1, Report SL-3689.* Sargent & Lundy Engineers.

# FIGURES


N

APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

10-11-2021

**Coleto Creek Power, LLC**

Figure 1

SITE LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
| --- | --- | --- | --- |

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL103.dwg


N

APPROXIMATE SCALE: 1" = 1000'

0 500 1000 2000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock
10-11-2021

**Coleto Creek Power, LLC**

Figure 2

PRIMARY ASH POND
LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:22pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL104.dwg

**COLETO CREEK POWER, LLC**
**Fannin, Texas**

# COAL COMBUSTION RESIDUALS
# PRIMARY ASH POND
# SAFETY FACTOR ASSESSMENT
# 5-Year Periodic Update

## COLETO CREEK POWER PLANT
## FANNIN, TEXAS

October 11, 2021

**Bullock, Bennett & Associates, LLC**
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**Certification Statement 40 C.F.R § 257.73(e) and 30 T.A.C. § 352.731 - Structural Integrity Criteria for Existing CCR Surface Impoundments, Periodic Safety Factor Assessment**

**CCR Unit: Coleto Creek Power, LLC; Coleto Creek Power Plant; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this assessment report has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the Safety Factor Assessment, dated October 11, 2021, meets the requirements of 40 C.F.R. § 257.73(e) and 30 T.A.C. § 352.731.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock, P.E. (TX 82596)

10-11-2021

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## 1.0 INTRODUCTION

Coleto Creek Power Plant is located at 45 FM 2987 just outside the city of Fannin in Goliad County, Texas. The power plant consists of one coal-fired boiler. Bottom ash and fly ash, or coal combustion residuals (CCR), generated in the boiler are either shipped off-site for beneficial re-use or managed in an on-site CCR surface impoundment (Coleto Creek Primary Ash Pond). Figures 1 and 2 provide site location maps showing the Primary Ash Pond configuration.

In April 2015, the Environmental Protection Agency (EPA) enacted rules codified in 40 C.F.R. Part 257, Subpart D to address potential risks associated with operating CCR surface impoundments at coal-fired power plants. The State of Texas subsequently codified 30 T.A.C. Chapter 352, which incorporated 40 C.F.R. Chapter 257 by reference, to address CCR management in surface impoundments and landfills. This report summarizes the results of the periodic Safety Factor Assessment (§ 257.73(e)(1)).

## 2.0 PERIODIC SAFETY FACTOR ASSESSMENTS

Section 257.63(e) requires that owners of existing and newly constructed CCR surface impoundments conduct initial and periodic safety factor assessments. The purpose of the safety factor assessment is to document that the as-constructed CCR surface impoundment configuration either meets or exceeds regulatory safety factor criteria under long-term, maximum storage pool loading conditions, and maximum surcharge pool loading conditions. In addition, the liquefaction and seismic factor of safety must be estimated.

The rule requires that the safety factor evaluation be performed across the critical cross section of the impoundment dikes. For the purposes of this initial assessment, previous data collected as part of historical site assessments were evaluated to determine whether it represented the critical cross section of the pond dikes that would be most susceptible to failure. The critical cross sections for the Primary Ash Pond, as shown in Figure 3, are in the areas of the pond that still contain water and generally have the tallest sections of dikes with representative side slopes.

Geotechnical sampling and analysis of as-constructed dike materials has been conducted during three different events. The first was performed by Sargent & Lundy (S&L) during and after construction of the pond in 1978 (S&L, December 1978). Subsequent studies were performed in 1981 by Underground Resource Management, Inc. (URM) (URM, July 29, 1981) and in 2012 by AECOM Technical Services, Inc. (AECOM, March 2012).

BBA reviewed the previous site geotechnical investigation data gathered by S&L, URM, and AECOM used in previously conducted stability analyses of the dikes and the data appears sufficient to provide a reliable estimation of current conditions; therefore, no further geotechnical testing was required for the current analysis. Coleto Creek Power provided all previous investigation data to BBA for use in evaluation and preparation of an updated structural stability analysis. The most recent stability analysis, conducted by AECOM in 2012, summarizes previous evaluations by others. A brief summary of previous geotechnical investigations was provided in the Initial Safety Factor Assessment.

BBA reviewed the data available from the S&L, URM, and the supplemental data gathered by AECOM including geotechnical data, cross sections, and methodology used by AECOM for modeling slope stability. The data and methods are suitable for evaluation of slope stability of the critical cross section locations. The geotechnical investigation data from the AECOM study, including soil bore logs and geotechnical laboratory data is included in Appendices A and B, respectively, of this report.

BBA contracted T. Baker Smith (TBS) (formerly Naismith Marine Services) in August 2021 to complete an existing conditions topographic survey of Primary Ash Pond including the critical cross section areas. Using the 2021 existing conditions survey data and geotechnical data obtained from the previous studies (including similar lithology as indicated in the AECOM study for the critical cross sections), BBA graphically reconstructed the cross-section locations A and B for completion of further analysis. BBA compared the existing 2021 topographic survey cross sections at cross section locations A and B to the original design sections and topographic data collected in 2016. The 2021 and 2016 topographic data is very similar, but both sets of survey data differ from the original design cross section which could be due to as-build construction geometry vs. design geometry, erosion, or accumulation of ash material on the interior dike sideslope. For example, the interior dike sideslopes are consistent with design grades closer to the dike crest but appear to have a gentler slope toward the toe of slope. This difference may be ash accumulation along the slope, but since this area is below the water surface, it could not be verified and is unknown.

For modeling purposes, portions of the perimeter dike above the water line, on the crest, and the exterior dike sideslopes were modeled using the 2021 topographic data, but the interior slope was modeled using a combination of topographic data and design slopes. The 2021 topographic data was used for the portion of the interior dike sideslope closer to the crest (above the water line) and the design slope (generally 4(H):1(V)) was used for potions of the slope closer to the toe. Material identified from the survey results that may have accumulated on the interior dike slope was considered to be water with no structural strength or stabilizing forces.

Based on review of bore logs and geotechnical laboratory test data, the lithology and soil engineering strength properties used in previous stability analyses were conservative and representative of the field and laboratory data gathered.

Similar to the previous stability evaluations, BBA evaluated the dikes using two sets of time-dependent strength parameters, effective stress and total stress. Effective stress analysis was used to model drained, long-term, steady-state loading conditions where excess pore pressures have had time to dissipate. This would be the normal steady state operating conditions (maximum storage pool) of the pond. Total stress analysis was used to model undrained, short-term loading conditions such as maximum surcharge pool, rapid drawdown, and seismic events, where excess pore water pressure could develop in fine grained silts and clays and not have had time to dissipate. The rapid drawdown case is representative of the conditions that would occur immediately after a significant flood event, or if the Secondary Pond was rapidly drained.

The seismic conditions analyze the effect an earthquake would have on the stability of the dike. BBA selected a maximum probable earthquake for the Coleto Creek Power Plant based on the 2014 United States Geological Survey National Seismic Hazard Maps found at (http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014pga2pct.pdf). The maximum probable earthquake has a peak ground acceleration of 0.03 g with a 2 percent Probability of Exceedance in 50 years.

Table 2-1 summarizes the effective and total stress soil strength parameters used for each soil layer in the analysis:

**TABLE 2-1**
Soil Strength Parameters used in Geotechnical Stability Analysis
(color shading as shown in cross sections)

**Cross Section A-A'**

| Soil Description | Unit Weight (pcf) | Effective Stress Strength Parameters | | Total Stress Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Ø' | c (psf) | Ø |
| Clayey Sand Fill Material (SC) | 130 | 150 | 29 | 3,000 | 0 |
| Natural Silty Clay or Clayey Sand (CL, SC, CL-Caliche) | 130 | 150 | 27 | 4,000 | 0 |
| Natural Sands (SM, SP, SC) | 130 | 0 | 36 | 0 | 36 |

**Cross Section B-B'**

| Soil Description | Unit Weight (pcf) | Effective Stress Strength Parameters | | Total Stress Strength Parameters | |
|---|---|---|---|---|---|
| | | c' (psf) | Ø' | c (psf) | Ø |
| Clayey Sand Fill Material (SC) | 130 | 150 | 29 | 3,000 | 0 |
| Caliche (SC) | 135 | 250 | 34 | 250 | 0 |
| Medium Dense to Dense Sands (SP) | 130 | 0 | 36 | 0 | 36 |
| Dense to Extremely Dense Sands (SP, SC, SM, SP-SM) | 133 | 0 | 38 | 0 | 38 |
| Very Stiff to Hard Silty Clay (CL, CL-ML, CH) | 128 | 0 | 29 | 3,250 | 0 |

Based on field observations, the ash located within the Primary Ash Pond tends to set up, much like cement, into a hard, blocky mass of material. However, as was assumed in the previous evaluations, for conservative modeling purposes the interior material was considered to be water, with no structural strength that would add a stabilizing force.

Four model conditions were evaluated at each cross-section location, as deemed applicable, including: maximum storage pool (the highest normal operating level) and maximum surcharge pool (level reached during inundation from design storm) conditions, rapid drawdown, and the seismic condition. The normal operating water level, based on the Hydrologic and Hydraulic Capacity Requirements evaluation completed by BBA (BBA, January 2018) is 136.1 (NAVD88).

The water level projected in event of a design storm (the 100 year, 24-hour storm) is 138.0 (NAVD88). The lowest top of dike elevation observed in the 2021 survey was 139.7 (NAVD88).

Cross section A, located in the observed historical seep location near the southeast corner of the Primary Ash Pond, was assumed to have a water table elevation at the ground surface along the exterior toe of slope, as observed in the field and as documented in previous inspections and reports. Cross section B, located along the separator dike between the Primary Ash Pond and Secondary Pond, was modeled with the maximum storage and maximum surcharge pool elevations. Cross section B was also evaluated for the rapid draw down (RDD) condition. Based on historical field observations of wet soil, it is assumed the phreatic surface at cross section A exits the exterior dike surface at the toe of the dike. The phreatic surface for cross section B is at the same elevation as the assumed pond water levels.

Dikes should be designed with appropriate safety factors. Required safety factors per § 257.73(e)(1)(i) through (e)(1)(iv) for critical embankment sections are as follows:

**Table 2-2**
Required Factors of Safety

| Condition | Required Factor of Safety |
|---|---|
| Long-Term, Maximum Storage Pool Loading Static Factor of Safety | 1.50 |
| Maximum Surcharge Pool Loading Static Factor of Safety | 1.40 |
| Seismic Factor of Safety | 1.00 |
| Liquefaction Factor of Safety | 1.20 |

BBA used the 2D limit equilibrium computer program SLIDE2 9.018 by Rocscience to complete the slope stability analysis for the critical cross sections. The Morgenstern-Price method of slices, for both circular and non-circular type failures, was used to analyze the stability of the slopes. Eighteen stability cases were evaluated for the critical cross sections as summarized in Table 2-3. Both upstream and downstream slopes were evaluated, and the lowest factor of safety generated for each case is reported.

**Table 2-3**
Slope Stability Analysis Summary

| Cross Section | Conditions | Effective Stress Analysis Safety Factor | | Total Stress Analysis Safety Factor | |
|---|---|---|---|---|---|
| | | Non-circular | Circular | Non-circular | Circular |
| A-A’ | Max Storage Pool/Static | 1.9 (1) | 1.9 (2) | 4.8 (3) | 6.0 (4) |
| A-A’ | Max Surcharge Pool/Static | 1.9 (5) | 1.9 (6) | 5.1 (7) | 6.0 (8) |
| A-A’ | Max Storage Pool /Seismic | NA | NA | 4.8 (9) | 5.2 (10) |
| B-B’ | Max Storage Pool /Static | 2.6 (11) | 2.7 (12) | 4.0 (13) | 5.1 (14) |
| B-B’ | Max Surcharge Pool, Rapid Drawdown | NA | NA | 2.7 (15) | 3.1 (16) |
| B-B’ | Max Storage Pool/Seismic | NA | NA | 1.8 (17) | 4.4 (18) |

Note: (#) = Case Number (referenced on model output data in Appendix C).

Cross sections, bore logs, laboratory data, and SLIDE2 9.018 stability model output data are included in Figure 3 and Appendices A, B, and C, respectively of this report.

As shown in Table 2-3, eighteen stability cases were modeled, and all cases meet or exceed required factors of safety.

## 2.1 Liquefaction Assessment

BBA utilized the liquefaction assessment process outlined in the U.S. EPA guidance document titled RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, April 1995, published by the Office of Research and Development and other relevant source documents to perform this liquefaction factor of safety evaluation. As identified in those documents, the liquefaction assessment process begins by screening the subject site for its liquefaction potential using the following criteria.

- Geologic age and origin. If a soil layer is a fluvial, lacustrine or aeolian deposit of Holocene age, a greater potential for liquefaction exists than for till, residual deposits, or older deposits.

- Fines content and plasticity index. Liquefaction potential in a soil layer increases with decreasing fines content and plasticity of the soil. Cohesionless soils having less than 15 percent (by weight) of particles smaller than 0.005 mm, a liquid limit less than 35

percent, and an in-situ water content greater than 0.9 times the liquid limit may be susceptible to liquefaction.

- Saturation. Although low water content soils have been reported to liquefy, at least 80 to 85 percent saturation is generally deemed to be a necessary condition for soil liquefaction.

- Depth below ground surface. If a soil layer is within 50 feet of the ground surface, it is more likely to liquefy than deeper layers.

- Soil Penetration Resistance. Soil layers with a normalized SPT blowcount [$(N_1)_{60}$] less than 22 have been known to liquefy. Other sources suggest an SPT value of [$(N_1)_{60}$] less than 30 as the threshold to use for suspecting liquefaction potential.

If three or more of the above criteria indicate that liquefaction is not likely, the potential for liquefaction is considered to be negligible. Otherwise, further evaluation of the liquefaction potential at a facility is required. The soils at the Coleto Creek Power facility generally meet at least three of the specified screening criteria and their liquefaction potential is unlikely. However, there are exceptions such as certain layers that are described in the soil borings logs as SP, or sandy soils, which would by definition have a low fines content. In addition, some liquid limits are below 35 percent. Therefore, further evaluation of the soil data has been completed, and factors of safety against liquefaction calculated for each critical layer, as further described below.

A review of existing data regarding site conditions, soil stratigraphy, soil properties, and potential critical layers as well as the methods used to develop that data indicate that the findings presented in the AECOM report (AECOM, 2012) are sufficient for use in this assessment. As noted in previous sections of this report, AECOM drilled eight borings through critical areas of the site to depths ranging from approximately 30 to 120 feet bgs. Standard penetrometer (SPT) blows per foot, plastic limit, water content, and liquid limit data were collected at two to five foot intervals. In addition, samples were collected and sent to an off-site laboratory for analyses of general geotechnical properties. Copies of the boring logs and laboratory data used in this assessment are provided in Appendices A and B.

When available, site-specific information such as SPT blow count and percent fines content (soils passing the #200 sieve) was used in the evaluation of liquefaction potential. For strata with no site-specific data, conservative estimates were used based on industry accepted references and engineering judgement. For example, earthquake potential maps and tables presented in the

USEPA guidance document were used to estimate the worst-case earthquake magnitude and associated maximum ground acceleration. USGS references for low to mid-ranges of fines content for the reported soil types were used when no laboratory data existed.

A complete discussion of the methodology used and the calculation spreadsheets for each stratum identified in the eight boring logs are presented in Appendix D. The findings of the liquefaction assessment indicate that the factor of safety is well above the 1.2 required. This finding is expected given the generally high fines content of most soil strata, the low water content, and low ground acceleration that would be observed in the unlikely event that an earthquake was to occur in this area.

## 2.2 Periodic Safety Factor Assessment Summary

In accordance with 30 T.A.C § 352.731 and, by reference, 40 C.F.R. § 257.73, Structural Integrity Criteria for Existing CCR Surface Impoundments, the critical cross sections of the Primary Ash Pond at the Coleto Creek facility have been evaluated for slope stability under appropriate loading conditions, including steady-state seepage, maximum surcharge pool, rapid drawdown, and seismic. In addition, a liquefaction assessment has been completed. Based on review of historic studies, geotechnical data that has been previously gathered, and on the updated stability analysis evaluation, the Primary Ash Pond has an adequate factor of safety for all evaluated loading conditions.

## 3.0 REFERENCES

AECOM. (March 2012). *Geotechnical Stability and Hydraulic Analysis of the Coleto Creek Energy Facility Primary and Secondary Ash Ponds.* Green Bay, Wisconsin: AECOM Technical Services, Inc.

BBA. (January 2018). *Coal Combustion Residuals Surface Impoundment History of Construction and Initial Hazard Potential Assessment, Structural Integrity Assessment, and Safety Factor Assessment (Rev. 1) (Original Submittal Date September 2016).* Bullock, Bennett & Associates.

CDM. (March 2011). *Assessment of Dam Safety of Coal Combustion Surface Impoundments Coleto LP, LLC Coleto Creek Power, LP.*

S&L. (December 1978). *Design and Construction Summary for Coal Pile and Wastewater Pond Facilities, Coleto Creek Power Station Unit 1, Report SL-3689.* Sargent & Lundy Engineers.

URM. (1982). Evaluation and Recommendations Regarding Subsurface Drainage System at Coleto Creek Power Station for Central Power & Light Company. Underground Resource Management, Inc.

URM. (July 29, 1981). *Investigation of Seepage from Primary and Secondary Settling Ponds at the Coleto Creek Power Station.* Underground Resource Managment, Inc.

# FIGURES


Plot Date: 10/11/21 - 1:23pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL103.dwg

N

APPROXIMATE SCALE: 1" = 3000'

0 750 1500 3000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

Daniel B. Bullock
10-11-2021

**Coleto Creek Power, LLC**

Figure 1

SITE LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127


N

APPROXIMATE SCALE: 1" = 1000'

0 500 1000 2000

SOURCE: AERIAL PHOTO PROVIDED BY BING, PHOTO TAKEN 2021.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED PROFESSIONAL ENGINEER

Daniel B. Bullock
10-11-2021

**Coleto Creek Power, LLC**

Figure 2

PRIMARY ASH POND LOCATION MAP

| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/11/21 - 1:22pm, Plotted by: Admin
Drawing Path: K:\clients\bba\Coleto Ck\21424-1\, Drawing Name: C-ST-PL104.dwg

N

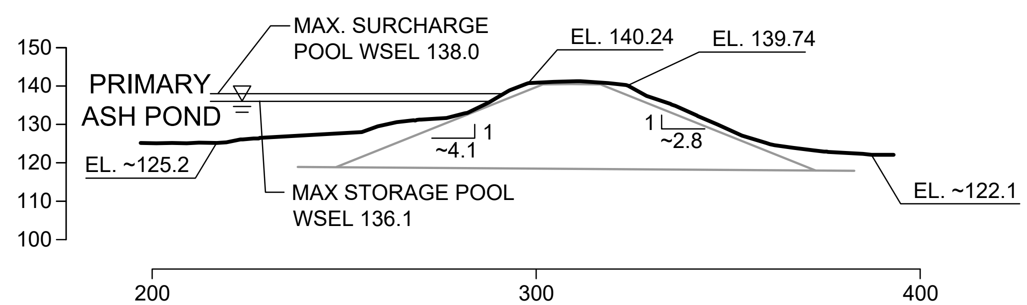
APPROXIMATE SCALE: 1"=800'

0 400 800 1600

**SOURCES:**

AERIAL PHOTO PROVIDED BY TBS, MAXAR TECHNOLOGIES, TEXAS GENERAL LAND OFFICE, PHOTO TAKEN 2021.

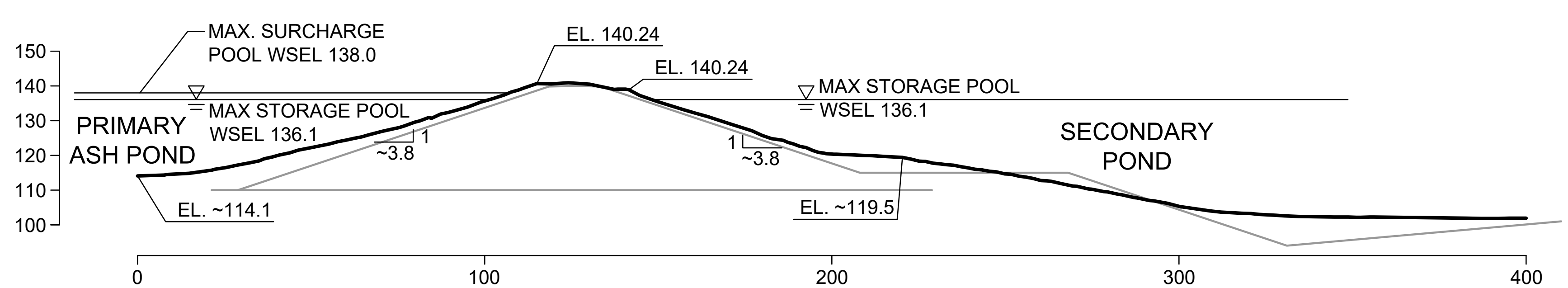
TOPOGRAPHIC MAP WAS PROVIDED BY: T. BAKER SMITH (TBS), 412 S. VAN AVE., HOUMA, LA 70363, (985) 868-1050, SEPTEMBER 2021. DATUM: TEXAS SOUTH CENTRAL ZONE, US FEET. DATUM: NAD83.




SECTION A-A'

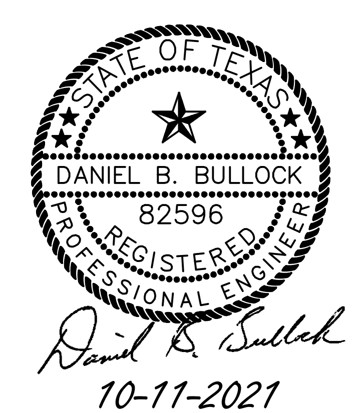
SCALE: 1"=50'


PARTIAL PLAN




SECTION B-B'

SCALE: 1"=50'




| **Coleto Creek Power, LLC** | | | |
|---|---|---|---|
| Figure 3<br>ASH POND PLAN AND CROSS SECTIONS | | | |
| PROJECT: 21424-1 | BY: RCAD-RR | DATE: OCT 2021 | CHECKED: DBB |
| Bullock, Bennett & Associates, LLC<br>Engineering and Geoscience<br>Texas Registrations: Engineering F-8542, Geoscience 50127 | | | |

Plot Date: 10/11/21 - 1:24pm, Plotted by: Admin
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# APPENDIX A

# Geotechnical Borelogs

**AECOM**

CLIENT: **IPR-GDF SUEZ North America**

LOG OF BORING NUMBER **B-1-1**

PROJECT NAME: **Coleto Creek Energy Facility Ash Pond**

ARCHITECT/ENGINEER

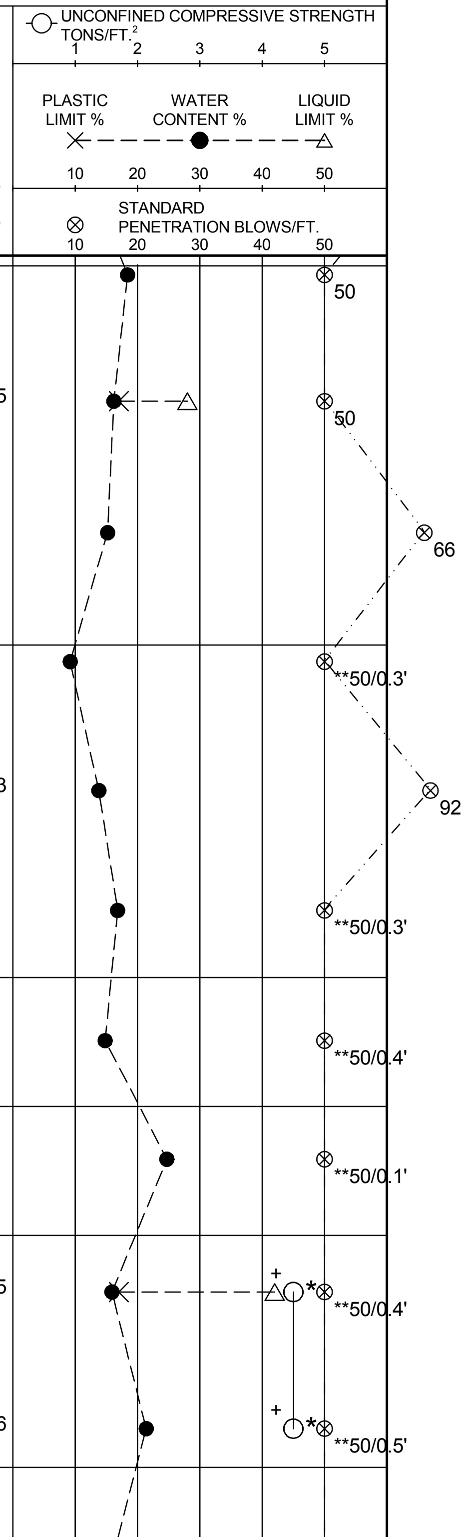
SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.6 (Continued)

| Depth (ft) to | Description of Material |
|---|---|
| 50.4 | |
| 65.1 | Grayish brown fine to coarse sand (SP), trace fine to coarse gravel - wet - very dense |
| 78.0 | White and gray clayey fine to coarse sand (SC-caliche) - wet - extremely dense |
| 83.0 | Light brown fine to coarse sand (SP) with occasional thin layers of white and gray silty fine to coarse sand (SM-Caliche) - moist to wet - extremely dense<br>Drillers noted hard drilling and gravel while drilling form 80.0 to 85.0 feet |
| 88.0 | Gray and white silty fine to medium sand (SM) with caliche - wet - extremely dense |
| 97.0 | Light gray silty clay (CL), some sand, trace caliche - moist to wet - hard |
| | Light gray clayey fine to coarse sand (SC) - moist - extremely dense |

| Sample No. | Sample Type | Unit Dry Wt. (lbs./ft³) | Standard Penetration Blows/ft. |
|---|---|---|---|
| 26 | SS | | 50 |
| 27 | SS | 113.5 | 50 |
| 28 | SS | | 66 |
| 29 | SS | | **50/0.3' |
| 30 | SS | 117.3 | 92 |
| 31 | SS | | **50/0.3' |
| 32 | SS | | **50/0.4' |
| ~~33~~ | ~~SS~~ | | **50/0.1' |
| 34 | SS | 126.5 | **50/0.4' |
| 35 | SS | 107.6 | **50/0.5' |

Depth scale (ft): 52.0, 54.0, 56.0, 58.0, 60.0, 62.0, 64.0, 66.0, 68.0, 70.0, 72.0, 74.0, 76.0, 78.0, 80.0, 82.0, 84.0, 86.0, 88.0, 90.0, 92.0, 94.0, 96.0, 98.0, 100.0




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 2 OF 3

STS060701 60225561.GPJ STS.GDT 1/4/12

**AECOM**

CLIENT: **IPR-GDF SUEZ North America**

LOG OF BORING NUMBER: **B-1-1**

PROJECT NAME: **Coleto Creek Energy Facility Ash Pond**

ARCHITECT/ENGINEER:

SITE LOCATION: **Goliad County, Fannin, Texas**

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

SURFACE ELEVATION: +139.6 (Continued)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ | Test data |
|---|---|---|---|---|---|
| | 36 | SS | Light gray clayey fine to coarse sand (SC) - moist - extremely dense | | **50/0.3' |
| 102.0 | | | | | |
| 103.0 | | | Brown silty clay (CH) with irrgular gray silty clay lenses - moist - hard | | |
| 104.0 | | | | | |
| 106.0 | 37 | SS | | 92.5 | 93 |
| 108.0 | | | | | |
| 110.0 | | | | | |
| | 38 | SS | | 102.6 | 51 |
| 112.0 | | | | | |
| 114.0 | | | | | |
| 116.0 | 39 | SS | | 94.8 | 38 |
| 118.0 | | | | | |
| 120.0 | | | | | |
| | 40 | ST | | 98.0 | 79.0 |
| 121.0 | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 50.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 50.0 feet to 100.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | | |

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | |
|---|---|---|
| WL Dry before casing installation | BORING STARTED 11/5/11 | AECOM OFFICE 1035 Kepler Drive, Green Bay, Wisconsin 54311 |
| WL 10.0 to 12.0 feet WS | BORING COMPLETED 11/6/11 | ENTERED BY CAH — SHEET NO. 3 OF 3 |
| WL | RIG/FOREMAN D-25/BZ | APP'D BY TMT — AECOM JOB NO. 60225561 |

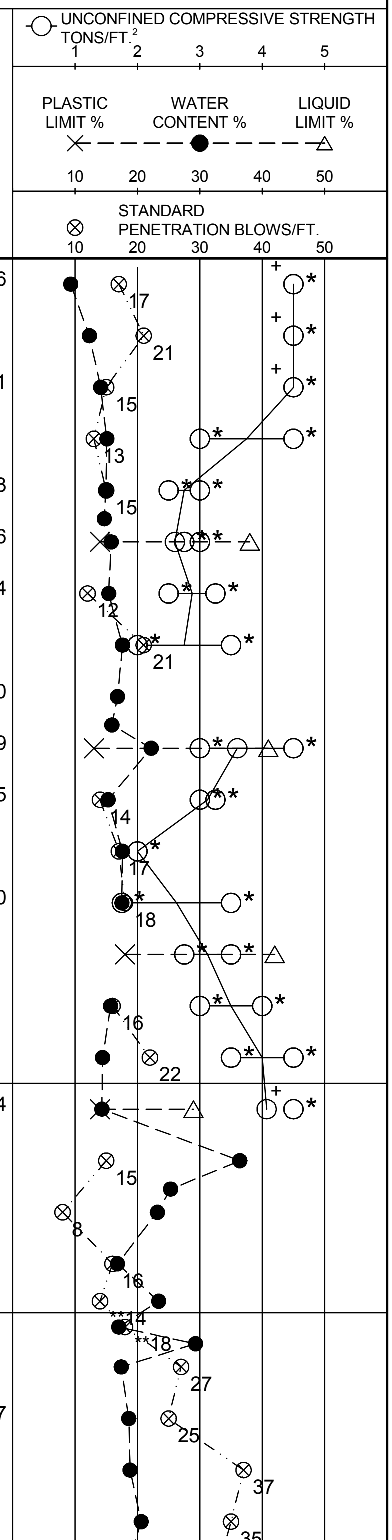
STS060701 60225561.GPJ STS.GDT 1/4/12

| | | | |
|---|---|---|---|
| **AECOM** | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-1** | |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| 2.0 | 1 | SS | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, trace caliche nodules and layers, occasional thin, saturated silty sand lenses - moist to wet - very stiff to hard | 121.6 |
| 4.0 | 2 | SS | | |
| 6.0 | 3 | SS | | 116.1 |
| 8.0 | 4 | SS | | |
| 10.0 | 5 | SS | | 121.3 |
| 12.0 | 6 | ST | | 118.6 |
| 14.0 | 7 | SS | | 117.4 |
| 16.0 | 8 | SS | | |
| 18.0 | 9 | 3" ST | | 114.0 |
| 20.0 | 10 | ST | | 110.9 |
| 22.0 | 11 | SS | | 114.5 |
| 24.0 | 12 | SS | | |
| 26.0 | 13 | SS | | 113.0 |
| 28.0 | 14 | 3" ST | | |
| 30.0 | 15 | SS | | |
| 32.0 | 16 | SS | 32.0 | |
| 34.0 | 17 | ST | White and light gray clayey sand (SC-caliche) - wet - loose to medium dense | 118.4 |
| 36.0 | 18 | SS | | |
| 38.0 | 19 | SS | Note: Saturated loose zone from 36.0 feet to 36.9 feet | |
| 40.0 | 20 | SS | | |
| | 21 | SS | 40.9 | |
| 42.0 | 21A | SS | Grayish brown fine to coarse sand (SP) - wet - medium dense to dense | |
| 44.0 | 22 | SS | Note: Clayey sand (SC-Caliche) layers encountered from 42.9 feet to 43.3 feet and 44.0 feet to 45.0 feet | |
| 46.0 | 23 | SS | | 136.7 |
| 48.0 | 24 | SS | | |
| 50.0 | 25 | SS | 50.0 | |




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 3

STS060701 60225561.GPJ STS.GDT 1/4/12

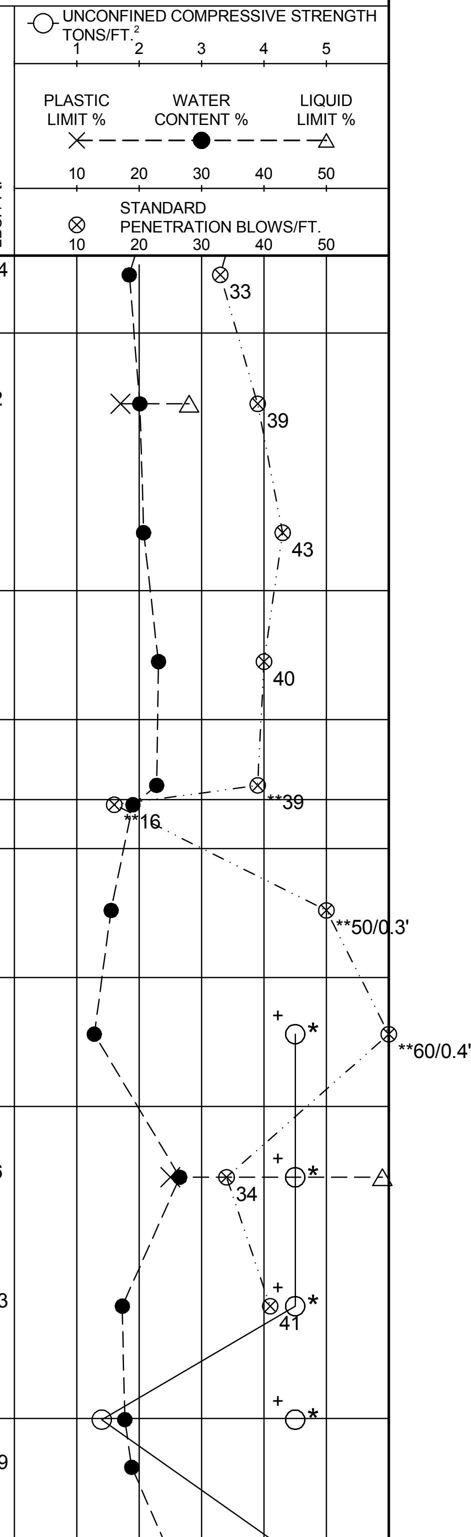
AECOM

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-2-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| 52.0 | 26 | SS | Grayish brown silty fine sand (SM) - wet - dense | 110.4 |
| 53.0 | | | | |
| 54.0 | | | Light gray clayey fine sand (SC) - wet - dense | |
| 56.0 | 27 | SS | | 99.2 |
| 58.0 | | | | |
| 60.0 | | | | |
| 62.0 | 28 | SS | | |
| 63.0 | | | | |
| 64.0 | | | Light gray fine sand (SP-SM), trace silt - wet - dense | |
| 66.0 | 29 | SS | | |
| 68.0 | | | | |
| 68.0 | | | Light gray fine to coarse sand (SP) - wet - dense | |
| 70.0 | 30 | SS | | |
| 71.1 | 30A | SS | Light gray and white clayey sand (SC-caliche) - wet - medium dense | |
| 72.0 | | | | |
| 73.0 | | | Light gray silty fine to medium sand (SM), trace to little clay, trace fine gravel - moist to wet - extremely dense | |
| 74.0 | | | | |
| 76.0 | 31 | SS | | |
| 78.0 | | | Tan clayey silt (CL-ML-Weathered Sandstone) - moist to wet - hard | |
| 80.0 | 32 | SS | | |
| 82.0 | | | | |
| 83.0 | | | Light gray and brown mottled silty clay (CH), trace sand - moist - hard | |
| 84.0 | | | | |
| 86.0 | 33 | SS | | 91.6 |
| 88.0 | | | | |
| 90.0 | | | | |
| 92.0 | 34 | SS | | 117.3 |
| 94.0 | | | | |
| 95.1 | 35 | ST | Light gray clayey fine sand (SC) - moist - extremely dense | |
| 96.0 | | | | |
| 98.0 | | | | 110.9 |
| 100.0 | | | | |




. . . continued

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 SHEET NO. 2 OF 3

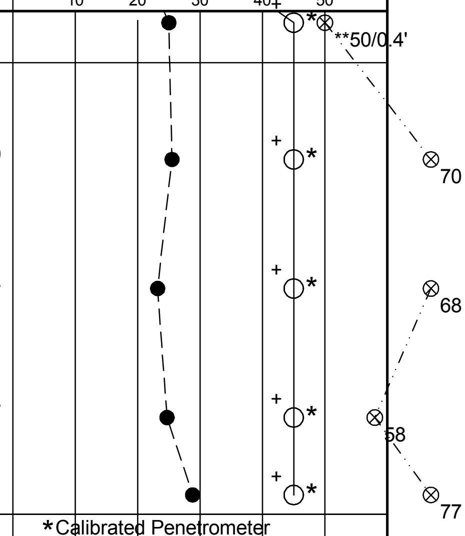
STS060701 60225561.GPJ STS.GDT 1/4/12

| AECOM | CLIENT: IPR-GDF SUEZ North America | LOG OF BORING NUMBER: B-2-1 |
|---|---|---|
| | PROJECT NAME: Coleto Creek Energy Facility Ash Pond | ARCHITECT/ENGINEER |

SITE LOCATION: Goliad County, Fannin, Texas

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.³ |
|---|---|---|---|---|---|
| | | 36 | SS | Light gray clayey fine sand (SC) - moist - extremely dense | |
| 102.0 | | | | 102.0 | |
| 104.0 | | | | Brown silty clay (CH) with gray silty clay and silt lenses, trace thin sand lenses - moist - hard | |
| 106.0 | | 37 | SS | | 99.9 |
| 108.0 | | | | | |
| 110.0 | | 38 | SS | | 96.4 |
| 112.0 | | | | | |
| 114.0 | | | | | |
| 116.0 | | 39 | SS | | 96.7 |
| 118.0 | | 40 | SS | 119.5 | |
| 119.5 | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 50.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 50.0 feet to 118.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

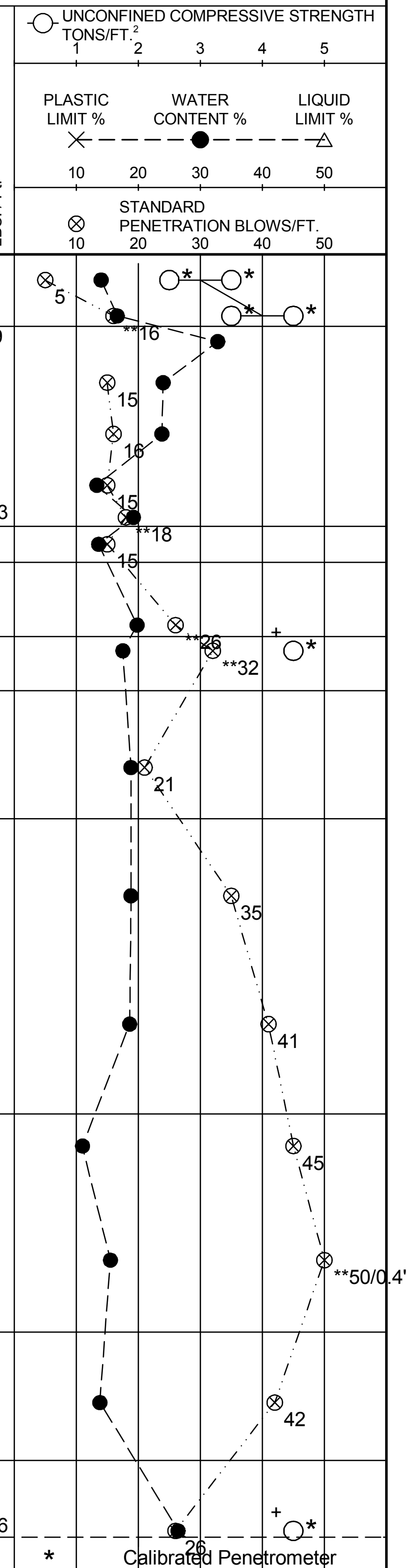
| WL: Dry before casing installation | BORING STARTED: 11/3/11 | AECOM OFFICE: 1035 Kepler Drive, Green Bay, Wisconsin 54311 | |
|---|---|---|---|
| WL: 8.0 to 10.0 feet WS | BORING COMPLETED: 11/4/11 | ENTERED BY: CAH | SHEET NO. 3 OF 3 |
| WL | RIG/FOREMAN: D-25/BZ | APP'D BY: TMT | AECOM JOB NO. 60225561 |

STS060701 60225561.GPJ STS.GDT 1/4/12

| | | | |
|---|---|---|---|
| CLIENT<br>**IPR-GDF SUEZ North America** | | LOG OF BORING NUMBER **B-2-2** | |
| PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | | ARCHITECT/ENGINEER | |
| SITE LOCATION<br>**Goliad County, Fannin, Texas** | | | |

SURFACE ELEVATION: +105.1

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | Strata Depth (FT) | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 0.0–2.8 | 1<br>2 | SS<br>SS | Black and dark brown organic sandy clay (OL), little fine gravel, trace wood - moist - very stiff to hard | 2.8 | |
| 2.8–10.6 | 2A<br>3<br>4<br>5<br>6 | SS<br>SS<br>SS<br>SS<br>SS | Light gray and white clayey fine to coarse sand (SC-Caliche), trace fine to coarse gravel - moist to wet - dense to medium dense<br><br>Note: Light brown fine to coarse sand (SP) layers encountered from 6.5 feet to 7.0 feet and 8.3 feet to 8.9 feet | 10.6 | 90.9<br>113.3 |
| 10.6–12.0 | 6A | SS | Light gray fine to coarse sand (SP) - wet - medium dense | 12.0 | |
| 12.0–14.9 | 7 | SS | Light gray and brown mottled silt (ML), trace clay, trace sand - moist - medium dense | 14.9 | |
| 14.9–17.0 | 7A | SS | Light gray silty clay (CL), trace sand - moist - hard | 17.0 | |
| 17.0–22.0 | 8 | SS | Light gray silt (ML), trace to little sand, trace clay - moist - medium dense | 22.0 | |
| 22.0–33.5 | 9<br>10 | SS<br>SS | Light brown fine sand (SP) - wet - dense | 33.5 | |
| 33.5–42.0 | 11<br>12 | SS<br>SS | Light gray and light brown mottled clayey fine to coarse sand (SC), trace fine to coarse gravel - moist - dense to extremely dense<br>Drillers noted hard drilling from 34.0 to 39.0 feet and gravel while drilling | 42.0 | |
| 42.0–47.0 | 13 | SS | Light brown fine to coarse sand (SP) - wet - dense | 47.0 | |
| 47.0–50.0 | | | Light gray and brown mottled silty clay (CL), trace sand - moist - hard | | 100.6 |

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* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

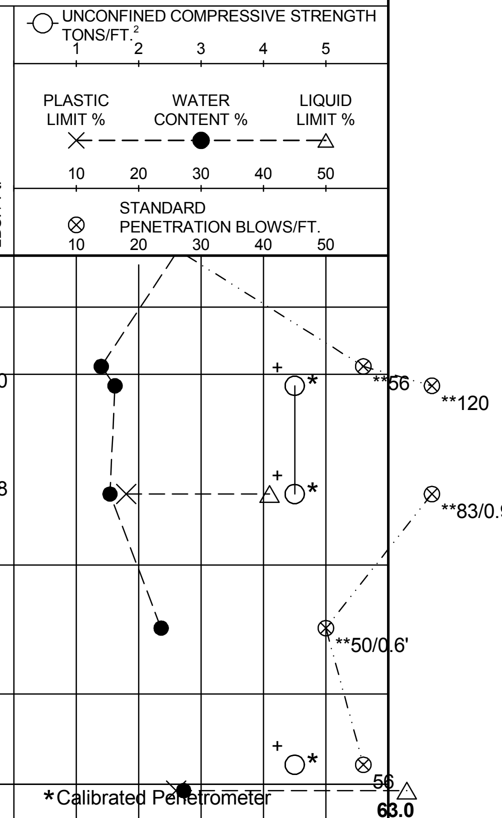
AECOM JOB NO. 60225561 SHEET NO. 1 OF 2

| | | | |
|---|---|---|---|
| **AECOM** | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-2-2** | |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +105.1 (Continued)

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | ELEVATION (FT) | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| | 14 | SS | | Light gray and brown mottled silty clay (CL), trace sand - moist - hard | |
| 52.0 | | | 52.0 | Light brown fine to coarse sand (SP) - wet - very dense | |
| 54.0 | 15 | SS | 54.6 | | |
| 56.0 | 15A | SS | | Light brown and light gray mottled silty sandy clay (CL), trace thin poorly-graded sand seams (SP) - moist - hard | 115.0 |
| 58.0 | | | | | |
| 60.0 | 16 | SS | | | 117.8 |
| 62.0 | | | 62.0 | Light brown and brown mottled silty fine sand (SM) - wet - extremely dense | |
| 64.0 | | | | | |
| 66.0 | 17 | SS | 67.0 | | |
| 68.0 | | | | Light gray silty clay (CH), trace sand, trace fine to coarse gravel - moist - hard | |
| 70.0 | 18 | SS | 70.5 | | |
| 70.5 | | SS | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 8.0 feet<br>Boring advanced from 6.0 feet to 16.0 feet with 3-inch rock bit and drilling fluid<br>HW casing driven from 8.0 feet to 10.0 feet<br>Boring advanced from 16.0 feet to 69.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **3.5 feet WS** | BORING STARTED **11/1/11** | AECOM OFFICE | **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **3.5 feet before casing installation** | BORING COMPLETED **11/1/11** | ENTERED BY **CAH** | SHEET NO. **2** OF **2** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

STS060701 60225561.GPJ STS.GDT 1/4/12

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-3-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

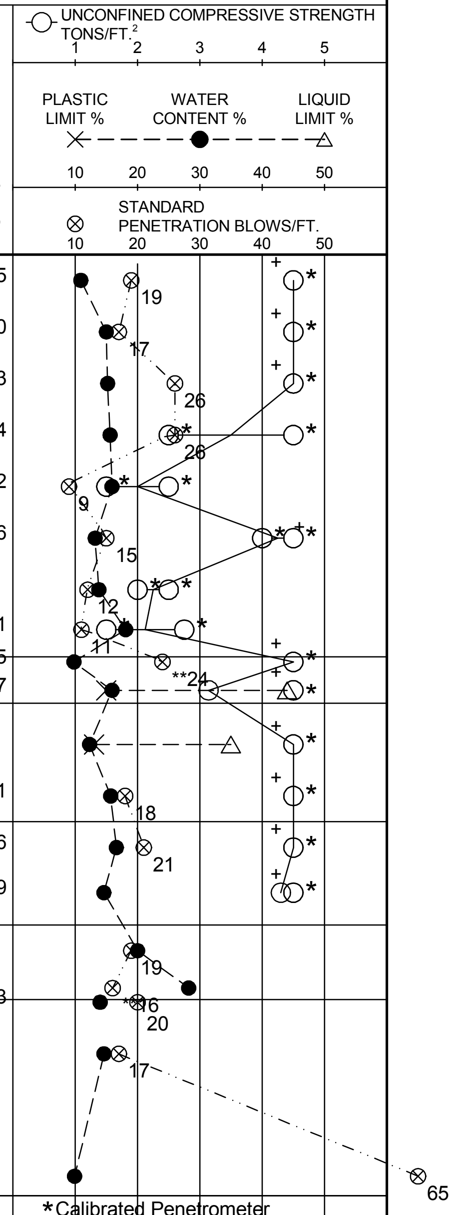
SURFACE ELEVATION: +139.3

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | UNIT DRY WT. LBS. / $Ft.^3$ |
|---|---|---|---|
| | 1 | SS | 114.5 |
| 2.0 | | | |
| | 2 | SS | 114.0 |
| 4.0 | | | |
| | 3 | SS | 115.3 |
| 6.0 | | | |
| | 4 | SS | 110.4 |
| 8.0 | | | |
| | 5 | SS | 112.2 |
| 10.0 | | | |
| | 6 | SS | 124.6 |
| 12.0 | | | |
| | 7 | SS | |
| 14.0 | | | |
| | 8 | SS | 106.1 |
| 16.0 | 8A | SS | 121.5 |
| | 9 | ST | 113.7 |
| 18.0 | | | |
| | 10 | SS | |
| 20.0 | | | |
| | 11 | SS | 109.1 |
| 22.0 | | | |
| | 12 | SS | 113.6 |
| 24.0 | | | |
| | 13 | SS | 117.9 |
| 26.0 | | | |
| | 14 | SS | |
| 28.0 | | | |
| | 15 | SS | |
| 30.0 | 15A | SS | 111.3 |
| | 16 | SS | |
| 32.0 | | | |
| 34.0 | | | |
| 36.0 | 17 | SS | |
| 36.5 | | | |

DESCRIPTION OF MATERIAL

- 0.0 – 15.6: Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, occasional irregular thin silty sand seams and lenses, trace caliche nodules and layers - moist to wet - stiff to hard
  Note: Saturated silty sand seams encountered from 10.5 feet to 10.9 feet, 12.5 feet to 12.7 feet, and from 15.4 feet to 15.5 feet
- 15.6 – 17.4: Gray clayey fine to medium sand (SC), trace caliche nodules, trace thin silty sand seams - moist to wet - very stiff to hard
- 17.4 – 22.0: Dark brown clayey sand (SC), trace caliche nodules - moist to wet - hard
- 22.0 – 26.0: Light gray silty sandy clay (CL), occasional irregular silty clayey caliche (CL-caliche) layers and lenses - moist to wet - hard
- 26.0 – 28.9: Light gray clayey sand (SC), occasional silty clay (CL-caliche) layers and lenses, trace fine gravel - moist to wet - medium dense
  Note: Saturated zone encountered from 28.0 feet to 28.5 feet
- 28.9 – 36.5: Light gray silty fine to coarse and (SM), trace to little clay, trace fine gravel, trace caliche nodules - moist to wet - medium dense to very dense

36.5 End of Boring
Boring advanced to 6.0 feet with solid-stem auger
HW casing driven to 5.0 feet
Boring advanced from 6.0 feet to 30.0 feet with 4-inch rock bit and drilling fluid
Boring advanced from 30.0 feet to 35.0 feet with 3-inch rock bit and drilling fluid
Boring abandoned with bentonite quick grout using tremie method
Split-spoons were driven with cathead and rope




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

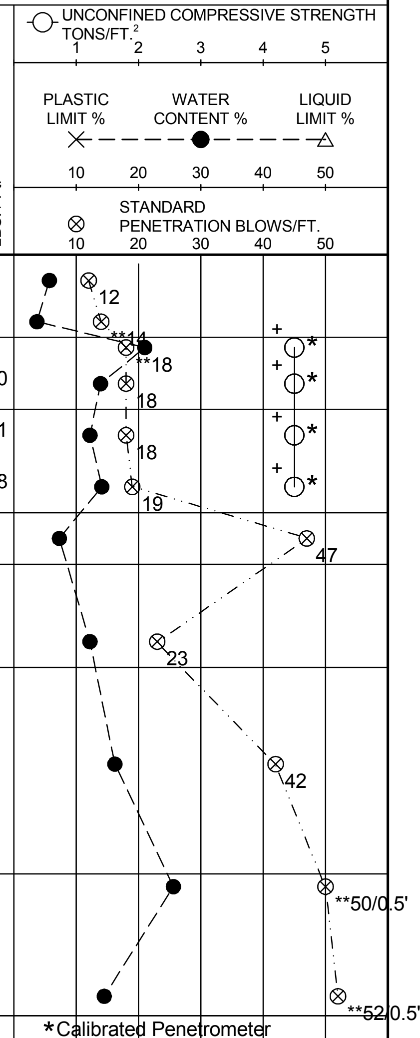
| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/8/11** | AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311** | |
| WL **8.0 to 10.0 feet WS** | BORING COMPLETED **11/8/11** | ENTERED BY **CAH** | SHEET NO. **1** OF **1** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

| AECOM | CLIENT: **IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-3-2** |
|---|---|---|
| | PROJECT NAME: **Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +122.8

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | STRATUM BOTTOM (FT) | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 2.0 | 1 | SS | | Fill: Dark brown or brown silty fine sand (SM), trace clay, trace roots - moist - medium dense | |
| | 2 | SS | 3.2 | | |
| 4.0 | 2A | SS | | Fill: Brown and gray mottled silty sandy clay (CL), trace fine gravel, trace roots - desiccated - hard | |
| 6.0 | 3 | SS | 6.0 | | 117.0 |
| 8.0 | 4 | SS | | Light gray and white silty sandy clay (CL-caliche), trace to little fine gravel - moist - hard | 122.1 |
| 10.0 | 5 | SS | 10.0 | | 113.8 |
| 12.0 | 6 | SS | 12.0 | White silty fine sand (SM-caliche), trace to little clay - moist - dense | |
| 14.0 | | | | Light brown fine to coarse sand (SP), trace fine gravel - wet - dense to medium dense | |
| 16.0 | 7 | SS | 16.0 | | |
| 18.0 | | | | Brown sitly fine to coarse sand (SM), trace to little fine gravel - wet - dense | |
| 20.0 | 8 | SS | | Drillers noted gravel while drilling from 16.0 feet to 19.0 feet and 23.0 feet and 24.0 feet | |
| 22.0 | | | | | |
| 24.0 | | | 24.0 | | |
| 26.0 | 9 | SS | | Light brown fine to coarse sand (SP) - wet - extremely dense | |
| 28.0 | 10 | SS | 29.5 | | |
| 29.5 | | | | End of Boring<br>Boring advanced to 10.0 feet with solid-stem auger<br>HW casing driven to 10.0 feet<br>Boring advanced from 10.0 feet to 20.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | |
|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/2/11** | AECOM OFFICE **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **14.0 feet WS** | BORING COMPLETED **11/2/11** | ENTERED BY **CAH** / SHEET NO. **1** OF **1** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** / AECOM JOB NO. **60225561** |

STS060701 60225561.GPJ STS.GDT 1/4/12

**AECOM**

CLIENT: **IPR-GDF SUEZ North America**

LOG OF BORING NUMBER: **B-4-1**

PROJECT NAME: **Coleto Creek Energy Facility Ash Pond**

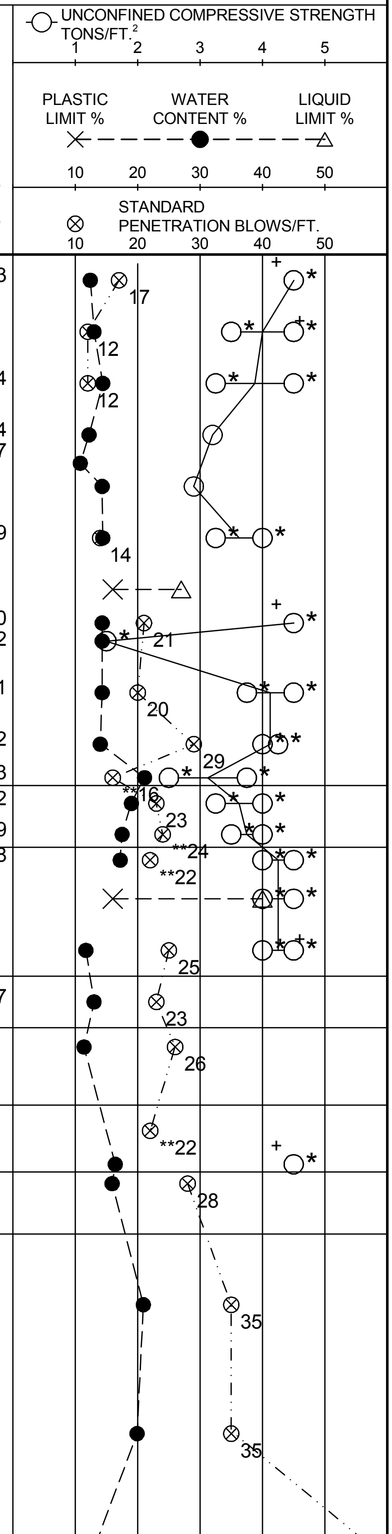
ARCHITECT/ENGINEER:

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2

| DEPTH (FT) | DESCRIPTION OF MATERIAL |
|---|---|
| 0.0 – 20.6 | Fill: Gray and brown mottled clayey sand (SC), trace fine gravel, trace thin irregular silty sand seams and lenses, trace silty clay caliche nodules and layers - moist - very stiff to hard |
| 20.6 – 23.0 | Light brown silty sandy clay (CL) with caliche - moist to wet - very stiff to hard |
| 23.0 – 28.0 | Light brown, dark brown, and gray mottled clayey sand (SC), trace organics, trace fine gravel, trace thin irregular silty sand seams and lenses - moist - hard<br>**Triaxial Test S-14**<br>**Dry Unit Weight = 121 pcf** **Ø' = 27 deg** |
| 28.0 – 30.0 | Light brown clayey sand (SC) - moist to wet - medium dense |
| 30.0 – 33.0 | Light brown silty fine to coarse sand (SM), trace clay - moist to wet - medium dense |
| 33.0 – 35.6 | Light brown silty sandy clay (CL) with caliche, trace fine gravel - moist to wet - hard |
| 35.6 – 38.0 | Light brown fine to coarse sand (SP) - wet - medium dense |
| 38.0 – 50.0 | Grayish brown fine to coarse sand (SP) - wet - dense<br><br>Drillers noted sporadic, thin gravel layers while drilling from 35.0 to 50.0 feet |

| SAMPLE NO. | SAMPLE TYPE | UNIT DRY WT. LBS./Ft.$^3$ |
|---|---|---|
| 1 | SS | 117.3 |
| 2 | SS | |
| 3 | SS | 111.4 |
| ~~4~~ | ~~ST~~ | 124.4 |
| 5 | ST | 117.7 |
| 6 | SS | 114.9 |
| 7 | 3" ST | |
| 8 | SS | 122.0 / 118.2 |
| 9 | SS | 110.1 |
| 10 | SS | 115.2 |
| 11 | SS | 102.3 |
| 11A | SS | 110.2 |
| 12 | SS | 107.9 |
| 12A | SS | 110.8 |
| 13 | 3" ST | |
| 14 | SS | |
| 15 | SS | 115.7 |
| 16 | SS | |
| 17 | SS | |
| 17A | SS | |
| 18 | SS | |
| 19 | SS | |

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* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

| AECOM | CLIENT: IPR-GDF SUEZ North America | LOG OF BORING NUMBER: B-4-1 |
|---|---|---|
| | PROJECT NAME: Coleto Creek Energy Facility Ash Pond | ARCHITECT/ENGINEER |

SITE LOCATION: **Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.2 (Continued)

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.³ | UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT %, WATER CONTENT %, LIQUID LIMIT % / STANDARD PENETRATION BLOWS/FT. |
|---|---|---|---|---|---|---|---|---|
| 51.5 | | 20 | SS | | | Grayish bown fine to coarse sand (SP), trace to little fine gravel, occasional thin layers of gray silty clay and caliche - moist to wet - very dense (51.5) | | 60 |

End of Boring
Boring advanced to 6.0 feet with solid-stem auger
HW casing driven to 5.5 feet
Boring advanced from 6.0 feet to 30.0 feet with 4-inch rock bit and drilling fluid
Boring advanced from 30.0 feet to 50.0 feet with 3-inch rock bit and drilling fluid
Boring abandoned with bentonite quick grout using tremie method
Split-spoons were driven with cathead and rope

*Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL: Dry before casing installation | BORING STARTED: 11/7/11 | AECOM OFFICE: 1035 Kepler Drive, Green Bay, Wisconsin 54311 | |
| WL: 10.0 to 12.0 feet | BORING COMPLETED: 11/7/11 | ENTERED BY: CAH | SHEET NO. 2 OF 2 |
| WL | RIG/FOREMAN: D-25/BZ | APP'D BY: TMT | AECOM JOB NO. 60225561 |

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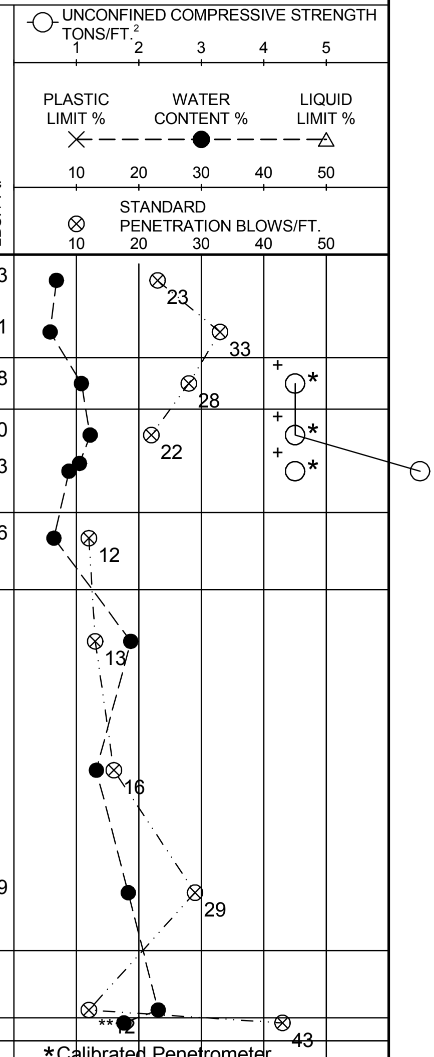
**AECOM**

| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-4-2** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +119.6

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | Strata depth | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|---|
| 2.0 | 1 | SS | | Fill: Dark brown and brown silty fine to medium sand (SM), trace fine gravel, trace roots, trace clay - moist - medium dense | 115.3 |
| 4.0 | 2 | SS | 4.0 | | 122.1 |
| 6.0 | 3 | SS | 6.0 | Buried Topsoil: Dark brown and black organic silty clay (OL), trace to little sand - desiccated - hard | 125.8 |
| 8.0 | 4 | SS | | Light brown and light gray mottled silty clayey sand (SC), trace fine gravel, trace irregular caliche nodules - moist - hard | 126.0 |
| | 5 | ST | | Note: Dark gray silty sandy clay (CL) layer from 8.0 feet to 8.3 feet | 129.3 |
| 10.0 | | | 10.0 | | |
| 12.0 | 6 | SS | 13.0 | Light brown silty fine sand (SM), trace clay - moist - medium dense<br>Note: Plastic liner was used within split-spoon for Sample 6 | 124.6 |
| 14.0 | | | | | |
| 16.0 | 7 | SS | | Light brown fine to coarse sand (SP) - wet - medium dense | |
| 18.0 | | | | | |
| 20.0 | 8 | SS | | | |
| 22.0 | | | | Drillers noted hard drilling at 22.0 feet | |
| 24.0 | | | | | |
| 26.0 | 9 | SS | 27.0 | Note: White silty clay (CL-caliche) layer from 24.7 feet to 25.1 feet | 106.9 |
| 28.0 | | | 29.6 | Light gray silty fine sand (SM), trace clay - wet - medium dense | |
| 30.0 | 10 | SS | | | |
| | 10A | SS | 30.5 | Light brown fine to coarse sand (SP) - wet - dense | |
| 30.5 | | | | End of Boring<br>Boring advanced to 10.0 feet with solid-stem auger<br>HW casing driven to 8.0 feet<br>Boring advanced from 10.0 feet to 29.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | |




The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| WL | BORING STARTED | AECOM OFFICE | |
|---|---|---|---|
| Dry before casing installation | 11/2/11 | 1035 Kepler Drive Green Bay, Wisconsin 54311 | |
| WL | BORING COMPLETED | ENTERED BY | SHEET NO. OF |
| 14.0 feet WS | 11/2/11 | CAH | 1 1 |
| WL | RIG/FOREMAN | APP'D BY | AECOM JOB NO. |
| | D-25/BZ | TMT | 60225561 |

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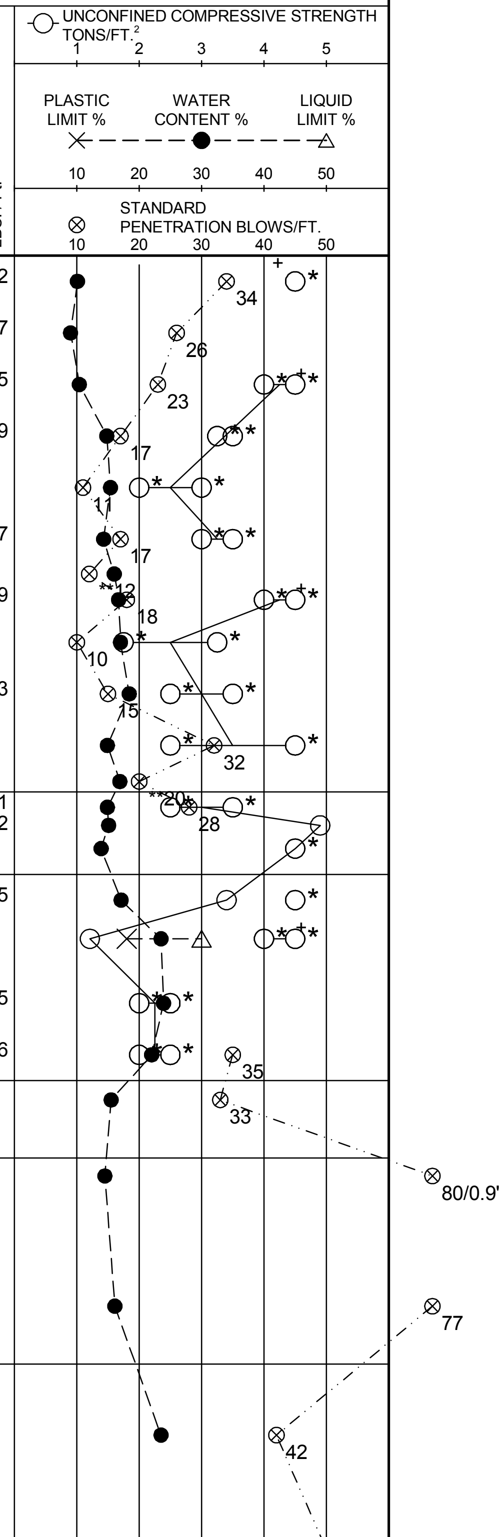
| CLIENT | LOG OF BORING NUMBER |
|---|---|
| **IPR-GDF SUEZ North America** | **B-5-1** |
| PROJECT NAME | ARCHITECT/ENGINEER |
| **Coleto Creek Energy Facility Ash Pond** | |

AECOM

SITE LOCATION
**Goliad County, Fannin, Texas**

SURFACE ELEVATION: +139.6

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | DESCRIPTION OF MATERIAL | UNIT DRY WT. LBS. / Ft.$^3$ |
|---|---|---|---|---|
| | 1 | SS | Fill: Light gray and brown mottled clayey sand (SC), trace fine gravel, occasional thin irregular silty sand seams, trace silty clay caliche nodules and layers - moist to wet - very stiff to hard | 128.2 |
| 2.0 | 2 | SS | | 124.7 |
| 4.0 | 3 | SS | | 127.5 |
| 6.0 | 4 | SS | | 111.9 |
| 8.0 | 5 | SS | | |
| 10.0 | 6 | SS | | 118.7 |
| 12.0 | 7 | SS | | |
| | 7A | SS | | 108.9 |
| 14.0 | 8 | SS | | |
| 16.0 | 9 | SS | | 111.3 |
| 18.0 | 10 | SS | | |
| 20.0 | 11 | SS | 20.8 | |
| | 11A | SS | Gray and brown silty clay (CL), trace organics, trace sand, trace thin saturated silty sand seams and lenses - moist to wet - very stiff to hard | 116.1 |
| 22.0 | 12 | ST | 24.0 | 118.2 |
| 24.0 | 13 | SS | White and gray silty clay (CL-caliche), little sand - moist to wet - stiff to hard | 107.5 |
| 26.0 | 14 | ST | | 99.1 |
| 28.0 | 15 | SS | | 102.5 |
| 30.0 | 16 | SS | 32.0 | 103.6 |
| 32.0 | 17 | SS | Gray silty fine to coarse sand (SM), trace fine gravel, trace clay - wet - dense<br>35.0 | |
| 34.0 | | | | |
| 36.0 | 18 | SS | Gray fine to coarse sand (SP), trace fine gravel - wet - extremely dense to very dense<br>Note: Hard white silty clay (CL-caliche) in tip of Sample 18 | |
| 38.0 | | | | |
| 40.0 | 19 | SS | 43.0 | |
| 42.0 | | | | |
| 44.0 | | | Gray silty fine sand (SM) - wet - dense to extremely dense | |
| 46.0 | 20 | SS | Drillers noted hard drilling and gravel and cobbles from 43.0 to 45.0 feet | |
| 48.0 | | | | |
| 50.0 | | | | |

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* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

AECOM JOB NO. 60225561 | SHEET NO. 1 OF 2

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| | | |
|---|---|---|
| AECOM | CLIENT<br>**IPR-GDF SUEZ North America** | LOG OF BORING NUMBER **B-5-1** |
| | PROJECT NAME<br>**Coleto Creek Energy Facility Ash Pond** | ARCHITECT/ENGINEER |

SITE LOCATION
**Goliad County, Fannin, Texas**

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.$^2$ — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. — 10 20 30 40 50

| DEPTH (FT) | ELEVATION (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DISTANCE | RECOVERY | DESCRIPTION OF MATERIAL<br>SURFACE ELEVATION: +139.6 (Continued) | UNIT DRY WT. LBS. / Ft.$^3$ | |
|---|---|---|---|---|---|---|---|---|
| | | 21 | SS | I | | 50.4 No recovery Sample 21 | | 50/0.4' |
| 50.4 | | | | | | End of Boring<br>Boring advanced to 6.0 feet with solid-stem auger<br>HW casing driven to 5.0 feet<br>Boring advanced from 6.0 feet to 32.0 feet with 4-inch rock bit and drilling fluid<br>Boring advanced from 32.0 feet to 50.0 feet with 3-inch rock bit and drilling fluid<br>Boring abandoned with bentonite quick grout using tremie method<br>Split-spoons were driven with cathead and rope | | *Calibrated Penetrometer |

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

| | | | |
|---|---|---|---|
| WL **Dry before casing installation** | BORING STARTED **11/7/11** | AECOM OFFICE | **1035 Kepler Drive Green Bay, Wisconsin 54311** |
| WL **8.0 to 10.0 feet WS** | BORING COMPLETED **11/7/11** | ENTERED BY **CAH** | SHEET NO. **2** OF **2** |
| WL | RIG/FOREMAN **D-25/BZ** | APP'D BY **TMT** | AECOM JOB NO. **60225561** |

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# WELL/DRILLHOLE/BOREHOLE ABANDONMENT

## (1) GENERAL INFORMATION

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-1-1 | Gov't Lot (if applicable): ____

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location
13453086.8 ft. ☒ N. ☐ S., 2543146.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well:

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/5/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 121.0
Casing Diameter (in.): 4.0
Casing Depth (ft.): 5.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet): 14.0

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☐ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 121.0 | 50 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/6/11

Signature of Person Doing Work: | Date Signed: 11/6/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-2-1 | Gov't Lot (if applicable): ____

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location: 13453065.2 ft. ☒ N. ☐ S., 2543576.6 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well: ____

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID: ____ | License/Permit/Monitoring No.: ____

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/3/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 119.5
Casing Diameter (in.): 4.0
Casing Depth (ft.): 5.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet) ____

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☐ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 19.5 | 50 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/4/11

Signature of Person Doing Work: ____ | Date Signed: 11/4/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

## (1) GENERAL INFORMATION

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name: B-2-2 — Gov't Lot (if applicable): ____

Grid Location: ___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

13452977.2 ft. ☒ N. ☐ S., 2543676.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ___ ft. N. ___ ft. E. ☐ S ☐ C ☐ N Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

| Facility ID | License/Permit/Monitoring No. |
|---|---|
| | |

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

| Present Well Owner | Original Owner |
|---|---|
| Coleto Creek Energy Facility | Same |

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/1/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 70.5
Casing Diameter (in.): 4.0
Casing Depth (ft.): 10.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If Yes, To What Depth? N/A Feet

Depth to Water (Feet): 3.5

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

| | Yes | No | Not Applicable |
|---|---|---|---|
| Pump & Piping Removed? | ☐ | ☐ | ☒ |
| Liner(s) Removed? | ☐ | ☐ | ☒ |
| Screen Removed? | ☐ | ☐ | ☒ |
| Casing Left in Place? | ☐ | ☒ | |

| | Yes | No |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ | ☒ |
| Did Sealing Material Rise to Surface? | ☒ | ☐ |
| Did Material Settle After 24 Hours? | ☐ | ☒ |
| If Yes, Was Hole Retopped? | ☐ | ☒ |

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

## (5)

| Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 70.5 | 30 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/2/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/2/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-3-1 | Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___; T. ___ N; R. ___ [ ] E [ ] W

Grid Location: 13451245.3 ft. [X] N. [ ] S., 2543663.1 ft. [X] E. [ ] W.

Local Grid Origin [ ] (estimated: [ ]) or Well Location [ ]

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ___ ft. N. ___ ft. E. S [ ] C [ ] N [ ] Zone

Reason For Abandonment: Geotech Boring | Unique Well No. of Replacement Well

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility | Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/8/11

[ ] Monitoring Well
[ ] Water Well
[X] Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify) ___

Formation Type:
[X] Unconsolidated Formation [ ] Bedrock

Total Well Depth (ft) (From ground surface): ___
Casing Diameter (in.): 4.0
Casing Depth (ft.): 5.0
Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? [ ] Yes [ ] No [ ] Unknown
If Yes, To What Depth? N/A Feet
Depth to Water (Feet): N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? [ ] Yes [ ] No [X] Not Applicable
Liner(s) Removed? [ ] Yes [ ] No [X] Not Applicable
Screen Removed? [ ] Yes [ ] No [X] Not Applicable
Casing Left in Place? [ ] Yes [X] No

Was Casing Cut Off Below Surface? [ ] Yes [X] No
Did Sealing Material Rise to Surface? [X] Yes [ ] No
Did Material Settle After 24 Hours? [ ] Yes [X] No
If Yes, Was Hole Retopped? [ ] Yes [X] No

Required Method of Placing Sealing Material
[ ] Conductor Pipe - Gravity [X] Conductor Pipe - Pumped
[ ] Screened & Poured (Bentonite Chips) [ ] Other (Explain)

Sealing Materials
[ ] Neat Cement Grout
[ ] Sand-Cement (Concrete) Grout
[ ] Concrete
[ ] Clay-Sand Slurry
[X] Bentonite-Sand Slurry
[ ] Chipped Bentonite

For monitoring wells and monitoring well boreholes only
[ ] Bentonite Chips
[ ] Granular Bentonite
[ ] Bentonite-Cement Grout
[ ] Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 36.5 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc. | Date of Abandonment: 11/8/11

Signature of Person Doing Work | Date Signed: 11/8/11

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

## (1) GENERAL INFORMATION

Unique Well No.: 
Well ID No.: 
County: Goliad

Common Well Name: B-3-2 — Gov't Lot (if applicable): 

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location: 1341251.3 ft. ☒ N. ☐ S., 2543721.2 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ___ ft. N. ___ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well: 

## (2) FACILITY /OWNER INFORMATION

Facility Name: Coleto Creek Energy Facility

Facility ID: 

License/Permit/Monitoring No.: 

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 11/2/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ___

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 29.5

Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): 14.0

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 29.5 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.

Date of Abandonment: 11/2/11

Signature of Person Doing Work: 

Date Signed: 11/2/11

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-4-1 ____ Gov't Lot (if applicable)

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location
1340613.7 ft. ☒ N. ☐ S., 2543740.9 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___° ___' ___" Long ___° ___' ___" or

State Plane ______ ft. N. ______ ft. E. S ☐ C ☐ N ☐ Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID:

License/Permit/Monitoring No.:

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date 11/7/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ______

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) 51.5 (From ground surface)

Casing Diameter (in.) 5.0

Casing Depth (ft.) 4.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

| | Yes | No | Not Applicable |
|---|---|---|---|
| Pump & Piping Removed? | ☐ | ☐ | ☒ |
| Liner(s) Removed? | ☐ | ☐ | ☒ |
| Screen Removed? | ☐ | ☐ | ☒ |
| Casing Left in Place? | ☐ | ☒ | |

| | Yes | No |
|---|---|---|
| Was Casing Cut Off Below Surface? | ☐ | ☒ |
| Did Sealing Material Rise to Surface? | ☒ | ☐ |
| Did Material Settle After 24 Hours? | ☐ | ☒ |
| If Yes, Was Hole Retopped? | ☐ | ☒ |

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only

☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 51.5 | 25 gallons | |
| | | | | |
| | | | | |

(6) Comments ______

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/7/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/7/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code: Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

## (1) GENERAL INFORMATION

| Unique Well No. | Well ID No. | County |
|---|---|---|
| | | Goliad |

Common Well Name B-4-2 ____ Gov't Lot (if applicable)

____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

Grid Location
13450619.3 ft. ☒ N. ☐ S., 2543806.7 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ____ ° ____ ' ____ " Long ____ ° ____ ' ____ " or

State Plane ____ ft. N. ____ ft. E. S ☐ C ☐ N ☐ Zone

| Reason For Abandonment | Unique Well No. of Replacement Well |
|---|---|
| Geotech Boring | |

## (2) FACILITY /OWNER INFORMATION

Facility Name
Coleto Creek Energy Facility

| Facility ID | License/Permit/Monitoring No. |
|---|---|
| | |

Street Address of Well
45 FM 2987

City, Village, or Town
Goliad County, Fannin, Texas 77960

| Present Well Owner | Original Owner |
|---|---|
| Coleto Creek Energy Facility | Same |

Street Address or Route of Owner
45 FM 2987

City, State, Zip Code
Fannin, Texas 77960

## (3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date 11/2/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface) 31.0 Casing Diameter (in.) 4.0

Casing Depth (ft.) 5.0

Lower Drillhole Diameter (in.) 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet) 14.0

## (4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 31.0 | 20 gallons | |
| | | | | |
| | | | | |

(6) Comments ____

| (7) Name of Person or Firm Doing Sealing Work | Date of Abandonment |
|---|---|
| AECOM Technical Services, Inc. | 11/2/11 |

| Signature of Person Doing Work | Date Signed |
|---|---|
| | 11/2/11 |

| Street or Route | Telephone Number |
|---|---|
| 1035 Kepler Drive | 920-468-1978 |

City, State, Zip Code
Green Bay, Wisconsin 54311

**WELL/DRILLHOLE/BOREHOLE ABANDONMENT**

**(1) GENERAL INFORMATION**

Unique Well No. | Well ID No. | County: Goliad

Common Well Name: B-5-1 | Gov't Lot (if applicable)

___ 1/4 of ___ 1/4 of Sec. ___ ; T. ___ N; R. ___ ☐ E ☐ W

Grid Location

13451003.7 ft. ☒ N. ☐ S., 2543693.8 ft. ☒ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐ ) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ___ ft. N. ___ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Geotech Boring

Unique Well No. of Replacement Well:

**(2) FACILITY /OWNER INFORMATION**

Facility Name: Coleto Creek Energy Facility

Facility ID | License/Permit/Monitoring No.

Street Address of Well: 45 FM 2987

City, Village, or Town: Goliad County, Fannin, Texas 77960

Present Well Owner: Coleto Creek Energy Facility

Original Owner: Same

Street Address or Route of Owner: 45 FM 2987

City, State, Zip Code: Fannin, Texas 77960

**(3) WELL/DRILLHOLE/BOREHOLE INFORMATION**

Original Construction Date: 11/7/11

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (Specify) ___

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 50.9

Casing Diameter (in.): 4.0

Casing Depth (ft.): 5.0

Lower Drillhole Diameter (in.): 3.0

Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown

If Yes, To What Depth? N/A Feet

Depth to Water (Feet): N/A

**(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL**

Pump & Piping Removed? ☐ Yes ☐ No ☒ Not Applicable
Liner(s) Removed? ☐ Yes ☐ No ☒ Not Applicable
Screen Removed? ☐ Yes ☐ No ☒ Not Applicable
Casing Left in Place? ☐ Yes ☒ No

Was Casing Cut Off Below Surface? ☐ Yes ☒ No
Did Sealing Material Rise to Surface? ☒ Yes ☐ No
Did Material Settle After 24 Hours? ☐ Yes ☒ No
If Yes, Was Hole Retopped? ☐ Yes ☒ No

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☒ Conductor Pipe - Pumped
☐ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☒ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only

☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

| (5) Sealing Material Used | From (Ft.) | To (Ft.) | No. Yards, Sacks, Sealant, or Volume | Mix Ratio or Mud Weight |
|---|---|---|---|---|
| Quik-Grout | Surface | 50.9 | 25 gallons | |
| | | | | |
| | | | | |

(6) Comments ___

(7) Name of Person or Firm Doing Sealing Work: AECOM Technical Services, Inc.

Date of Abandonment: 11/7/11

Signature of Person Doing Work:

Date Signed: 11/7/11

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311

AECOM

# AECOM General Notes

## Drilling and Sampling Symbols:

| | |
|---|---|
| SS : Split Spoon - 1-3/8" I.D. 2" O.D. (Unless otherwise noted) | HS : Hollow Stem Auger |
| ST : Shelby Tube-2" O.D. (Unless otherwise noted) | WS : Wash Sample |
| PA : Power Auger | FT : Fish Tail |
| DB : Diamond Bit-NX, BX, AX | RB : Rock Bit |
| AS : Auger Sample | BS : Bulk Sample |
| JS : Jar Sample | PM : Pressuremeter Test |
| VS : Vane Shear | GS : Giddings Sampler |
| OS : Osterberg Sampler | |

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

## Water Level Measurement Symbols:

| | |
|---|---|
| WL : Water Level | WCI : Wet Cave In |
| WS : While Sampling | DCI : Dry Cave In |
| WD : While Drilling | BCR : Before Casing Removal |
| AB : After Boring | ACR : After Casing Removal |

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

## Gradation Description and Terminology:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

| Major Component of Sample | Size Range | Description of Other Components Present in Sample | Percent Dry Weight |
|---|---|---|---|
| Boulders | Over 8 in. (200 mm) | Trace | 1-9 |
| Cobbles | 8 inches to 3 inches (200 mm to 75 mm) | Little | 10-19 |
| Gravel | 3 inches to #4 sieve (75 mm to 4.76 mm) | Some | 20-34 |
| Sand | #4 to #200 sieve (4.76 mm to 0.074 mm) | And | 35-50 |
| Silt | Passing #200 sieve (0.074 mm to 0.005 mm) | | |
| Clay | Smaller than 0.005 mm | | |

## Consistency of Cohesive Soils: Relative Density of Granular Soils:

| Unconfined Compressive Strength, Qu, tsf | Consistency | N-Blows per foot | Relative Density |
|---|---|---|---|
| <0.25 | Very Soft | 0 - 3 | Very Loose |
| 0.25 - 0.49 | Soft | 4 - 9 | Loose |
| 0.50 - 0.99 | Medium (firm) | 10 - 29 | Medium Dense |
| 1.00 - 1.99 | Stiff | 30 - 49 | Dense |
| 2.00 - 3.99 | Very Stiff | 50 - 80 | Very Dense |
| 4.00 - 8.00 | Hard | >80 | Extremely Dense |
| >8.00 | Very Hard | | |

# AECOM Field and Laboratory Procedures

Field Sampling Procedures

## Auger Sampling (AS)

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

## Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

## Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

## Giddings Sampler (GS)

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.

# AECOM Field and Laboratory Procedures

Subsurface Exploration Procedures

## Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

## Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

## Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

## Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

## Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

AECOM

# AECOM Laboratory Procedures

## Water Content (Wc)
The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

## Hand Penetrometer (Qp)
In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

## Unconfined Compression Tests (Qu)
In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

## Dry Density (γd)
The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

## Classification of Samples
In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the AECOM Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "AECOM General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the AECOM Soil Classification System.

# AECOM Standard Boring Log Procedures

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

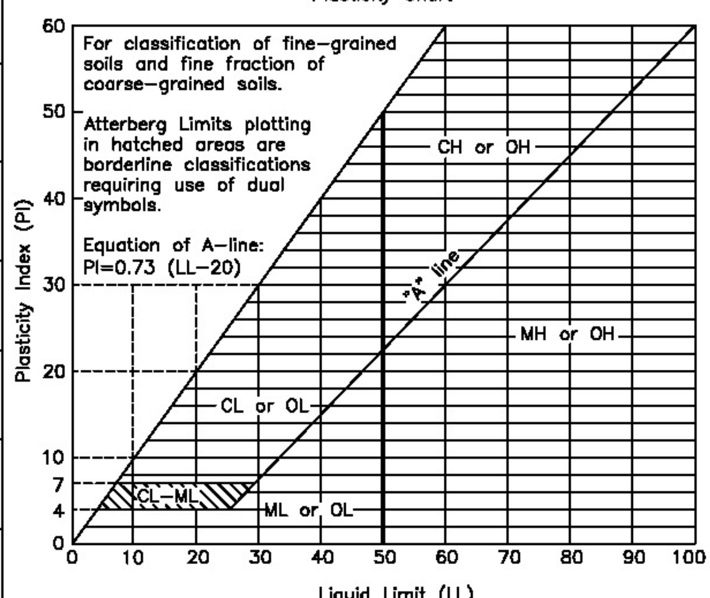
Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.

# AECOM Soil Classification System [1]

| Major Divisions | | | Group Symbols | Typical Names | Laboratory Classification Criteria | | |
|---|---|---|---|---|---|---|---|
| Coarse-grained soils (More than half of material is ***larger*** than No. 200 sieve size) | Gravel (More than half of coarse fraction is larger than No. 4 sieve size) | Clean gravel (Little or no fines) | GW | Well-graded, gravel, gravel-sand mixtures, little or no fines | Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent . . . . . GW, GP, SW, SP; More than 12 percent . . . . . GM, GC, SM, SC; 5 to 12 percent . . . . . Borderline cases ***requiring*** dual symbols [3] | $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3 | |
| | | | GP | Poorly graded gravel, gravel-sand mixtures, little or no fines | | Not meeting all gradation requirements for GW | |
| | | Gravel with fines (Appreciable amount of fines) | GM | Silty gravel, gravel-sand-silt mixtures | | Atterberg limits below "A" line or PI less than 4 | Above "A" line with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols |
| | | | GC | Clayey gravel, gravel-sand-clay mixtures | | Atterberg limits above "A" line or PI greater than 7 | |
| | Sand (More than half of coarse fraction is smaller than No. 4 sieve size) | Clean sand (Little or no fines) | SW | Well-graded sand, gravelly sand, little or no fines | | $C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3 | |
| | | | SP | Poorly graded sand, gravelly sand, little or no fines | | Not meeting all gradation requirements for SW | |
| | | Sand with fines (Appreciable amount of fines) | SM | Silty sand, sand-silt mixtures | | Atterberg limits below "A" line or PI less than 4 | Limits plotting in hatched zone with PI between 4 and 7 are ***borderline*** cases requiring use of dual symbols |
| | | | SC | Clayey sand, sand-clay mixtures | | Atterberg limits above "A" line or PI greater than 7 | |
| Fine-grained soils (More than half of material is ***smaller*** than No. 200 sieve size) | Silt and clay (Liquid limit less than 50) | | ML | Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity | Plasticity Chart [2] (see chart below) | | |
| | | | CL | Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay | | | |
| | | | OL | Organic silt and organic silty clay of low plasticity | | | |
| | Silt and clay (Liquid limit greater than 50) | | MH | Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt | | | |
| | | | CH | Inorganic clay of high plasticity, fat clay | | | |
| | | | OH | Organic clay of medium to high plasticity, organic silt | | | |
| | Highly organic soils | | PT | Peat and other highly organic soil | | | |

Plasticity Chart [2]

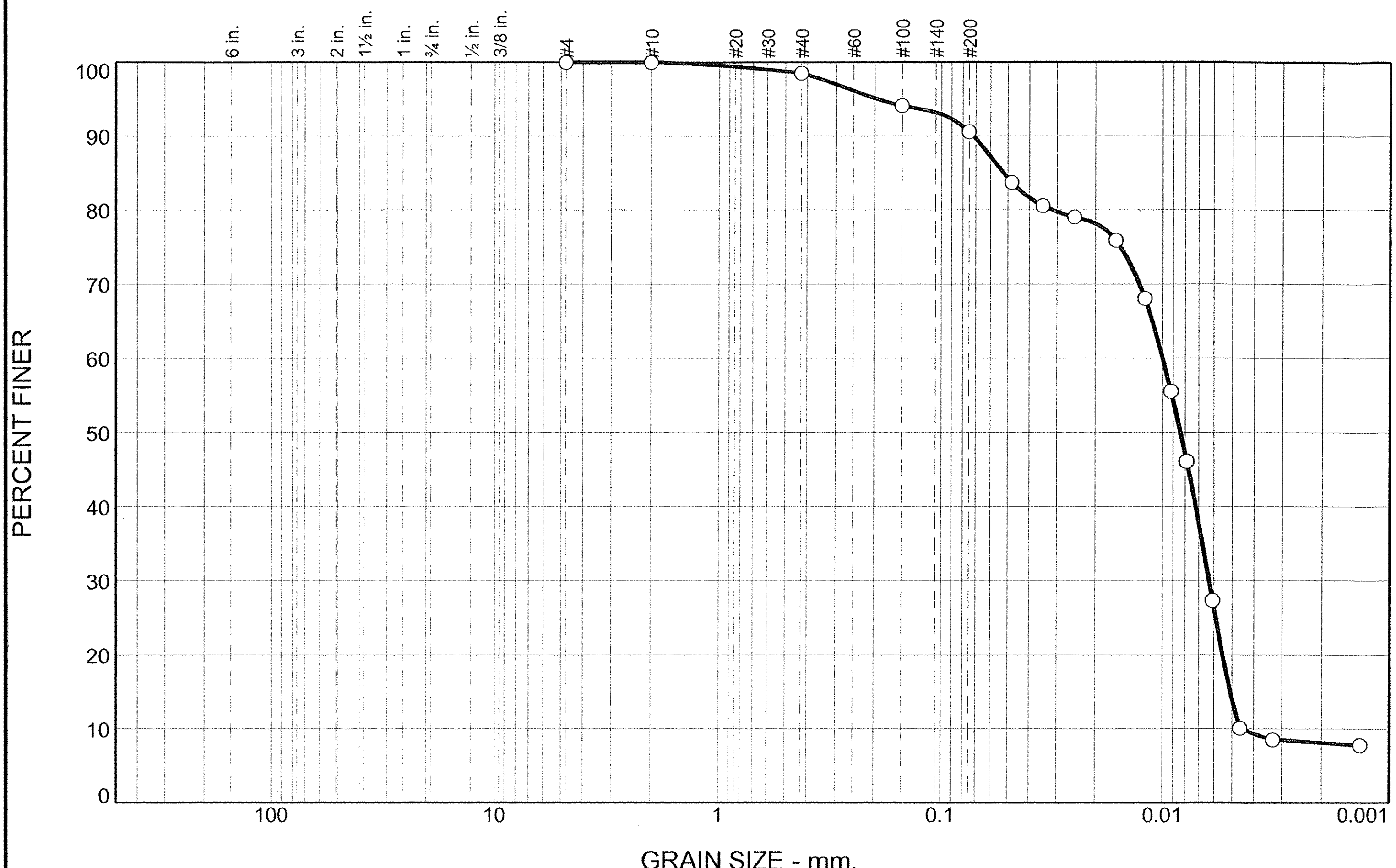



1. See AECOM General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
2. Reference: Unified Soil Classification Systems
3. Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

# APPENDIX B

## Geotechnical Laboratory Data

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.5 | 7.9 | 76.7 | 13.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 100.0 | | |
| #40 | 98.5 | | |
| #100 | 94.1 | | |
| #200 | 90.6 | | |

* (no specification provided)

**Material Description**

LIGHT GRAY SILTY CLAY, TRACE SAND

**Atterberg Limits**

PL= 14 LL= 22 PI= 8

**Coefficients**

$D_{90}$= 0.0716 $D_{85}$= 0.0523 $D_{60}$= 0.0100
$D_{50}$= 0.0084 $D_{30}$= 0.0063 $D_{15}$= 0.0051
$D_{10}$= 0.0045 $C_u$= 2.21 $C_c$= 0.88

**Classification**

USCS= CL AASHTO= A-4(5)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 8'-10'
**Sample Number:** B-1-1 S-5

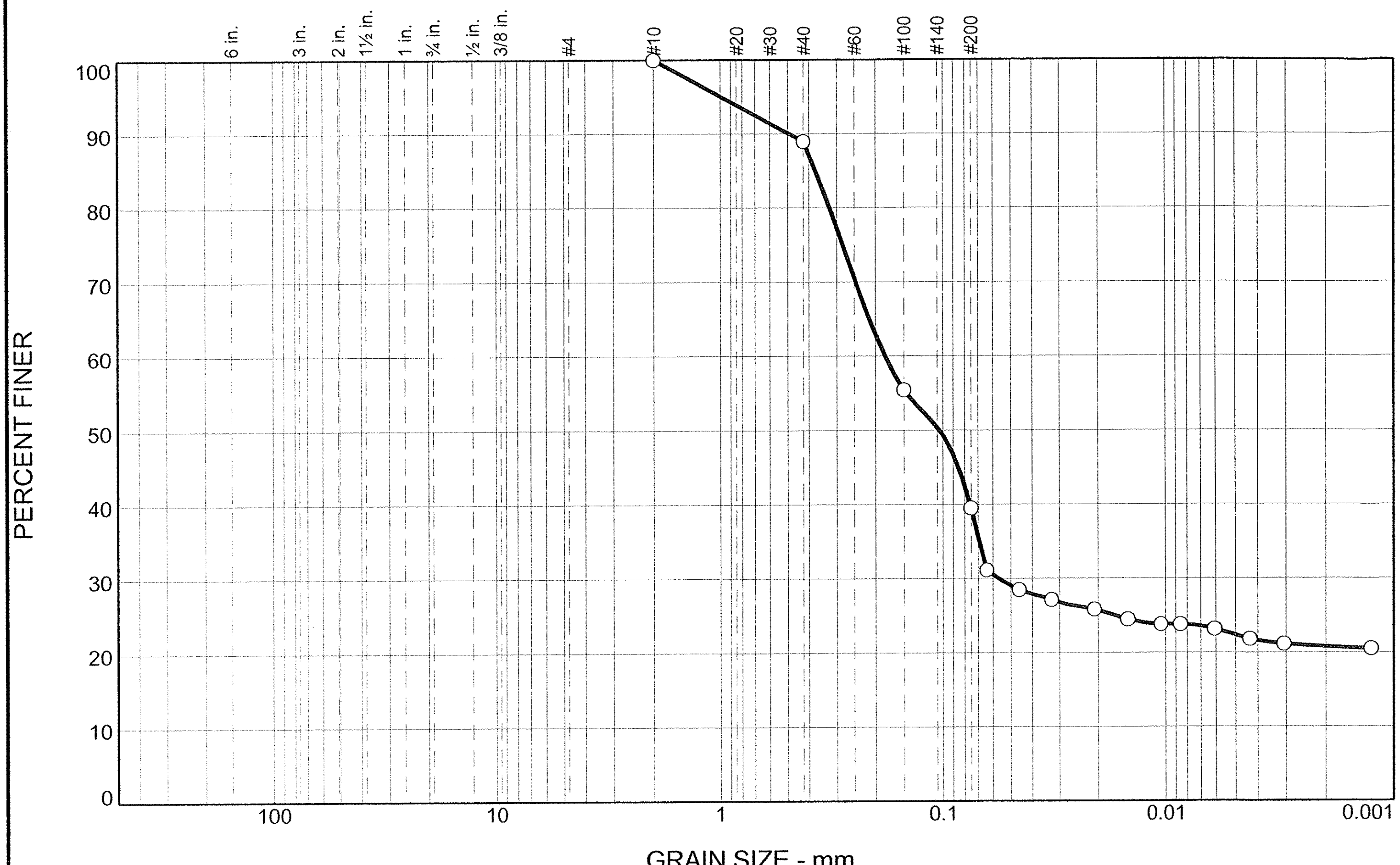
**Date:** 12/09/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 11.0 | 49.5 | 17.1 | 22.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 89.0 | | |
| #100 | 55.5 | | |
| #200 | 39.5 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, BROWNISH GRAY

**Atterberg Limits**

PL= 14 LL= 38 PI= 24

**Coefficients**

$D_{90}$= 0.4902 $D_{85}$= 0.3732 $D_{60}$= 0.1816
$D_{50}$= 0.1036 $D_{30}$= 0.0564 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(4)

**Remarks**

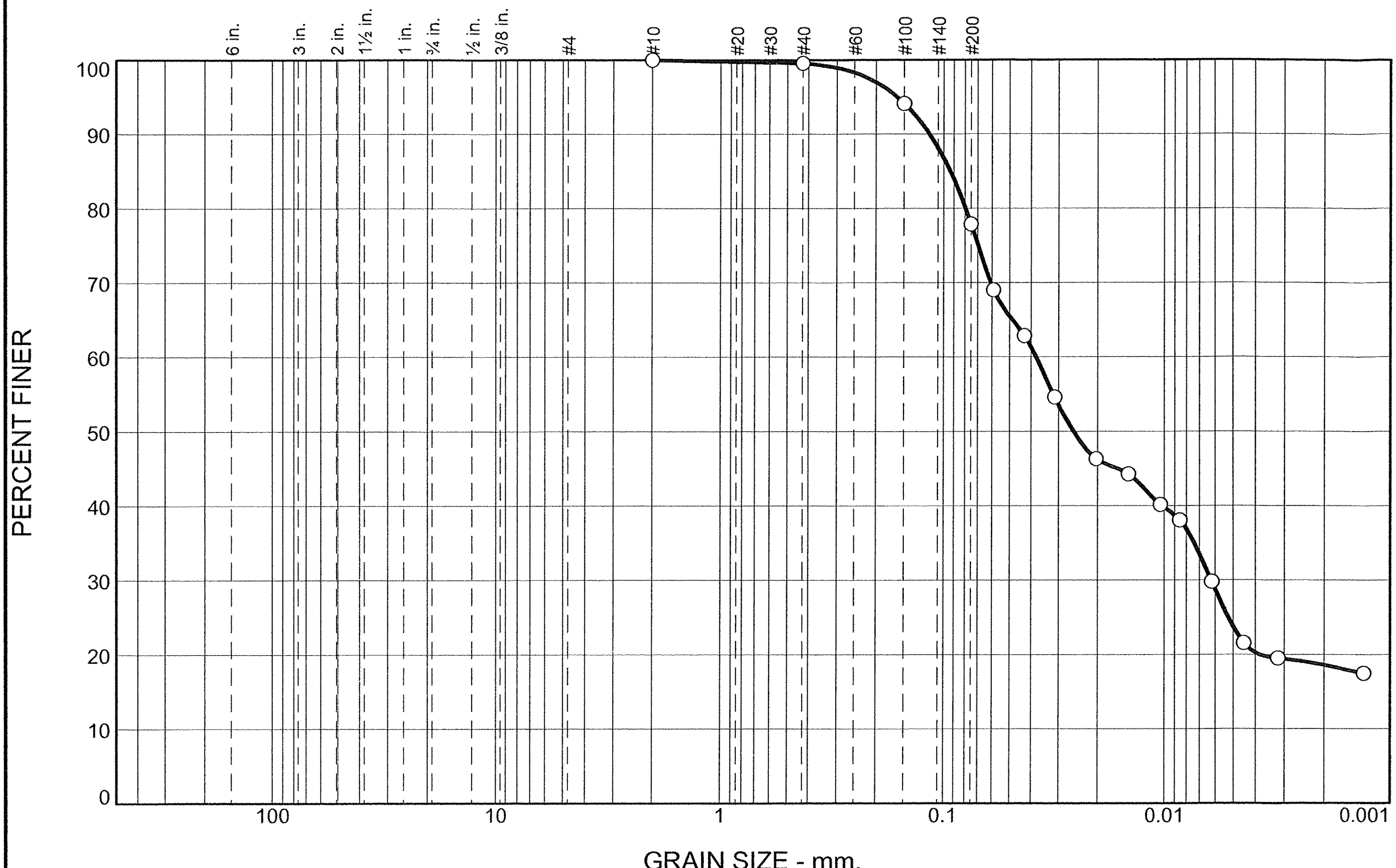
**Source of Sample:** B-1-1 **Depth:** 20'-22'
**Sample Number:** B-1-1 S-11

**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 21.7 | 54.2 | 23.7 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 99.6 | | |
| #100 | 94.1 | | |
| #200 | 77.9 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, SOME SAND, LIGHT GRAY

**Atterberg Limits**

PL= 17 LL= 42 PI= 25

**Coefficients**

$D_{90}$= 0.1156 $D_{85}$= 0.0934 $D_{60}$= 0.0380
$D_{50}$= 0.0258 $D_{30}$= 0.0062 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-7-6(18)

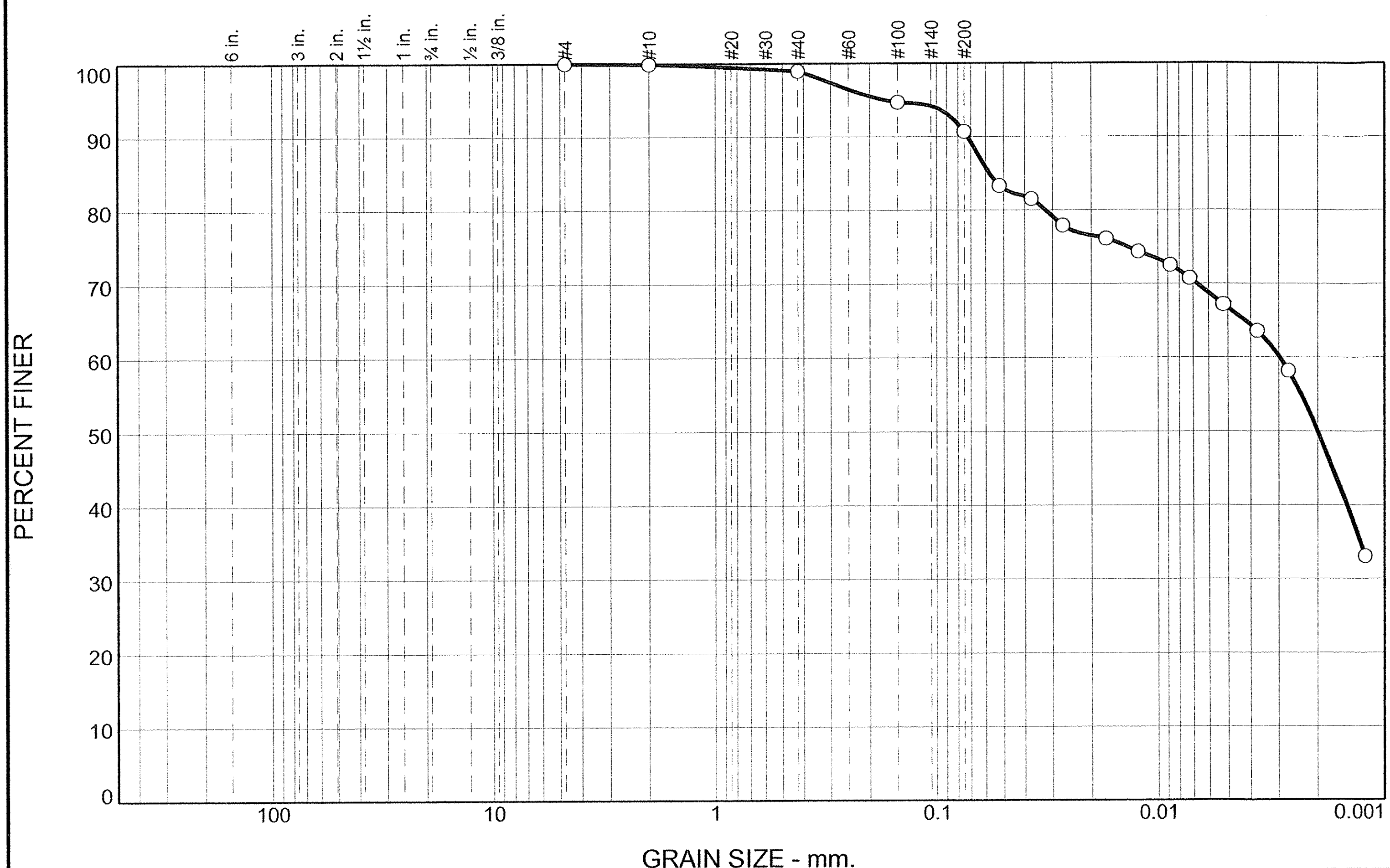
**Remarks**

**Source of Sample:** B-1-1 **Depth:** 90'-90.4'
**Sample Number:** B-1-1 S-34 **Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 8.2 | 23.9 | 66.8 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #40 | 98.9 | | |
| #100 | 94.7 | | |
| #200 | 90.7 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, TRACE SAND, BROWN

**Atterberg Limits**

PL= 28 LL= 79 PI= 51

**Coefficients**

$D_{90}$= 0.0724 $D_{85}$= 0.0576 $D_{60}$= 0.0030
$D_{50}$= 0.0020 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CH AASHTO= A-7-6(53)

**Remarks**

**Source of Sample:** B-1-1 **Depth:** 120'-121'
**Sample Number:** B-1-1 S-40

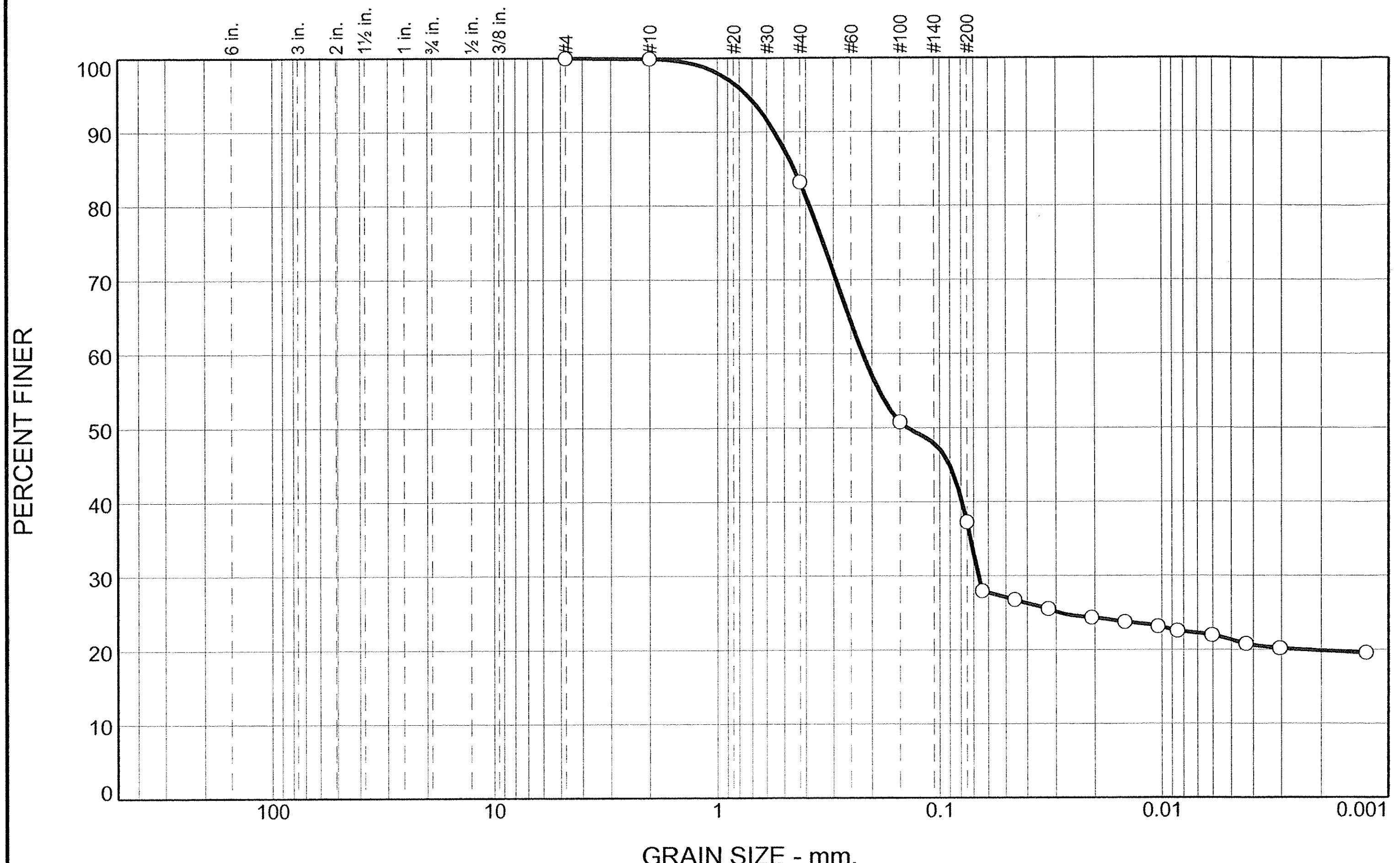
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 16.7 | 45.9 | 15.9 | 21.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #40 | 83.2 | | |
| #100 | 50.8 | | |
| #200 | 37.3 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAYISH BROWN

**Atterberg Limits**

PL= 14 LL= 38 PI= 24

**Coefficients**

$D_{90}$= 0.5520 $D_{85}$= 0.4512 $D_{60}$= 0.2202
$D_{50}$= 0.1389 $D_{30}$= 0.0666 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(3)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 10'-12'
**Sample Number:** B-2-1 S-6

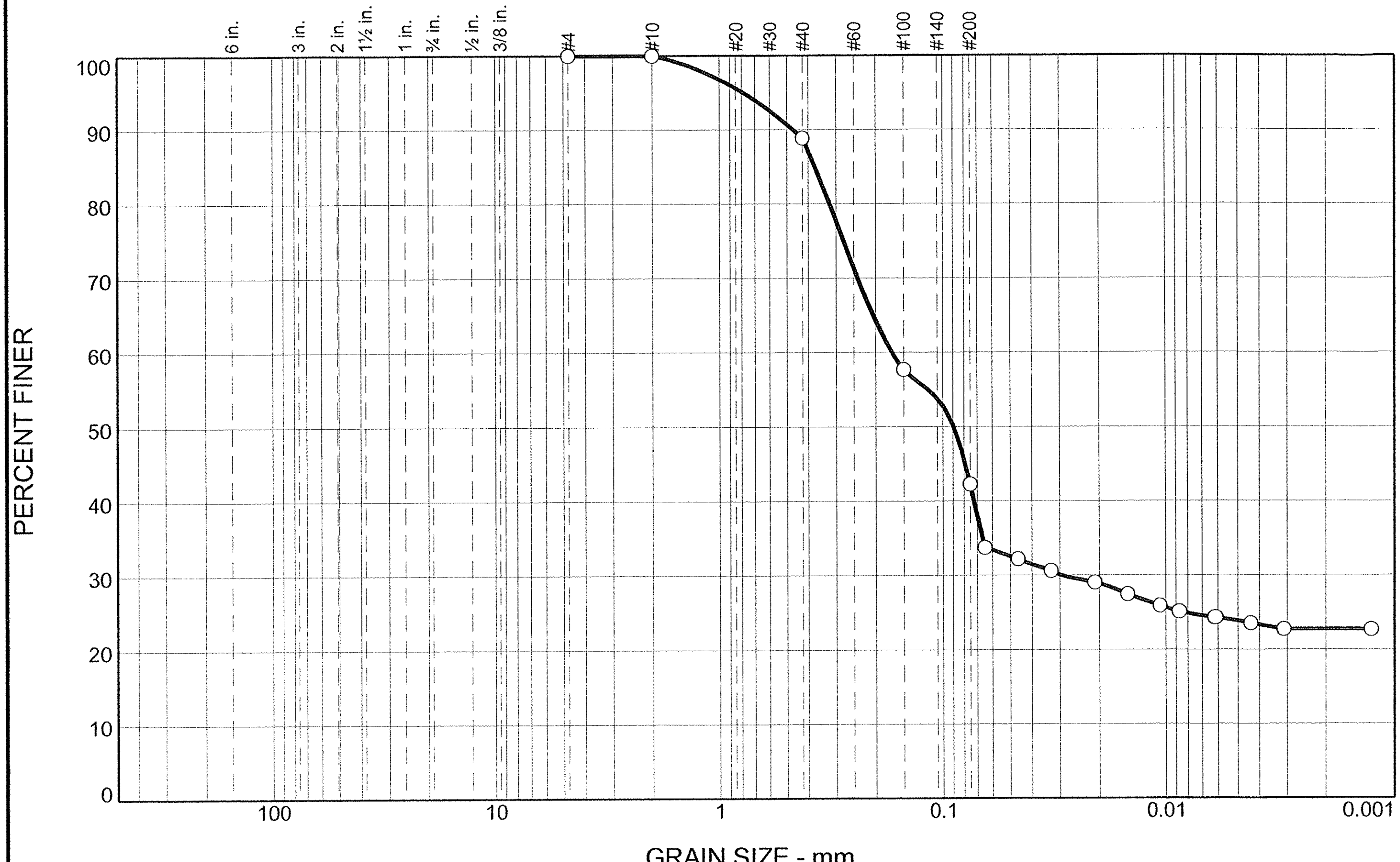
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 11.1 | 46.6 | 18.4 | 23.9 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 100.0 | | |
| #40 | 88.9 | | |
| #100 | 57.7 | | |
| #200 | 42.3 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAYISH BROWN

**Atterberg Limits**

PL= 13 LL= 41 PI= 28

**Coefficients**

$D_{90}$= 0.4679 $D_{85}$= 0.3722 $D_{60}$= 0.1697
$D_{50}$= 0.0893 $D_{30}$= 0.0293 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-7-6(6)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 18'-20'
**Sample Number:** B-2-1 S-10

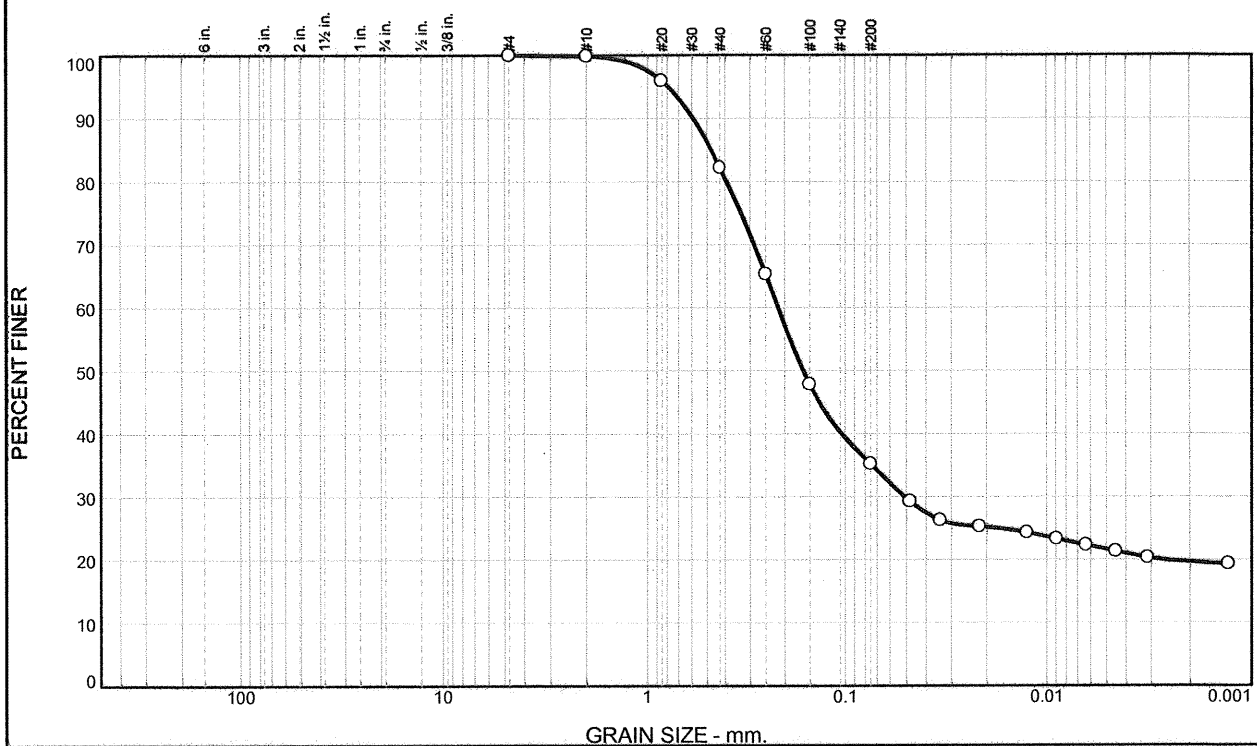
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.1 | 17.7 | 47.0 | 13.6 | 21.6 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.9 | | |
| #20 | 96.0 | | |
| #40 | 82.2 | | |
| #60 | 65.3 | | |
| #100 | 47.8 | | |
| #200 | 35.2 | | |

* (no specification provided)

**Material Description**

Clayey F-M Sand Little Silt - Brownish Gray

**Atterberg Limits**

PL= 18 LL= 42 PI= 24

**Coefficients**

$D_{90}$= 0.5889 $D_{85}$= 0.4733 $D_{60}$= 0.2159
$D_{50}$= 0.1616 $D_{30}$= 0.0509 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-2-7(3)

**Remarks**

**Source of Sample:** Boring 2-1 **Depth:** 26.0-28.0
**Sample Number:** S-14

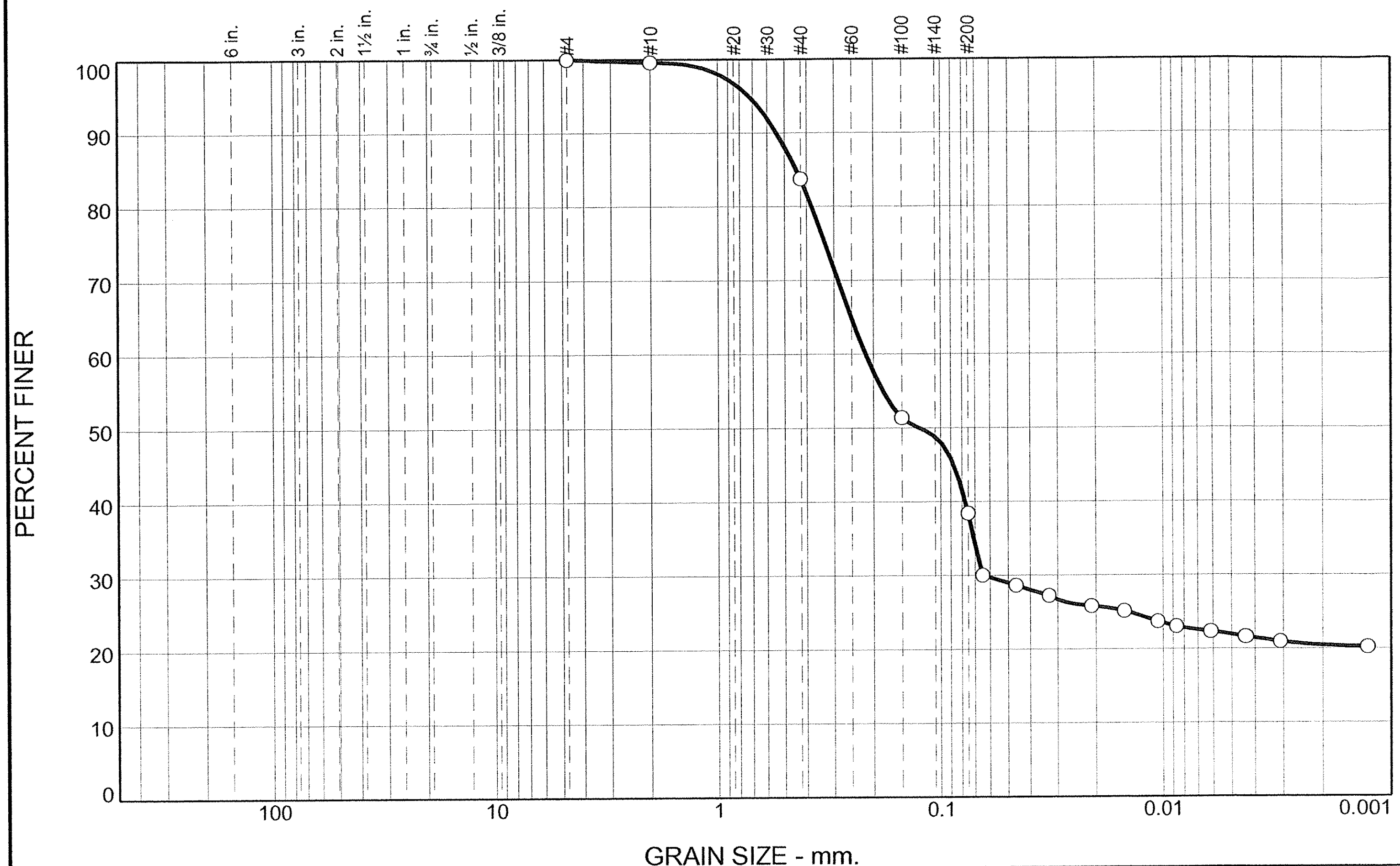
**Date:** 12/7/2011

AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility
**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.4 | 15.8 | 45.4 | 16.4 | 22.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.6 | | |
| #40 | 83.8 | | |
| #100 | 51.4 | | |
| #200 | 38.4 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAY

**Atterberg Limits**

PL= 14 LL= 29 PI= 15

**Coefficients**

$D_{90}$= 0.5414 $D_{85}$= 0.4433 $D_{60}$= 0.2165
$D_{50}$= 0.1251 $D_{30}$= 0.0637 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(2)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 32'-34'
**Sample Number:** B-2-1 S-17

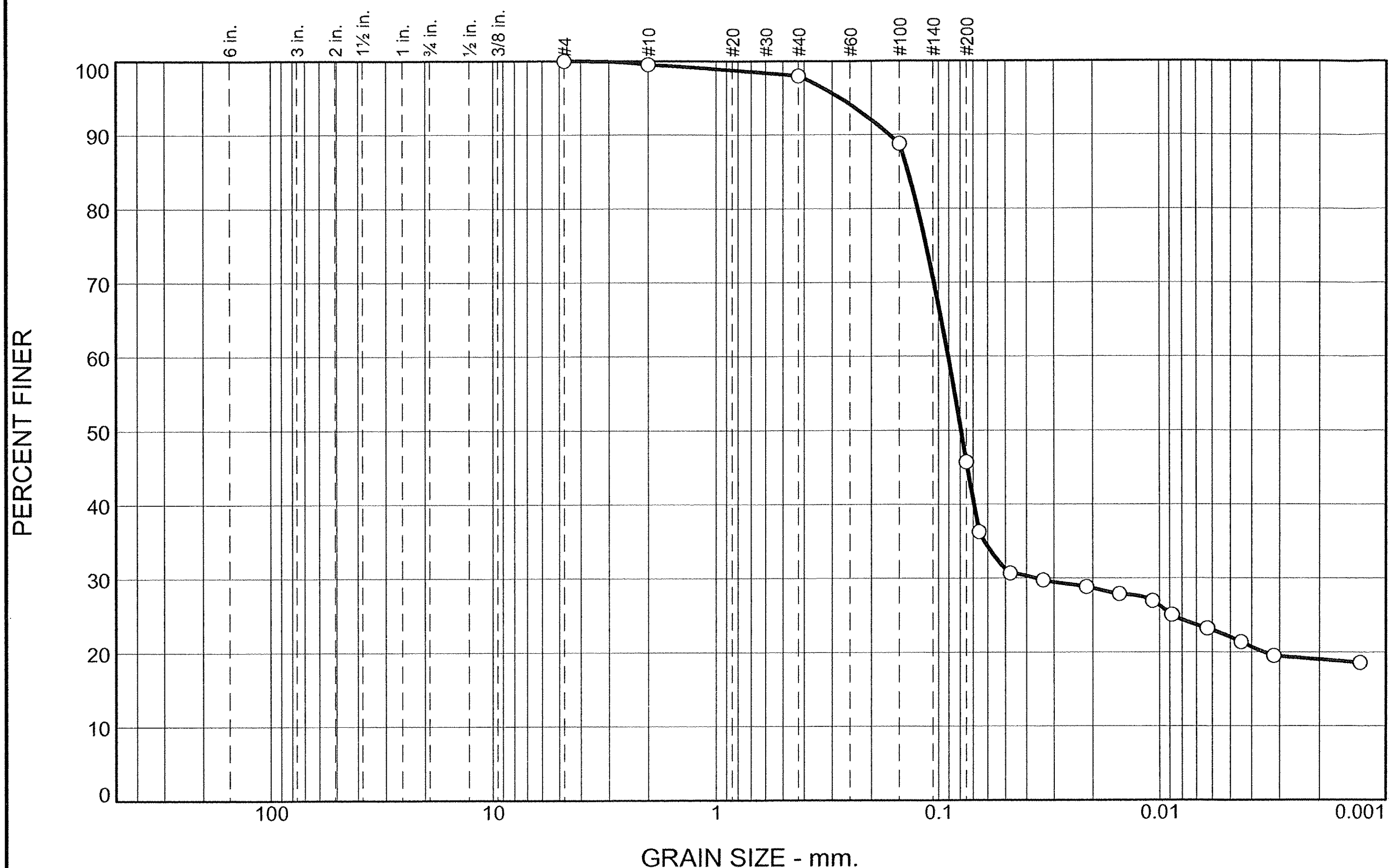
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.5 | 1.5 | 52.3 | 23.7 | 22.0 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.5 | | |
| #40 | 98.0 | | |
| #100 | 88.8 | | |
| #200 | 45.7 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE SAND, LIGHT GRAY

**Atterberg Limits**

PL= 17 LL= 28 PI= 11

**Coefficients**

$D_{90}$= 0.1663 $D_{85}$= 0.1371 $D_{60}$= 0.0906
$D_{50}$= 0.0793 $D_{30}$= 0.0362 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(2)

**Remarks**

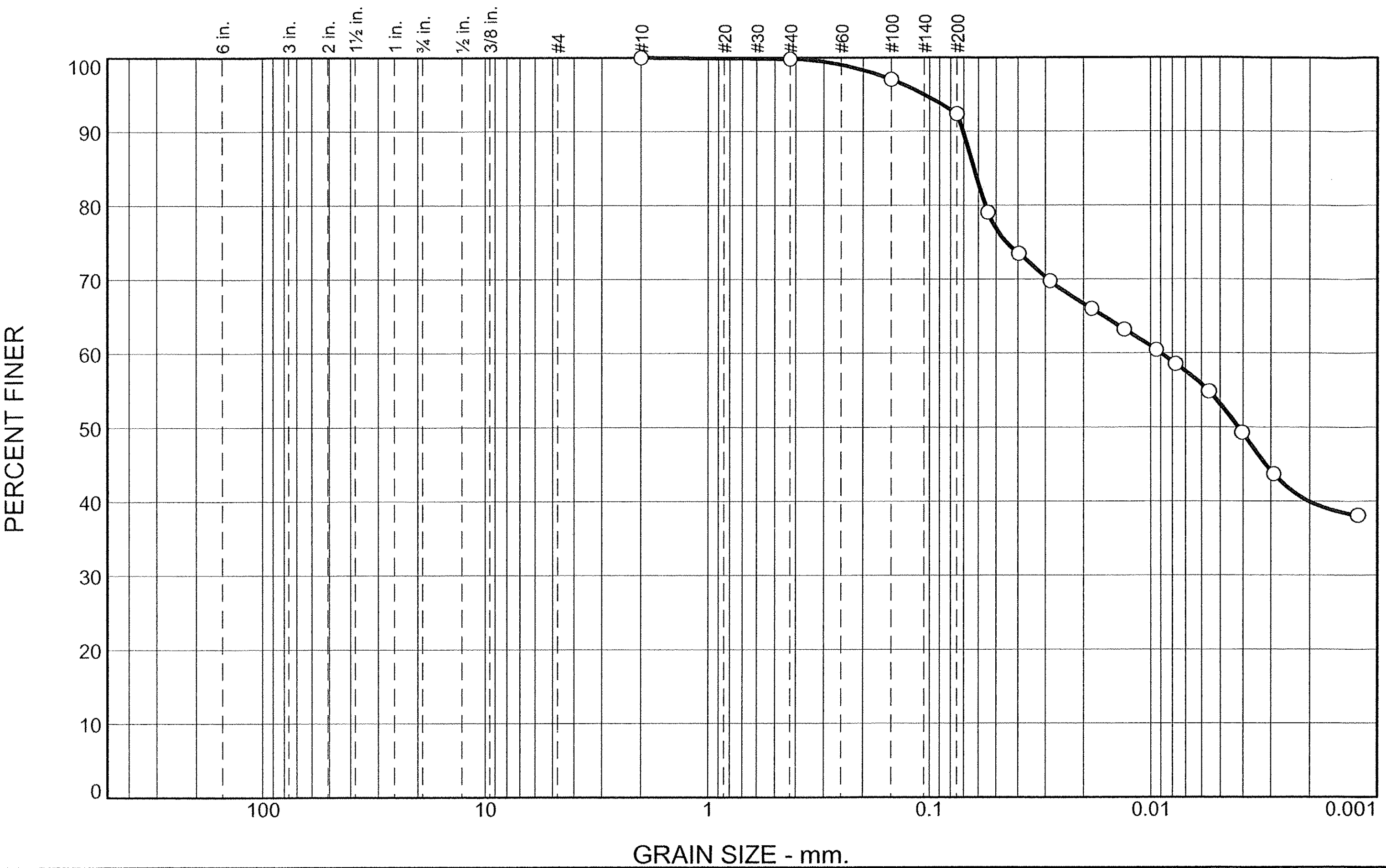
**Source of Sample:** B-2-1 **Depth:** 55.0'-56.6'
**Sample Number:** B-2-1 S-27

**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 7.4 | 39.2 | 53.2 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 99.8 | | |
| #100 | 97.0 | | |
| #200 | 92.4 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, TRACE SAND, LIGHT GRAYISH BROWN

**Atterberg Limits**

PL= 25 LL= 59 PI= 34

**Coefficients**

$D_{90}$= 0.0705 $D_{85}$= 0.0630 $D_{60}$= 0.0090
$D_{50}$= 0.0042 $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CH AASHTO= A-7-6(35)

**Remarks**

**Source of Sample:** B-2-1 **Depth:** 85.0'-86.5'
**Sample Number:** B-2-1 S-33

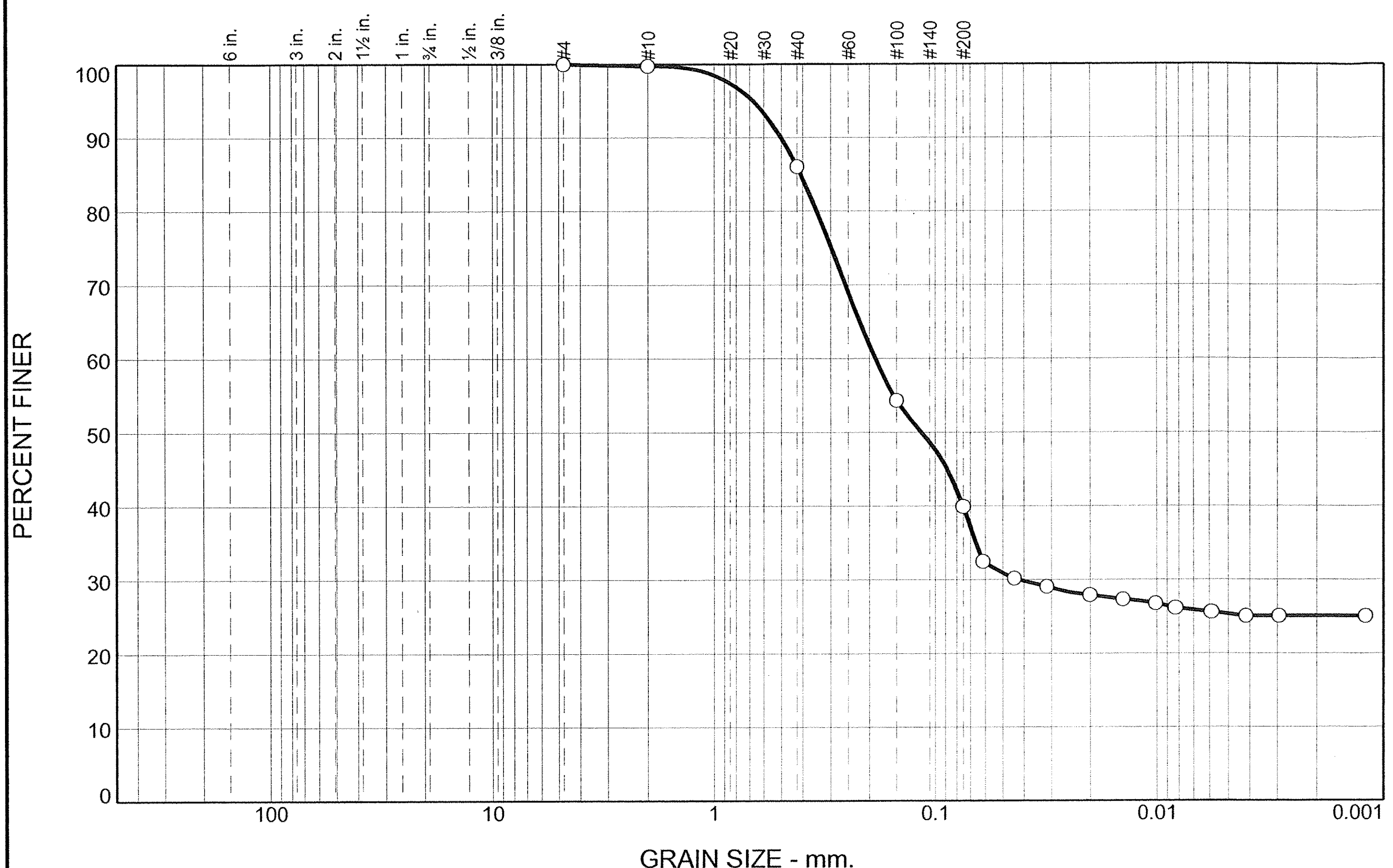
**Date:** 12/15/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.3 | 13.6 | 46.1 | 14.6 | 25.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.7 | | |
| #40 | 86.1 | | |
| #100 | 54.4 | | |
| #200 | 40.0 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, GRAY

**Atterberg Limits**

PL= 15 LL= 44 PI= 29

**Coefficients**

$D_{90}$= 0.5011 $D_{85}$= 0.4085 $D_{60}$= 0.1882
$D_{50}$= 0.1152 $D_{30}$= 0.0416 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-7-6(6)

**Remarks**

**Source of Sample:** B-3-1 **Depth:** 16.0'-17.8'
**Sample Number:** B-3-1 S-9

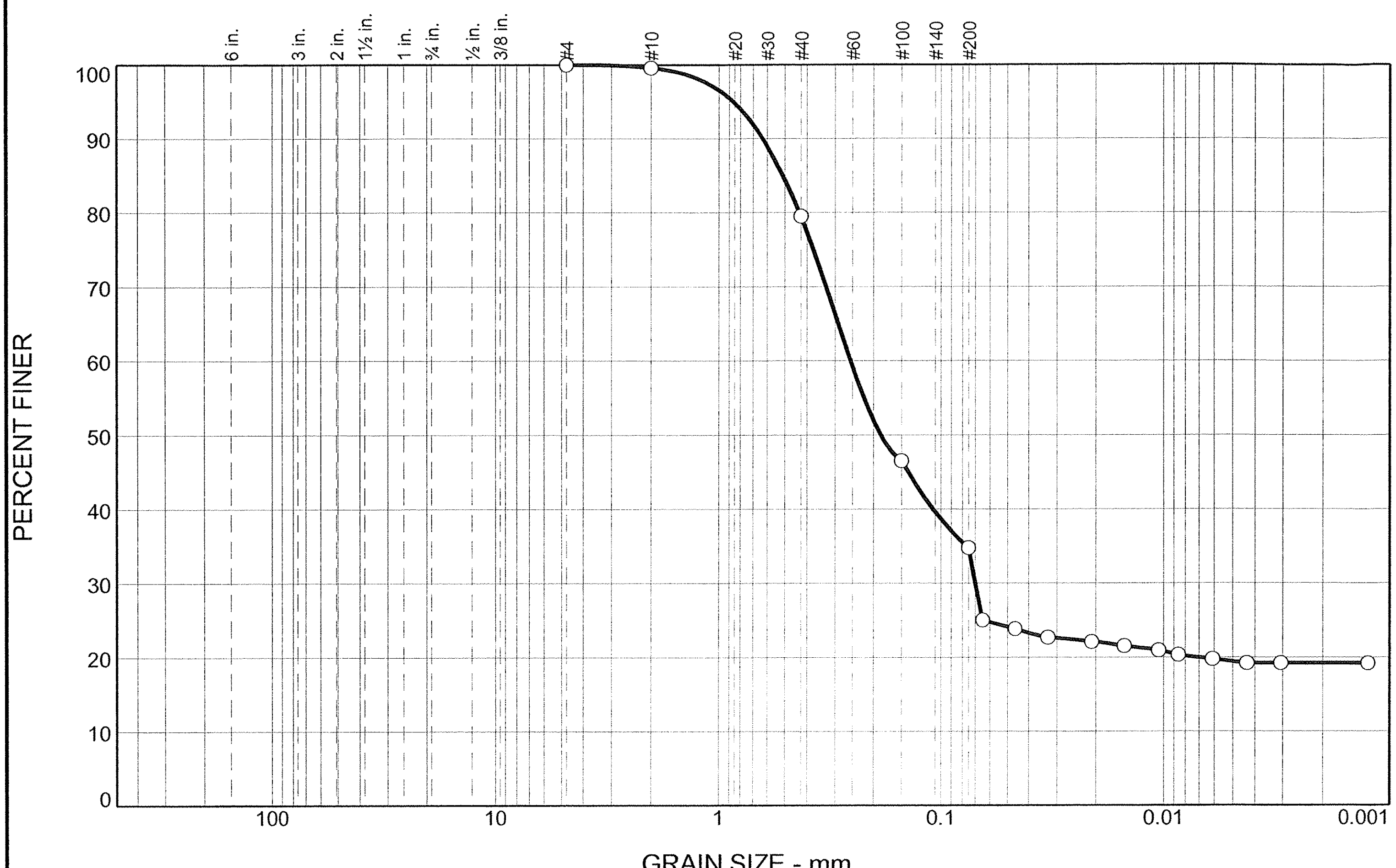
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.4 | 20.1 | 44.7 | 15.4 | 19.4 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #4 | 100.0 | | |
| #10 | 99.6 | | |
| #40 | 79.5 | | |
| #100 | 46.5 | | |
| #200 | 34.8 | | |

* (no specification provided)

**Material Description**

CLAYEY FINE TO MEDIUM SAND, DARK BROWN

**Atterberg Limits**

PL= 13 LL= 35 PI= 22

**Coefficients**

$D_{90}$= 0.6299 $D_{85}$= 0.5094 $D_{60}$= 0.2547
$D_{50}$= 0.1856 $D_{30}$= 0.0701 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-2-6(2)

**Remarks**

**Source of Sample:** B-3-1 **Depth:** 18'-20'
**Sample Number:** B-3-1 S-10

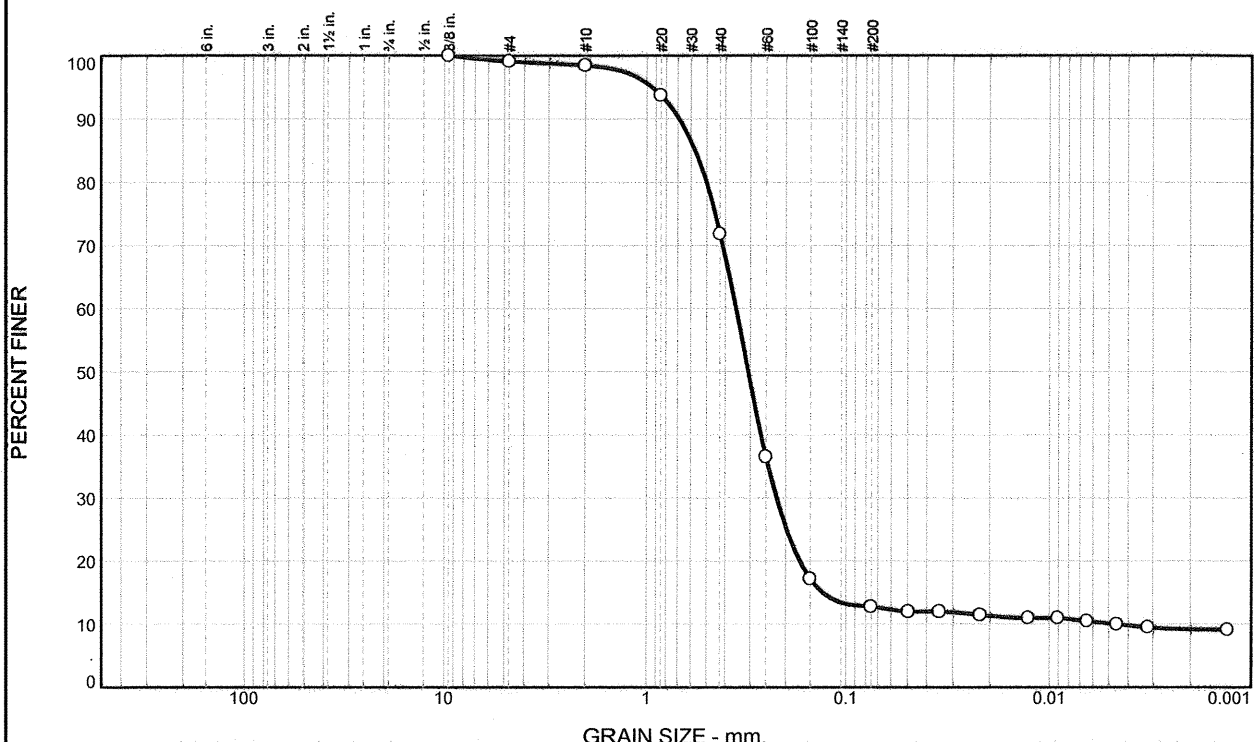
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.9 | 0.6 | 26.7 | 59.0 | 2.7 | 10.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| .375 | 100.0 | | |
| #4 | 99.1 | | |
| #10 | 98.5 | | |
| #20 | 93.7 | | |
| #40 | 71.8 | | |
| #60 | 36.5 | | |
| #100 | 17.2 | | |
| #200 | 12.8 | | |

* (no specification provided)

**Material Description**

F-M Sand Little Clay Trace Silt - Brownish Gray

**Atterberg Limits**

PL= 16 LL= 27 PI= 11

**Coefficients**

$D_{90}$= 0.6879 $D_{85}$= 0.5721 $D_{60}$= 0.3538
$D_{50}$= 0.3070 $D_{30}$= 0.2214 $D_{15}$= 0.1304
$D_{10}$= 0.0046 $C_u$= 76.58 $C_c$= 29.98

**Classification**

USCS= SC AASHTO= A-2-6(0)

**Remarks**

**Source of Sample:** Boring 4-1 **Depth:** 12.0-14.0
**Sample Number:** S-7

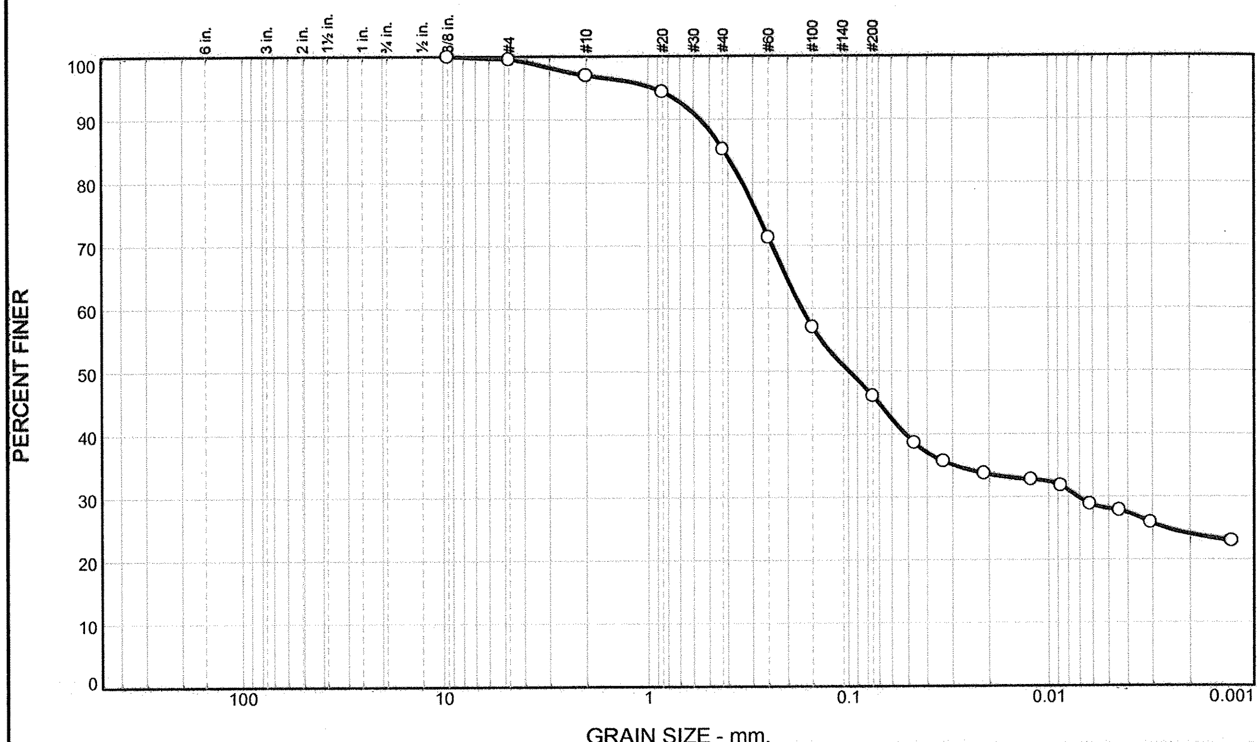
**Date:** 12/7/11

AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility
**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# PARTICLE SIZE ANALYSIS OF SOILS ASTM D422




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.4 | 2.6 | 11.8 | 39.2 | 17.9 | 28.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| .375 | 100.0 | | |
| #4 | 99.6 | | |
| #10 | 97.0 | | |
| #20 | 94.3 | | |
| #40 | 85.2 | | |
| #60 | 71.3 | | |
| #100 | 57.0 | | |
| #200 | 46.0 | | |

* (no specification provided)

**Material Description**

Clayey F-M Sand Little Silt - Brownish Gray

**Atterberg Limits**

PL= 16 LL= 40 PI= 24

**Coefficients**

$D_{90}$= 0.5576 $D_{85}$= 0.4206 $D_{60}$= 0.1695
$D_{50}$= 0.0994 $D_{30}$= 0.0071 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= SC AASHTO= A-6(7)

**Remarks**

**Source of Sample:** Boring 4-1 **Depth:** 24.0-26.0
**Sample Number:** S-13

**Date:** 12/7/11

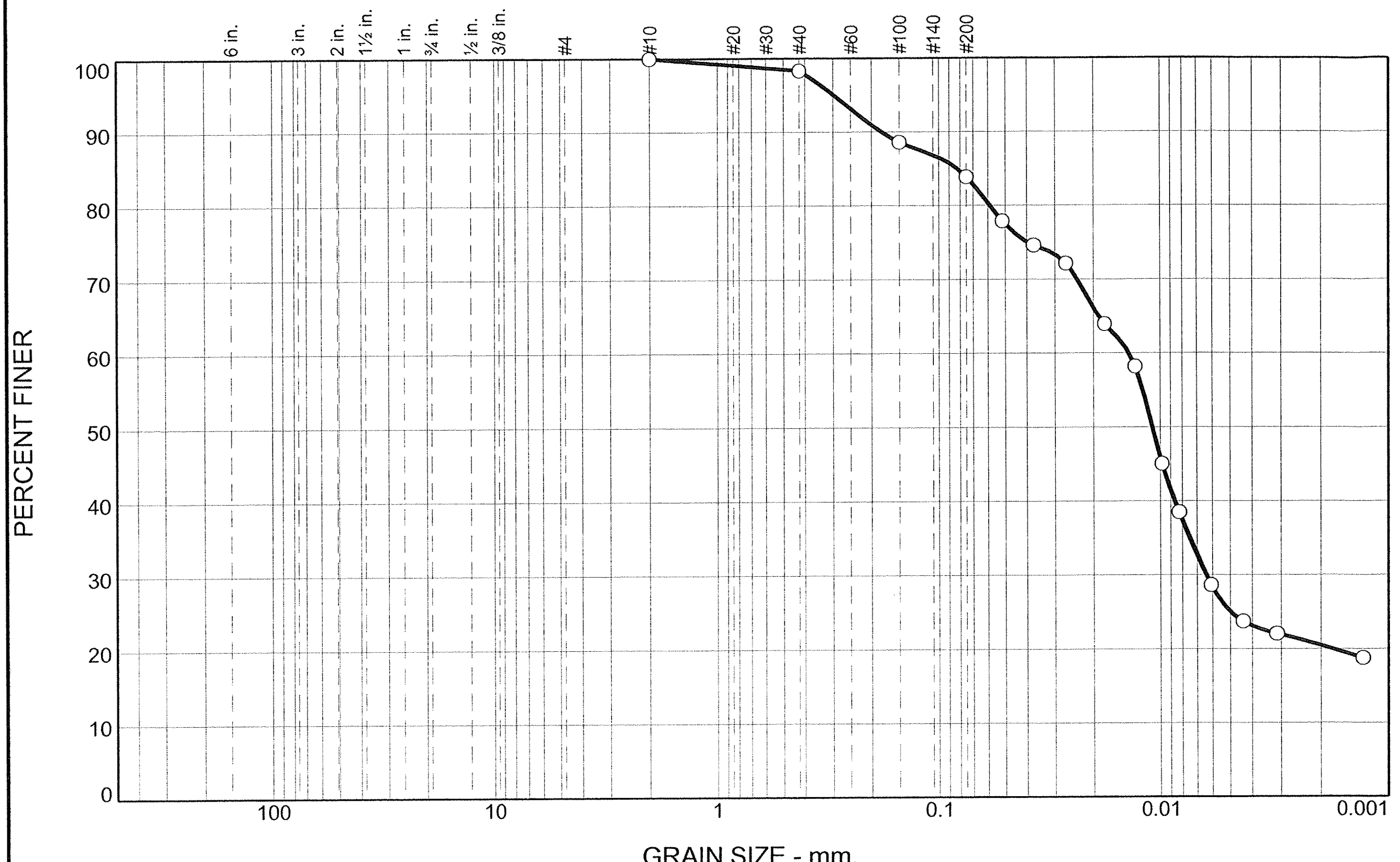
AECOM

**Client:** IPR-GDP Suez
**Project:** Coleto Creek Facility

**Project No:** 60225561

**Tested By:** BCM **Checked By:** WPQ

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| 0.0 | 0.0 | 0.0 | 0.0 | 1.7 | 14.4 | 58.8 | 25.1 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #10 | 100.0 | | |
| #40 | 98.3 | | |
| #100 | 88.6 | | |
| #200 | 83.9 | | |

* (no specification provided)

**Material Description**

SILTY CLAY, LITTLE FINE TO MEDIUM SAND, WHITE AND GRAY

**Atterberg Limits**

PL= 18 LL= 30 PI= 12

**Coefficients**

$D_{90}$= 0.1803 $D_{85}$= 0.0826 $D_{60}$= 0.0138
$D_{50}$= 0.0108 $D_{30}$= 0.0064 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= CL AASHTO= A-6(9)

**Remarks**

**Source of Sample:** B-5-1 **Depth:** 26'-27'
**Sample Number:** B-5-1 S-14

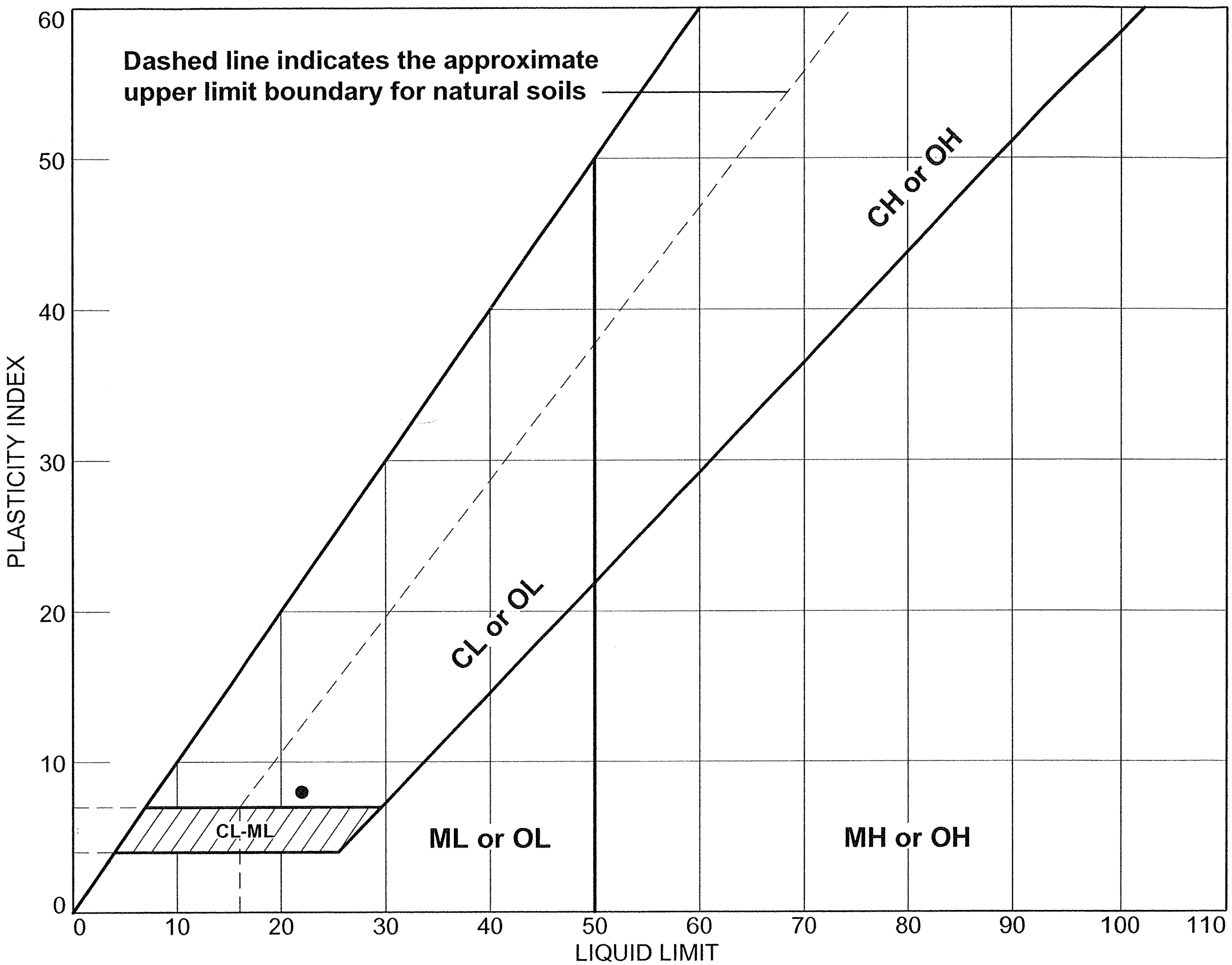
**Date:** 12/9/11

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



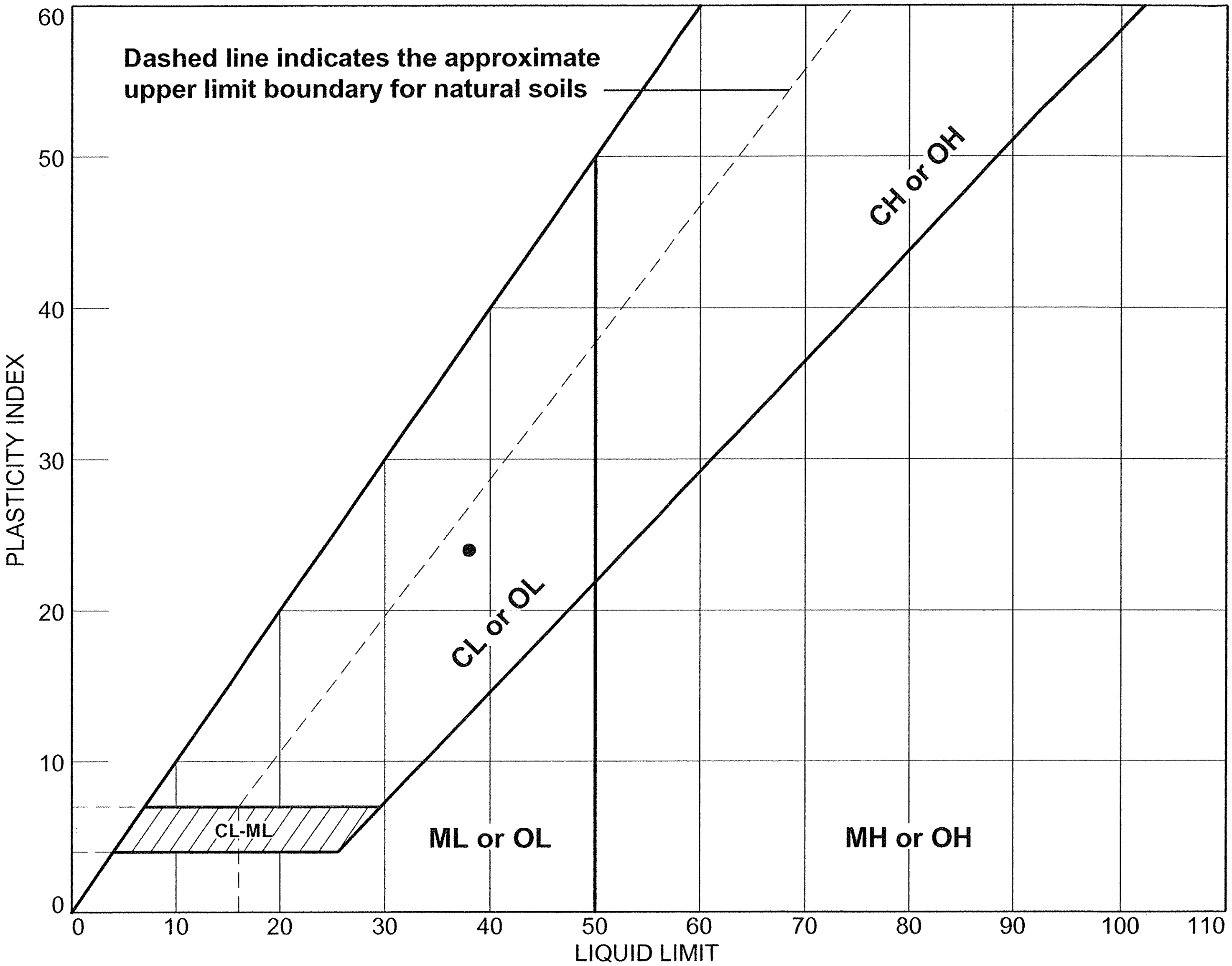

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-5 | 8'-10' | | 14 | 22 | 8 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



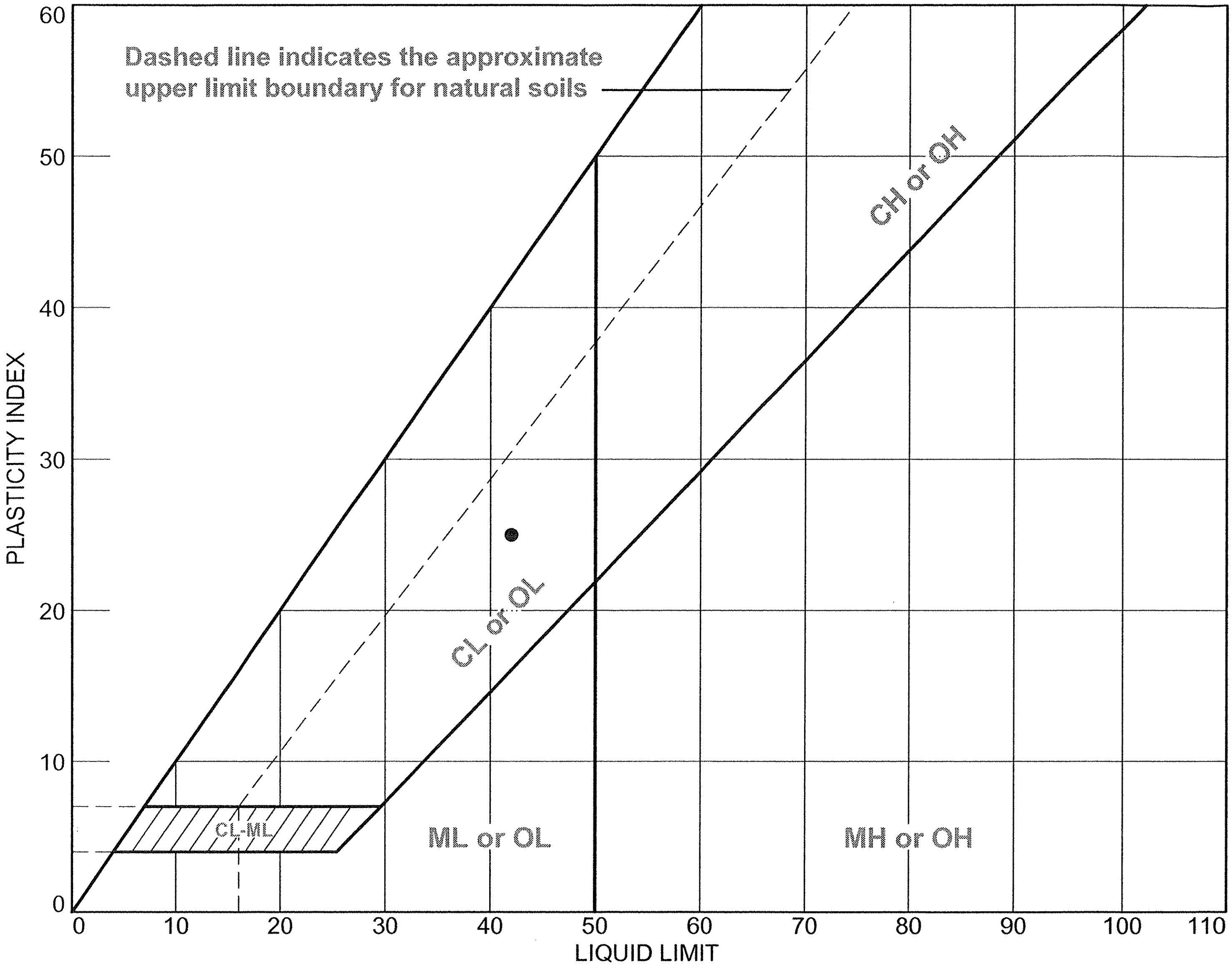

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-11 | 20'-22' | | 14 | 38 | 24 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




## SOIL DATA

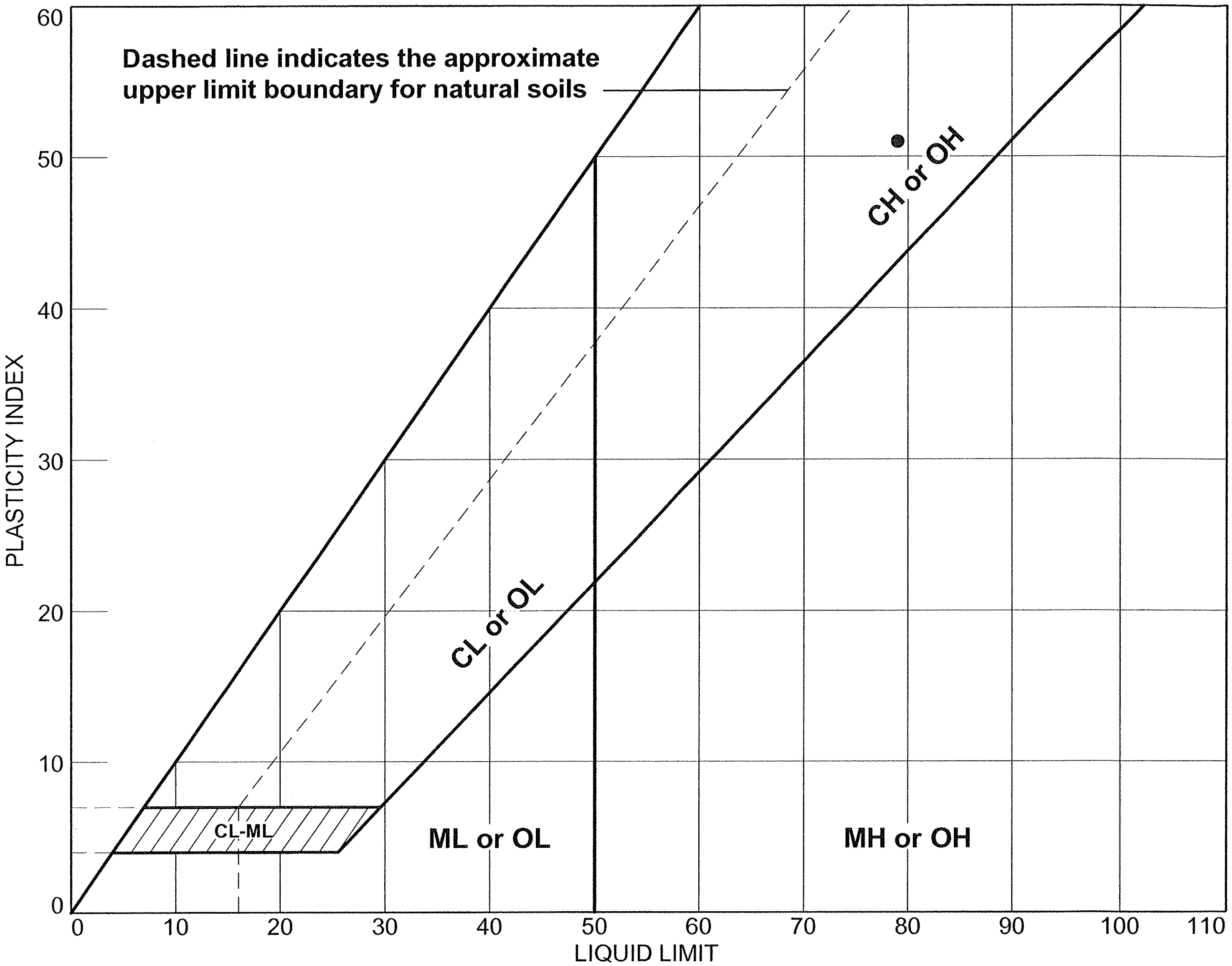
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | B-1-1 | B-1-1 S-34 | 90'-90.4' | | 17 | 42 | 25 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



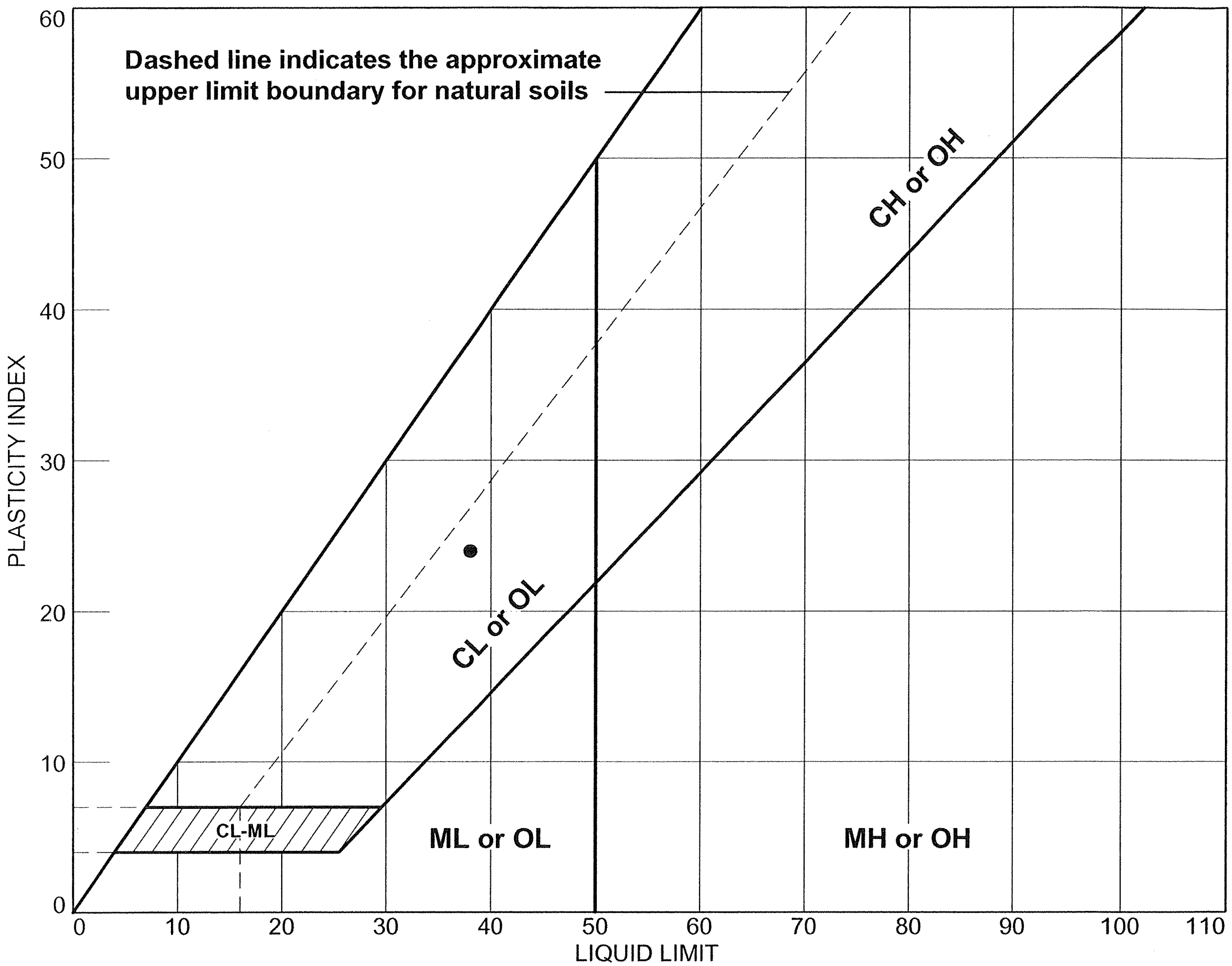

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-1-1 | B-1-1 S-40 | 120'-121' | | 28 | 79 | 51 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



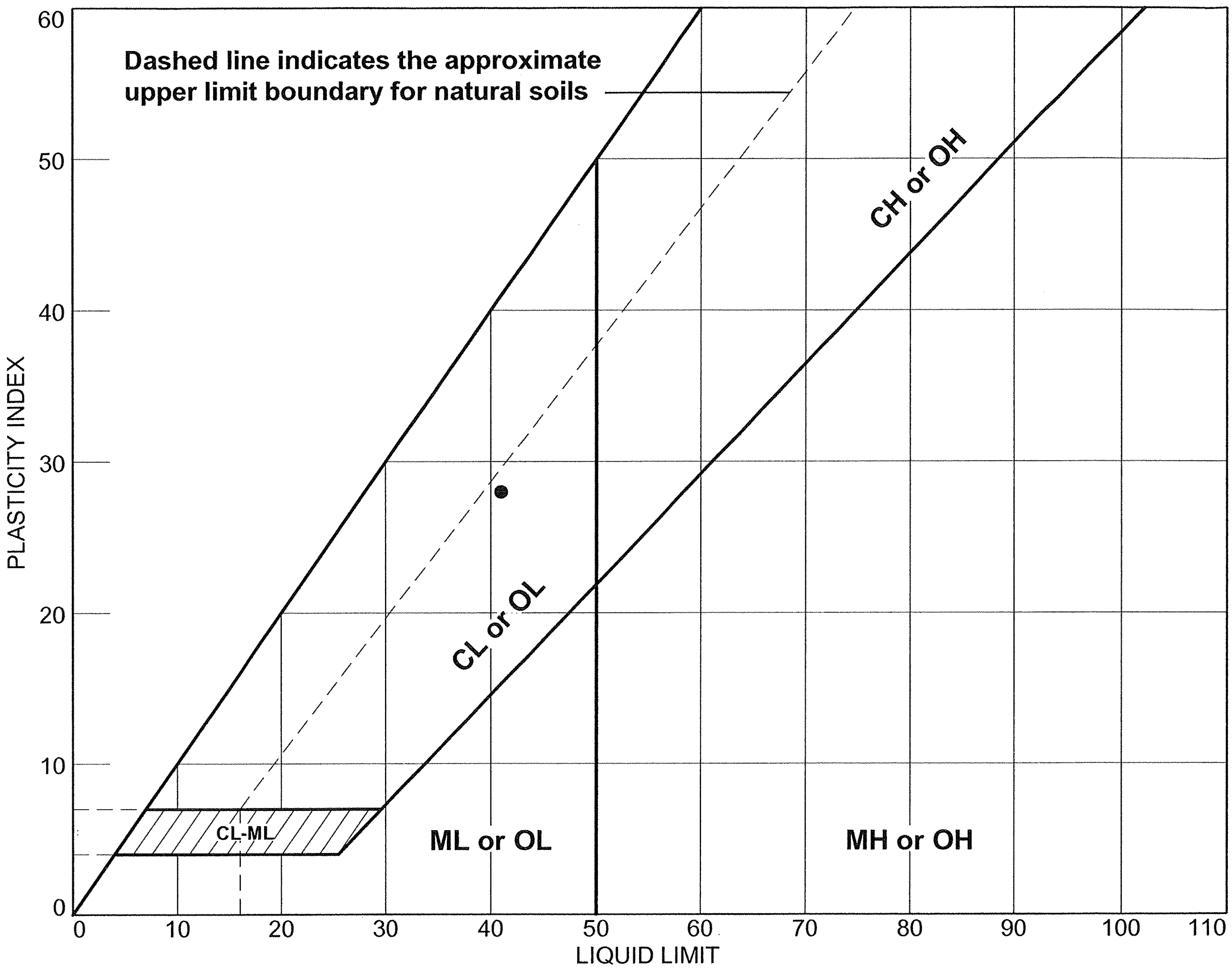

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-6 | 10'-12' | | 14 | 38 | 24 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT

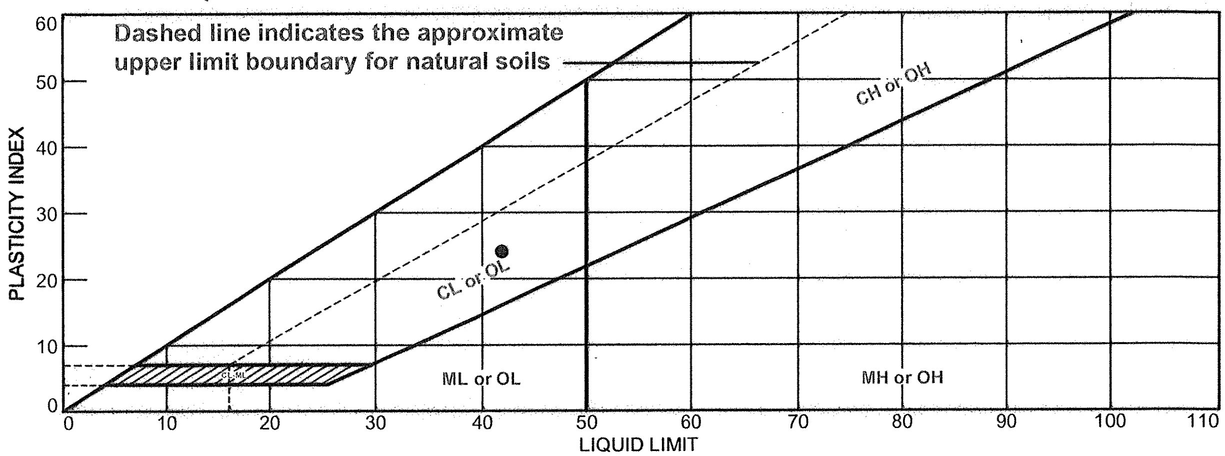


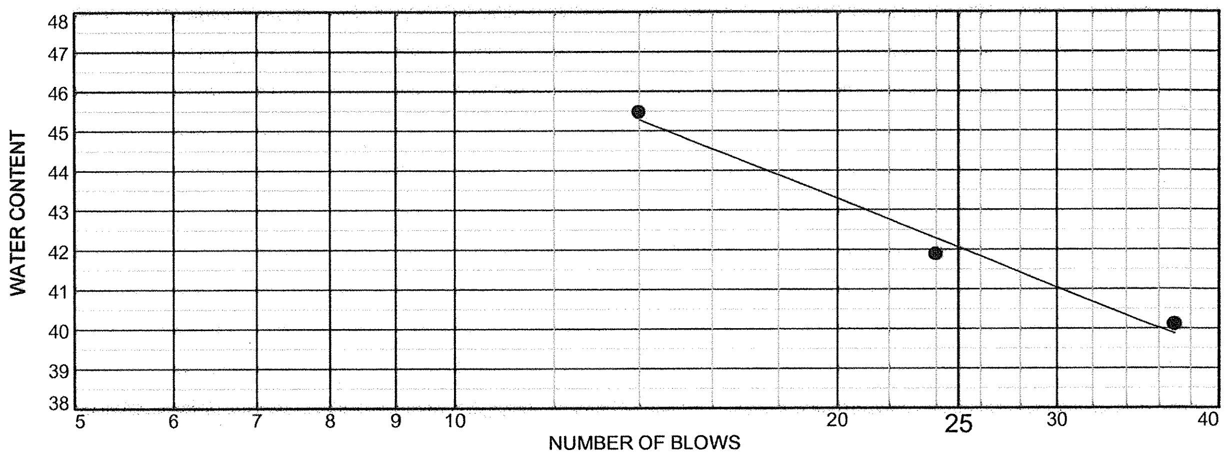

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-10 | 18'-20' | | 13 | 41 | 28 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No.:** 60225561
**Figure**

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Clayey F-M Sand Little Silt - Brownish Gray | 42 | 18 | 24 | 82.2 | 35.2 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

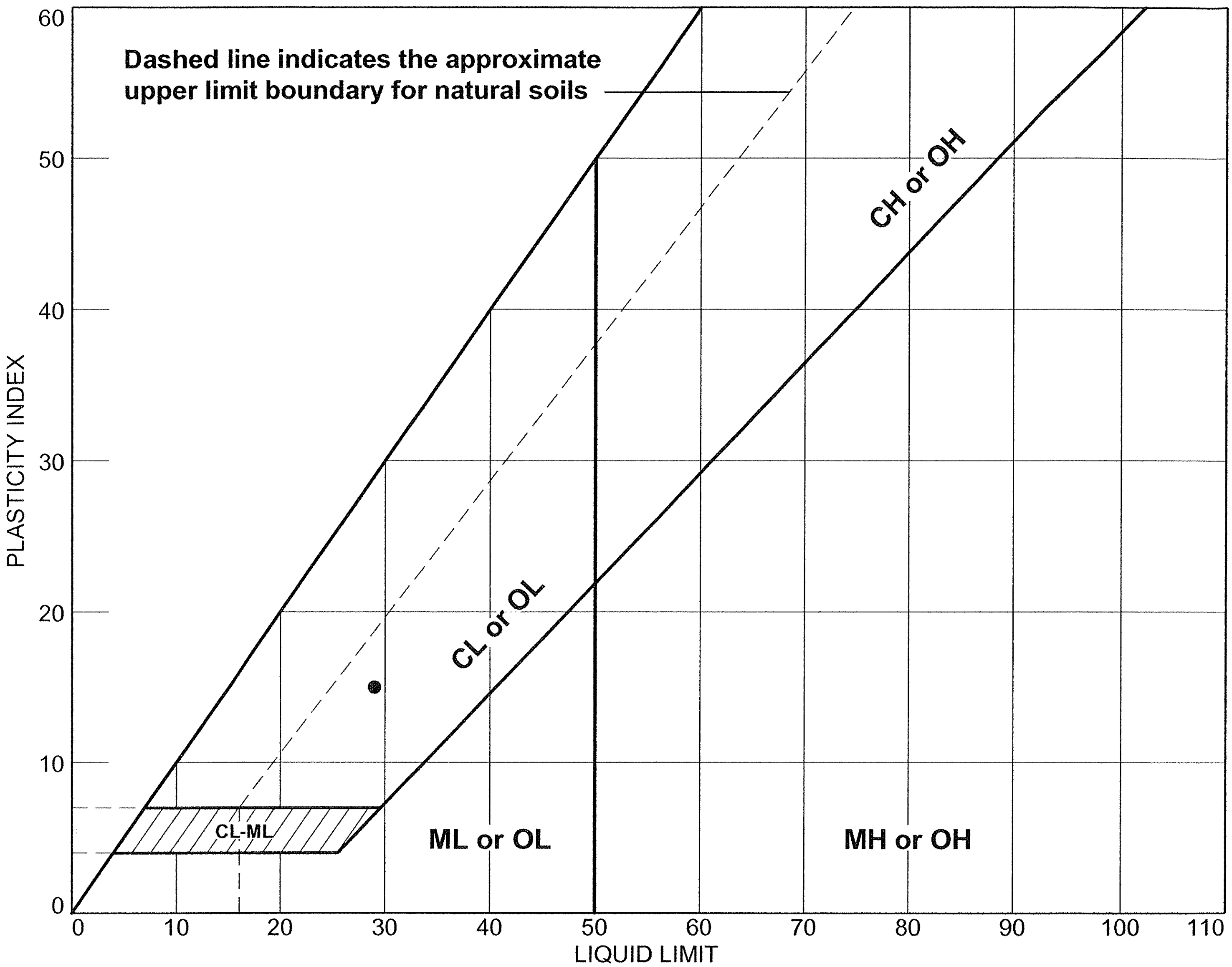
**Project:** Coleto Creek Facility

●**Source of Sample:** Boring 2-1 **Depth:** 26.0-28.0 **Sample Number:** S-14

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST REPORT



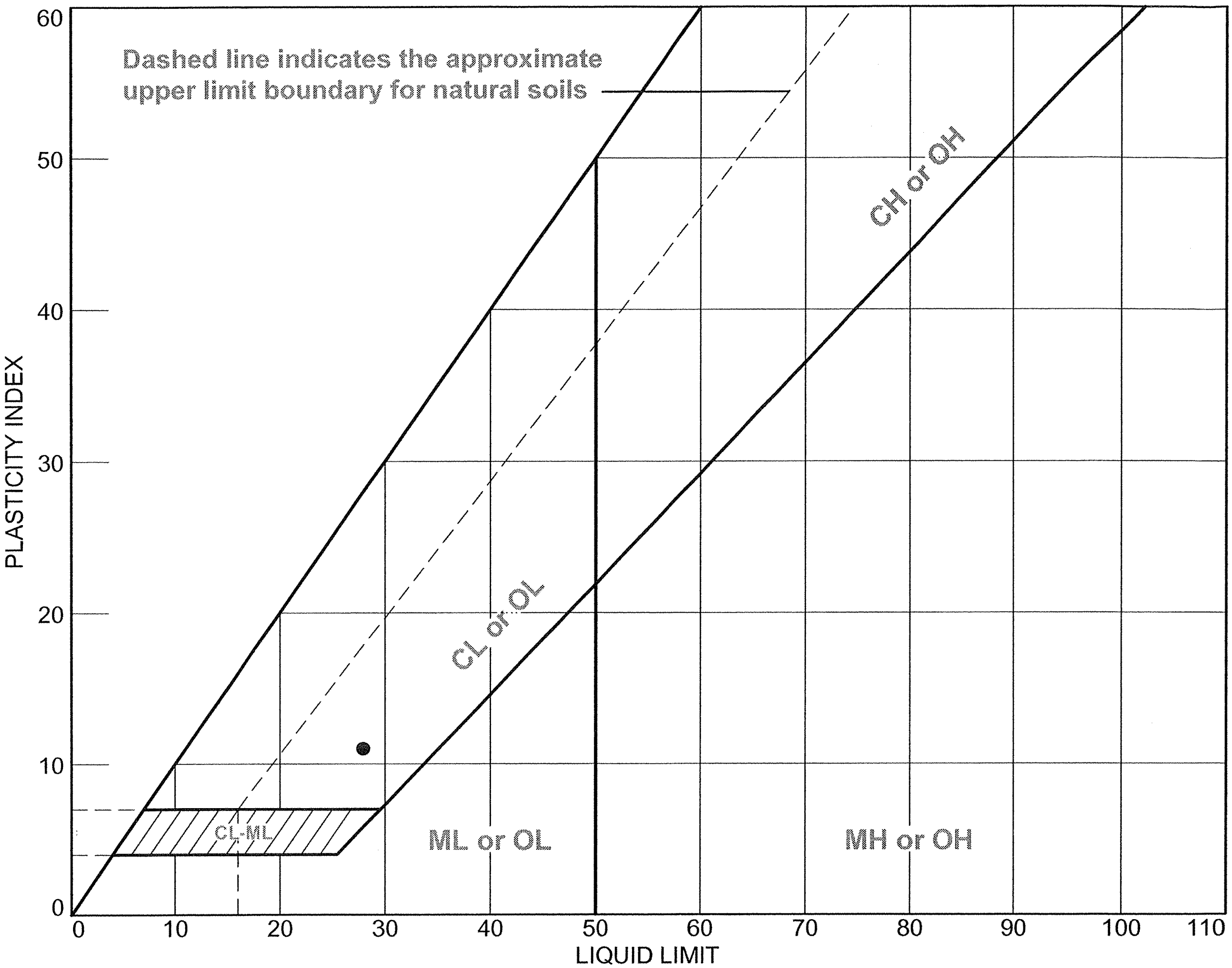

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-17 | 32'-34' | | 14 | 29 | 15 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




## SOIL DATA

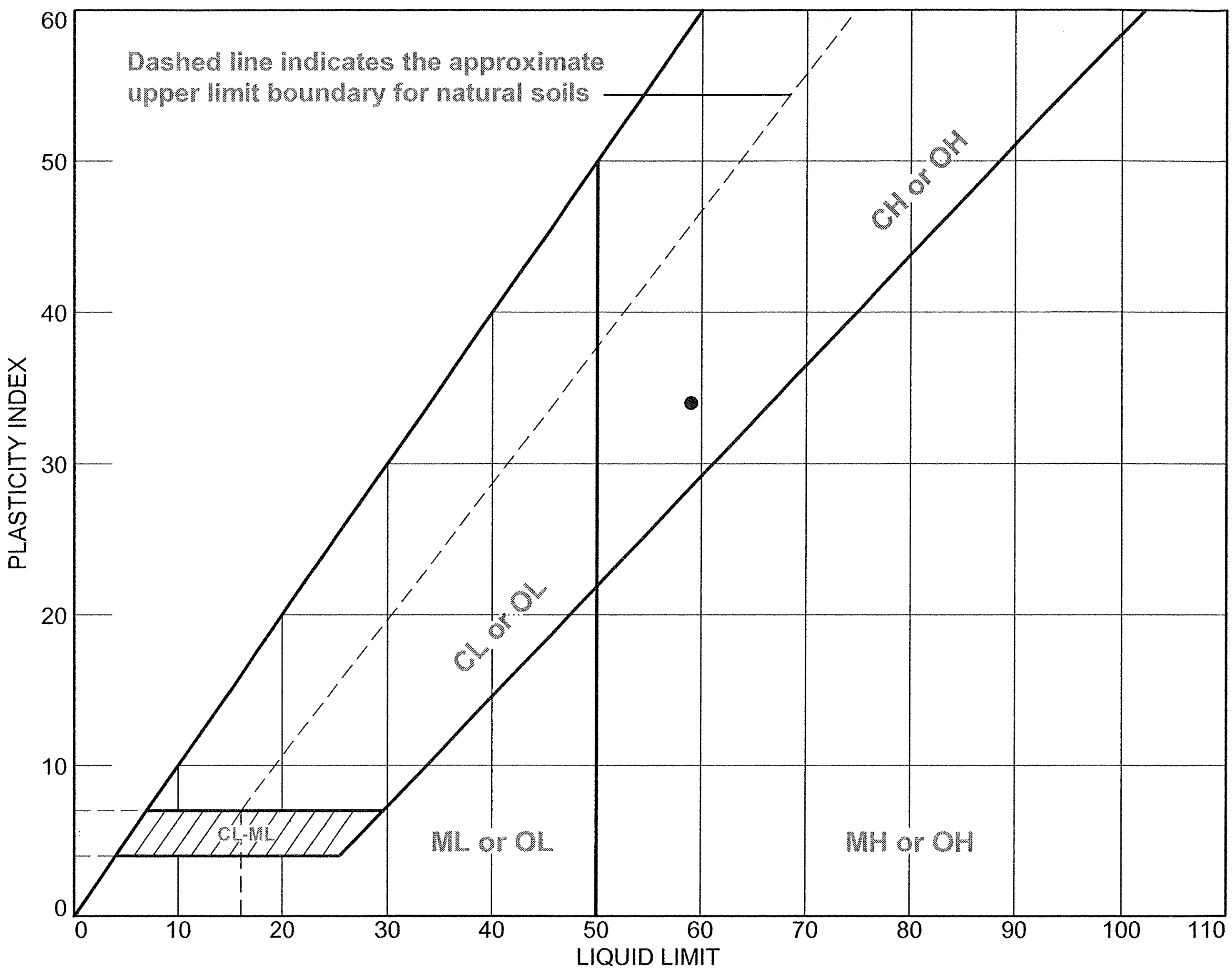
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
|---|---|---|---|---|---|---|---|---|
| ● | B-2-1 | B-2-1 S-27 | 55.0'-56.6' | | 17 | 28 | 11 | SC |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-1 | B-2-1 S-33 | 85.0'-86.5' | | 25 | 59 | 34 | CH |

AECOM

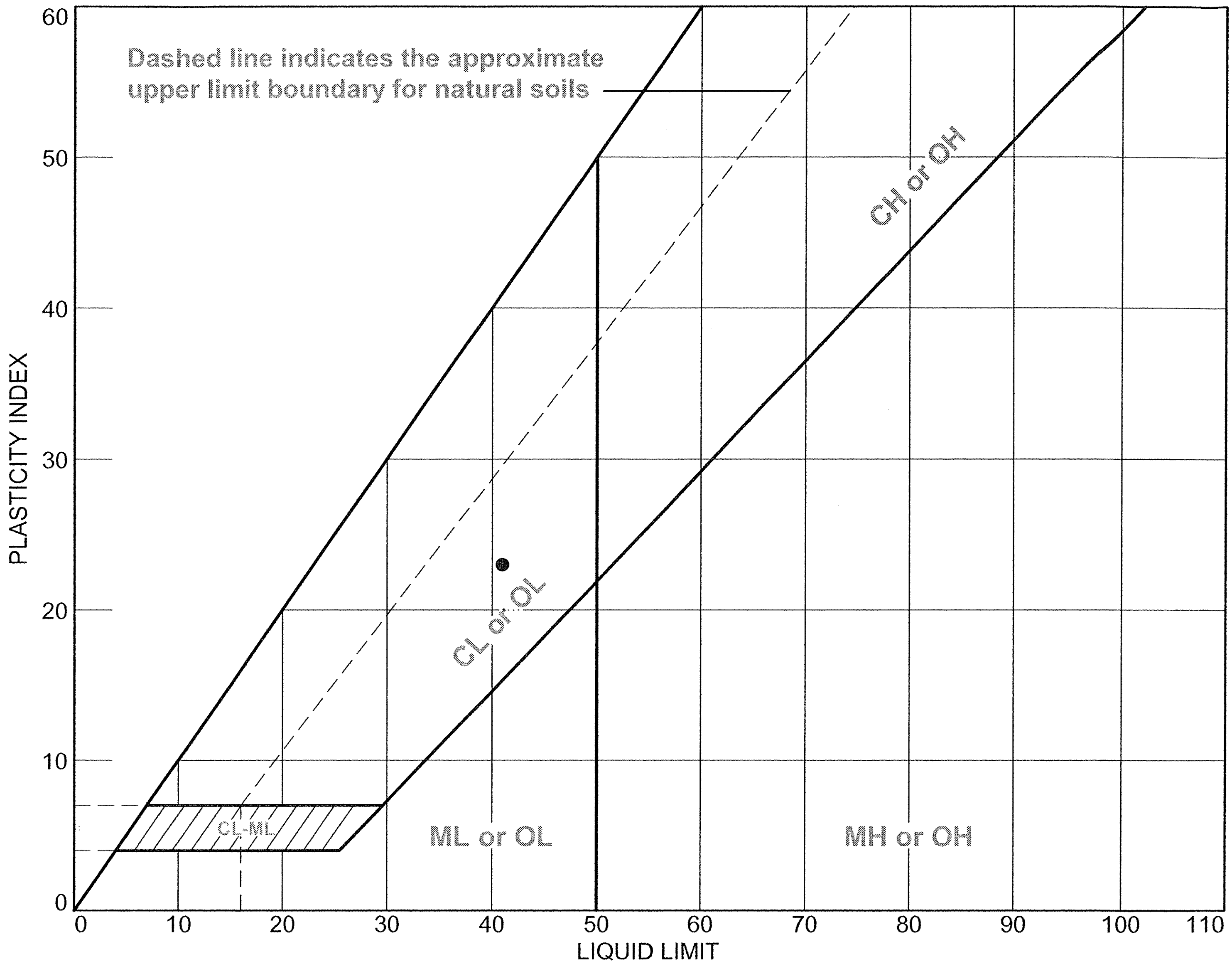
**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561

**Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



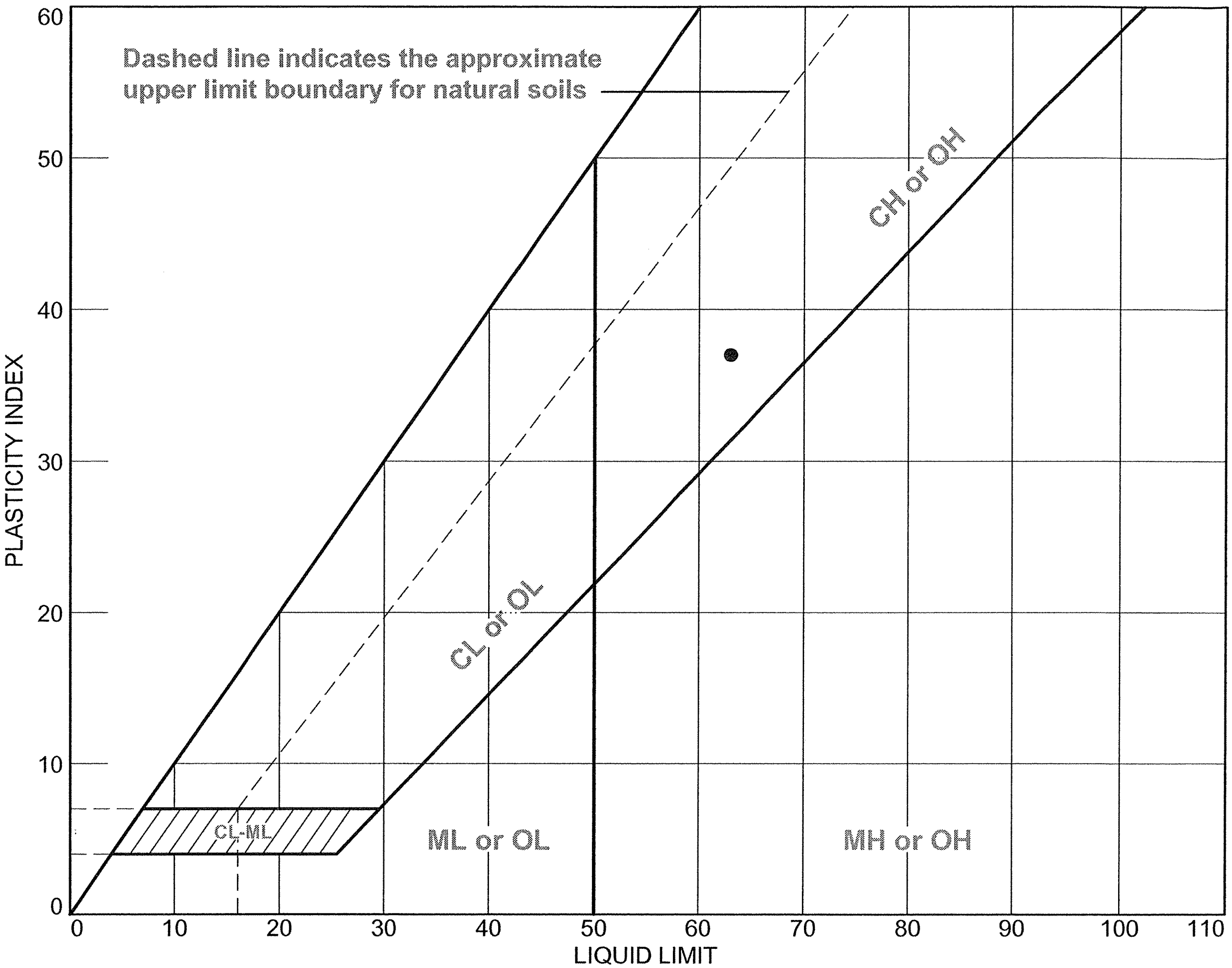

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-2 | B-2-2 S-16 | 59.0'-60.5' | | 18 | 41 | 23 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT

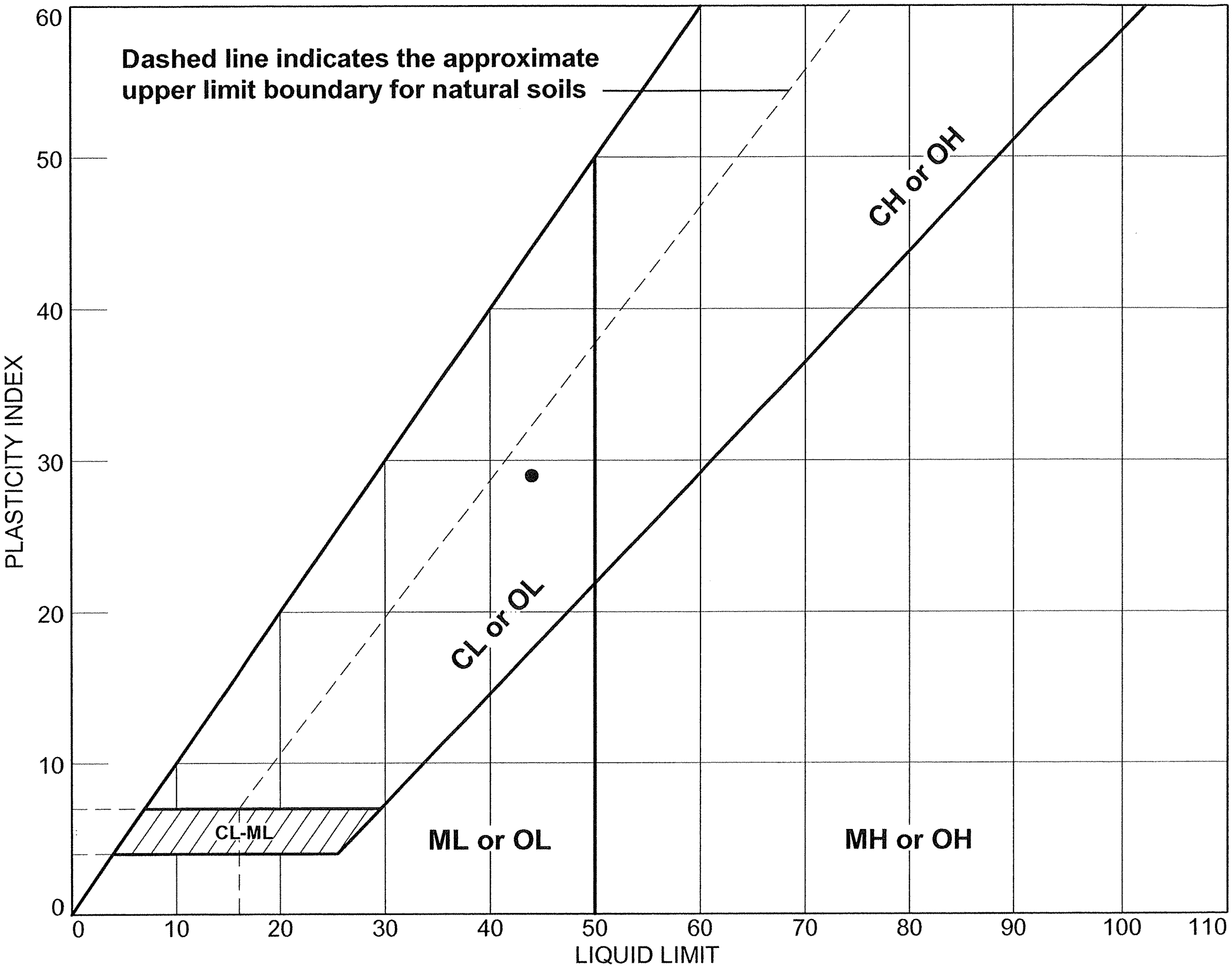



| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-2-2 | B-2-2 S-18 | 69.0'-70.5' | | 26 | 63 | 37 | CH |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK
**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-3-1 | B-3-1 S-9 | 16.0'-17.8' | | 15 | 44 | 29 | SC |

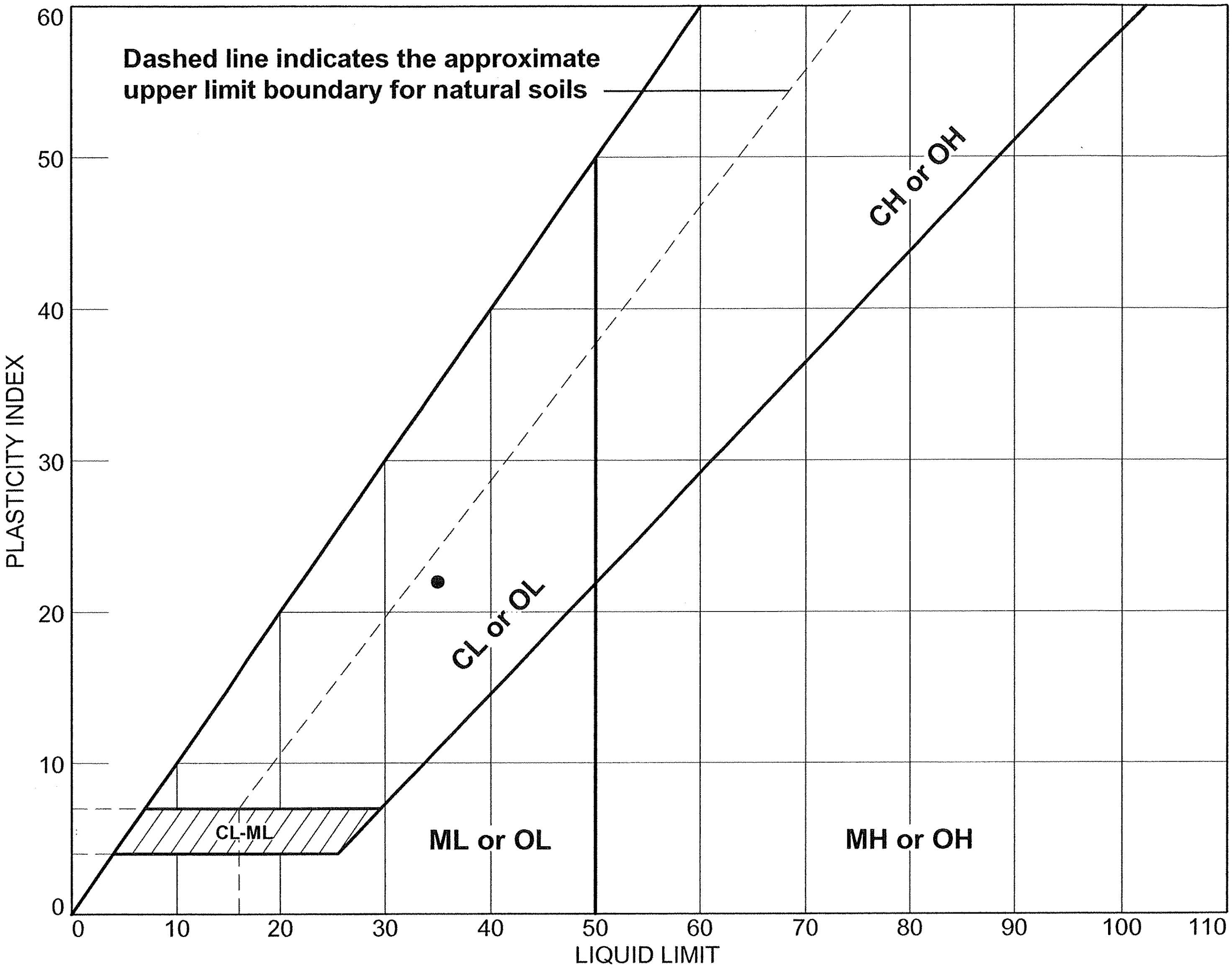
AECOM

**Client:** IPR-GDF SUEZ

**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST REPORT



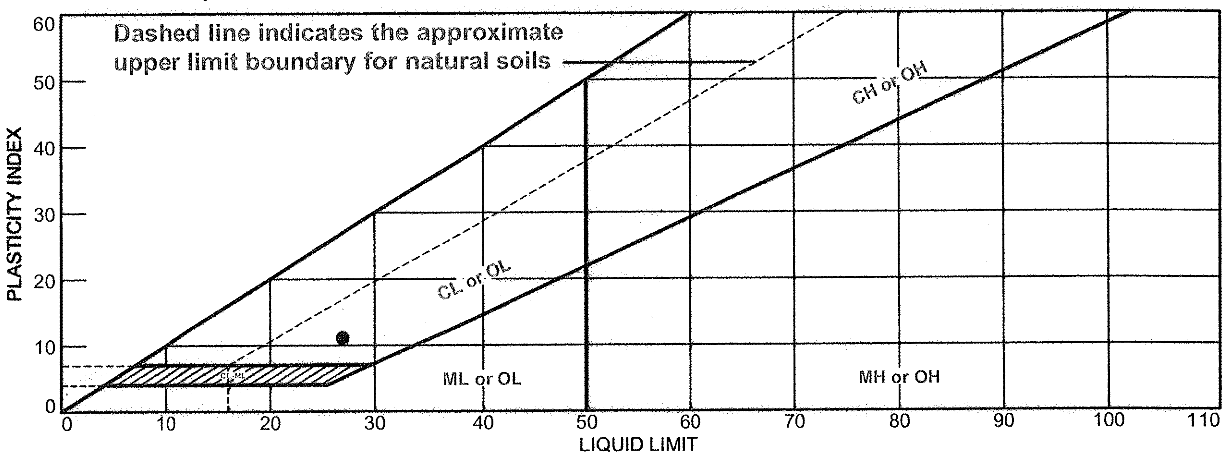

| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-3-1 | B-3-1 S-10 | 18'-20' | | 13 | 35 | 22 | SC |

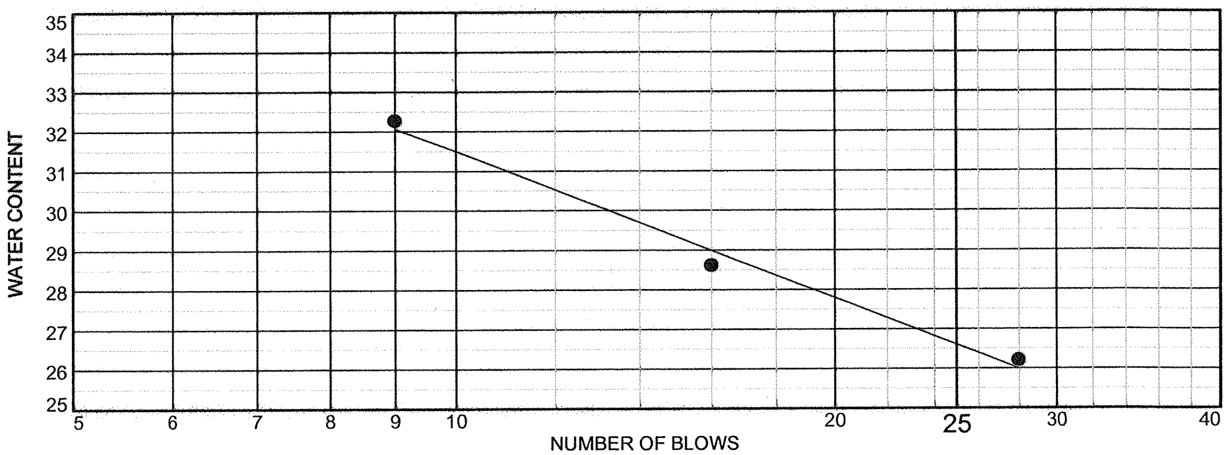
AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | F-M Sand Little Clay Trace Silt - Brownish Gray | 27 | 16 | 11 | 71.8 | 12.8 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

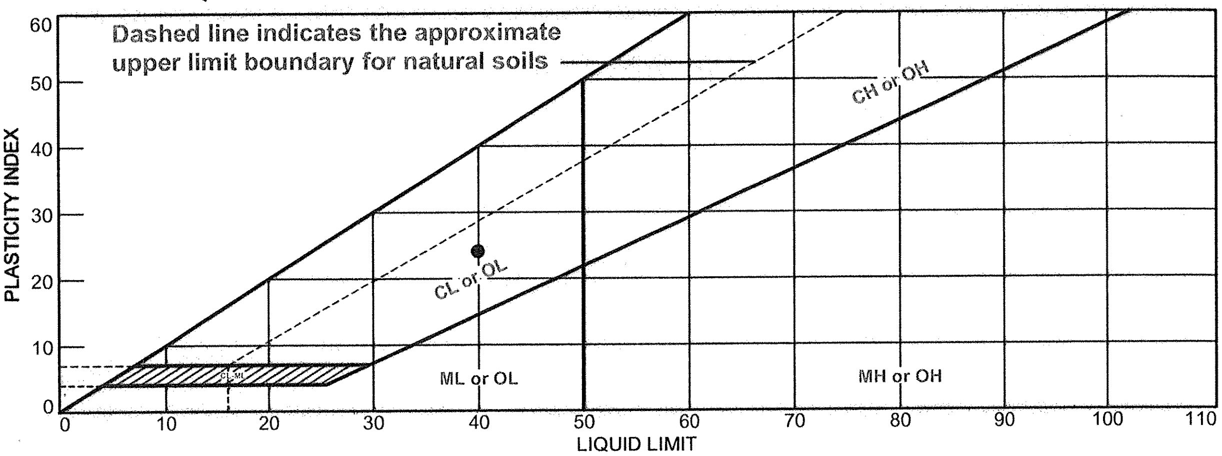
**Project:** Coleto Creek Facility

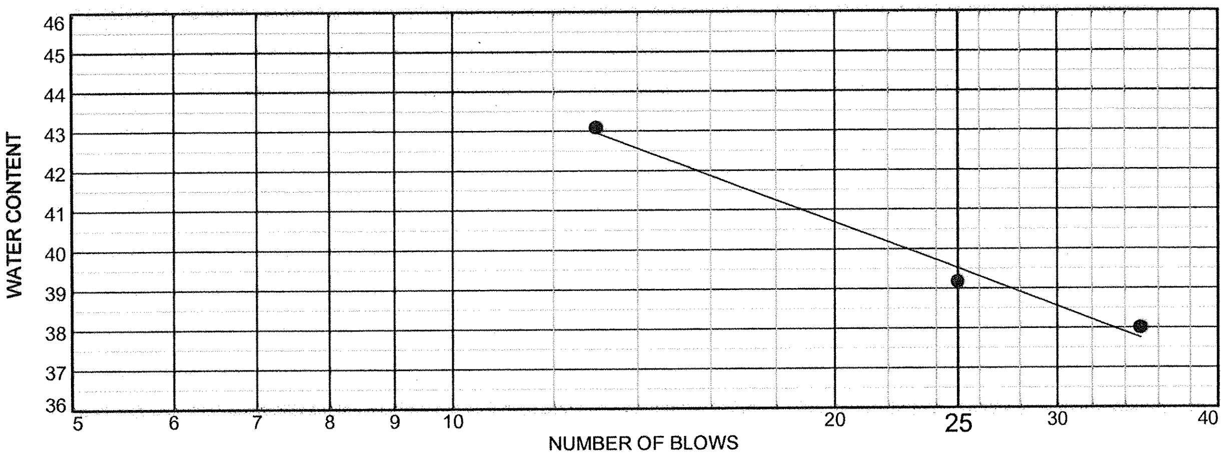
●**Source of Sample:** Boring 4-1 **Depth:** 12.0-14.0 **Sample Number:** S-7

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST ASTM D4318




| | MATERIAL DESCRIPTION | LL | PL | PI | %<#40 | %<#200 | USCS |
|---|---|---|---|---|---|---|---|
| ● | Clayey F-M Sand Little Silt - Brownish Gray | 40 | 16 | 24 | 85.2 | 46.0 | SC |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Project No.** 60225561 **Client:** IPR-GDP Suez

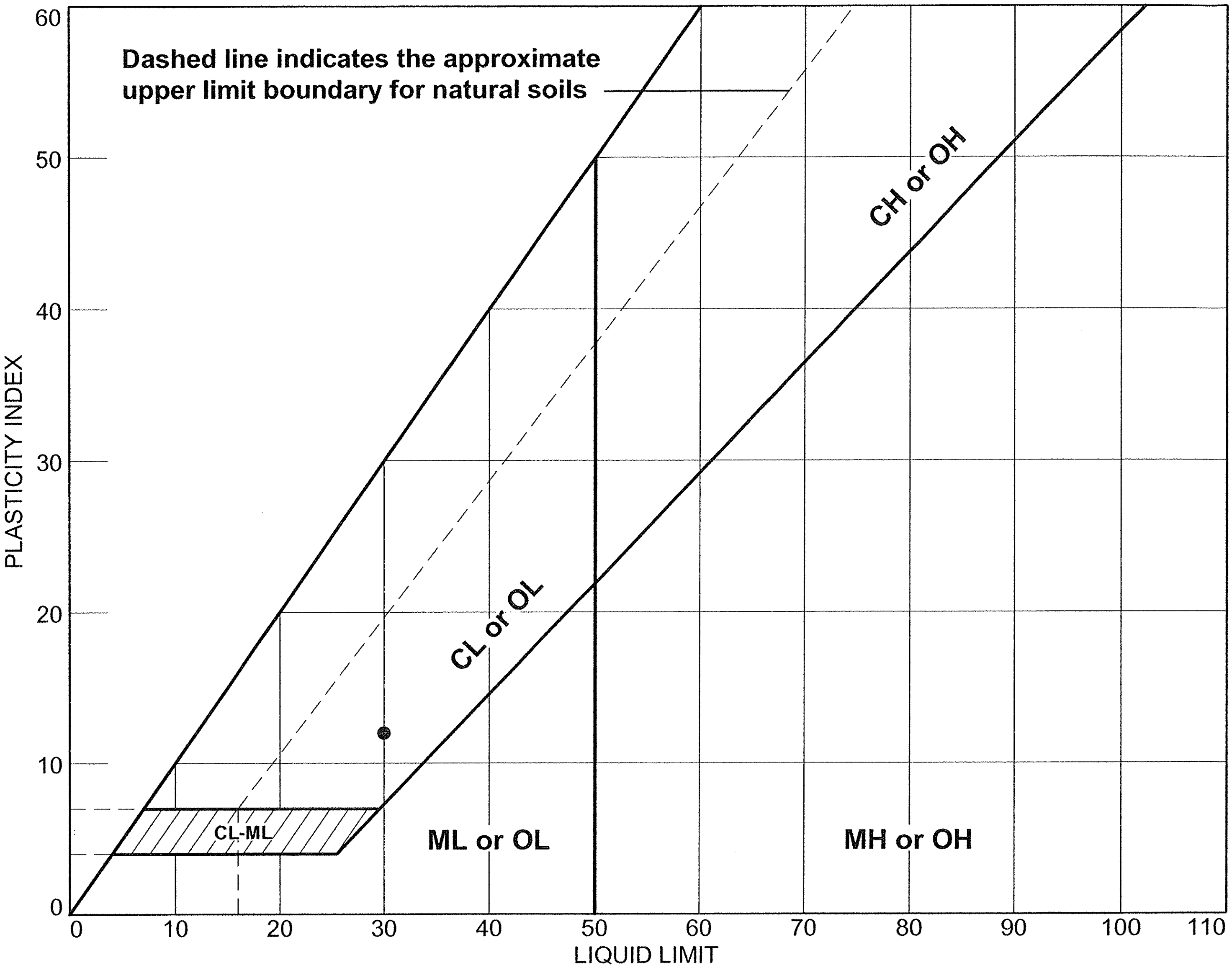
**Project:** Coleto Creek Facility

● **Source of Sample:** Boring 4-1 **Depth:** 24.0-26.0 **Sample Number:** S-13

**Remarks:**

AECOM

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | B-5-1 | B-5-1 S-14 | 26'-27' | | 18 | 30 | 12 | CL |

AECOM

**Client:** IPR-GDF SUEZ
**Project:** COLETO CREEK

**Project No.:** 60225561 **Figure**

AECOM

# SPECIFIC GRAVITY OF SOIL SOLIDS
## ASTM D-854

*Laboratory Services Group* *750 Corporate Woods Parkway* *Vernon Hills, IL 60061* *Phone: (847) 279-2500* *Fax: (847) 279-2550*

**AECOM Project No.: 60225561** **Test Date: 12/6/2011**
**Project Name:** **Coleto Creek Facility**
**IPR-GDP Suez**

Boring/Source: 1-1
Sample No.: 16,17,18
Depth (ft.): 30.0-36.7
Description: Caliche - White

| | Test 1 |
|---|---|
| **Flask No.** | **SG-3** |
| **Wt. Flask + Soil + Water (W2)** | 742.20 |
| **Wt. Flask + Water (W3)** | 677.46 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-4** |
| **Wt. Tare** | 578.17 |
| **Wt. Tare + Soil** | 681.20 |
| **Wt. Soil (W2-W3)** | 103.03 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.690** |

Boring/Source: 4-1
Sample No.: 7
Depth (ft.): 12.0-14.0
Description: F-M Sand Little Clay Trace Silt - Brownish Gray SC

| | Test 2 |
|---|---|
| **Flask No.** | **SG-10** |
| **Wt. Flask + Soil + Water (W2)** | 742.38 |
| **Wt. Flask + Water (W3)** | 668.44 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-4** |
| **Wt. Tare** | 576.51 |
| **Wt. Tare + Soil** | 695.11 |
| **Wt. Soil (W2-W3)** | 118.60 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.655** |

Boring/Source: 4-1
Sample No.: 13
Depth (ft.): 24.0-26.0
Description: Clayey F-M Sand Little Silt - Brownish Gray SC

| | Test 3 |
|---|---|
| **Flask No.** | **SG-1** |
| **Wt. Flask + Soil + Water (W2)** | 726.62 |
| **Wt. Flask + Water (W3)** | 675.32 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-6** |
| **Wt. Tare** | 602.23 |
| **Wt. Tare + Soil** | 684.30 |
| **Wt. Soil (W2-W3)** | 82.07 |
| **(k) Temp. Correction** | 0.99680 |
| **Specific Gravity (Gs)** | **2.659** |

Boring/Source: 2-1
Sample No.: 14
Depth (ft.): 26.0-28..0
Description: Clayey F-M Sand Little Silt - Brownish Gray SC

| | Test 4 |
|---|---|
| **Flask No.** | **SG-2** |
| **Wt. Flask + Soil + Water (W2)** | 738.44 |
| **Wt. Flask + Water (W3)** | 668.48 |
| **Temperature ( C )** | 21.5 |
| **Density of Water @ test Tem.** | 0.99789 |
| **Tare No.** | **ED-10** |
| **Wt. Tare** | 619.18 |
| **Wt. Tare + Soil** | 730.96 |
| **Wt. Soil (W2-W3)** | 111.78 |
| **(k) Temp. Correction** | 0.99968 |
| **Specific Gravity (Gs)** | **2.672** |

Technician **BCM** Calculated **BCM** Checked **WPQ**
Date **12/2/11** Date **12/2/11** Date **12/6/11**

AECOM

# ORGANIC CONTENT TEST
**ASTM D-2974**
**Method C**

*Laboratory Services Group* | *750 Corporate Woods Parkway, Vernon Hills, Illinois 60061* | *Phone: (847) 279-2500 Fax:(847) 279-2550*

| | |
|---|---|
| **AECOM Project No.:** | 60225561 |
| **Project Name:** | Coleto Creek Facility - IPR-GDP Suez |
| **Date Tested:** | 12/6/2011 |

## Sample Information

| | |
|---|---|
| Boring / Source: | B-4-1 |
| Sample No.: | 13 |
| Depth (ft.): | 24.0-26.0 |

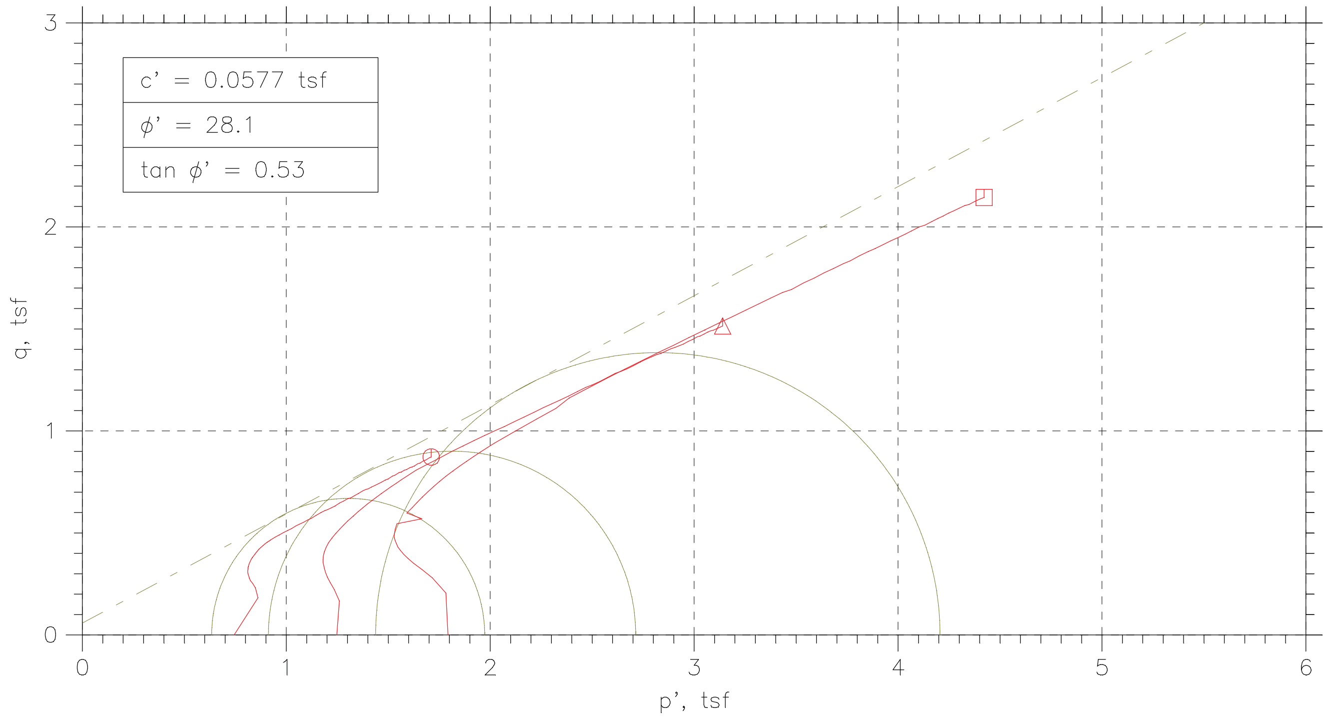
## Organic Content Test Data

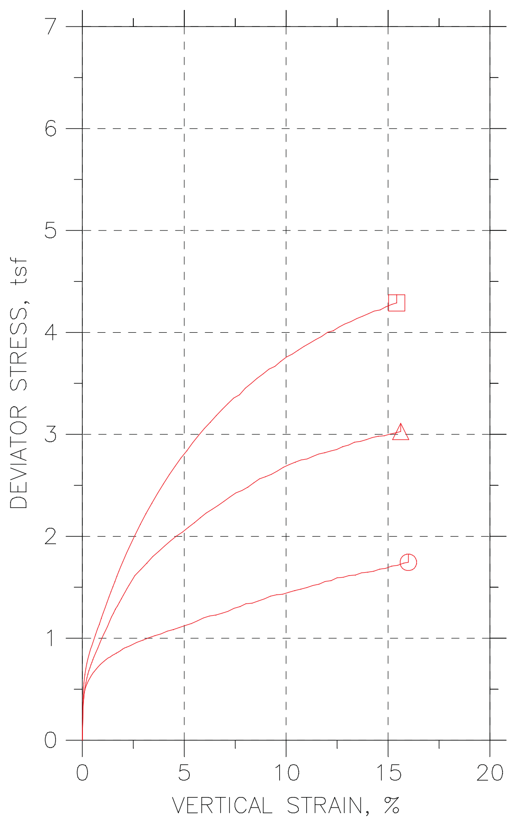
| | |
|---|---|
| Tare No.: | N |
| Tare Wt. (gm): T | 17.71 |
| Wet Wt. + Tare (gm): A+T | 48.27 |
| Dry Wt. + Tare (gm): B+T | 44.70 |
| **Moisture Content (%):** | **13.23** |
| Wt. of Ash + Tare (gm): D+T | 44.65 |
| Percent Ash: (D-T/B-T)x100 = E | 99.81 |
| **Organic Content (%):** | **0.19** |

** Note: Test performed by heating the sample to 440 degrees centigrade for a period of three hours.

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| Symbol | | ○ | △ | □ | |
|---|---|---|---|---|---|
| Test No. | | 10.4 PSI | 17.4 PSI | 24.3 PSI | |
| Initial | Diameter, in | 2.8362 | 2.8441 | 2.8457 | |
| | Height, in | 5.9134 | 6.0831 | 6.0173 | |
| | Water Content, % | 21.81 | 14.93 | 13.70 | |
| | Dry Density, pcf | 105.5 | 115.9 | 120.2 | |
| | Saturation, % | 100.17 | 90.88 | 94.34 | |
| | Void Ratio | 0.58172 | 0.4389 | 0.38805 | |
| Before Shear | Water Content, % | 21.39 | 15.80 | 14.06 | |
| | Dry Density, pcf | 106.1 | 117.3 | 121.3 | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.57165 | 0.42209 | 0.37567 | |
| | Back Press., tsf | 5.0449 | 5.0454 | 5.0404 | |
| Minor Prin. Stress, tsf | | 0.74395 | 1.2474 | 1.7924 | |
| Max. Dev. Stress, tsf | | 1.7444 | 3.0288 | 4.2889 | |
| Time to Failure, min | | 1612.1 | 1613.1 | 1614.3 | |
| Strain Rate, %/min | | 0.02 | 0.02 | 0.03 | |
| B-Value | | .98 | .97 | .95 | |
| Measured Specific Gravity | | 2.67 | 2.67 | 2.67 | |
| Liquid Limit | | 42 | 42 | 42 | |
| Plastic Limit | | 24 | 24 | 24 | |
| Plasticity Index | | 18 | 18 | 18 | |
| Failure Sketch | |  |  |  | |

Project: COLETO CREEK FACILITY

Location: IPR-GDF SUEZ

Project No.: 60225561

Boring No.: B-2-1 S-14

Sample Type: 3" ST

Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

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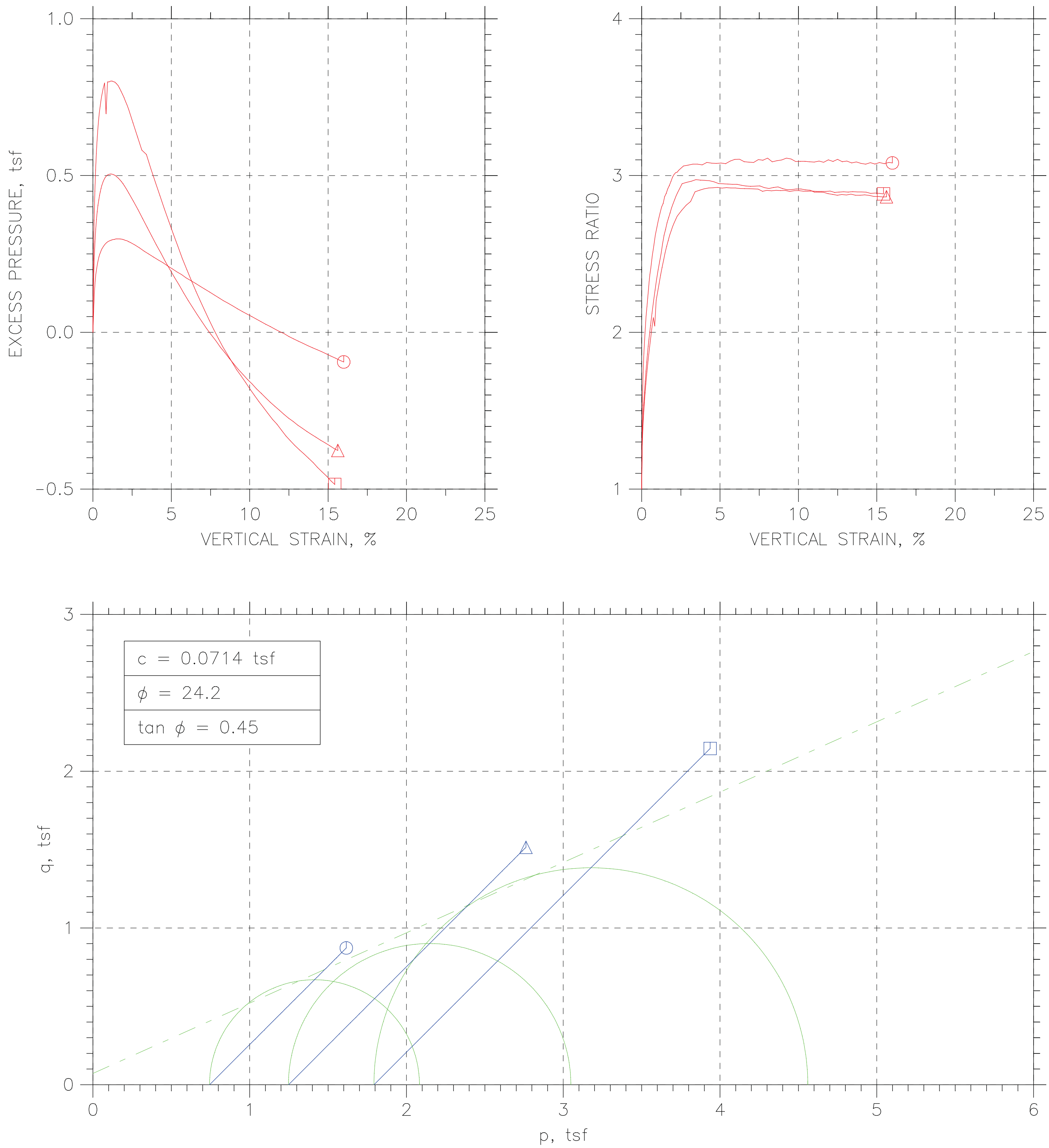
# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-2-1 S-14 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-14 | Test Date: 12/5/11 | Depth: 26.0'-28.0' |
| Test No.: B-2-1 S-14 | Sample Type: 3" ST | Elevation: ---- |
| Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | | |
| | | |

Mon, 12-DEC-2011 10:08:34

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.91 in
Specimen Area: 6.32 in^2
Specimen Volume: 37.36 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3179 | 0 | 0 | 5.0449 | 5.7888 | 5.7888 |
| 2 | 5.0001 | 0.045204 | 6.3207 | 31.887 | 0.36323 | 5.1097 | 5.7888 | 6.152 |
| 3 | 10 | 0.094782 | 6.3239 | 40.44 | 0.46042 | 5.1704 | 5.7888 | 6.2492 |
| 4 | 15 | 0.14144 | 6.3268 | 44.344 | 0.50464 | 5.2061 | 5.7888 | 6.2934 |
| 5 | 20 | 0.18956 | 6.3299 | 46.761 | 0.53189 | 5.2306 | 5.7888 | 6.3207 |
| 6 | 25 | 0.23768 | 6.3329 | 48.992 | 0.557 | 5.2487 | 5.7888 | 6.3458 |
| 7 | 30.001 | 0.28726 | 6.3361 | 51.038 | 0.57997 | 5.2633 | 5.7888 | 6.3688 |
| 8 | 35.001 | 0.33538 | 6.3391 | 52.618 | 0.59764 | 5.275 | 5.7888 | 6.3864 |
| 9 | 40.001 | 0.3835 | 6.3422 | 54.012 | 0.61318 | 5.2849 | 5.7888 | 6.402 |
| 10 | 45.001 | 0.43308 | 6.3453 | 55.5 | 0.62975 | 5.2931 | 5.7888 | 6.4186 |
| 11 | 50.001 | 0.4812 | 6.3484 | 57.08 | 0.64737 | 5.3001 | 5.7888 | 6.4362 |
| 12 | 55.001 | 0.53078 | 6.3516 | 58.289 | 0.66075 | 5.3066 | 5.7888 | 6.4495 |
| 13 | 60.001 | 0.5789 | 6.3546 | 59.311 | 0.67202 | 5.3112 | 5.7888 | 6.4608 |
| 14 | 70.001 | 0.6766 | 6.3609 | 61.636 | 0.69766 | 5.3194 | 5.7888 | 6.4865 |
| 15 | 80.001 | 0.77576 | 6.3673 | 63.588 | 0.71904 | 5.3258 | 5.7888 | 6.5078 |
| 16 | 90.002 | 0.87346 | 6.3735 | 65.633 | 0.74144 | 5.3311 | 5.7888 | 6.5302 |
| 17 | 100 | 0.97115 | 6.3798 | 67.213 | 0.75854 | 5.3346 | 5.7888 | 6.5473 |
| 18 | 110 | 1.0703 | 6.3862 | 68.794 | 0.7756 | 5.3369 | 5.7888 | 6.5644 |
| 19 | 120 | 1.1695 | 6.3926 | 70.281 | 0.79158 | 5.3387 | 5.7888 | 6.5804 |
| 20 | 130 | 1.2701 | 6.3991 | 71.676 | 0.80646 | 5.3404 | 5.7888 | 6.5953 |
| 21 | 140 | 1.3707 | 6.4057 | 72.605 | 0.81609 | 5.341 | 5.7888 | 6.6049 |
| 22 | 150 | 1.4699 | 6.4121 | 74.093 | 0.83197 | 5.3428 | 5.7888 | 6.6208 |
| 23 | 160 | 1.5676 | 6.4185 | 75.023 | 0.84157 | 5.3428 | 5.7888 | 6.6304 |
| 24 | 170 | 1.6682 | 6.425 | 76.231 | 0.85426 | 5.3428 | 5.7888 | 6.6431 |
| 25 | 180 | 1.7688 | 6.4316 | 77.254 | 0.86483 | 5.3422 | 5.7888 | 6.6536 |
| 26 | 190 | 1.8694 | 6.4382 | 78.462 | 0.87746 | 5.3416 | 5.7888 | 6.6663 |
| 27 | 200 | 1.9715 | 6.4449 | 79.95 | 0.89316 | 5.3399 | 5.7888 | 6.682 |
| 28 | 210 | 2.0706 | 6.4514 | 81.065 | 0.90471 | 5.3381 | 5.7888 | 6.6935 |
| 29 | 220 | 2.1712 | 6.4581 | 81.809 | 0.91207 | 5.3369 | 5.7888 | 6.7009 |
| 30 | 230 | 2.2719 | 6.4647 | 82.553 | 0.91942 | 5.334 | 5.7888 | 6.7082 |
| 31 | 240 | 2.3725 | 6.4714 | 83.575 | 0.92985 | 5.3317 | 5.7888 | 6.7186 |
| 32 | 270 | 2.6699 | 6.4912 | 86.457 | 0.95898 | 5.3235 | 5.7888 | 6.7478 |
| 33 | 300 | 2.9674 | 6.5111 | 88.688 | 0.98072 | 5.3142 | 5.7888 | 6.7695 |
| 34 | 330 | 3.2678 | 6.5313 | 91.198 | 1.0054 | 5.3036 | 5.7888 | 6.7942 |
| 35 | 360 | 3.5609 | 6.5511 | 93.244 | 1.0248 | 5.2943 | 5.7888 | 6.8136 |
| 36 | 390 | 3.8584 | 6.5714 | 95.103 | 1.042 | 5.2849 | 5.7888 | 6.8308 |
| 37 | 420 | 4.1602 | 6.5921 | 97.892 | 1.0692 | 5.2756 | 5.7888 | 6.858 |
| 38 | 450 | 4.4621 | 6.6129 | 99.658 | 1.0851 | 5.2668 | 5.7888 | 6.8739 |
| 39 | 480 | 4.761 | 6.6337 | 101.8 | 1.1049 | 5.2569 | 5.7888 | 6.8937 |
| 40 | 510 | 5.0585 | 6.6545 | 104.03 | 1.1256 | 5.2476 | 5.7888 | 6.9144 |
| 41 | 540 | 5.3574 | 6.6755 | 106.07 | 1.1441 | 5.2376 | 5.7888 | 6.9329 |
| 42 | 570 | 5.6505 | 6.6962 | 108.95 | 1.1715 | 5.2289 | 5.7888 | 6.9603 |
| 43 | 600 | 5.9465 | 6.7173 | 111.93 | 1.1997 | 5.2184 | 5.7888 | 6.9885 |
| 44 | 630 | 6.244 | 6.7386 | 114.07 | 1.2188 | 5.2096 | 5.7888 | 7.0076 |
| 45 | 660 | 6.5458 | 6.7604 | 115.28 | 1.2277 | 5.2008 | 5.7888 | 7.0165 |
| 46 | 690 | 6.8477 | 6.7823 | 117.32 | 1.2455 | 5.1915 | 5.7888 | 7.0343 |
| 47 | 720 | 7.1466 | 6.8041 | 119.46 | 1.2641 | 5.1821 | 5.7888 | 7.0529 |
| 48 | 750 | 7.4441 | 6.826 | 122.62 | 1.2934 | 5.1734 | 5.7888 | 7.0822 |
| 49 | 780 | 7.7386 | 6.8478 | 124.67 | 1.3108 | 5.164 | 5.7888 | 7.0996 |
| 50 | 810 | 8.0332 | 6.8697 | 127.73 | 1.3387 | 5.1547 | 5.7888 | 7.1275 |
| 51 | 840 | 8.3306 | 6.892 | 128.57 | 1.3432 | 5.1453 | 5.7888 | 7.132 |
| 52 | 870 | 8.6296 | 6.9146 | 131.08 | 1.3649 | 5.1372 | 5.7888 | 7.1537 |
| 53 | 900 | 8.9329 | 6.9376 | 133.59 | 1.3864 | 5.1284 | 5.7888 | 7.1752 |
| 54 | 930 | 9.2333 | 6.9605 | 136.57 | 1.4126 | 5.1196 | 5.7888 | 7.2014 |
| 55 | 960 | 9.5336 | 6.9837 | 138.42 | 1.4271 | 5.1109 | 5.7888 | 7.2159 |
| 56 | 990 | 9.8282 | 7.0065 | 139.35 | 1.432 | 5.1033 | 5.7888 | 7.2208 |
| 57 | 1020 | 10.121 | 7.0293 | 141.59 | 1.4502 | 5.0951 | 5.7888 | 7.239 |
| 58 | 1050 | 10.419 | 7.0527 | 143.72 | 1.4673 | 5.0869 | 5.7888 | 7.2561 |
| 59 | 1080 | 10.718 | 7.0763 | 145.68 | 1.4822 | 5.0787 | 5.7888 | 7.271 |
| 60 | 1110 | 11.017 | 7.1 | 147.72 | 1.498 | 5.0706 | 5.7888 | 7.2868 |
| 61 | 1140 | 11.317 | 7.1241 | 150.23 | 1.5183 | 5.063 | 5.7888 | 7.3071 |
| 62 | 1170 | 11.613 | 7.148 | 151.9 | 1.5301 | 5.0548 | 5.7888 | 7.3189 |
| 63 | 1200 | 11.91 | 7.1721 | 155.16 | 1.5576 | 5.0472 | 5.7888 | 7.3464 |
| 64 | 1230 | 12.205 | 7.1962 | 156.37 | 1.5645 | 5.0402 | 5.7888 | 7.3533 |
| 65 | 1260 | 12.5 | 7.2204 | 159.71 | 1.5926 | 5.0314 | 5.7888 | 7.3814 |
| 66 | 1290 | 12.794 | 7.2448 | 160.74 | 1.5974 | 5.0238 | 5.7888 | 7.3862 |
| 67 | 1320 | 13.092 | 7.2696 | 163.06 | 1.615 | 5.0168 | 5.7888 | 7.4038 |
| 68 | 1350 | 13.395 | 7.295 | 164.18 | 1.6204 | 5.0098 | 5.7888 | 7.4092 |
| 69 | 1380 | 13.697 | 7.3205 | 166.87 | 1.6412 | 5.0022 | 5.7888 | 7.43 |
| 70 | 1410 | 13.996 | 7.346 | 168.08 | 1.6474 | 4.9958 | 5.7888 | 7.4362 |
| 71 | 1440 | 14.293 | 7.3715 | 169.66 | 1.6571 | 4.9894 | 5.7888 | 7.4459 |
| 72 | 1470 | 14.589 | 7.397 | 172.36 | 1.6777 | 4.9829 | 5.7888 | 7.4665 |
| 73 | 1500 | 14.881 | 7.4224 | 173.75 | 1.6855 | 4.9759 | 5.7888 | 7.4743 |
| 74 | 1530 | 15.174 | 7.448 | 176.63 | 1.7075 | 4.9689 | 5.7888 | 7.4963 |
| 75 | 1560 | 15.473 | 7.4744 | 178.03 | 1.7149 | 4.9625 | 5.7888 | 7.5037 |
| 76 | 1590 | 15.773 | 7.501 | 181 | 1.7374 | 4.9549 | 5.7888 | 7.5262 |
| 77 | 1612.1 | 15.995 | 7.5208 | 182.21 | 1.7444 | 4.9502 | 5.7888 | 7.5332 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.91 in
Specimen Area: 6.32 in^2
Specimen Volume: 37.36 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.7888 | 5.7888 | 0 | 0.000 | 0.74395 | 0.74395 | 1.000 | 0.74395 | 0 |
| 2 | 0.05 | 6.152 | 5.7888 | 0.064842 | 0.179 | 1.0423 | 0.6791 | 1.535 | 0.86072 | 0.18161 |
| 3 | 0.09 | 6.2492 | 5.7888 | 0.1256 | 0.273 | 1.0788 | 0.61835 | 1.745 | 0.84856 | 0.23021 |
| 4 | 0.14 | 6.2934 | 5.7888 | 0.16123 | 0.319 | 1.0874 | 0.58272 | 1.866 | 0.83504 | 0.25232 |
| 5 | 0.19 | 6.3207 | 5.7888 | 0.18576 | 0.349 | 1.0901 | 0.55818 | 1.953 | 0.82413 | 0.26595 |
| 6 | 0.24 | 6.3458 | 5.7888 | 0.20387 | 0.366 | 1.0971 | 0.54007 | 2.031 | 0.81857 | 0.2785 |
| 7 | 0.29 | 6.3688 | 5.7888 | 0.21848 | 0.377 | 1.1054 | 0.52547 | 2.104 | 0.81545 | 0.28998 |
| 8 | 0.34 | 6.3864 | 5.7888 | 0.23016 | 0.385 | 1.1114 | 0.51379 | 2.163 | 0.8126 | 0.29882 |
| 9 | 0.38 | 6.402 | 5.7888 | 0.24009 | 0.392 | 1.117 | 0.50385 | 2.217 | 0.81044 | 0.30659 |
| 10 | 0.43 | 6.4186 | 5.7888 | 0.24827 | 0.394 | 1.1254 | 0.49568 | 2.270 | 0.81055 | 0.31488 |
| 11 | 0.48 | 6.4362 | 5.7888 | 0.25528 | 0.394 | 1.136 | 0.48867 | 2.325 | 0.81235 | 0.32369 |
| 12 | 0.53 | 6.4495 | 5.7888 | 0.26171 | 0.396 | 1.143 | 0.48224 | 2.370 | 0.81262 | 0.33037 |
| 13 | 0.58 | 6.4608 | 5.7888 | 0.26638 | 0.396 | 1.1496 | 0.47757 | 2.407 | 0.81358 | 0.33601 |
| 14 | 0.68 | 6.4865 | 5.7888 | 0.27456 | 0.394 | 1.1671 | 0.46939 | 2.486 | 0.81822 | 0.34883 |
| 15 | 0.78 | 6.5078 | 5.7888 | 0.28098 | 0.391 | 1.182 | 0.46296 | 2.553 | 0.82248 | 0.35952 |
| 16 | 0.87 | 6.5302 | 5.7888 | 0.28624 | 0.386 | 1.1991 | 0.45771 | 2.620 | 0.82842 | 0.37072 |
| 17 | 0.97 | 6.5473 | 5.7888 | 0.28975 | 0.382 | 1.2127 | 0.4542 | 2.670 | 0.83347 | 0.37927 |
| 18 | 1.07 | 6.5644 | 5.7888 | 0.29208 | 0.377 | 1.2275 | 0.45186 | 2.716 | 0.83966 | 0.3878 |
| 19 | 1.17 | 6.5804 | 5.7888 | 0.29384 | 0.371 | 1.2417 | 0.45011 | 2.759 | 0.8459 | 0.39579 |
| 20 | 1.27 | 6.5953 | 5.7888 | 0.29559 | 0.367 | 1.2548 | 0.44836 | 2.799 | 0.85159 | 0.40323 |
| 21 | 1.37 | 6.6049 | 5.7888 | 0.29617 | 0.363 | 1.2639 | 0.44777 | 2.823 | 0.85582 | 0.40804 |
| 22 | 1.47 | 6.6208 | 5.7888 | 0.29792 | 0.358 | 1.278 | 0.44602 | 2.865 | 0.86201 | 0.41599 |
| 23 | 1.57 | 6.6304 | 5.7888 | 0.29792 | 0.354 | 1.2876 | 0.44602 | 2.887 | 0.86681 | 0.42079 |
| 24 | 1.67 | 6.6431 | 5.7888 | 0.29792 | 0.349 | 1.3003 | 0.44602 | 2.915 | 0.87315 | 0.42713 |
| 25 | 1.77 | 6.6536 | 5.7888 | 0.29734 | 0.344 | 1.3114 | 0.44661 | 2.936 | 0.87902 | 0.43242 |
| 26 | 1.87 | 6.6663 | 5.7888 | 0.29676 | 0.338 | 1.3247 | 0.44719 | 2.962 | 0.88592 | 0.43873 |
| 27 | 1.97 | 6.682 | 5.7888 | 0.295 | 0.330 | 1.3421 | 0.44894 | 2.989 | 0.89553 | 0.44658 |
| 28 | 2.07 | 6.6935 | 5.7888 | 0.29325 | 0.324 | 1.3554 | 0.4507 | 3.007 | 0.90305 | 0.45236 |
| 29 | 2.17 | 6.7009 | 5.7888 | 0.29208 | 0.320 | 1.3639 | 0.45186 | 3.018 | 0.9079 | 0.45604 |
| 30 | 2.27 | 6.7082 | 5.7888 | 0.28916 | 0.315 | 1.3742 | 0.45478 | 3.022 | 0.91449 | 0.45971 |
| 31 | 2.37 | 6.7186 | 5.7888 | 0.28683 | 0.308 | 1.387 | 0.45712 | 3.034 | 0.92205 | 0.46492 |
| 32 | 2.67 | 6.7478 | 5.7888 | 0.27865 | 0.291 | 1.4243 | 0.4653 | 3.061 | 0.94479 | 0.47949 |
| 33 | 2.97 | 6.7695 | 5.7888 | 0.2693 | 0.275 | 1.4554 | 0.47465 | 3.066 | 0.96501 | 0.49036 |
| 34 | 3.27 | 6.7942 | 5.7888 | 0.25879 | 0.257 | 1.4905 | 0.48516 | 3.072 | 0.98784 | 0.50268 |
| 35 | 3.56 | 6.8136 | 5.7888 | 0.24944 | 0.243 | 1.5193 | 0.49451 | 3.072 | 1.0069 | 0.51239 |
| 36 | 3.86 | 6.8308 | 5.7888 | 0.24009 | 0.230 | 1.5459 | 0.50385 | 3.068 | 1.0249 | 0.521 |
| 37 | 4.16 | 6.858 | 5.7888 | 0.23075 | 0.216 | 1.5824 | 0.5132 | 3.083 | 1.0478 | 0.5346 |
| 38 | 4.46 | 6.8739 | 5.7888 | 0.22198 | 0.205 | 1.607 | 0.52196 | 3.079 | 1.0645 | 0.54253 |
| 39 | 4.76 | 6.8937 | 5.7888 | 0.21205 | 0.192 | 1.6368 | 0.53189 | 3.077 | 1.0843 | 0.55243 |
| 40 | 5.06 | 6.9144 | 5.7888 | 0.20271 | 0.180 | 1.6668 | 0.54124 | 3.080 | 1.104 | 0.56278 |
| 41 | 5.36 | 6.9329 | 5.7888 | 0.19277 | 0.168 | 1.6952 | 0.55117 | 3.076 | 1.1232 | 0.57204 |
| 42 | 5.65 | 6.9603 | 5.7888 | 0.18401 | 0.157 | 1.7314 | 0.55993 | 3.092 | 1.1457 | 0.58576 |
| 43 | 5.95 | 6.9885 | 5.7888 | 0.1735 | 0.145 | 1.7702 | 0.57045 | 3.103 | 1.1703 | 0.59986 |
| 44 | 6.24 | 7.0076 | 5.7888 | 0.16473 | 0.135 | 1.798 | 0.57921 | 3.104 | 1.1886 | 0.60939 |
| 45 | 6.55 | 7.0165 | 5.7888 | 0.15597 | 0.127 | 1.8157 | 0.58797 | 3.088 | 1.2018 | 0.61386 |
| 46 | 6.85 | 7.0343 | 5.7888 | 0.14663 | 0.118 | 1.8428 | 0.59732 | 3.085 | 1.2201 | 0.62274 |
| 47 | 7.15 | 7.0529 | 5.7888 | 0.13728 | 0.109 | 1.8708 | 0.60667 | 3.084 | 1.2387 | 0.63205 |
| 48 | 7.44 | 7.0822 | 5.7888 | 0.12852 | 0.099 | 1.9088 | 0.61543 | 3.102 | 1.2621 | 0.6467 |
| 49 | 7.74 | 7.0996 | 5.7888 | 0.11917 | 0.091 | 1.9356 | 0.62478 | 3.098 | 1.2802 | 0.65539 |
| 50 | 8.03 | 7.1275 | 5.7888 | 0.10982 | 0.082 | 1.9729 | 0.63412 | 3.111 | 1.3035 | 0.66937 |
| 51 | 8.33 | 7.132 | 5.7888 | 0.10048 | 0.075 | 1.9866 | 0.64347 | 3.087 | 1.315 | 0.67158 |
| 52 | 8.63 | 7.1537 | 5.7888 | 0.092298 | 0.068 | 2.0166 | 0.65165 | 3.095 | 1.3341 | 0.68246 |
| 53 | 8.93 | 7.1752 | 5.7888 | 0.083536 | 0.060 | 2.0468 | 0.66041 | 3.099 | 1.3536 | 0.69322 |
| 54 | 9.23 | 7.2014 | 5.7888 | 0.074773 | 0.053 | 2.0818 | 0.66917 | 3.111 | 1.3755 | 0.70632 |
| 55 | 9.53 | 7.2159 | 5.7888 | 0.066011 | 0.046 | 2.1051 | 0.67794 | 3.105 | 1.3915 | 0.71356 |
| 56 | 9.83 | 7.2208 | 5.7888 | 0.058417 | 0.041 | 2.1176 | 0.68553 | 3.089 | 1.4015 | 0.71602 |
| 57 | 10.12 | 7.239 | 5.7888 | 0.050238 | 0.035 | 2.1439 | 0.69371 | 3.091 | 1.4188 | 0.72512 |
| 58 | 10.42 | 7.2561 | 5.7888 | 0.04206 | 0.029 | 2.1691 | 0.70189 | 3.090 | 1.4355 | 0.73363 |
| 59 | 10.72 | 7.271 | 5.7888 | 0.033882 | 0.023 | 2.1923 | 0.71006 | 3.087 | 1.4512 | 0.74111 |
| 60 | 11.02 | 7.2868 | 5.7888 | 0.025703 | 0.017 | 2.2162 | 0.71824 | 3.086 | 1.4672 | 0.749 |
| 61 | 11.32 | 7.3071 | 5.7888 | 0.018109 | 0.012 | 2.2442 | 0.72584 | 3.092 | 1.485 | 0.75916 |
| 62 | 11.61 | 7.3189 | 5.7888 | 0.0099308 | 0.006 | 2.2641 | 0.73402 | 3.085 | 1.4991 | 0.76505 |
| 63 | 11.91 | 7.3464 | 5.7888 | 0.0023367 | 0.002 | 2.2992 | 0.74161 | 3.100 | 1.5204 | 0.77881 |
| 64 | 12.21 | 7.3533 | 5.7888 | -0.0046733 | -0.003 | 2.3131 | 0.74862 | 3.090 | 1.5309 | 0.78225 |
| 65 | 12.50 | 7.3814 | 5.7888 | -0.013436 | -0.008 | 2.35 | 0.75738 | 3.103 | 1.5537 | 0.79631 |
| 66 | 12.79 | 7.3862 | 5.7888 | -0.02103 | -0.013 | 2.3624 | 0.76498 | 3.088 | 1.5637 | 0.79871 |
| 67 | 13.09 | 7.4038 | 5.7888 | -0.02804 | -0.017 | 2.387 | 0.77199 | 3.092 | 1.5795 | 0.8075 |
| 68 | 13.39 | 7.4092 | 5.7888 | -0.03505 | -0.022 | 2.3994 | 0.779 | 3.080 | 1.5892 | 0.81019 |
| 69 | 13.70 | 7.43 | 5.7888 | -0.042644 | -0.026 | 2.4278 | 0.78659 | 3.087 | 1.6072 | 0.82062 |
| 70 | 14.00 | 7.4362 | 5.7888 | -0.04907 | -0.030 | 2.4404 | 0.79302 | 3.077 | 1.6167 | 0.8237 |
| 71 | 14.29 | 7.4459 | 5.7888 | -0.055496 | -0.033 | 2.4566 | 0.79944 | 3.073 | 1.628 | 0.82857 |
| 72 | 14.59 | 7.4665 | 5.7888 | -0.061922 | -0.037 | 2.4835 | 0.80587 | 3.082 | 1.6447 | 0.83883 |
| 73 | 14.88 | 7.4743 | 5.7888 | -0.068932 | -0.041 | 2.4983 | 0.81288 | 3.073 | 1.6556 | 0.84273 |
| 74 | 15.17 | 7.4963 | 5.7888 | -0.075942 | -0.044 | 2.5274 | 0.81989 | 3.083 | 1.6736 | 0.85376 |
| 75 | 15.47 | 7.5037 | 5.7888 | -0.082367 | -0.048 | 2.5412 | 0.82631 | 3.075 | 1.6838 | 0.85746 |
| 76 | 15.77 | 7.5262 | 5.7888 | -0.089961 | -0.052 | 2.5713 | 0.83391 | 3.083 | 1.7026 | 0.86869 |
| 77 | 15.99 | 7.5332 | 5.7888 | -0.094635 | -0.054 | 2.583 | 0.83858 | 3.080 | 1.7108 | 0.87219 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.08 in
Specimen Area: 6.35 in^2
Specimen Volume: 38.65 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.353 | 0 | 0 | 5.0454 | 6.2928 | 6.2928 |
| 2 | 5.0038 | 0.0388 | 6.3555 | 29.35 | 0.3325 | 5.1985 | 6.2928 | 6.6253 |
| 3 | 10.004 | 0.085062 | 6.3584 | 39.31 | 0.44513 | 5.2806 | 6.2928 | 6.7379 |
| 4 | 15.004 | 0.13132 | 6.3613 | 45.38 | 0.51363 | 5.3339 | 6.2928 | 6.8064 |
| 5 | 20.004 | 0.17908 | 6.3644 | 50.036 | 0.56606 | 5.3744 | 6.2928 | 6.8589 |
| 6 | 25 | 0.22683 | 6.3674 | 53.985 | 0.61044 | 5.4054 | 6.2928 | 6.9032 |
| 7 | 30 | 0.27459 | 6.3705 | 57.344 | 0.64811 | 5.4298 | 6.2928 | 6.9409 |
| 8 | 35 | 0.32234 | 6.3735 | 60.35 | 0.68176 | 5.4504 | 6.2928 | 6.9746 |
| 9 | 40 | 0.37159 | 6.3767 | 62.884 | 0.71004 | 5.4676 | 6.2928 | 7.0028 |
| 10 | 45 | 0.42083 | 6.3798 | 65.477 | 0.73895 | 5.482 | 6.2928 | 7.0317 |
| 11 | 50 | 0.46859 | 6.3829 | 67.658 | 0.76319 | 5.4936 | 6.2928 | 7.056 |
| 12 | 55.001 | 0.51634 | 6.386 | 70.074 | 0.79007 | 5.5042 | 6.2928 | 7.0829 |
| 13 | 60.001 | 0.5641 | 6.389 | 72.196 | 0.8136 | 5.513 | 6.2928 | 7.1064 |
| 14 | 70.001 | 0.65961 | 6.3952 | 76.204 | 0.85794 | 5.5269 | 6.2928 | 7.1507 |
| 15 | 80.001 | 0.75512 | 6.4013 | 80.27 | 0.90285 | 5.5375 | 6.2928 | 7.1957 |
| 16 | 90.001 | 0.85361 | 6.4077 | 84.573 | 0.9503 | 5.5436 | 6.2928 | 7.2431 |
| 17 | 100 | 0.95061 | 6.414 | 88.698 | 0.99568 | 5.5474 | 6.2928 | 7.2885 |
| 18 | 110 | 1.0491 | 6.4203 | 92.706 | 1.0396 | 5.5497 | 6.2928 | 7.3324 |
| 19 | 120 | 1.1446 | 6.4265 | 96.124 | 1.0769 | 5.5502 | 6.2928 | 7.3697 |
| 20 | 130 | 1.2401 | 6.4328 | 99.719 | 1.1161 | 5.5497 | 6.2928 | 7.4089 |
| 21 | 140 | 1.3356 | 6.439 | 104.26 | 1.1658 | 5.5474 | 6.2928 | 7.4586 |
| 22 | 150 | 1.4326 | 6.4453 | 108.32 | 1.2101 | 5.5452 | 6.2928 | 7.5029 |
| 23 | 160 | 1.5266 | 6.4515 | 111.57 | 1.2451 | 5.5408 | 6.2928 | 7.5379 |
| 24 | 170 | 1.6251 | 6.4579 | 115.28 | 1.2852 | 5.5369 | 6.2928 | 7.578 |
| 25 | 180 | 1.7206 | 6.4642 | 118.28 | 1.3175 | 5.5314 | 6.2928 | 7.6103 |
| 26 | 190 | 1.8162 | 6.4705 | 121.41 | 1.351 | 5.5258 | 6.2928 | 7.6438 |
| 27 | 200 | 1.9102 | 6.4767 | 124.71 | 1.3863 | 5.5197 | 6.2928 | 7.6791 |
| 28 | 210 | 2.0057 | 6.483 | 127.83 | 1.4197 | 5.5125 | 6.2928 | 7.7125 |
| 29 | 220 | 2.1012 | 6.4893 | 131.01 | 1.4536 | 5.5053 | 6.2928 | 7.7464 |
| 30 | 230 | 2.1967 | 6.4957 | 134.2 | 1.4875 | 5.4975 | 6.2928 | 7.7803 |
| 31 | 240 | 2.2907 | 6.5019 | 137.2 | 1.5193 | 5.4892 | 6.2928 | 7.8121 |
| 32 | 270 | 2.5817 | 6.5213 | 146.28 | 1.615 | 5.4637 | 6.2928 | 7.9078 |
| 33 | 300 | 2.8757 | 6.5411 | 152.23 | 1.6757 | 5.4365 | 6.2928 | 7.9685 |
| 34 | 330 | 3.1682 | 6.5608 | 158.3 | 1.7372 | 5.4082 | 6.2928 | 8.03 |
| 35 | 360 | 3.4592 | 6.5806 | 164.61 | 1.801 | 5.3805 | 6.2928 | 8.0938 |
| 36 | 390 | 3.7502 | 6.6005 | 169.79 | 1.8521 | 5.3527 | 6.2928 | 8.1449 |
| 37 | 420 | 4.0397 | 6.6204 | 175.22 | 1.9055 | 5.325 | 6.2928 | 8.1983 |
| 38 | 450 | 4.3292 | 6.6405 | 180.28 | 1.9547 | 5.2989 | 6.2928 | 8.2475 |
| 39 | 480 | 4.6202 | 6.6607 | 185.23 | 2.0023 | 5.2712 | 6.2928 | 8.2951 |
| 40 | 510 | 4.9127 | 6.6812 | 189.48 | 2.0419 | 5.2451 | 6.2928 | 8.3347 |
| 41 | 540 | 5.2082 | 6.702 | 194.43 | 2.0887 | 5.2201 | 6.2928 | 8.3815 |
| 42 | 570 | 5.5007 | 6.7228 | 199.32 | 2.1347 | 5.1957 | 6.2928 | 8.4275 |
| 43 | 600 | 5.7902 | 6.7434 | 204.39 | 2.1823 | 5.1702 | 6.2928 | 8.4751 |
| 44 | 630 | 6.0782 | 6.7641 | 209.28 | 2.2277 | 5.1469 | 6.2928 | 8.5205 |
| 45 | 660 | 6.3692 | 6.7851 | 213.41 | 2.2645 | 5.1242 | 6.2928 | 8.5573 |
| 46 | 690 | 6.6587 | 6.8062 | 217.65 | 2.3024 | 5.1014 | 6.2928 | 8.5952 |
| 47 | 720 | 6.9497 | 6.8275 | 222.13 | 2.3425 | 5.0798 | 6.2928 | 8.6353 |
| 48 | 750 | 7.2407 | 6.8489 | 226.9 | 2.3853 | 5.0582 | 6.2928 | 8.6781 |
| 49 | 780 | 7.5362 | 6.8708 | 231.56 | 2.4265 | 5.0382 | 6.2928 | 8.7193 |
| 50 | 810 | 7.8302 | 6.8927 | 234.5 | 2.4496 | 5.0188 | 6.2928 | 8.7424 |
| 51 | 840 | 8.1197 | 6.9144 | 238.39 | 2.4824 | 4.9982 | 6.2928 | 8.7752 |
| 52 | 870 | 8.4107 | 6.9364 | 243.17 | 2.5241 | 4.9805 | 6.2928 | 8.8169 |
| 53 | 900 | 8.6987 | 6.9583 | 247.82 | 2.5643 | 4.9622 | 6.2928 | 8.8571 |
| 54 | 930 | 8.9883 | 6.9804 | 250.54 | 2.5842 | 4.9444 | 6.2928 | 8.877 |
| 55 | 960 | 9.2793 | 7.0028 | 253.72 | 2.6086 | 4.9267 | 6.2928 | 8.9014 |
| 56 | 990 | 9.5718 | 7.0254 | 257.61 | 2.6401 | 4.9106 | 6.2928 | 8.9329 |
| 57 | 1020 | 9.8643 | 7.0482 | 261.97 | 2.6761 | 4.8945 | 6.2928 | 8.9689 |
| 58 | 1050 | 10.157 | 7.0712 | 265.5 | 2.7034 | 4.8806 | 6.2928 | 8.9962 |
| 59 | 1080 | 10.446 | 7.094 | 268.63 | 2.7264 | 4.8646 | 6.2928 | 9.0192 |
| 60 | 1110 | 10.736 | 7.1171 | 271.69 | 2.7486 | 4.8507 | 6.2928 | 9.0414 |
| 61 | 1140 | 11.024 | 7.1401 | 273.58 | 2.7587 | 4.8363 | 6.2928 | 9.0515 |
| 62 | 1170 | 11.31 | 7.1632 | 277 | 2.7842 | 4.8224 | 6.2928 | 9.077 |
| 63 | 1200 | 11.6 | 7.1866 | 280.18 | 2.807 | 4.8096 | 6.2928 | 9.0998 |
| 64 | 1230 | 11.889 | 7.2102 | 282.3 | 2.819 | 4.7969 | 6.2928 | 9.1118 |
| 65 | 1260 | 12.183 | 7.2344 | 285.01 | 2.8366 | 4.7836 | 6.2928 | 9.1294 |
| 66 | 1290 | 12.477 | 7.2587 | 287.49 | 2.8516 | 4.7714 | 6.2928 | 9.1444 |
| 67 | 1320 | 12.771 | 7.2831 | 291.2 | 2.8788 | 4.7608 | 6.2928 | 9.1716 |
| 68 | 1350 | 13.064 | 7.3076 | 293.85 | 2.8952 | 4.7492 | 6.2928 | 9.188 |
| 69 | 1380 | 13.355 | 7.3322 | 297.62 | 2.9226 | 4.7392 | 6.2928 | 9.2154 |
| 70 | 1410 | 13.643 | 7.3566 | 299.45 | 2.9308 | 4.7292 | 6.2928 | 9.2236 |
| 71 | 1440 | 13.932 | 7.3814 | 302.28 | 2.9485 | 4.7198 | 6.2928 | 9.2413 |
| 72 | 1470 | 14.226 | 7.4067 | 305.4 | 2.9688 | 4.7109 | 6.2928 | 9.2616 |
| 73 | 1500 | 14.519 | 7.432 | 307.76 | 2.9815 | 4.7015 | 6.2928 | 9.2743 |
| 74 | 1530 | 14.814 | 7.4578 | 309.29 | 2.986 | 4.6926 | 6.2928 | 9.2788 |
| 75 | 1560 | 15.107 | 7.4835 | 312.12 | 3.003 | 4.6837 | 6.2928 | 9.2958 |
| 76 | 1590 | 15.398 | 7.5092 | 314.54 | 3.0159 | 4.6743 | 6.2928 | 9.3087 |
| 77 | 1613.1 | 15.62 | 7.529 | 316.72 | 3.0288 | 4.6682 | 6.2928 | 9.3216 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.08 in
Specimen Area: 6.35 in^2
Specimen Volume: 38.65 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.2928 | 6.2928 | 0 | 0.000 | 1.2474 | 1.2474 | 1.000 | 1.2474 | 0 |
| 2 | 0.04 | 6.6253 | 6.2928 | 0.15311 | 0.460 | 1.4268 | 1.0943 | 1.304 | 1.2605 | 0.16625 |
| 3 | 0.09 | 6.7379 | 6.2928 | 0.23521 | 0.528 | 1.4573 | 1.0122 | 1.440 | 1.2348 | 0.22257 |
| 4 | 0.13 | 6.8064 | 6.2928 | 0.28847 | 0.562 | 1.4726 | 0.95893 | 1.536 | 1.2158 | 0.25682 |
| 5 | 0.18 | 6.8589 | 6.2928 | 0.32896 | 0.581 | 1.4845 | 0.91844 | 1.616 | 1.2015 | 0.28303 |
| 6 | 0.23 | 6.9032 | 6.2928 | 0.36003 | 0.590 | 1.4978 | 0.88737 | 1.688 | 1.1926 | 0.30522 |
| 7 | 0.27 | 6.9409 | 6.2928 | 0.38444 | 0.593 | 1.5111 | 0.86296 | 1.751 | 1.187 | 0.32406 |
| 8 | 0.32 | 6.9746 | 6.2928 | 0.40496 | 0.594 | 1.5242 | 0.84244 | 1.809 | 1.1833 | 0.34088 |
| 9 | 0.37 | 7.0028 | 6.2928 | 0.42216 | 0.595 | 1.5353 | 0.82524 | 1.860 | 1.1803 | 0.35502 |
| 10 | 0.42 | 7.0317 | 6.2928 | 0.43658 | 0.591 | 1.5498 | 0.81082 | 1.911 | 1.1803 | 0.36947 |
| 11 | 0.47 | 7.056 | 6.2928 | 0.44823 | 0.587 | 1.5624 | 0.79917 | 1.955 | 1.1808 | 0.3816 |
| 12 | 0.52 | 7.0829 | 6.2928 | 0.45877 | 0.581 | 1.5787 | 0.78863 | 2.002 | 1.1837 | 0.39504 |
| 13 | 0.56 | 7.1064 | 6.2928 | 0.46765 | 0.575 | 1.5934 | 0.77975 | 2.043 | 1.1866 | 0.4068 |
| 14 | 0.66 | 7.1507 | 6.2928 | 0.48152 | 0.561 | 1.6238 | 0.76588 | 2.120 | 1.1949 | 0.42897 |
| 15 | 0.76 | 7.1957 | 6.2928 | 0.49206 | 0.545 | 1.6582 | 0.75534 | 2.195 | 1.2068 | 0.45143 |
| 16 | 0.85 | 7.2431 | 6.2928 | 0.49816 | 0.524 | 1.6995 | 0.74924 | 2.268 | 1.2244 | 0.47515 |
| 17 | 0.95 | 7.2885 | 6.2928 | 0.50204 | 0.504 | 1.741 | 0.74536 | 2.336 | 1.2432 | 0.49784 |
| 18 | 1.05 | 7.3324 | 6.2928 | 0.50426 | 0.485 | 1.7828 | 0.74314 | 2.399 | 1.263 | 0.51982 |
| 19 | 1.14 | 7.3697 | 6.2928 | 0.50482 | 0.469 | 1.8195 | 0.74258 | 2.450 | 1.281 | 0.53846 |
| 20 | 1.24 | 7.4089 | 6.2928 | 0.50426 | 0.452 | 1.8593 | 0.74314 | 2.502 | 1.3012 | 0.55806 |
| 21 | 1.34 | 7.4586 | 6.2928 | 0.50204 | 0.431 | 1.9111 | 0.74536 | 2.564 | 1.3283 | 0.5829 |
| 22 | 1.43 | 7.5029 | 6.2928 | 0.49982 | 0.413 | 1.9576 | 0.74758 | 2.619 | 1.3526 | 0.60504 |
| 23 | 1.53 | 7.5379 | 6.2928 | 0.49539 | 0.398 | 1.9971 | 0.75202 | 2.656 | 1.3746 | 0.62255 |
| 24 | 1.63 | 7.578 | 6.2928 | 0.4915 | 0.382 | 2.0411 | 0.7559 | 2.700 | 1.3985 | 0.64262 |
| 25 | 1.72 | 7.6103 | 6.2928 | 0.48596 | 0.369 | 2.0789 | 0.76145 | 2.730 | 1.4202 | 0.65874 |
| 26 | 1.82 | 7.6438 | 6.2928 | 0.48041 | 0.356 | 2.1179 | 0.76699 | 2.761 | 1.4425 | 0.67548 |
| 27 | 1.91 | 7.6791 | 6.2928 | 0.47431 | 0.342 | 2.1594 | 0.7731 | 2.793 | 1.4663 | 0.69317 |
| 28 | 2.01 | 7.7125 | 6.2928 | 0.46709 | 0.329 | 2.2 | 0.78031 | 2.819 | 1.4902 | 0.70984 |
| 29 | 2.10 | 7.7464 | 6.2928 | 0.45988 | 0.316 | 2.2411 | 0.78752 | 2.846 | 1.5143 | 0.72681 |
| 30 | 2.20 | 7.7803 | 6.2928 | 0.45212 | 0.304 | 2.2828 | 0.79529 | 2.870 | 1.539 | 0.74374 |
| 31 | 2.29 | 7.8121 | 6.2928 | 0.4438 | 0.292 | 2.3229 | 0.80361 | 2.891 | 1.5633 | 0.75966 |
| 32 | 2.58 | 7.9078 | 6.2928 | 0.41828 | 0.259 | 2.4441 | 0.82912 | 2.948 | 1.6366 | 0.8075 |
| 33 | 2.88 | 7.9685 | 6.2928 | 0.39109 | 0.233 | 2.532 | 0.85631 | 2.957 | 1.6941 | 0.83783 |
| 34 | 3.17 | 8.03 | 6.2928 | 0.3628 | 0.209 | 2.6218 | 0.8846 | 2.964 | 1.7532 | 0.86861 |
| 35 | 3.46 | 8.0938 | 6.2928 | 0.33507 | 0.186 | 2.7133 | 0.91234 | 2.974 | 1.8128 | 0.9005 |
| 36 | 3.75 | 8.1449 | 6.2928 | 0.30733 | 0.166 | 2.7922 | 0.94007 | 2.970 | 1.8661 | 0.92607 |
| 37 | 4.04 | 8.1983 | 6.2928 | 0.27959 | 0.147 | 2.8734 | 0.96781 | 2.969 | 1.9206 | 0.95277 |
| 38 | 4.33 | 8.2475 | 6.2928 | 0.25352 | 0.130 | 2.9486 | 0.99388 | 2.967 | 1.9713 | 0.97737 |
| 39 | 4.62 | 8.2951 | 6.2928 | 0.22578 | 0.113 | 3.0239 | 1.0216 | 2.960 | 2.0228 | 1.0012 |
| 40 | 4.91 | 8.3347 | 6.2928 | 0.19971 | 0.098 | 3.0896 | 1.0477 | 2.949 | 2.0686 | 1.021 |
| 41 | 5.21 | 8.3815 | 6.2928 | 0.17474 | 0.084 | 3.1614 | 1.0727 | 2.947 | 2.117 | 1.0444 |
| 42 | 5.50 | 8.4275 | 6.2928 | 0.15034 | 0.070 | 3.2318 | 1.0971 | 2.946 | 2.1644 | 1.0673 |
| 43 | 5.79 | 8.4751 | 6.2928 | 0.12482 | 0.057 | 3.3048 | 1.1226 | 2.944 | 2.2137 | 1.0911 |
| 44 | 6.08 | 8.5205 | 6.2928 | 0.10152 | 0.046 | 3.3735 | 1.1459 | 2.944 | 2.2597 | 1.1138 |
| 45 | 6.37 | 8.5573 | 6.2928 | 0.078774 | 0.035 | 3.4332 | 1.1686 | 2.938 | 2.3009 | 1.1323 |
| 46 | 6.66 | 8.5952 | 6.2928 | 0.056029 | 0.024 | 3.4938 | 1.1914 | 2.933 | 2.3426 | 1.1512 |
| 47 | 6.95 | 8.6353 | 6.2928 | 0.034394 | 0.015 | 3.5555 | 1.213 | 2.931 | 2.3842 | 1.1712 |
| 48 | 7.24 | 8.6781 | 6.2928 | 0.012759 | 0.005 | 3.62 | 1.2346 | 2.932 | 2.4273 | 1.1927 |
| 49 | 7.54 | 8.7193 | 6.2928 | -0.0072117 | -0.003 | 3.6811 | 1.2546 | 2.934 | 2.4679 | 1.2133 |
| 50 | 7.83 | 8.7424 | 6.2928 | -0.026628 | -0.011 | 3.7236 | 1.274 | 2.923 | 2.4988 | 1.2248 |
| 51 | 8.12 | 8.7752 | 6.2928 | -0.047153 | -0.019 | 3.777 | 1.2946 | 2.918 | 2.5358 | 1.2412 |
| 52 | 8.41 | 8.8169 | 6.2928 | -0.064905 | -0.026 | 3.8364 | 1.3123 | 2.923 | 2.5744 | 1.262 |
| 53 | 8.70 | 8.8571 | 6.2928 | -0.083212 | -0.032 | 3.895 | 1.3306 | 2.927 | 2.6128 | 1.2822 |
| 54 | 8.99 | 8.877 | 6.2928 | -0.10096 | -0.039 | 3.9325 | 1.3484 | 2.917 | 2.6404 | 1.2921 |
| 55 | 9.28 | 8.9014 | 6.2928 | -0.11872 | -0.046 | 3.9747 | 1.3661 | 2.910 | 2.6704 | 1.3043 |
| 56 | 9.57 | 8.9329 | 6.2928 | -0.1348 | -0.051 | 4.0223 | 1.3822 | 2.910 | 2.7022 | 1.32 |
| 57 | 9.86 | 8.9689 | 6.2928 | -0.15089 | -0.056 | 4.0744 | 1.3983 | 2.914 | 2.7363 | 1.338 |
| 58 | 10.16 | 8.9962 | 6.2928 | -0.16476 | -0.061 | 4.1156 | 1.4122 | 2.914 | 2.7639 | 1.3517 |
| 59 | 10.45 | 9.0192 | 6.2928 | -0.18085 | -0.066 | 4.1547 | 1.4282 | 2.909 | 2.7915 | 1.3632 |
| 60 | 10.74 | 9.0414 | 6.2928 | -0.19472 | -0.071 | 4.1907 | 1.4421 | 2.906 | 2.8164 | 1.3743 |
| 61 | 11.02 | 9.0515 | 6.2928 | -0.20914 | -0.076 | 4.2153 | 1.4565 | 2.894 | 2.8359 | 1.3794 |
| 62 | 11.31 | 9.077 | 6.2928 | -0.22301 | -0.080 | 4.2546 | 1.4704 | 2.893 | 2.8625 | 1.3921 |
| 63 | 11.60 | 9.0998 | 6.2928 | -0.23577 | -0.084 | 4.2902 | 1.4832 | 2.893 | 2.8867 | 1.4035 |
| 64 | 11.89 | 9.1118 | 6.2928 | -0.24853 | -0.088 | 4.3149 | 1.4959 | 2.884 | 2.9054 | 1.4095 |
| 65 | 12.18 | 9.1294 | 6.2928 | -0.26184 | -0.092 | 4.3458 | 1.5092 | 2.879 | 2.9275 | 1.4183 |
| 66 | 12.48 | 9.1444 | 6.2928 | -0.27404 | -0.096 | 4.3731 | 1.5214 | 2.874 | 2.9473 | 1.4258 |
| 67 | 12.77 | 9.1716 | 6.2928 | -0.28458 | -0.099 | 4.4108 | 1.532 | 2.879 | 2.9714 | 1.4394 |
| 68 | 13.06 | 9.188 | 6.2928 | -0.29623 | -0.102 | 4.4389 | 1.5436 | 2.876 | 2.9913 | 1.4476 |
| 69 | 13.35 | 9.2154 | 6.2928 | -0.30622 | -0.105 | 4.4762 | 1.5536 | 2.881 | 3.0149 | 1.4613 |
| 70 | 13.64 | 9.2236 | 6.2928 | -0.3162 | -0.108 | 4.4944 | 1.5636 | 2.874 | 3.029 | 1.4654 |
| 71 | 13.93 | 9.2413 | 6.2928 | -0.32563 | -0.110 | 4.5216 | 1.573 | 2.874 | 3.0473 | 1.4743 |
| 72 | 14.23 | 9.2616 | 6.2928 | -0.33451 | -0.113 | 4.5507 | 1.5819 | 2.877 | 3.0663 | 1.4844 |
| 73 | 14.52 | 9.2743 | 6.2928 | -0.34394 | -0.115 | 4.5729 | 1.5913 | 2.874 | 3.0821 | 1.4908 |
| 74 | 14.81 | 9.2788 | 6.2928 | -0.35282 | -0.118 | 4.5862 | 1.6002 | 2.866 | 3.0932 | 1.493 |
| 75 | 15.11 | 9.2958 | 6.2928 | -0.36169 | -0.120 | 4.6121 | 1.6091 | 2.866 | 3.1106 | 1.5015 |
| 76 | 15.40 | 9.3087 | 6.2928 | -0.37112 | -0.123 | 4.6344 | 1.6185 | 2.863 | 3.1265 | 1.5079 |
| 77 | 15.62 | 9.3216 | 6.2928 | -0.37723 | -0.125 | 4.6534 | 1.6246 | 2.864 | 3.139 | 1.5144 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.02 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.27 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 24

Measured Specific Gravity: 2.67

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.36 | 0 | 0 | 5.0404 | 6.8328 | 6.8328 |
| 2 | 5.0037 | 0.032682 | 6.3621 | 36.347 | 0.41134 | 5.2561 | 6.8328 | 7.2441 |
| 3 | 10.004 | 0.078153 | 6.365 | 49.512 | 0.56007 | 5.3969 | 6.8328 | 7.3929 |
| 4 | 15.004 | 0.12504 | 6.368 | 56.855 | 0.64283 | 5.4904 | 6.8328 | 7.4756 |
| 5 | 20.004 | 0.17194 | 6.371 | 61.995 | 0.70062 | 5.5581 | 6.8328 | 7.5334 |
| 6 | 25.004 | 0.22025 | 6.3741 | 66.401 | 0.75005 | 5.6109 | 6.8328 | 7.5828 |
| 7 | 30 | 0.26714 | 6.3771 | 70.072 | 0.79115 | 5.6527 | 6.8328 | 7.6239 |
| 8 | 35 | 0.31261 | 6.38 | 73.376 | 0.82808 | 5.6874 | 6.8328 | 7.6609 |
| 9 | 40 | 0.3595 | 6.383 | 76.366 | 0.86141 | 5.716 | 6.8328 | 7.6942 |
| 10 | 45 | 0.40924 | 6.3862 | 79.355 | 0.89468 | 5.7402 | 6.8328 | 7.7275 |
| 11 | 50 | 0.45755 | 6.3893 | 81.978 | 0.9238 | 5.7605 | 6.8328 | 7.7566 |
| 12 | 55 | 0.50444 | 6.3923 | 84.443 | 0.95113 | 5.7781 | 6.8328 | 7.7839 |
| 13 | 60.001 | 0.55133 | 6.3953 | 86.961 | 0.97903 | 5.793 | 6.8328 | 7.8118 |
| 14 | 70.001 | 0.64512 | 6.4013 | 92.153 | 1.0365 | 5.8172 | 6.8328 | 7.8693 |
| 15 | 80.001 | 0.74458 | 6.4077 | 97.083 | 1.0909 | 5.8354 | 6.8328 | 7.9237 |
| 16 | 90.001 | 0.83695 | 6.4137 | 101.44 | 1.1387 | 5.7374 | 6.8328 | 7.9715 |
| 17 | 100 | 0.92789 | 6.4196 | 106.63 | 1.1959 | 5.8392 | 6.8328 | 8.0287 |
| 18 | 110 | 1.0217 | 6.4257 | 111.51 | 1.2494 | 5.8392 | 6.8328 | 8.0822 |
| 19 | 120 | 1.1169 | 6.4319 | 116.07 | 1.2993 | 5.8414 | 6.8328 | 8.1321 |
| 20 | 130 | 1.2107 | 6.438 | 120.95 | 1.3526 | 5.842 | 6.8328 | 8.1854 |
| 21 | 140 | 1.3059 | 6.4442 | 125.67 | 1.4041 | 5.8398 | 6.8328 | 8.2369 |
| 22 | 150 | 1.4039 | 6.4506 | 130.28 | 1.4542 | 5.8381 | 6.8328 | 8.287 |
| 23 | 160 | 1.4949 | 6.4565 | 134.85 | 1.5037 | 5.8337 | 6.8328 | 8.3365 |
| 24 | 170 | 1.5943 | 6.4631 | 139.57 | 1.5548 | 5.8282 | 6.8328 | 8.3876 |
| 25 | 180 | 1.6924 | 6.4695 | 144.34 | 1.6064 | 5.8194 | 6.8328 | 8.4392 |
| 26 | 190 | 1.7862 | 6.4757 | 148.8 | 1.6544 | 5.8101 | 6.8328 | 8.4872 |
| 27 | 200 | 1.8814 | 6.482 | 153.15 | 1.7012 | 5.8002 | 6.8328 | 8.534 |
| 28 | 210 | 1.9794 | 6.4885 | 157.5 | 1.7478 | 5.7892 | 6.8328 | 8.5806 |
| 29 | 220 | 2.076 | 6.4949 | 161.7 | 1.7926 | 5.777 | 6.8328 | 8.6254 |
| 30 | 230 | 2.1727 | 6.5013 | 165.74 | 1.8355 | 5.766 | 6.8328 | 8.6683 |
| 31 | 240 | 2.2707 | 6.5078 | 169.99 | 1.8807 | 5.7523 | 6.8328 | 8.7135 |
| 32 | 270 | 2.5577 | 6.527 | 181.26 | 1.9996 | 5.7083 | 6.8328 | 8.8324 |
| 33 | 300 | 2.8433 | 6.5462 | 192.44 | 2.1166 | 5.6637 | 6.8328 | 8.9494 |
| 34 | 330 | 3.1219 | 6.565 | 202.56 | 2.2215 | 5.6214 | 6.8328 | 9.0543 |
| 35 | 360 | 3.406 | 6.5843 | 212.47 | 2.3234 | 5.6076 | 6.8328 | 9.1562 |
| 36 | 390 | 3.6945 | 6.604 | 222.12 | 2.4217 | 5.5625 | 6.8328 | 9.2545 |
| 37 | 420 | 3.9815 | 6.6238 | 231.46 | 2.5159 | 5.519 | 6.8328 | 9.3487 |
| 38 | 450 | 4.2714 | 6.6438 | 240.43 | 2.6055 | 5.4761 | 6.8328 | 9.4383 |
| 39 | 480 | 4.557 | 6.6637 | 248.71 | 2.6873 | 5.4343 | 6.8328 | 9.5201 |
| 40 | 510 | 4.8398 | 6.6835 | 256.9 | 2.7675 | 5.3947 | 6.8328 | 9.6003 |
| 41 | 540 | 5.1254 | 6.7036 | 264.34 | 2.8392 | 5.354 | 6.8328 | 9.672 |
| 42 | 570 | 5.411 | 6.7239 | 272.37 | 2.9166 | 5.316 | 6.8328 | 9.7494 |
| 43 | 600 | 5.6995 | 6.7444 | 280.03 | 2.9894 | 5.2759 | 6.8328 | 9.8222 |
| 44 | 630 | 5.9894 | 6.7652 | 287.37 | 3.0584 | 5.2401 | 6.8328 | 9.8912 |
| 45 | 660 | 6.2778 | 6.786 | 294.03 | 3.1197 | 5.2054 | 6.8328 | 9.9525 |
| 46 | 690 | 6.5705 | 6.8073 | 301.01 | 3.1837 | 5.1713 | 6.8328 | 10.016 |
| 47 | 720 | 6.8604 | 6.8285 | 307.77 | 3.2452 | 5.1389 | 6.8328 | 10.078 |
| 48 | 750 | 7.1432 | 6.8493 | 314.07 | 3.3015 | 5.1086 | 6.8328 | 10.134 |
| 49 | 780 | 7.426 | 6.8702 | 320.31 | 3.3568 | 5.0784 | 6.8328 | 10.19 |
| 50 | 810 | 7.7101 | 6.8914 | 324.19 | 3.3871 | 5.0492 | 6.8328 | 10.22 |
| 51 | 840 | 7.9943 | 6.9126 | 331.48 | 3.4526 | 5.0212 | 6.8328 | 10.285 |
| 52 | 870 | 8.2828 | 6.9344 | 336.93 | 3.4984 | 4.9942 | 6.8328 | 10.331 |
| 53 | 900 | 8.5741 | 6.9565 | 342.91 | 3.5492 | 4.9705 | 6.8328 | 10.382 |
| 54 | 930 | 8.8668 | 6.9788 | 348.21 | 3.5925 | 4.9458 | 6.8328 | 10.425 |
| 55 | 960 | 9.1609 | 7.0014 | 353.93 | 3.6396 | 4.9216 | 6.8328 | 10.472 |
| 56 | 990 | 9.448 | 7.0236 | 357.76 | 3.6674 | 4.9012 | 6.8328 | 10.5 |
| 57 | 1020 | 9.7336 | 7.0458 | 363.58 | 3.7153 | 4.8809 | 6.8328 | 10.548 |
| 58 | 1050 | 10.022 | 7.0684 | 368.98 | 3.7585 | 4.8589 | 6.8328 | 10.591 |
| 59 | 1080 | 10.301 | 7.0904 | 373.02 | 3.7879 | 4.8391 | 6.8328 | 10.621 |
| 60 | 1110 | 10.585 | 7.1129 | 377.95 | 3.8258 | 4.8192 | 6.8328 | 10.659 |
| 61 | 1140 | 10.877 | 7.1363 | 382.93 | 3.8635 | 4.8005 | 6.8328 | 10.696 |
| 62 | 1170 | 11.167 | 7.1596 | 387.34 | 3.8952 | 4.7813 | 6.8328 | 10.728 |
| 63 | 1200 | 11.457 | 7.183 | 392.06 | 3.9299 | 4.7626 | 6.8328 | 10.763 |
| 64 | 1230 | 11.743 | 7.2062 | 396.36 | 3.9601 | 4.7472 | 6.8328 | 10.793 |
| 65 | 1260 | 12.027 | 7.2295 | 401.76 | 4.0012 | 4.7279 | 6.8328 | 10.834 |
| 66 | 1290 | 12.308 | 7.2527 | 404.59 | 4.0165 | 4.7098 | 6.8328 | 10.849 |
| 67 | 1320 | 12.591 | 7.2762 | 409.47 | 4.0518 | 4.6944 | 6.8328 | 10.885 |
| 68 | 1350 | 12.88 | 7.3003 | 413.98 | 4.0829 | 4.6795 | 6.8328 | 10.916 |
| 69 | 1380 | 13.172 | 7.3249 | 417.76 | 4.1063 | 4.6652 | 6.8328 | 10.939 |
| 70 | 1410 | 13.464 | 7.3495 | 422.16 | 4.1357 | 4.6526 | 6.8328 | 10.969 |
| 71 | 1440 | 13.758 | 7.3746 | 425.99 | 4.1591 | 4.6388 | 6.8328 | 10.992 |
| 72 | 1470 | 14.042 | 7.399 | 429.93 | 4.1836 | 4.625 | 6.8328 | 11.016 |
| 73 | 1500 | 14.323 | 7.4233 | 434.02 | 4.2096 | 4.6096 | 6.8328 | 11.042 |
| 74 | 1530 | 14.609 | 7.4481 | 436.53 | 4.2199 | 4.5953 | 6.8328 | 11.053 |
| 75 | 1560 | 14.897 | 7.4734 | 441.31 | 4.2516 | 4.5816 | 6.8328 | 11.084 |
| 76 | 1590 | 15.19 | 7.4992 | 445.29 | 4.2753 | 4.5662 | 6.8328 | 11.108 |
| 77 | 1614.3 | 15.429 | 7.5203 | 447.97 | 4.2889 | 4.5552 | 6.8328 | 11.122 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-2-1 S-14
Sample No.: S-14
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/5/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Soil Description: CLAYEY F-M SAND LITTLE SILT- BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.02 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.27 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

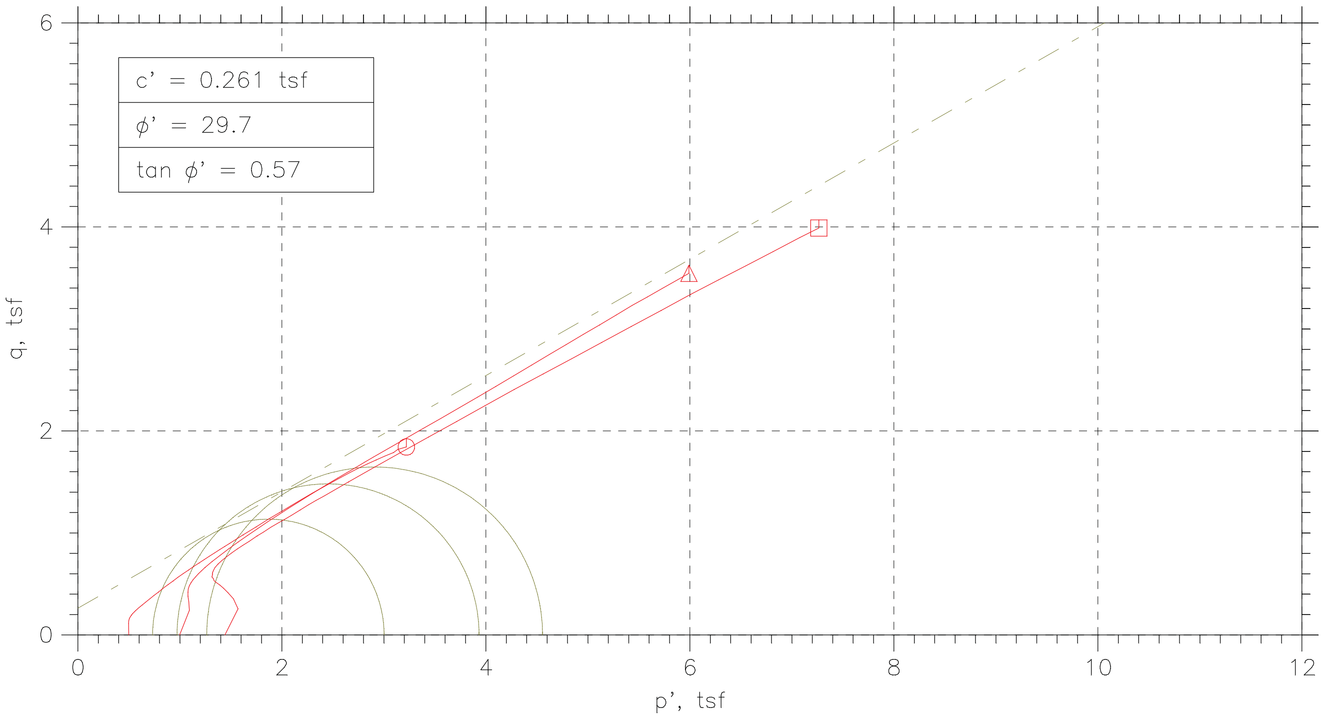
Plastic Limit: 24

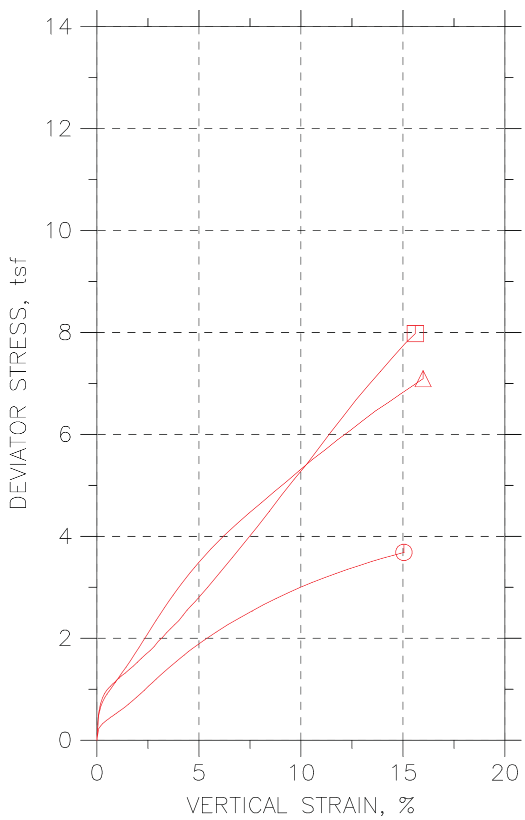
Measured Specific Gravity: 2.67

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.8328 | 6.8328 | 0 | 0.000 | 1.7924 | 1.7924 | 1.000 | 1.7924 | 0 |
| 2 | 0.03 | 7.2441 | 6.8328 | 0.21566 | 0.524 | 1.9881 | 1.5767 | 1.261 | 1.7824 | 0.20567 |
| 3 | 0.08 | 7.3929 | 6.8328 | 0.35649 | 0.637 | 1.996 | 1.4359 | 1.390 | 1.7159 | 0.28004 |
| 4 | 0.13 | 7.4756 | 6.8328 | 0.45002 | 0.700 | 1.9852 | 1.3424 | 1.479 | 1.6638 | 0.32142 |
| 5 | 0.17 | 7.5334 | 6.8328 | 0.51768 | 0.739 | 1.9753 | 1.2747 | 1.550 | 1.625 | 0.35031 |
| 6 | 0.22 | 7.5828 | 6.8328 | 0.5705 | 0.761 | 1.9719 | 1.2219 | 1.614 | 1.5969 | 0.37502 |
| 7 | 0.27 | 7.6239 | 6.8328 | 0.61231 | 0.774 | 1.9712 | 1.1801 | 1.670 | 1.5757 | 0.39557 |
| 8 | 0.31 | 7.6609 | 6.8328 | 0.64697 | 0.781 | 1.9735 | 1.1454 | 1.723 | 1.5595 | 0.41404 |
| 9 | 0.36 | 7.6942 | 6.8328 | 0.67558 | 0.784 | 1.9782 | 1.1168 | 1.771 | 1.5475 | 0.4307 |
| 10 | 0.41 | 7.7275 | 6.8328 | 0.69978 | 0.782 | 1.9873 | 1.0926 | 1.819 | 1.54 | 0.44734 |
| 11 | 0.46 | 7.7566 | 6.8328 | 0.72014 | 0.780 | 1.9961 | 1.0723 | 1.862 | 1.5342 | 0.4619 |
| 12 | 0.50 | 7.7839 | 6.8328 | 0.73774 | 0.776 | 2.0058 | 1.0547 | 1.902 | 1.5302 | 0.47557 |
| 13 | 0.55 | 7.8118 | 6.8328 | 0.7526 | 0.769 | 2.0188 | 1.0398 | 1.942 | 1.5293 | 0.48951 |
| 14 | 0.65 | 7.8693 | 6.8328 | 0.7768 | 0.749 | 2.0521 | 1.0156 | 2.021 | 1.5338 | 0.51825 |
| 15 | 0.74 | 7.9237 | 6.8328 | 0.79496 | 0.729 | 2.0883 | 0.99744 | 2.094 | 1.5429 | 0.54543 |
| 16 | 0.84 | 7.9715 | 6.8328 | 0.69703 | 0.612 | 2.2341 | 1.0954 | 2.040 | 1.6647 | 0.56936 |
| 17 | 0.93 | 8.0287 | 6.8328 | 0.79881 | 0.668 | 2.1895 | 0.99359 | 2.204 | 1.5915 | 0.59796 |
| 18 | 1.02 | 8.0822 | 6.8328 | 0.79881 | 0.639 | 2.243 | 0.99359 | 2.258 | 1.6183 | 0.62472 |
| 19 | 1.12 | 8.1321 | 6.8328 | 0.80101 | 0.616 | 2.2907 | 0.99139 | 2.311 | 1.641 | 0.64966 |
| 20 | 1.21 | 8.1854 | 6.8328 | 0.80156 | 0.593 | 2.3435 | 0.99084 | 2.365 | 1.6672 | 0.67632 |
| 21 | 1.31 | 8.2369 | 6.8328 | 0.79936 | 0.569 | 2.3971 | 0.99304 | 2.414 | 1.6951 | 0.70204 |
| 22 | 1.40 | 8.287 | 6.8328 | 0.79771 | 0.549 | 2.4489 | 0.99469 | 2.462 | 1.7218 | 0.7271 |
| 23 | 1.49 | 8.3365 | 6.8328 | 0.79331 | 0.528 | 2.5028 | 0.99909 | 2.505 | 1.751 | 0.75187 |
| 24 | 1.59 | 8.3876 | 6.8328 | 0.7878 | 0.507 | 2.5594 | 1.0046 | 2.548 | 1.782 | 0.7774 |
| 25 | 1.69 | 8.4392 | 6.8328 | 0.779 | 0.485 | 2.6198 | 1.0134 | 2.585 | 1.8166 | 0.80319 |
| 26 | 1.79 | 8.4872 | 6.8328 | 0.76965 | 0.465 | 2.6772 | 1.0227 | 2.618 | 1.8499 | 0.82721 |
| 27 | 1.88 | 8.534 | 6.8328 | 0.75975 | 0.447 | 2.7338 | 1.0326 | 2.647 | 1.8832 | 0.85058 |
| 28 | 1.98 | 8.5806 | 6.8328 | 0.74874 | 0.428 | 2.7914 | 1.0436 | 2.675 | 1.9175 | 0.87389 |
| 29 | 2.08 | 8.6254 | 6.8328 | 0.73664 | 0.411 | 2.8483 | 1.0558 | 2.698 | 1.952 | 0.89628 |
| 30 | 2.17 | 8.6683 | 6.8328 | 0.72564 | 0.395 | 2.9023 | 1.0668 | 2.721 | 1.9845 | 0.91776 |
| 31 | 2.27 | 8.7135 | 6.8328 | 0.71188 | 0.379 | 2.9612 | 1.0805 | 2.741 | 2.0209 | 0.94034 |
| 32 | 2.56 | 8.8324 | 6.8328 | 0.66787 | 0.334 | 3.1241 | 1.1245 | 2.778 | 2.1243 | 0.99978 |
| 33 | 2.84 | 8.9494 | 6.8328 | 0.62331 | 0.294 | 3.2856 | 1.1691 | 2.810 | 2.2274 | 1.0583 |
| 34 | 3.12 | 9.0543 | 6.8328 | 0.58095 | 0.262 | 3.433 | 1.2114 | 2.834 | 2.3222 | 1.1108 |
| 35 | 3.41 | 9.1562 | 6.8328 | 0.5672 | 0.244 | 3.5486 | 1.2252 | 2.896 | 2.3869 | 1.1617 |
| 36 | 3.69 | 9.2545 | 6.8328 | 0.52209 | 0.216 | 3.692 | 1.2703 | 2.906 | 2.4811 | 1.2108 |
| 37 | 3.98 | 9.3487 | 6.8328 | 0.47862 | 0.190 | 3.8297 | 1.3138 | 2.915 | 2.5717 | 1.258 |
| 38 | 4.27 | 9.4383 | 6.8328 | 0.43571 | 0.167 | 3.9622 | 1.3567 | 2.921 | 2.6595 | 1.3028 |
| 39 | 4.56 | 9.5201 | 6.8328 | 0.3939 | 0.147 | 4.0858 | 1.3985 | 2.922 | 2.7421 | 1.3437 |
| 40 | 4.84 | 9.6003 | 6.8328 | 0.35429 | 0.128 | 4.2056 | 1.4381 | 2.924 | 2.8218 | 1.3837 |
| 41 | 5.13 | 9.672 | 6.8328 | 0.31358 | 0.110 | 4.318 | 1.4788 | 2.920 | 2.8984 | 1.4196 |
| 42 | 5.41 | 9.7494 | 6.8328 | 0.27562 | 0.095 | 4.4333 | 1.5168 | 2.923 | 2.9751 | 1.4583 |
| 43 | 5.70 | 9.8222 | 6.8328 | 0.23546 | 0.079 | 4.5463 | 1.5569 | 2.920 | 3.0516 | 1.4947 |
| 44 | 5.99 | 9.8912 | 6.8328 | 0.1997 | 0.065 | 4.6511 | 1.5927 | 2.920 | 3.1219 | 1.5292 |
| 45 | 6.28 | 9.9525 | 6.8328 | 0.16504 | 0.053 | 4.747 | 1.6274 | 2.917 | 3.1872 | 1.5598 |
| 46 | 6.57 | 10.016 | 6.8328 | 0.13093 | 0.041 | 4.8452 | 1.6615 | 2.916 | 3.2533 | 1.5918 |
| 47 | 6.86 | 10.078 | 6.8328 | 0.098476 | 0.030 | 4.9391 | 1.6939 | 2.916 | 3.3165 | 1.6226 |
| 48 | 7.14 | 10.134 | 6.8328 | 0.068218 | 0.021 | 5.0256 | 1.7242 | 2.915 | 3.3749 | 1.6507 |
| 49 | 7.43 | 10.19 | 6.8328 | 0.03796 | 0.011 | 5.1113 | 1.7544 | 2.913 | 3.4328 | 1.6784 |
| 50 | 7.71 | 10.22 | 6.8328 | 0.0088023 | 0.003 | 5.1707 | 1.7836 | 2.899 | 3.4771 | 1.6935 |
| 51 | 7.99 | 10.285 | 6.8328 | -0.019255 | -0.006 | 5.2642 | 1.8116 | 2.906 | 3.5379 | 1.7263 |
| 52 | 8.28 | 10.331 | 6.8328 | -0.046212 | -0.013 | 5.337 | 1.8386 | 2.903 | 3.5878 | 1.7492 |
| 53 | 8.57 | 10.382 | 6.8328 | -0.069868 | -0.020 | 5.4114 | 1.8623 | 2.906 | 3.6368 | 1.7746 |
| 54 | 8.87 | 10.425 | 6.8328 | -0.094625 | -0.026 | 5.4795 | 1.887 | 2.904 | 3.6832 | 1.7962 |
| 55 | 9.16 | 10.472 | 6.8328 | -0.11883 | -0.033 | 5.5509 | 1.9112 | 2.904 | 3.731 | 1.8198 |
| 56 | 9.45 | 10.5 | 6.8328 | -0.13919 | -0.038 | 5.599 | 1.9316 | 2.899 | 3.7653 | 1.8337 |
| 57 | 9.73 | 10.548 | 6.8328 | -0.15954 | -0.043 | 5.6673 | 1.9519 | 2.903 | 3.8096 | 1.8577 |
| 58 | 10.02 | 10.591 | 6.8328 | -0.18155 | -0.048 | 5.7324 | 1.9739 | 2.904 | 3.8532 | 1.8792 |
| 59 | 10.30 | 10.621 | 6.8328 | -0.20135 | -0.053 | 5.7816 | 1.9937 | 2.900 | 3.8877 | 1.8939 |
| 60 | 10.58 | 10.659 | 6.8328 | -0.22116 | -0.058 | 5.8393 | 2.0136 | 2.900 | 3.9264 | 1.9129 |
| 61 | 10.88 | 10.696 | 6.8328 | -0.23986 | -0.062 | 5.8958 | 2.0323 | 2.901 | 3.964 | 1.9318 |
| 62 | 11.17 | 10.728 | 6.8328 | -0.25912 | -0.067 | 5.9468 | 2.0515 | 2.899 | 3.9991 | 1.9476 |
| 63 | 11.46 | 10.763 | 6.8328 | -0.27782 | -0.071 | 6.0001 | 2.0702 | 2.898 | 4.0351 | 1.9649 |
| 64 | 11.74 | 10.793 | 6.8328 | -0.29323 | -0.074 | 6.0458 | 2.0856 | 2.899 | 4.0657 | 1.9801 |
| 65 | 12.03 | 10.834 | 6.8328 | -0.31248 | -0.078 | 6.1061 | 2.1049 | 2.901 | 4.1055 | 2.0006 |
| 66 | 12.31 | 10.849 | 6.8328 | -0.33064 | -0.082 | 6.1395 | 2.123 | 2.892 | 4.1313 | 2.0083 |
| 67 | 12.59 | 10.885 | 6.8328 | -0.34604 | -0.085 | 6.1903 | 2.1384 | 2.895 | 4.1643 | 2.0259 |
| 68 | 12.88 | 10.916 | 6.8328 | -0.36089 | -0.088 | 6.2362 | 2.1533 | 2.896 | 4.1948 | 2.0415 |
| 69 | 13.17 | 10.939 | 6.8328 | -0.3752 | -0.091 | 6.2739 | 2.1676 | 2.894 | 4.2208 | 2.0532 |
| 70 | 13.46 | 10.969 | 6.8328 | -0.38785 | -0.094 | 6.316 | 2.1802 | 2.897 | 4.2481 | 2.0679 |
| 71 | 13.76 | 10.992 | 6.8328 | -0.4016 | -0.097 | 6.3531 | 2.194 | 2.896 | 4.2735 | 2.0795 |
| 72 | 14.04 | 11.016 | 6.8328 | -0.41536 | -0.099 | 6.3914 | 2.2078 | 2.895 | 4.2996 | 2.0918 |
| 73 | 14.32 | 11.042 | 6.8328 | -0.43076 | -0.102 | 6.4328 | 2.2232 | 2.894 | 4.328 | 2.1048 |
| 74 | 14.61 | 11.053 | 6.8328 | -0.44507 | -0.105 | 6.4574 | 2.2375 | 2.886 | 4.3474 | 2.11 |
| 75 | 14.90 | 11.084 | 6.8328 | -0.45882 | -0.108 | 6.5029 | 2.2512 | 2.889 | 4.377 | 2.1258 |
| 76 | 15.19 | 11.108 | 6.8328 | -0.47422 | -0.111 | 6.5419 | 2.2666 | 2.886 | 4.4043 | 2.1376 |
| 77 | 15.43 | 11.122 | 6.8328 | -0.48523 | -0.113 | 6.5665 | 2.2776 | 2.883 | 4.4221 | 2.1444 |

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|
| | Test No. | 7 PSI | 13.9 PSI | 20.8 PSI | |
| Initial | Diameter, in | 2.8457 | 2.8382 | 2.837 | |
| | Height, in | 5.9839 | 5.9646 | 5.7075 | |
| | Water Content, % | 13.01 | 13.76 | 17.65 | |
| | Dry Density, pcf | 117.3 | 118. | 109.8 | |
| | Saturation, % | 83.50 | 90.24 | 92.02 | |
| | Void Ratio | 0.41352 | 0.40495 | 0.50912 | |
| Before Shear | Water Content, % | 15.40 | 14.54 | 18.60 | |
| | Dry Density, pcf | 117.7 | 119.6 | 111. | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.40877 | 0.3861 | 0.49381 | |
| | Back Press., tsf | 5.046 | 5.0443 | 5.0958 | |
| | Minor Prin. Stress, tsf | 0.49798 | 0.99651 | 1.4418 | |
| | Max. Dev. Stress, tsf | 3.6849 | 7.0909 | 7.9769 | |
| | Time to Failure, min | 770.98 | 772.22 | 773.86 | |
| | Strain Rate, %/min | 0.02 | 0.02 | 0.02 | |
| | B-Value | .97 | .95 | .99 | |
| | Measured Specific Gravity | 2.65 | 2.65 | 2.65 | |
| | Liquid Limit | 27 | 27 | 27 | |
| | Plastic Limit | 11 | 11 | 11 | |
| | Plasticity Index | 16 | 16 | 16 | |
| | Failure Sketch |  |  |  | |

Project: COLETO CREEK FACILITY

Location: IPR-GDF SUEZ

Project No.: 60225561

Boring No.: B-4-1 S-7

Sample Type: 3" ST

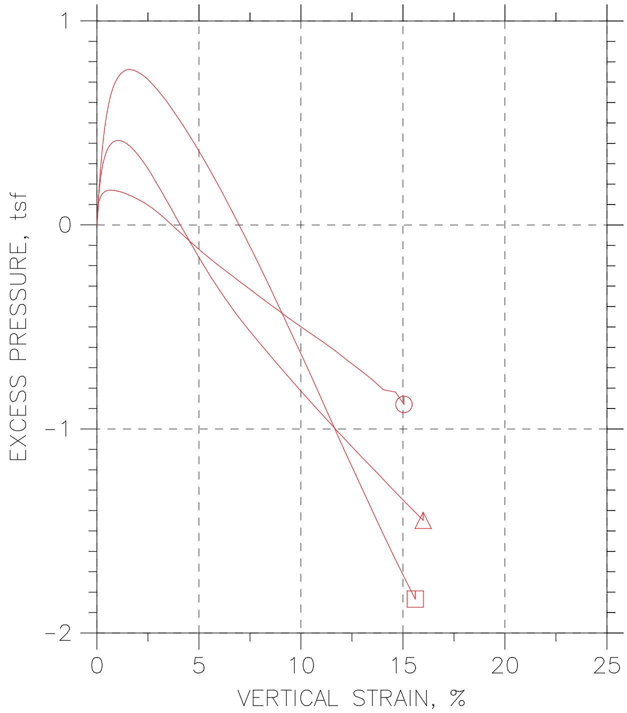
Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC

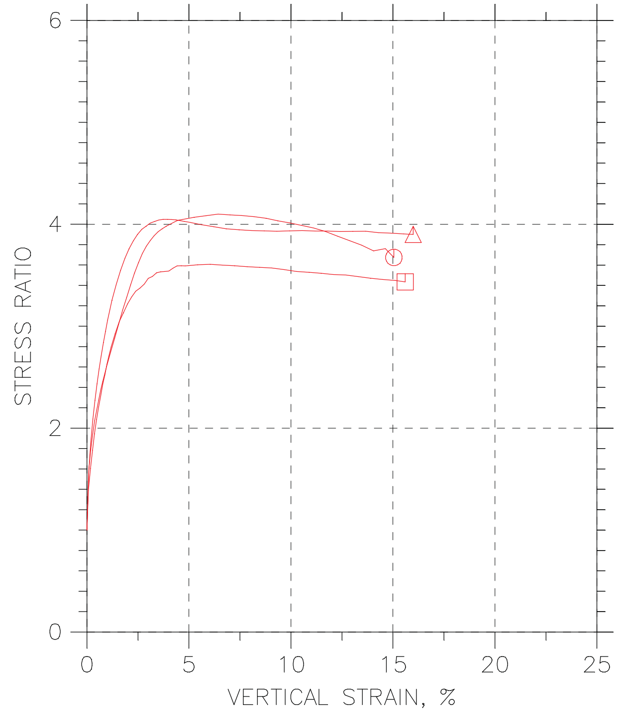
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

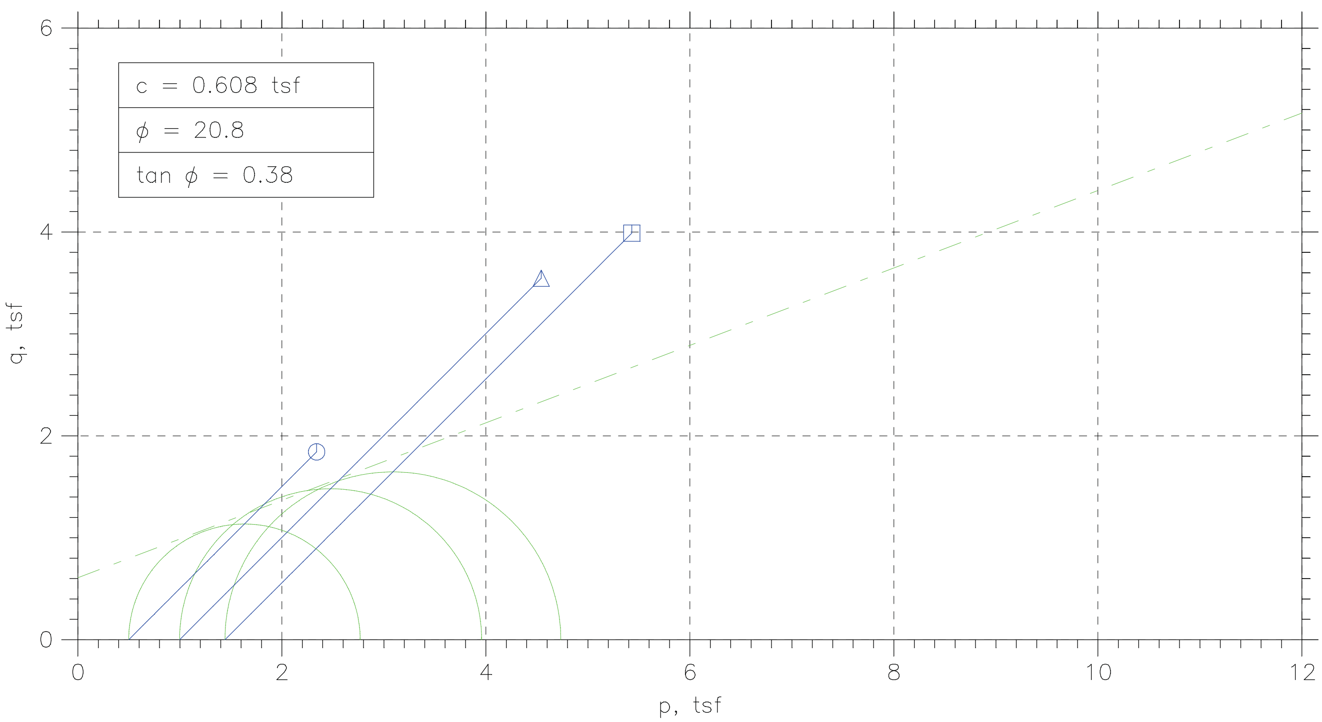
Mon, 12-DEC-2011 10:34:18

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-4-1 S-7 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-7 | Test Date: 12/1/11 | Depth: 12.0'-14.0' |
| Test No.: B-4-1 S-7 | Sample Type: 3" ST | Elevation: ---- |
| Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767 | | |
| | | |

Mon, 12-DEC-2011 10:34:58

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 7 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.06 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.36 | 0 | 0 | 5.046 | 5.544 | 5.544 |
| 2 | 5 | 0.086461 | 6.3655 | 19.795 | 0.2239 | 5.1593 | 5.544 | 5.7679 |
| 3 | 10 | 0.18589 | 6.3719 | 24.744 | 0.2796 | 5.1856 | 5.544 | 5.8236 |
| 4 | 15 | 0.28388 | 6.3781 | 28.64 | 0.3233 | 5.2008 | 5.544 | 5.8673 |
| 5 | 20 | 0.38187 | 6.3844 | 31.851 | 0.3592 | 5.209 | 5.544 | 5.9032 |
| 6 | 25 | 0.47842 | 6.3906 | 34.536 | 0.38911 | 5.2137 | 5.544 | 5.9331 |
| 7 | 30.001 | 0.57785 | 6.397 | 37.116 | 0.41775 | 5.216 | 5.544 | 5.9618 |
| 8 | 35.001 | 0.6744 | 6.4032 | 40.064 | 0.4505 | 5.2166 | 5.544 | 5.9945 |
| 9 | 40.001 | 0.77094 | 6.4094 | 42.433 | 0.47667 | 5.216 | 5.544 | 6.0207 |
| 10 | 45.001 | 0.86893 | 6.4158 | 44.961 | 0.50456 | 5.2148 | 5.544 | 6.0486 |
| 11 | 50.001 | 0.96692 | 6.4221 | 47.488 | 0.5324 | 5.2125 | 5.544 | 6.0764 |
| 12 | 55.001 | 1.0649 | 6.4285 | 50.015 | 0.56017 | 5.2102 | 5.544 | 6.1042 |
| 13 | 60.001 | 1.1629 | 6.4349 | 52.436 | 0.58671 | 5.2078 | 5.544 | 6.1307 |
| 14 | 70.001 | 1.3589 | 6.4476 | 57.701 | 0.64434 | 5.2014 | 5.544 | 6.1883 |
| 15 | 80.001 | 1.5549 | 6.4605 | 63.545 | 0.70819 | 5.1932 | 5.544 | 6.2522 |
| 16 | 90.002 | 1.7494 | 6.4733 | 69.652 | 0.77472 | 5.1851 | 5.544 | 6.3187 |
| 17 | 100 | 1.9454 | 6.4862 | 75.812 | 0.84155 | 5.1751 | 5.544 | 6.3855 |
| 18 | 110 | 2.1399 | 6.4991 | 82.287 | 0.91162 | 5.1652 | 5.544 | 6.4556 |
| 19 | 120 | 2.333 | 6.5119 | 89.026 | 0.98433 | 5.1535 | 5.544 | 6.5283 |
| 20 | 130 | 2.5261 | 6.5248 | 95.87 | 1.0579 | 5.1407 | 5.544 | 6.6019 |
| 21 | 140 | 2.7178 | 6.5377 | 102.5 | 1.1289 | 5.1278 | 5.544 | 6.6729 |
| 22 | 150 | 2.9109 | 6.5507 | 109.3 | 1.2013 | 5.1126 | 5.544 | 6.7453 |
| 23 | 160 | 3.1054 | 6.5639 | 115.93 | 1.2716 | 5.0963 | 5.544 | 6.8156 |
| 24 | 170 | 3.2999 | 6.5771 | 122.56 | 1.3417 | 5.0793 | 5.544 | 6.8857 |
| 25 | 180 | 3.4959 | 6.5904 | 129.2 | 1.4115 | 5.0618 | 5.544 | 6.9555 |
| 26 | 190 | 3.6904 | 6.6037 | 135.46 | 1.4769 | 5.0443 | 5.544 | 7.0209 |
| 27 | 200 | 3.8879 | 6.6173 | 141.83 | 1.5432 | 5.0262 | 5.544 | 7.0872 |
| 28 | 210 | 4.0838 | 6.6308 | 148.15 | 1.6087 | 5.0081 | 5.544 | 7.1527 |
| 29 | 220 | 4.2798 | 6.6444 | 154.31 | 1.6721 | 4.9905 | 5.544 | 7.2161 |
| 30 | 230 | 4.4744 | 6.6579 | 160.52 | 1.7359 | 4.973 | 5.544 | 7.2799 |
| 31 | 240 | 4.6675 | 6.6714 | 166.1 | 1.7926 | 4.9555 | 5.544 | 7.3366 |
| 32 | 270 | 5.2482 | 6.7123 | 182.69 | 1.9596 | 4.9052 | 5.544 | 7.5036 |
| 33 | 300 | 5.839 | 6.7544 | 198.8 | 2.1191 | 4.8568 | 5.544 | 7.6631 |
| 34 | 330 | 6.4298 | 6.7971 | 214.22 | 2.2692 | 4.8118 | 5.544 | 7.8132 |
| 35 | 360 | 7.012 | 6.8396 | 228.12 | 2.4014 | 4.7674 | 5.544 | 7.9454 |
| 36 | 390 | 7.597 | 6.8829 | 242.18 | 2.5333 | 4.723 | 5.544 | 8.0773 |
| 37 | 420 | 8.1879 | 6.9272 | 255.97 | 2.6605 | 4.6786 | 5.544 | 8.2045 |
| 38 | 450 | 8.7758 | 6.9719 | 269.13 | 2.7794 | 4.6354 | 5.544 | 8.3234 |
| 39 | 480 | 9.3565 | 7.0165 | 281.45 | 2.8881 | 4.5921 | 5.544 | 8.4321 |
| 40 | 510 | 9.943 | 7.0622 | 293.66 | 2.9939 | 4.5506 | 5.544 | 8.5379 |
| 41 | 540 | 10.532 | 7.1087 | 305.19 | 3.0911 | 4.5098 | 5.544 | 8.6351 |
| 42 | 570 | 11.116 | 7.1554 | 316.25 | 3.1822 | 4.47 | 5.544 | 8.7262 |
| 43 | 600 | 11.698 | 7.2026 | 326.89 | 3.2677 | 4.428 | 5.544 | 8.8117 |
| 44 | 630 | 12.285 | 7.2508 | 337.63 | 3.3526 | 4.3812 | 5.544 | 8.8966 |
| 45 | 660 | 12.874 | 7.2998 | 347.58 | 3.4282 | 4.3368 | 5.544 | 8.9722 |
| 46 | 690 | 13.463 | 7.3495 | 357.84 | 3.5056 | 4.2901 | 5.544 | 9.0496 |
| 47 | 720 | 14.047 | 7.3994 | 367.48 | 3.5757 | 4.2381 | 5.544 | 9.1197 |
| 48 | 750 | 14.632 | 7.4501 | 376.32 | 3.6369 | 4.2264 | 5.544 | 9.1809 |
| 49 | 770.98 | 15.049 | 7.4867 | 383.16 | 3.6849 | 4.1663 | 5.544 | 9.2289 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 7 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.98 in
Specimen Area: 6.36 in^2
Specimen Volume: 38.06 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.544 | 5.544 | 0 | 0.000 | 0.49798 | 0.49798 | 1.000 | 0.49798 | 0 |
| 2 | 0.09 | 5.7679 | 5.544 | 0.11333 | 0.506 | 0.60855 | 0.38465 | 1.582 | 0.4966 | 0.11195 |
| 3 | 0.19 | 5.8236 | 5.544 | 0.13962 | 0.499 | 0.63796 | 0.35836 | 1.780 | 0.49816 | 0.1398 |
| 4 | 0.28 | 5.8673 | 5.544 | 0.1548 | 0.479 | 0.66648 | 0.34317 | 1.942 | 0.50483 | 0.16165 |
| 5 | 0.38 | 5.9032 | 5.544 | 0.16298 | 0.454 | 0.6942 | 0.335 | 2.072 | 0.5146 | 0.1796 |
| 6 | 0.48 | 5.9331 | 5.544 | 0.16766 | 0.431 | 0.71943 | 0.33032 | 2.178 | 0.52488 | 0.19455 |
| 7 | 0.58 | 5.9618 | 5.544 | 0.16999 | 0.407 | 0.74574 | 0.32799 | 2.274 | 0.53686 | 0.20888 |
| 8 | 0.67 | 5.9945 | 5.544 | 0.17058 | 0.379 | 0.7779 | 0.3274 | 2.376 | 0.55265 | 0.22525 |
| 9 | 0.77 | 6.0207 | 5.544 | 0.16999 | 0.357 | 0.80466 | 0.32799 | 2.453 | 0.56632 | 0.23834 |
| 10 | 0.87 | 6.0486 | 5.544 | 0.16882 | 0.335 | 0.83372 | 0.32915 | 2.533 | 0.58144 | 0.25228 |
| 11 | 0.97 | 6.0764 | 5.544 | 0.16649 | 0.313 | 0.86389 | 0.33149 | 2.606 | 0.59769 | 0.2662 |
| 12 | 1.06 | 6.1042 | 5.544 | 0.16415 | 0.293 | 0.894 | 0.33383 | 2.678 | 0.61391 | 0.28009 |
| 13 | 1.16 | 6.1307 | 5.544 | 0.16181 | 0.276 | 0.92288 | 0.33616 | 2.745 | 0.62952 | 0.29336 |
| 14 | 1.36 | 6.1883 | 5.544 | 0.15539 | 0.241 | 0.98693 | 0.34259 | 2.881 | 0.66476 | 0.32217 |
| 15 | 1.55 | 6.2522 | 5.544 | 0.14721 | 0.208 | 1.059 | 0.35077 | 3.019 | 0.70486 | 0.35409 |
| 16 | 1.75 | 6.3187 | 5.544 | 0.13903 | 0.179 | 1.1337 | 0.35895 | 3.158 | 0.7463 | 0.38736 |
| 17 | 1.95 | 6.3855 | 5.544 | 0.1291 | 0.153 | 1.2104 | 0.36888 | 3.281 | 0.78965 | 0.42077 |
| 18 | 2.14 | 6.4556 | 5.544 | 0.11917 | 0.131 | 1.2904 | 0.37881 | 3.407 | 0.83462 | 0.45581 |
| 19 | 2.33 | 6.5283 | 5.544 | 0.10749 | 0.109 | 1.3748 | 0.39049 | 3.521 | 0.88265 | 0.49216 |
| 20 | 2.53 | 6.6019 | 5.544 | 0.094635 | 0.089 | 1.4612 | 0.40334 | 3.623 | 0.93229 | 0.52895 |
| 21 | 2.72 | 6.6729 | 5.544 | 0.081783 | 0.072 | 1.5451 | 0.4162 | 3.712 | 0.98063 | 0.56444 |
| 22 | 2.91 | 6.7453 | 5.544 | 0.066595 | 0.055 | 1.6327 | 0.43138 | 3.785 | 1.032 | 0.60064 |
| 23 | 3.11 | 6.8156 | 5.544 | 0.050238 | 0.040 | 1.7194 | 0.44774 | 3.840 | 1.0836 | 0.63582 |
| 24 | 3.30 | 6.8857 | 5.544 | 0.033297 | 0.025 | 1.8064 | 0.46468 | 3.887 | 1.1355 | 0.67085 |
| 25 | 3.50 | 6.9555 | 5.544 | 0.015772 | 0.011 | 1.8937 | 0.48221 | 3.927 | 1.1879 | 0.70573 |
| 26 | 3.69 | 7.0209 | 5.544 | -0.0017525 | -0.001 | 1.9766 | 0.49973 | 3.955 | 1.2382 | 0.73846 |
| 27 | 3.89 | 7.0872 | 5.544 | -0.019862 | -0.013 | 2.061 | 0.51784 | 3.980 | 1.2894 | 0.7716 |
| 28 | 4.08 | 7.1527 | 5.544 | -0.037971 | -0.024 | 2.1446 | 0.53595 | 4.002 | 1.3403 | 0.80433 |
| 29 | 4.28 | 7.2161 | 5.544 | -0.055496 | -0.033 | 2.2256 | 0.55347 | 4.021 | 1.3895 | 0.83606 |
| 30 | 4.47 | 7.2799 | 5.544 | -0.073021 | -0.042 | 2.3069 | 0.571 | 4.040 | 1.4389 | 0.86795 |
| 31 | 4.67 | 7.3366 | 5.544 | -0.090546 | -0.051 | 2.3811 | 0.58852 | 4.046 | 1.4848 | 0.89631 |
| 32 | 5.25 | 7.5036 | 5.544 | -0.14078 | -0.072 | 2.5983 | 0.63876 | 4.068 | 1.6186 | 0.97979 |
| 33 | 5.84 | 7.6631 | 5.544 | -0.18927 | -0.089 | 2.8063 | 0.68725 | 4.083 | 1.7468 | 1.0595 |
| 34 | 6.43 | 7.8132 | 5.544 | -0.23425 | -0.103 | 3.0014 | 0.73223 | 4.099 | 1.8668 | 1.1346 |
| 35 | 7.01 | 7.9454 | 5.544 | -0.27865 | -0.116 | 3.178 | 0.77663 | 4.092 | 1.9773 | 1.2007 |
| 36 | 7.60 | 8.0773 | 5.544 | -0.32304 | -0.128 | 3.3543 | 0.82102 | 4.086 | 2.0877 | 1.2667 |
| 37 | 8.19 | 8.2045 | 5.544 | -0.36744 | -0.138 | 3.5259 | 0.86542 | 4.074 | 2.1957 | 1.3302 |
| 38 | 8.78 | 8.3234 | 5.544 | -0.41067 | -0.148 | 3.688 | 0.90865 | 4.059 | 2.2983 | 1.3897 |
| 39 | 9.36 | 8.4321 | 5.544 | -0.4539 | -0.157 | 3.84 | 0.95187 | 4.034 | 2.3959 | 1.4441 |
| 40 | 9.94 | 8.5379 | 5.544 | -0.49537 | -0.165 | 3.9873 | 0.99335 | 4.014 | 2.4903 | 1.497 |
| 41 | 10.53 | 8.6351 | 5.544 | -0.53626 | -0.173 | 4.1254 | 1.0342 | 3.989 | 2.5798 | 1.5456 |
| 42 | 11.12 | 8.7262 | 5.544 | -0.57599 | -0.181 | 4.2562 | 1.074 | 3.963 | 2.6651 | 1.5911 |
| 43 | 11.70 | 8.8117 | 5.544 | -0.61805 | -0.189 | 4.3837 | 1.116 | 3.928 | 2.7499 | 1.6338 |
| 44 | 12.28 | 8.8966 | 5.544 | -0.66478 | -0.198 | 4.5154 | 1.1628 | 3.883 | 2.8391 | 1.6763 |
| 45 | 12.87 | 8.9722 | 5.544 | -0.70918 | -0.207 | 4.6354 | 1.2072 | 3.840 | 2.9213 | 1.7141 |
| 46 | 13.46 | 9.0496 | 5.544 | -0.75591 | -0.216 | 4.7595 | 1.2539 | 3.796 | 3.0067 | 1.7528 |
| 47 | 14.05 | 9.1197 | 5.544 | -0.8079 | -0.226 | 4.8816 | 1.3059 | 3.738 | 3.0937 | 1.7879 |
| 48 | 14.63 | 9.1809 | 5.544 | -0.81958 | -0.225 | 4.9544 | 1.3176 | 3.760 | 3.136 | 1.8184 |
| 49 | 15.05 | 9.2289 | 5.544 | -0.87975 | -0.239 | 5.0627 | 1.3777 | 3.675 | 3.2202 | 1.8425 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 13.9 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.96 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.74 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3266 | 0 | 0 | 5.0443 | 6.0408 | 6.0408 |
| 2 | 5.0001 | 0.088226 | 6.3322 | 42.594 | 0.48432 | 5.1902 | 6.0408 | 6.5251 |
| 3 | 10 | 0.18929 | 6.3386 | 57.838 | 0.65698 | 5.2828 | 6.0408 | 6.6978 |
| 4 | 15 | 0.29035 | 6.3451 | 67.028 | 0.76059 | 5.3416 | 6.0408 | 6.8014 |
| 5 | 20 | 0.39301 | 6.3516 | 74.03 | 0.83918 | 5.381 | 6.0408 | 6.88 |
| 6 | 25 | 0.49407 | 6.358 | 79.864 | 0.9044 | 5.4104 | 6.0408 | 6.9452 |
| 7 | 30.001 | 0.59834 | 6.3647 | 85.335 | 0.96534 | 5.4304 | 6.0408 | 7.0061 |
| 8 | 35.001 | 0.7026 | 6.3714 | 90.44 | 1.022 | 5.4431 | 6.0408 | 7.0628 |
| 9 | 40.001 | 0.80687 | 6.3781 | 95.837 | 1.0819 | 5.4526 | 6.0408 | 7.1227 |
| 10 | 45.001 | 0.91274 | 6.3849 | 101.02 | 1.1391 | 5.4565 | 6.0408 | 7.1799 |
| 11 | 50.001 | 1.0154 | 6.3915 | 106.41 | 1.1987 | 5.4587 | 6.0408 | 7.2395 |
| 12 | 55.001 | 1.1213 | 6.3984 | 111.81 | 1.2582 | 5.4581 | 6.0408 | 7.299 |
| 13 | 60.001 | 1.2223 | 6.4049 | 117.43 | 1.32 | 5.4554 | 6.0408 | 7.3608 |
| 14 | 70.001 | 1.4357 | 6.4188 | 128 | 1.4358 | 5.4448 | 6.0408 | 7.4766 |
| 15 | 80.002 | 1.649 | 6.4327 | 139.67 | 1.5633 | 5.4271 | 6.0408 | 7.6041 |
| 16 | 90.002 | 1.8576 | 6.4464 | 151.49 | 1.692 | 5.406 | 6.0408 | 7.7328 |
| 17 | 100 | 2.0661 | 6.4601 | 163.52 | 1.8225 | 5.3805 | 6.0408 | 7.8633 |
| 18 | 110 | 2.273 | 6.4738 | 175.56 | 1.9525 | 5.3527 | 6.0408 | 7.9933 |
| 19 | 120 | 2.4816 | 6.4876 | 187.81 | 2.0843 | 5.3222 | 6.0408 | 8.1251 |
| 20 | 130 | 2.6885 | 6.5014 | 200.21 | 2.2172 | 5.2895 | 6.0408 | 8.258 |
| 21 | 140 | 2.8954 | 6.5153 | 212.32 | 2.3463 | 5.2534 | 6.0408 | 8.3871 |
| 22 | 150 | 3.1056 | 6.5294 | 224.42 | 2.4747 | 5.219 | 6.0408 | 8.5155 |
| 23 | 160 | 3.3157 | 6.5436 | 236.46 | 2.6018 | 5.1813 | 6.0408 | 8.6426 |
| 24 | 170 | 3.5242 | 6.5577 | 248.35 | 2.7267 | 5.1441 | 6.0408 | 8.7675 |
| 25 | 180 | 3.736 | 6.5722 | 259.8 | 2.8461 | 5.107 | 6.0408 | 8.8869 |
| 26 | 190 | 3.9461 | 6.5865 | 270.88 | 2.9611 | 5.0693 | 6.0408 | 9.0019 |
| 27 | 200 | 4.1563 | 6.601 | 281.75 | 3.0732 | 5.0321 | 6.0408 | 9.114 |
| 28 | 210 | 4.3648 | 6.6154 | 292.4 | 3.1824 | 4.9949 | 6.0408 | 9.2232 |
| 29 | 220 | 4.5717 | 6.6297 | 302.54 | 3.2856 | 4.9583 | 6.0408 | 9.3264 |
| 30 | 230 | 4.7787 | 6.6441 | 312.53 | 3.3868 | 4.9222 | 6.0408 | 9.4276 |
| 31 | 240 | 4.984 | 6.6585 | 322.3 | 3.4851 | 4.8873 | 6.0408 | 9.5259 |
| 32 | 270 | 5.6016 | 6.7021 | 349.8 | 3.7579 | 4.7863 | 6.0408 | 9.7987 |
| 33 | 300 | 6.224 | 6.7465 | 375.84 | 4.011 | 4.6926 | 6.0408 | 10.052 |
| 34 | 330 | 6.8335 | 6.7907 | 399.69 | 4.2378 | 4.6066 | 6.0408 | 10.279 |
| 35 | 360 | 7.4495 | 6.8359 | 422.95 | 4.4548 | 4.5289 | 6.0408 | 10.496 |
| 36 | 390 | 8.0687 | 6.8819 | 445.56 | 4.6616 | 4.454 | 6.0408 | 10.702 |
| 37 | 420 | 8.6911 | 6.9288 | 468.98 | 4.8733 | 4.3803 | 6.0408 | 10.914 |
| 38 | 450 | 9.3087 | 6.976 | 492.1 | 5.079 | 4.3087 | 6.0408 | 11.12 |
| 39 | 480 | 9.9279 | 7.024 | 516.31 | 5.2925 | 4.2377 | 6.0408 | 11.333 |
| 40 | 510 | 10.552 | 7.073 | 540.67 | 5.5038 | 4.1678 | 6.0408 | 11.545 |
| 41 | 540 | 11.176 | 7.1226 | 563.06 | 5.6918 | 4.1007 | 6.0408 | 11.733 |
| 42 | 570 | 11.797 | 7.1728 | 587.2 | 5.8943 | 4.0319 | 6.0408 | 11.935 |
| 43 | 600 | 12.416 | 7.2235 | 609.6 | 6.0761 | 3.9659 | 6.0408 | 12.117 |
| 44 | 630 | 13.033 | 7.2748 | 633.59 | 6.2708 | 3.9004 | 6.0408 | 12.312 |
| 45 | 660 | 13.659 | 7.3275 | 657.66 | 6.4622 | 3.8366 | 6.0408 | 12.503 |
| 46 | 690 | 14.283 | 7.3808 | 679.18 | 6.6254 | 3.7706 | 6.0408 | 12.666 |
| 47 | 720 | 14.902 | 7.4345 | 701.93 | 6.7979 | 3.7068 | 6.0408 | 12.839 |
| 48 | 750 | 15.525 | 7.4893 | 724.47 | 6.9648 | 3.643 | 6.0408 | 13.006 |
| 49 | 772.22 | 15.991 | 7.5309 | 741.68 | 7.0909 | 3.5959 | 6.0408 | 13.132 |

# TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 13.9 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

AECOM

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.96 in
Specimen Area: 6.33 in^2
Specimen Volume: 37.74 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.0408 | 6.0408 | 0 | 0.000 | 0.99651 | 0.99651 | 1.000 | 0.99651 | 0 |
| 2 | 0.09 | 6.5251 | 6.0408 | 0.1459 | 0.301 | 1.3349 | 0.85061 | 1.569 | 1.0928 | 0.24216 |
| 3 | 0.19 | 6.6978 | 6.0408 | 0.23854 | 0.363 | 1.4149 | 0.75797 | 1.867 | 1.0865 | 0.32849 |
| 4 | 0.29 | 6.8014 | 6.0408 | 0.29734 | 0.391 | 1.4598 | 0.69917 | 2.088 | 1.0795 | 0.3803 |
| 5 | 0.39 | 6.88 | 6.0408 | 0.33673 | 0.401 | 1.499 | 0.65978 | 2.272 | 1.0794 | 0.41959 |
| 6 | 0.49 | 6.9452 | 6.0408 | 0.36613 | 0.405 | 1.5348 | 0.63038 | 2.435 | 1.0826 | 0.4522 |
| 7 | 0.60 | 7.0061 | 6.0408 | 0.3861 | 0.400 | 1.5757 | 0.61041 | 2.581 | 1.0931 | 0.48267 |
| 8 | 0.70 | 7.0628 | 6.0408 | 0.39886 | 0.390 | 1.6197 | 0.59765 | 2.710 | 1.1087 | 0.51101 |
| 9 | 0.81 | 7.1227 | 6.0408 | 0.40829 | 0.377 | 1.6701 | 0.58822 | 2.839 | 1.1292 | 0.54094 |
| 10 | 0.91 | 7.1799 | 6.0408 | 0.41217 | 0.362 | 1.7235 | 0.58434 | 2.949 | 1.1539 | 0.56956 |
| 11 | 1.02 | 7.2395 | 6.0408 | 0.41439 | 0.346 | 1.7809 | 0.58212 | 3.059 | 1.1815 | 0.59937 |
| 12 | 1.12 | 7.299 | 6.0408 | 0.41384 | 0.329 | 1.8409 | 0.58267 | 3.159 | 1.2118 | 0.62909 |
| 13 | 1.22 | 7.3608 | 6.0408 | 0.41107 | 0.311 | 1.9055 | 0.58545 | 3.255 | 1.2455 | 0.66002 |
| 14 | 1.44 | 7.4766 | 6.0408 | 0.40053 | 0.279 | 2.0318 | 0.59599 | 3.409 | 1.3139 | 0.7179 |
| 15 | 1.65 | 7.6041 | 6.0408 | 0.38277 | 0.245 | 2.1771 | 0.61374 | 3.547 | 1.3954 | 0.78166 |
| 16 | 1.86 | 7.7328 | 6.0408 | 0.36169 | 0.214 | 2.3268 | 0.63482 | 3.665 | 1.4808 | 0.84599 |
| 17 | 2.07 | 7.8633 | 6.0408 | 0.33617 | 0.184 | 2.4828 | 0.66034 | 3.760 | 1.5716 | 0.91125 |
| 18 | 2.27 | 7.9933 | 6.0408 | 0.30844 | 0.158 | 2.6406 | 0.68807 | 3.838 | 1.6643 | 0.97625 |
| 19 | 2.48 | 8.1251 | 6.0408 | 0.27793 | 0.133 | 2.8029 | 0.71858 | 3.901 | 1.7607 | 1.0422 |
| 20 | 2.69 | 8.258 | 6.0408 | 0.2452 | 0.111 | 2.9685 | 0.75131 | 3.951 | 1.8599 | 1.1086 |
| 21 | 2.90 | 8.3871 | 6.0408 | 0.20914 | 0.089 | 3.1337 | 0.78737 | 3.980 | 1.9605 | 1.1731 |
| 22 | 3.11 | 8.5155 | 6.0408 | 0.17474 | 0.071 | 3.2965 | 0.82177 | 4.011 | 2.0591 | 1.2374 |
| 23 | 3.32 | 8.6426 | 6.0408 | 0.13702 | 0.053 | 3.4613 | 0.85949 | 4.027 | 2.1604 | 1.3009 |
| 24 | 3.52 | 8.7675 | 6.0408 | 0.099854 | 0.037 | 3.6233 | 0.89666 | 4.041 | 2.26 | 1.3633 |
| 25 | 3.74 | 8.8869 | 6.0408 | 0.062686 | 0.022 | 3.78 | 0.93383 | 4.048 | 2.3569 | 1.4231 |
| 26 | 3.95 | 9.0019 | 6.0408 | 0.024963 | 0.008 | 3.9327 | 0.97155 | 4.048 | 2.4521 | 1.4806 |
| 27 | 4.16 | 9.114 | 6.0408 | -0.012204 | -0.004 | 4.0819 | 1.0087 | 4.047 | 2.5453 | 1.5366 |
| 28 | 4.36 | 9.2232 | 6.0408 | -0.049372 | -0.016 | 4.2283 | 1.0459 | 4.043 | 2.6371 | 1.5912 |
| 29 | 4.57 | 9.3264 | 6.0408 | -0.085985 | -0.026 | 4.3681 | 1.0825 | 4.035 | 2.7253 | 1.6428 |
| 30 | 4.78 | 9.4276 | 6.0408 | -0.12204 | -0.036 | 4.5053 | 1.1186 | 4.028 | 2.8119 | 1.6934 |
| 31 | 4.98 | 9.5259 | 6.0408 | -0.15699 | -0.045 | 4.6386 | 1.1535 | 4.021 | 2.8961 | 1.7426 |
| 32 | 5.60 | 9.7987 | 6.0408 | -0.25796 | -0.069 | 5.0124 | 1.2545 | 3.996 | 3.1334 | 1.8789 |
| 33 | 6.22 | 10.052 | 6.0408 | -0.35171 | -0.088 | 5.3592 | 1.3482 | 3.975 | 3.3537 | 2.0055 |
| 34 | 6.83 | 10.279 | 6.0408 | -0.43769 | -0.103 | 5.672 | 1.4342 | 3.955 | 3.5531 | 2.1189 |
| 35 | 7.45 | 10.496 | 6.0408 | -0.51536 | -0.116 | 5.9667 | 1.5119 | 3.947 | 3.7393 | 2.2274 |
| 36 | 8.07 | 10.702 | 6.0408 | -0.59025 | -0.127 | 6.2483 | 1.5868 | 3.938 | 3.9175 | 2.3308 |
| 37 | 8.69 | 10.914 | 6.0408 | -0.66403 | -0.136 | 6.5338 | 1.6605 | 3.935 | 4.0972 | 2.4367 |
| 38 | 9.31 | 11.12 | 6.0408 | -0.73559 | -0.145 | 6.8111 | 1.7321 | 3.932 | 4.2716 | 2.5395 |
| 39 | 9.93 | 11.333 | 6.0408 | -0.8066 | -0.152 | 7.0956 | 1.8031 | 3.935 | 4.4494 | 2.6463 |
| 40 | 10.55 | 11.545 | 6.0408 | -0.8765 | -0.159 | 7.3768 | 1.873 | 3.938 | 4.6249 | 2.7519 |
| 41 | 11.18 | 11.733 | 6.0408 | -0.94362 | -0.166 | 7.6319 | 1.9401 | 3.934 | 4.786 | 2.8459 |
| 42 | 11.80 | 11.935 | 6.0408 | -1.0124 | -0.172 | 7.9032 | 2.0089 | 3.934 | 4.9561 | 2.9472 |
| 43 | 12.42 | 12.117 | 6.0408 | -1.0784 | -0.177 | 8.1511 | 2.0749 | 3.928 | 5.113 | 3.0381 |
| 44 | 13.03 | 12.312 | 6.0408 | -1.1439 | -0.182 | 8.4112 | 2.1404 | 3.930 | 5.2758 | 3.1354 |
| 45 | 13.66 | 12.503 | 6.0408 | -1.2077 | -0.187 | 8.6664 | 2.2042 | 3.932 | 5.4353 | 3.2311 |
| 46 | 14.28 | 12.666 | 6.0408 | -1.2737 | -0.192 | 8.8956 | 2.2702 | 3.918 | 5.5829 | 3.3127 |
| 47 | 14.90 | 12.839 | 6.0408 | -1.3375 | -0.197 | 9.1319 | 2.334 | 3.913 | 5.7329 | 3.3989 |
| 48 | 15.52 | 13.006 | 6.0408 | -1.4013 | -0.201 | 9.3626 | 2.3978 | 3.905 | 5.8802 | 3.4824 |
| 49 | 15.99 | 13.132 | 6.0408 | -1.4484 | -0.204 | 9.5358 | 2.4449 | 3.900 | 5.9904 | 3.5454 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 20.8 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.71 in
Specimen Area: 6.32 in^2
Specimen Volume: 36.08 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

Plastic Limit: 11

Measured Specific Gravity: 2.65

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.3214 | 0 | 0 | 5.0958 | 6.5376 | 6.5376 |
| 2 | 5.0038 | 0.074905 | 6.3261 | 45.054 | 0.51278 | 5.2246 | 6.5376 | 7.0504 |
| 3 | 10.004 | 0.17378 | 6.3324 | 62.257 | 0.70787 | 5.3665 | 6.5376 | 7.2455 |
| 4 | 15.004 | 0.27265 | 6.3386 | 72.957 | 0.82871 | 5.4806 | 6.5376 | 7.3663 |
| 5 | 20.004 | 0.37303 | 6.345 | 80.614 | 0.91477 | 5.5686 | 6.5376 | 7.4524 |
| 6 | 25.004 | 0.4749 | 6.3515 | 86.279 | 0.97804 | 5.636 | 6.5376 | 7.5156 |
| 7 | 30 | 0.57677 | 6.358 | 90.422 | 1.024 | 5.6898 | 6.5376 | 7.5616 |
| 8 | 35 | 0.67415 | 6.3643 | 93.779 | 1.0609 | 5.7316 | 6.5376 | 7.5985 |
| 9 | 40 | 0.77752 | 6.3709 | 97.975 | 1.1073 | 5.7648 | 6.5376 | 7.6449 |
| 10 | 45.002 | 0.87939 | 6.3774 | 100.65 | 1.1363 | 5.7909 | 6.5376 | 7.6739 |
| 11 | 50.003 | 0.97976 | 6.3839 | 104.95 | 1.1837 | 5.8104 | 6.5376 | 7.7213 |
| 12 | 55.003 | 1.0801 | 6.3904 | 107.84 | 1.215 | 5.8262 | 6.5376 | 7.7526 |
| 13 | 60.003 | 1.1835 | 6.3971 | 111.51 | 1.255 | 5.8387 | 6.5376 | 7.7926 |
| 14 | 70.003 | 1.3842 | 6.4101 | 117.22 | 1.3167 | 5.8539 | 6.5376 | 7.8543 |
| 15 | 80.004 | 1.5895 | 6.4235 | 123.99 | 1.3898 | 5.8583 | 6.5376 | 7.9274 |
| 16 | 90.004 | 1.7887 | 6.4365 | 130.13 | 1.4556 | 5.855 | 6.5376 | 7.9932 |
| 17 | 100 | 1.9925 | 6.4499 | 137.42 | 1.534 | 5.8463 | 6.5376 | 8.0716 |
| 18 | 110 | 2.1962 | 6.4633 | 144.6 | 1.6108 | 5.8338 | 6.5376 | 8.1484 |
| 19 | 120 | 2.3955 | 6.4765 | 151.58 | 1.6851 | 5.8186 | 6.5376 | 8.2227 |
| 20 | 130 | 2.5992 | 6.4901 | 158.24 | 1.7555 | 5.7979 | 6.5376 | 8.2931 |
| 21 | 140 | 2.8059 | 6.5039 | 165.9 | 1.8365 | 5.7762 | 6.5376 | 8.3741 |
| 22 | 150 | 3.0097 | 6.5175 | 175.55 | 1.9393 | 5.7523 | 6.5376 | 8.4769 |
| 23 | 160 | 3.2119 | 6.5311 | 182.73 | 2.0145 | 5.7278 | 6.5376 | 8.5521 |
| 24 | 170 | 3.4142 | 6.5448 | 191.81 | 2.1101 | 5.7018 | 6.5376 | 8.6477 |
| 25 | 180 | 3.6119 | 6.5582 | 199.36 | 2.1887 | 5.6735 | 6.5376 | 8.7263 |
| 26 | 190 | 3.8127 | 6.5719 | 206.81 | 2.2657 | 5.6442 | 6.5376 | 8.8033 |
| 27 | 200 | 4.0164 | 6.5859 | 214.52 | 2.3452 | 5.6148 | 6.5376 | 8.8828 |
| 28 | 210 | 4.2187 | 6.5998 | 224.32 | 2.4473 | 5.5849 | 6.5376 | 8.9849 |
| 29 | 220 | 4.4164 | 6.6134 | 234.24 | 2.5501 | 5.5534 | 6.5376 | 9.0877 |
| 30 | 230 | 4.6187 | 6.6275 | 242.73 | 2.637 | 5.5208 | 6.5376 | 9.1746 |
| 31 | 240 | 4.8209 | 6.6415 | 250.97 | 2.7207 | 5.4876 | 6.5376 | 9.2583 |
| 32 | 270 | 5.4291 | 6.6843 | 278.4 | 2.9988 | 5.3849 | 6.5376 | 9.5364 |
| 33 | 300 | 6.0389 | 6.7276 | 307.61 | 3.2921 | 5.2746 | 6.5376 | 9.8297 |
| 34 | 330 | 6.6411 | 6.771 | 336.99 | 3.5833 | 5.1589 | 6.5376 | 10.121 |
| 35 | 360 | 7.2433 | 6.815 | 367.41 | 3.8816 | 5.0409 | 6.5376 | 10.419 |
| 36 | 390 | 7.8605 | 6.8607 | 398.56 | 4.1827 | 4.9187 | 6.5376 | 10.72 |
| 37 | 420 | 8.4643 | 6.9059 | 431.13 | 4.4949 | 4.7937 | 6.5376 | 11.033 |
| 38 | 450 | 9.0605 | 6.9512 | 464.49 | 4.8112 | 4.6665 | 6.5376 | 11.349 |
| 39 | 480 | 9.6658 | 6.9978 | 497.43 | 5.118 | 4.535 | 6.5376 | 11.656 |
| 40 | 510 | 10.283 | 7.0459 | 529.79 | 5.4138 | 4.4035 | 6.5376 | 11.951 |
| 41 | 540 | 10.887 | 7.0936 | 564.88 | 5.7335 | 4.2698 | 6.5376 | 12.271 |
| 42 | 570 | 11.48 | 7.1412 | 599.97 | 6.0491 | 4.1361 | 6.5376 | 12.587 |
| 43 | 600 | 12.084 | 7.1902 | 634.95 | 6.3581 | 4.0008 | 6.5376 | 12.896 |
| 44 | 630 | 12.699 | 7.2409 | 671.35 | 6.6755 | 3.8687 | 6.5376 | 13.213 |
| 45 | 660 | 13.303 | 7.2913 | 704.92 | 6.9608 | 3.7378 | 6.5376 | 13.498 |
| 46 | 690 | 13.902 | 7.3421 | 738.01 | 7.2373 | 3.6073 | 6.5376 | 13.775 |
| 47 | 720 | 14.505 | 7.3938 | 771.63 | 7.514 | 3.4807 | 6.5376 | 14.052 |
| 48 | 750 | 15.119 | 7.4473 | 805.72 | 7.7897 | 3.3563 | 6.5376 | 14.327 |
| 49 | 773.86 | 15.606 | 7.4903 | 829.85 | 7.9769 | 3.2617 | 6.5376 | 14.514 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-7
Sample No.: S-7
Test No.: 20.8 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/1/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 12.0'-14.0'
Elevation: ----

AECOM

Soil Description: F-M SAND LITTLE CLAY TRACE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767

Specimen Height: 5.71 in
Specimen Area: 6.32 in^2
Specimen Volume: 36.08 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 27

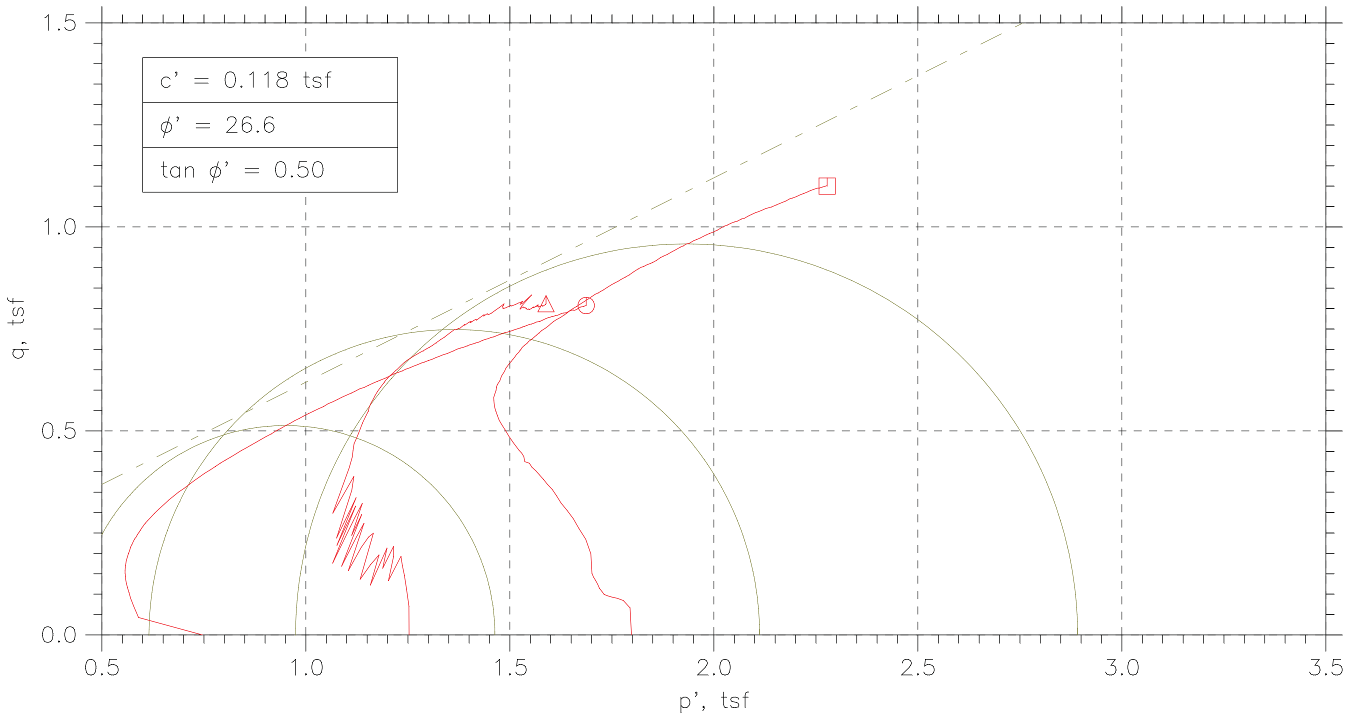
Plastic Limit: 11

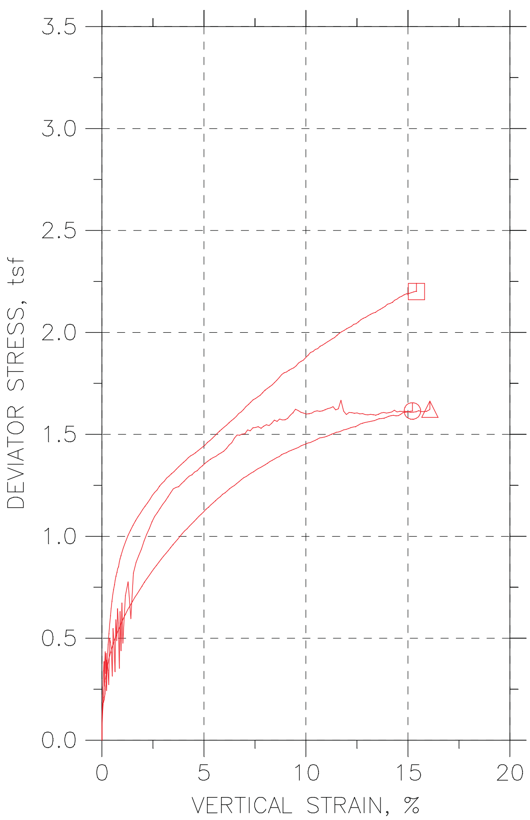
Measured Specific Gravity: 2.65

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.5376 | 6.5376 | 0 | 0.000 | 1.4418 | 1.4418 | 1.000 | 1.4418 | 0 |
| 2 | 0.07 | 7.0504 | 6.5376 | 0.12879 | 0.251 | 1.8258 | 1.313 | 1.391 | 1.5694 | 0.25639 |
| 3 | 0.17 | 7.2455 | 6.5376 | 0.27063 | 0.382 | 1.879 | 1.1711 | 1.604 | 1.5251 | 0.35394 |
| 4 | 0.27 | 7.3663 | 6.5376 | 0.38475 | 0.464 | 1.8857 | 1.057 | 1.784 | 1.4714 | 0.41435 |
| 5 | 0.37 | 7.4524 | 6.5376 | 0.47279 | 0.517 | 1.8838 | 0.96898 | 1.944 | 1.4264 | 0.45738 |
| 6 | 0.47 | 7.5156 | 6.5376 | 0.54018 | 0.552 | 1.8796 | 0.9016 | 2.085 | 1.3906 | 0.48902 |
| 7 | 0.58 | 7.5616 | 6.5376 | 0.59398 | 0.580 | 1.8718 | 0.8478 | 2.208 | 1.3598 | 0.51198 |
| 8 | 0.67 | 7.5985 | 6.5376 | 0.63582 | 0.599 | 1.8669 | 0.80595 | 2.316 | 1.3364 | 0.53047 |
| 9 | 0.78 | 7.6449 | 6.5376 | 0.66897 | 0.604 | 1.8801 | 0.7728 | 2.433 | 1.3264 | 0.55363 |
| 10 | 0.88 | 7.6739 | 6.5376 | 0.69506 | 0.612 | 1.883 | 0.74672 | 2.522 | 1.3149 | 0.56816 |
| 11 | 0.98 | 7.7213 | 6.5376 | 0.71462 | 0.604 | 1.9108 | 0.72715 | 2.628 | 1.319 | 0.59183 |
| 12 | 1.08 | 7.7526 | 6.5376 | 0.73038 | 0.601 | 1.9264 | 0.71139 | 2.708 | 1.3189 | 0.60749 |
| 13 | 1.18 | 7.7926 | 6.5376 | 0.74288 | 0.592 | 1.9539 | 0.69889 | 2.796 | 1.3264 | 0.62751 |
| 14 | 1.38 | 7.8543 | 6.5376 | 0.7581 | 0.576 | 2.0004 | 0.68368 | 2.926 | 1.342 | 0.65834 |
| 15 | 1.59 | 7.9274 | 6.5376 | 0.76244 | 0.549 | 2.0691 | 0.67933 | 3.046 | 1.3742 | 0.69489 |
| 16 | 1.79 | 7.9932 | 6.5376 | 0.75918 | 0.522 | 2.1382 | 0.68259 | 3.132 | 1.4104 | 0.72781 |
| 17 | 1.99 | 8.0716 | 6.5376 | 0.75049 | 0.489 | 2.2253 | 0.69129 | 3.219 | 1.4583 | 0.76699 |
| 18 | 2.20 | 8.1484 | 6.5376 | 0.73799 | 0.458 | 2.3146 | 0.70379 | 3.289 | 1.5092 | 0.80542 |
| 19 | 2.40 | 8.2227 | 6.5376 | 0.72277 | 0.429 | 2.4041 | 0.719 | 3.344 | 1.5616 | 0.84255 |
| 20 | 2.60 | 8.2931 | 6.5376 | 0.70212 | 0.400 | 2.4951 | 0.73965 | 3.373 | 1.6174 | 0.87774 |
| 21 | 2.81 | 8.3741 | 6.5376 | 0.68039 | 0.370 | 2.5979 | 0.76139 | 3.412 | 1.6797 | 0.91827 |
| 22 | 3.01 | 8.4769 | 6.5376 | 0.65647 | 0.339 | 2.7246 | 0.7853 | 3.469 | 1.7549 | 0.96965 |
| 23 | 3.21 | 8.5521 | 6.5376 | 0.63202 | 0.314 | 2.8242 | 0.80976 | 3.488 | 1.817 | 1.0072 |
| 24 | 3.41 | 8.6477 | 6.5376 | 0.60593 | 0.287 | 2.9459 | 0.83584 | 3.524 | 1.8909 | 1.055 |
| 25 | 3.61 | 8.7263 | 6.5376 | 0.57768 | 0.264 | 3.0528 | 0.8641 | 3.533 | 1.9584 | 1.0943 |
| 26 | 3.81 | 8.8033 | 6.5376 | 0.54833 | 0.242 | 3.1592 | 0.89345 | 3.536 | 2.0263 | 1.1329 |
| 27 | 4.02 | 8.8828 | 6.5376 | 0.51898 | 0.221 | 3.268 | 0.92279 | 3.541 | 2.0954 | 1.1726 |
| 28 | 4.22 | 8.9849 | 6.5376 | 0.48909 | 0.200 | 3.3999 | 0.95268 | 3.569 | 2.1763 | 1.2236 |
| 29 | 4.42 | 9.0877 | 6.5376 | 0.45758 | 0.179 | 3.5343 | 0.9842 | 3.591 | 2.2593 | 1.2751 |
| 30 | 4.62 | 9.1746 | 6.5376 | 0.42497 | 0.161 | 3.6538 | 1.0168 | 3.593 | 2.3353 | 1.3185 |
| 31 | 4.82 | 9.2583 | 6.5376 | 0.39182 | 0.144 | 3.7707 | 1.05 | 3.591 | 2.4103 | 1.3604 |
| 32 | 5.43 | 9.5364 | 6.5376 | 0.28911 | 0.096 | 4.1515 | 1.1527 | 3.602 | 2.6521 | 1.4994 |
| 33 | 6.04 | 9.8297 | 6.5376 | 0.17879 | 0.054 | 4.5551 | 1.263 | 3.607 | 2.909 | 1.6461 |
| 34 | 6.64 | 10.121 | 6.5376 | 0.063039 | 0.018 | 4.9621 | 1.3787 | 3.599 | 3.1704 | 1.7917 |
| 35 | 7.24 | 10.419 | 6.5376 | -0.054887 | -0.014 | 5.3783 | 1.4967 | 3.594 | 3.4375 | 1.9408 |
| 36 | 7.86 | 10.72 | 6.5376 | -0.17716 | -0.042 | 5.8017 | 1.6189 | 3.584 | 3.7103 | 2.0914 |
| 37 | 8.46 | 11.033 | 6.5376 | -0.30215 | -0.067 | 6.2388 | 1.7439 | 3.577 | 3.9914 | 2.2475 |
| 38 | 9.06 | 11.349 | 6.5376 | -0.42932 | -0.089 | 6.6822 | 1.8711 | 3.571 | 4.2767 | 2.4056 |
| 39 | 9.67 | 11.656 | 6.5376 | -0.56083 | -0.110 | 7.1206 | 2.0026 | 3.556 | 4.5616 | 2.559 |
| 40 | 10.28 | 11.951 | 6.5376 | -0.69234 | -0.128 | 7.5479 | 2.1341 | 3.537 | 4.841 | 2.7069 |
| 41 | 10.89 | 12.271 | 6.5376 | -0.82603 | -0.144 | 8.0013 | 2.2678 | 3.528 | 5.1345 | 2.8667 |
| 42 | 11.48 | 12.587 | 6.5376 | -0.95971 | -0.159 | 8.4506 | 2.4015 | 3.519 | 5.426 | 3.0245 |
| 43 | 12.08 | 12.896 | 6.5376 | -1.095 | -0.172 | 8.8949 | 2.5368 | 3.506 | 5.7159 | 3.1791 |
| 44 | 12.70 | 13.213 | 6.5376 | -1.2271 | -0.184 | 9.3444 | 2.6689 | 3.501 | 6.0066 | 3.3378 |
| 45 | 13.30 | 13.498 | 6.5376 | -1.3581 | -0.195 | 9.7607 | 2.7998 | 3.486 | 6.2803 | 3.4804 |
| 46 | 13.90 | 13.775 | 6.5376 | -1.4885 | -0.206 | 10.168 | 2.9303 | 3.470 | 6.5489 | 3.6186 |
| 47 | 14.50 | 14.052 | 6.5376 | -1.6151 | -0.215 | 10.571 | 3.0569 | 3.458 | 6.8139 | 3.757 |
| 48 | 15.12 | 14.327 | 6.5376 | -1.7395 | -0.223 | 10.971 | 3.1813 | 3.449 | 7.0762 | 3.8948 |
| 49 | 15.61 | 14.514 | 6.5376 | -1.8341 | -0.230 | 11.253 | 3.2759 | 3.435 | 7.2643 | 3.9884 |

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|
| | Test No. | 10.4 PSI | 17.4 PSI | 24.3 PSI | |
| Initial | Diameter, in | 2.722 | 2.8299 | 2.6157 | |
| | Height, in | 6.0571 | 5.4106 | 5.9323 | |
| | Water Content, % | 5.02 | 7.46 | 5.91 | |
| | Dry Density, pcf | 121.2 | 121.3 | 120.9 | |
| | Saturation, % | 36.18 | 53.82 | 42.11 | |
| | Void Ratio | 0.36923 | 0.3684 | 0.37292 | |
| Before Shear | Water Content, % | 13.55 | 13.79 | 12.58 | |
| | Dry Density, pcf | 122. | 121.5 | 124.4 | |
| | Saturation, % | 100.00 | 100.00 | 100.00 | |
| | Void Ratio | 0.36021 | 0.36668 | 0.33456 | |
| | Back Press., tsf | 5.0425 | 5.0399 | 5.042 | |
| | Minor Prin. Stress, tsf | 0.74626 | 1.2529 | 1.798 | |
| | Max. Dev. Stress, tsf | 1.6147 | 1.6669 | 2.202 | |
| | Time to Failure, min | 3930 | 2700 | 3930 | |
| | Strain Rate, %/min | 0.006 | 0.006 | 0.006 | |
| | B-Value | .95 | .95 | .97 | |
| | Measured Specific Gravity | 2.66 | 2.66 | 2.66 | |
| | Liquid Limit | 40 | 40 | 40 | |
| | Plastic Limit | 24 | 24 | 24 | |
| | Plasticity Index | 16 | 16 | 16 | |
| | Failure Sketch |  |  |  | |

Project: COLETO CREEK FACILITY

Location: IPR-GDF SUEZ

Project No.: 60225561

Boring No.: B-4-1 S-13

Sample Type: 3'' ST

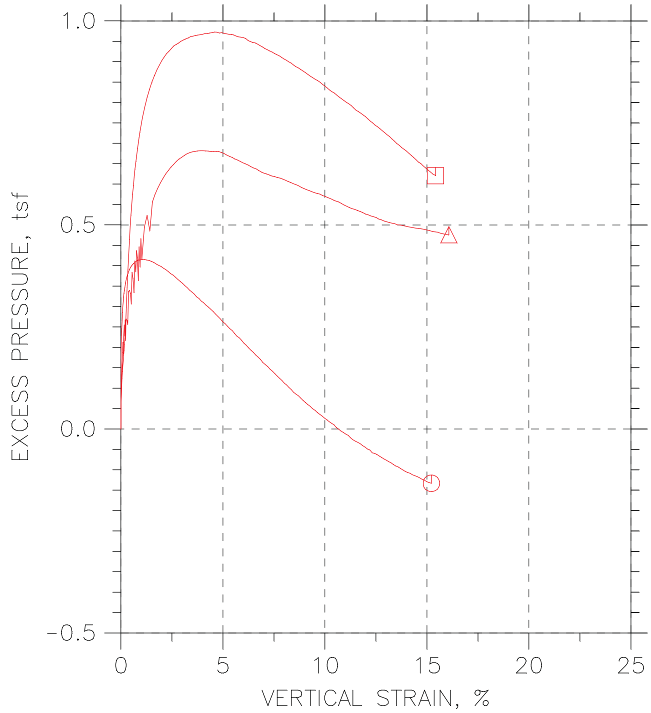
Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC

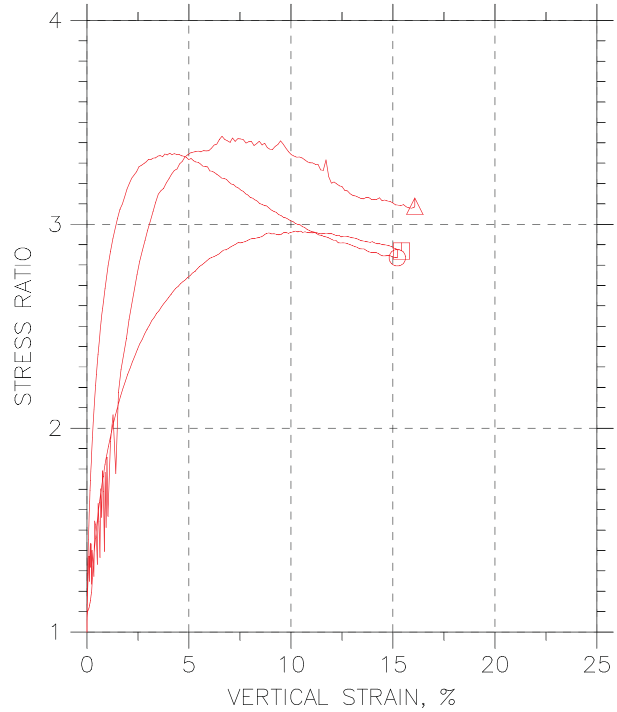
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

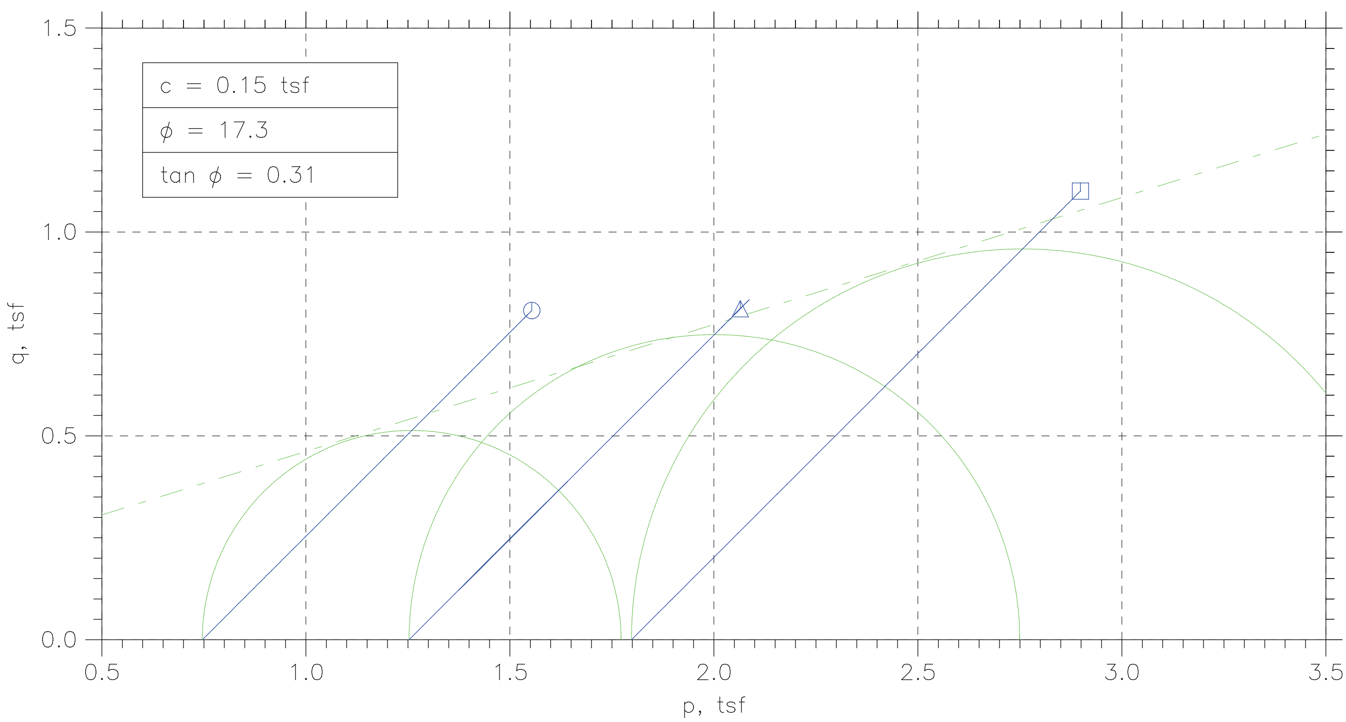
Mon, 12-DEC-2011 10:51:49

# TRIAXIAL COMPRESSION TEST REPORT

AECOM




| | | |
|---|---|---|
| Project: COLETO CREEK FACILITY | Location: IPR-GDF SUEZ | Project No.: 60225561 |
| Boring No.: B-4-1 S-13 | Tested By: BCM | Checked By: WPQ |
| Sample No.: S-13 | Test Date: 12/2/11 | Depth: 24.0'-26.0' |
| Test No.: B-4-1 S-13 | Sample Type: 3" ST | Elevation: ----- |
| Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC | | |
| Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767 | | |
| | | |

Mon, 12-DEC-2011 10:58:11

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: -----

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.06 in
Specimen Area: 5.82 in^2
Specimen Volume: 35.25 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5.8194 | 0 | 0 | 5.0425 | 5.7888 | 5.7888 |
| 2 | 5.0041 | 0.017083 | 5.8204 | 6.8968 | 0.085314 | 5.2419 | 5.7888 | 5.8741 |
| 3 | 10 | 0.037013 | 5.8216 | 11.372 | 0.14064 | 5.2811 | 5.7888 | 5.9294 |
| 4 | 15 | 0.056944 | 5.8228 | 14.478 | 0.17902 | 5.308 | 5.7888 | 5.9678 |
| 5 | 20 | 0.075451 | 5.8238 | 16.9 | 0.20893 | 5.3273 | 5.7888 | 5.9977 |
| 6 | 25 | 0.093957 | 5.8249 | 18.795 | 0.23232 | 5.3425 | 5.7888 | 6.0211 |
| 7 | 30 | 0.11389 | 5.8261 | 20.48 | 0.25309 | 5.3553 | 5.7888 | 6.0419 |
| 8 | 35.001 | 0.13239 | 5.8272 | 21.901 | 0.27061 | 5.3658 | 5.7888 | 6.0594 |
| 9 | 40.001 | 0.1509 | 5.8282 | 23.27 | 0.28747 | 5.3746 | 5.7888 | 6.0763 |
| 10 | 45.001 | 0.17083 | 5.8294 | 24.428 | 0.30172 | 5.3828 | 5.7888 | 6.0905 |
| 11 | 50.001 | 0.19076 | 5.8306 | 25.481 | 0.31466 | 5.3892 | 5.7888 | 6.1035 |
| 12 | 55.001 | 0.21069 | 5.8317 | 26.481 | 0.32695 | 5.3951 | 5.7888 | 6.1157 |
| 13 | 60.001 | 0.2292 | 5.8328 | 27.482 | 0.33923 | 5.4003 | 5.7888 | 6.128 |
| 14 | 70.001 | 0.26764 | 5.8351 | 29.272 | 0.36119 | 5.4097 | 5.7888 | 6.15 |
| 15 | 80.001 | 0.3075 | 5.8374 | 30.904 | 0.38118 | 5.4173 | 5.7888 | 6.17 |
| 16 | 90.002 | 0.34593 | 5.8396 | 32.325 | 0.39856 | 5.4231 | 5.7888 | 6.1874 |
| 17 | 100 | 0.38579 | 5.842 | 33.694 | 0.41527 | 5.4284 | 5.7888 | 6.2041 |
| 18 | 110 | 0.42281 | 5.8441 | 34.905 | 0.43003 | 5.4337 | 5.7888 | 6.2188 |
| 19 | 120 | 0.46124 | 5.8464 | 36.063 | 0.44413 | 5.4372 | 5.7888 | 6.2329 |
| 20 | 130 | 0.50111 | 5.8487 | 37.116 | 0.45691 | 5.4407 | 5.7888 | 6.2457 |
| 21 | 140 | 0.54097 | 5.8511 | 38.169 | 0.46969 | 5.4436 | 5.7888 | 6.2585 |
| 22 | 150 | 0.5794 | 5.8534 | 39.117 | 0.48116 | 5.4454 | 5.7888 | 6.27 |
| 23 | 160 | 0.61784 | 5.8556 | 40.012 | 0.49198 | 5.4477 | 5.7888 | 6.2808 |
| 24 | 170 | 0.65628 | 5.8579 | 40.907 | 0.50279 | 5.4494 | 5.7888 | 6.2916 |
| 25 | 180 | 0.69471 | 5.8602 | 41.802 | 0.51359 | 5.4512 | 5.7888 | 6.3024 |
| 26 | 190 | 0.73457 | 5.8625 | 42.644 | 0.52373 | 5.453 | 5.7888 | 6.3125 |
| 27 | 200 | 0.77159 | 5.8647 | 43.276 | 0.53129 | 5.4541 | 5.7888 | 6.3201 |
| 28 | 210 | 0.81145 | 5.867 | 44.013 | 0.54012 | 5.4553 | 5.7888 | 6.3289 |
| 29 | 220 | 0.84846 | 5.8692 | 44.75 | 0.54896 | 5.4565 | 5.7888 | 6.3378 |
| 30 | 230 | 0.8869 | 5.8715 | 45.645 | 0.55973 | 5.4565 | 5.7888 | 6.3485 |
| 31 | 270 | 1.0406 | 5.8806 | 48.593 | 0.59495 | 5.4576 | 5.7888 | 6.3838 |
| 32 | 300 | 1.156 | 5.8875 | 50.541 | 0.61808 | 5.4576 | 5.7888 | 6.4069 |
| 33 | 330 | 1.2713 | 5.8944 | 52.489 | 0.64116 | 5.4565 | 5.7888 | 6.43 |
| 34 | 360 | 1.3866 | 5.9013 | 54.174 | 0.66096 | 5.4553 | 5.7888 | 6.4498 |
| 35 | 390 | 1.5005 | 5.9081 | 55.911 | 0.68137 | 5.453 | 5.7888 | 6.4702 |
| 36 | 420 | 1.6172 | 5.9151 | 57.596 | 0.70107 | 5.4506 | 5.7888 | 6.4899 |
| 37 | 450 | 1.7325 | 5.922 | 59.07 | 0.71817 | 5.4465 | 5.7888 | 6.507 |
| 38 | 480 | 1.8492 | 5.9291 | 60.702 | 0.73714 | 5.4436 | 5.7888 | 6.5259 |
| 39 | 510 | 1.966 | 5.9361 | 62.334 | 0.75606 | 5.4407 | 5.7888 | 6.5449 |
| 40 | 540 | 2.0841 | 5.9433 | 63.966 | 0.77492 | 5.4366 | 5.7888 | 6.5637 |
| 41 | 570 | 2.2009 | 5.9504 | 65.44 | 0.79183 | 5.4331 | 5.7888 | 6.5806 |
| 42 | 600 | 2.3176 | 5.9575 | 66.862 | 0.80806 | 5.4284 | 5.7888 | 6.5969 |
| 43 | 630 | 2.4358 | 5.9647 | 68.388 | 0.82551 | 5.4231 | 5.7888 | 6.6143 |
| 44 | 660 | 2.5539 | 5.972 | 69.863 | 0.84229 | 5.4196 | 5.7888 | 6.6311 |
| 45 | 690 | 2.6721 | 5.9792 | 71.179 | 0.85711 | 5.4144 | 5.7888 | 6.6459 |
| 46 | 720 | 2.7902 | 5.9865 | 72.548 | 0.87254 | 5.4091 | 5.7888 | 6.6613 |
| 47 | 750 | 2.9056 | 5.9936 | 73.916 | 0.88795 | 5.4038 | 5.7888 | 6.6767 |
| 48 | 780 | 3.0223 | 6.0008 | 75.285 | 0.9033 | 5.3992 | 5.7888 | 6.6921 |
| 49 | 810 | 3.1376 | 6.0079 | 76.391 | 0.91548 | 5.3939 | 5.7888 | 6.7043 |
| 50 | 840 | 3.2515 | 6.015 | 77.707 | 0.93016 | 5.3886 | 5.7888 | 6.719 |
| 51 | 870 | 3.3654 | 6.0221 | 78.971 | 0.94417 | 5.3828 | 5.7888 | 6.733 |
| 52 | 900 | 3.4807 | 6.0293 | 80.287 | 0.95876 | 5.3781 | 5.7888 | 6.7476 |
| 53 | 930 | 3.5946 | 6.0364 | 81.498 | 0.97207 | 5.3729 | 5.7888 | 6.7609 |
| 54 | 960 | 3.7085 | 6.0436 | 82.656 | 0.98472 | 5.3664 | 5.7888 | 6.7735 |
| 55 | 990 | 3.8238 | 6.0508 | 84.025 | 0.99983 | 5.3623 | 5.7888 | 6.7886 |
| 56 | 1020 | 3.9377 | 6.058 | 85.235 | 1.013 | 5.3559 | 5.7888 | 6.8018 |
| 57 | 1050 | 4.053 | 6.0653 | 86.446 | 1.0262 | 5.3518 | 5.7888 | 6.815 |
| 58 | 1080 | 4.1683 | 6.0726 | 87.447 | 1.0368 | 5.346 | 5.7888 | 6.8256 |
| 59 | 1110 | 4.285 | 6.08 | 88.658 | 1.0499 | 5.3413 | 5.7888 | 6.8387 |
| 60 | 1140 | 4.4018 | 6.0874 | 89.658 | 1.0604 | 5.336 | 5.7888 | 6.8492 |
| 61 | 1170 | 4.5185 | 6.0948 | 90.816 | 1.0728 | 5.3308 | 5.7888 | 6.8616 |
| 62 | 1200 | 4.6352 | 6.1023 | 91.974 | 1.0852 | 5.3243 | 5.7888 | 6.874 |
| 63 | 1230 | 4.752 | 6.1098 | 93.133 | 1.0975 | 5.3185 | 5.7888 | 6.8863 |
| 64 | 1260 | 4.8701 | 6.1174 | 94.185 | 1.1085 | 5.3126 | 5.7888 | 6.8973 |
| 65 | 1290 | 4.9883 | 6.125 | 95.238 | 1.1195 | 5.3056 | 5.7888 | 6.9083 |
| 66 | 1320 | 5.1064 | 6.1326 | 96.502 | 1.133 | 5.301 | 5.7888 | 6.9218 |
| 67 | 1350 | 5.2232 | 6.1402 | 97.45 | 1.1427 | 5.2945 | 5.7888 | 6.9315 |
| 68 | 1380 | 5.3385 | 6.1476 | 98.555 | 1.1543 | 5.2881 | 5.7888 | 6.9431 |
| 69 | 1410 | 5.4552 | 6.1552 | 99.555 | 1.1645 | 5.2834 | 5.7888 | 6.9533 |
| 70 | 1440 | 5.5705 | 6.1627 | 100.56 | 1.1748 | 5.277 | 5.7888 | 6.9636 |
| 71 | 1470 | 5.683 | 6.1701 | 101.61 | 1.1857 | 5.27 | 5.7888 | 6.9745 |
| 72 | 1500 | 5.7983 | 6.1776 | 102.45 | 1.1941 | 5.2659 | 5.7888 | 6.9829 |
| 73 | 1530 | 5.9136 | 6.1852 | 103.61 | 1.2061 | 5.26 | 5.7888 | 6.9949 |
| 74 | 1560 | 6.0275 | 6.1927 | 104.35 | 1.2132 | 5.2524 | 5.7888 | 7.002 |
| 75 | 1590 | 6.1428 | 6.2003 | 105.29 | 1.2227 | 5.2477 | 5.7888 | 7.0115 |
| 76 | 1620 | 6.2581 | 6.2079 | 106.35 | 1.2334 | 5.2413 | 5.7888 | 7.0222 |
| 77 | 1650 | 6.372 | 6.2155 | 107.24 | 1.2423 | 5.2355 | 5.7888 | 7.0311 |
| 78 | 1680 | 6.4887 | 6.2233 | 107.98 | 1.2493 | 5.2302 | 5.7888 | 7.0381 |
| 79 | 1710 | 6.6041 | 6.2309 | 108.87 | 1.2581 | 5.2238 | 5.7888 | 7.0469 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1740 | 6.7236 | 6.2389 | 109.93 | 1.2686 | 5.2185 | 5.7888 | 7.0574 |
| 81 | 1770 | 6.8418 | 6.2468 | 110.98 | 1.2791 | 5.2127 | 5.7888 | 7.0679 |
| 82 | 1800 | 6.9585 | 6.2547 | 111.82 | 1.2872 | 5.2057 | 5.7888 | 7.076 |
| 83 | 1830 | 7.0767 | 6.2626 | 112.56 | 1.2941 | 5.1998 | 5.7888 | 7.0829 |
| 84 | 1860 | 7.1948 | 6.2706 | 113.45 | 1.3027 | 5.1951 | 5.7888 | 7.0915 |
| 85 | 1890 | 7.3144 | 6.2787 | 114.24 | 1.3101 | 5.1887 | 5.7888 | 7.0989 |
| 86 | 1920 | 7.4326 | 6.2867 | 114.98 | 1.3168 | 5.184 | 5.7888 | 7.1056 |
| 87 | 1950 | 7.5493 | 6.2946 | 115.82 | 1.3248 | 5.1776 | 5.7888 | 7.1136 |
| 88 | 1980 | 7.6646 | 6.3025 | 116.61 | 1.3322 | 5.1723 | 5.7888 | 7.121 |
| 89 | 2010 | 7.7814 | 6.3105 | 117.24 | 1.3377 | 5.1665 | 5.7888 | 7.1265 |
| 90 | 2040 | 7.8953 | 6.3183 | 118.03 | 1.3451 | 5.1612 | 5.7888 | 7.1339 |
| 91 | 2070 | 8.0077 | 6.326 | 118.72 | 1.3512 | 5.1548 | 5.7888 | 7.14 |
| 92 | 2100 | 8.1216 | 6.3339 | 119.56 | 1.3591 | 5.1501 | 5.7888 | 7.1479 |
| 93 | 2130 | 8.2369 | 6.3418 | 120.35 | 1.3664 | 5.1443 | 5.7888 | 7.1552 |
| 94 | 2160 | 8.3522 | 6.3498 | 121.09 | 1.373 | 5.139 | 5.7888 | 7.1618 |
| 95 | 2190 | 8.4647 | 6.3576 | 121.77 | 1.3791 | 5.1326 | 5.7888 | 7.1679 |
| 96 | 2220 | 8.58 | 6.3656 | 122.56 | 1.3863 | 5.1279 | 5.7888 | 7.1751 |
| 97 | 2250 | 8.6939 | 6.3735 | 123.14 | 1.3911 | 5.1238 | 5.7888 | 7.1799 |
| 98 | 2280 | 8.8092 | 6.3816 | 124.14 | 1.4006 | 5.1185 | 5.7888 | 7.1894 |
| 99 | 2310 | 8.9259 | 6.3898 | 124.77 | 1.4059 | 5.1127 | 5.7888 | 7.1947 |
| 100 | 2340 | 9.0441 | 6.3981 | 125.3 | 1.41 | 5.1074 | 5.7888 | 7.1988 |
| 101 | 2370 | 9.1608 | 6.4063 | 126.04 | 1.4165 | 5.1022 | 5.7888 | 7.2053 |
| 102 | 2400 | 9.279 | 6.4147 | 126.67 | 1.4218 | 5.0981 | 5.7888 | 7.2106 |
| 103 | 2430 | 9.3957 | 6.4229 | 127.25 | 1.4264 | 5.0922 | 5.7888 | 7.2152 |
| 104 | 2460 | 9.5139 | 6.4313 | 127.83 | 1.4311 | 5.0881 | 5.7888 | 7.2199 |
| 105 | 2490 | 9.632 | 6.4397 | 128.41 | 1.4357 | 5.0829 | 5.7888 | 7.2245 |
| 106 | 2520 | 9.7516 | 6.4482 | 129.25 | 1.4432 | 5.0782 | 5.7888 | 7.232 |
| 107 | 2550 | 9.8698 | 6.4567 | 129.88 | 1.4483 | 5.0735 | 5.7888 | 7.2371 |
| 108 | 2580 | 9.9837 | 6.4649 | 130.35 | 1.4518 | 5.0688 | 5.7888 | 7.2406 |
| 109 | 2610 | 10.102 | 6.4734 | 131.04 | 1.4575 | 5.0648 | 5.7888 | 7.2463 |
| 110 | 2640 | 10.219 | 6.4818 | 131.46 | 1.4603 | 5.0601 | 5.7888 | 7.2491 |
| 111 | 2670 | 10.332 | 6.49 | 132.09 | 1.4654 | 5.056 | 5.7888 | 7.2542 |
| 112 | 2700 | 10.448 | 6.4984 | 132.72 | 1.4705 | 5.0525 | 5.7888 | 7.2593 |
| 113 | 2730 | 10.562 | 6.5066 | 133.46 | 1.4768 | 5.046 | 5.7888 | 7.2656 |
| 114 | 2760 | 10.677 | 6.515 | 134.2 | 1.4831 | 5.0414 | 5.7888 | 7.2719 |
| 115 | 2790 | 10.792 | 6.5235 | 134.46 | 1.484 | 5.0373 | 5.7888 | 7.2728 |
| 116 | 2820 | 10.909 | 6.532 | 134.88 | 1.4867 | 5.0338 | 5.7888 | 7.2755 |
| 117 | 2850 | 11.024 | 6.5405 | 135.41 | 1.4906 | 5.0297 | 5.7888 | 7.2794 |
| 118 | 2880 | 11.14 | 6.549 | 135.99 | 1.4951 | 5.0268 | 5.7888 | 7.2839 |
| 119 | 2910 | 11.256 | 6.5576 | 136.67 | 1.5006 | 5.0209 | 5.7888 | 7.2894 |
| 120 | 2940 | 11.373 | 6.5662 | 137.2 | 1.5044 | 5.0162 | 5.7888 | 7.2932 |
| 121 | 2970 | 11.491 | 6.575 | 137.88 | 1.5099 | 5.0127 | 5.7888 | 7.2987 |
| 122 | 3000 | 11.609 | 6.5838 | 138.25 | 1.5119 | 5.0098 | 5.7888 | 7.3007 |
| 123 | 3030 | 11.73 | 6.5928 | 138.83 | 1.5162 | 5.0063 | 5.7888 | 7.305 |
| 124 | 3060 | 11.847 | 6.6015 | 139.57 | 1.5222 | 5.0016 | 5.7888 | 7.311 |
| 125 | 3090 | 11.965 | 6.6104 | 139.94 | 1.5242 | 4.9981 | 5.7888 | 7.313 |
| 126 | 3120 | 12.083 | 6.6193 | 140.51 | 1.5284 | 4.9934 | 5.7888 | 7.3172 |
| 127 | 3150 | 12.2 | 6.6281 | 141.15 | 1.5333 | 4.9911 | 5.7888 | 7.3221 |
| 128 | 3180 | 12.317 | 6.6369 | 141.62 | 1.5364 | 4.9841 | 5.7888 | 7.3252 |
| 129 | 3210 | 12.432 | 6.6456 | 141.94 | 1.5378 | 4.9829 | 5.7888 | 7.3266 |
| 130 | 3240 | 12.55 | 6.6546 | 142.67 | 1.5437 | 4.98 | 5.7888 | 7.3325 |
| 131 | 3270 | 12.666 | 6.6634 | 143.52 | 1.5507 | 4.9759 | 5.7888 | 7.3395 |
| 132 | 3300 | 12.78 | 6.6721 | 144.09 | 1.555 | 4.9724 | 5.7888 | 7.3438 |
| 133 | 3330 | 12.893 | 6.6808 | 144.57 | 1.558 | 4.9689 | 5.7888 | 7.3468 |
| 134 | 3360 | 13.009 | 6.6897 | 144.99 | 1.5605 | 4.966 | 5.7888 | 7.3493 |
| 135 | 3390 | 13.124 | 6.6986 | 145.36 | 1.5624 | 4.9624 | 5.7888 | 7.3512 |
| 136 | 3420 | 13.238 | 6.7074 | 145.83 | 1.5654 | 4.9595 | 5.7888 | 7.3542 |
| 137 | 3450 | 13.355 | 6.7164 | 146.2 | 1.5673 | 4.9554 | 5.7888 | 7.3561 |
| 138 | 3480 | 13.471 | 6.7255 | 146.89 | 1.5725 | 4.9519 | 5.7888 | 7.3613 |
| 139 | 3510 | 13.588 | 6.7345 | 147.46 | 1.5766 | 4.9496 | 5.7888 | 7.3654 |
| 140 | 3540 | 13.706 | 6.7438 | 147.78 | 1.5778 | 4.9455 | 5.7888 | 7.3666 |
| 141 | 3570 | 13.823 | 6.7529 | 148.1 | 1.579 | 4.942 | 5.7888 | 7.3678 |
| 142 | 3600 | 13.938 | 6.7619 | 148.68 | 1.5831 | 4.9385 | 5.7888 | 7.3719 |
| 143 | 3630 | 14.058 | 6.7714 | 149.41 | 1.5887 | 4.9355 | 5.7888 | 7.3775 |
| 144 | 3660 | 14.175 | 6.7806 | 149.89 | 1.5916 | 4.9338 | 5.7888 | 7.3804 |
| 145 | 3690 | 14.291 | 6.7898 | 150.25 | 1.5933 | 4.9303 | 5.7888 | 7.3821 |
| 146 | 3720 | 14.411 | 6.7993 | 150.25 | 1.5911 | 4.9279 | 5.7888 | 7.3799 |
| 147 | 3750 | 14.529 | 6.8087 | 150.52 | 1.5917 | 4.9256 | 5.7888 | 7.3805 |
| 148 | 3780 | 14.645 | 6.8179 | 151.31 | 1.5979 | 4.9227 | 5.7888 | 7.3867 |
| 149 | 3810 | 14.76 | 6.8271 | 152.36 | 1.6068 | 4.9192 | 5.7888 | 7.3956 |
| 150 | 3840 | 14.875 | 6.8364 | 152.73 | 1.6085 | 4.9168 | 5.7888 | 7.3973 |
| 151 | 3870 | 14.99 | 6.8456 | 153.04 | 1.6097 | 4.9133 | 5.7888 | 7.3985 |
| 152 | 3900 | 15.104 | 6.8548 | 153.57 | 1.613 | 4.911 | 5.7888 | 7.4018 |
| 153 | 3930 | 15.218 | 6.864 | 153.94 | 1.6147 | 4.9092 | 5.7888 | 7.4035 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 10.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: -----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.06 in
Specimen Area: 5.82 in^2
Specimen Volume: 35.25 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 5.7888 | 5.7888 | 0 | 0.000 | 0.74626 | 0.74626 | 1.000 | 0.74626 | 0 |
| 2 | 0.02 | 5.8741 | 5.7888 | 0.19936 | 2.337 | 0.63221 | 0.5469 | 1.156 | 0.58956 | 0.042657 |
| 3 | 0.04 | 5.9294 | 5.7888 | 0.23853 | 1.696 | 0.64837 | 0.50773 | 1.277 | 0.57805 | 0.070321 |
| 4 | 0.06 | 5.9678 | 5.7888 | 0.26543 | 1.483 | 0.65986 | 0.48083 | 1.372 | 0.57035 | 0.089512 |
| 5 | 0.08 | 5.9977 | 5.7888 | 0.28472 | 1.363 | 0.67047 | 0.46154 | 1.453 | 0.56601 | 0.10447 |
| 6 | 0.09 | 6.0211 | 5.7888 | 0.29992 | 1.291 | 0.67866 | 0.44634 | 1.520 | 0.5625 | 0.11616 |
| 7 | 0.11 | 6.0419 | 5.7888 | 0.31278 | 1.236 | 0.68657 | 0.43348 | 1.584 | 0.56002 | 0.12655 |
| 8 | 0.13 | 6.0594 | 5.7888 | 0.32331 | 1.195 | 0.69356 | 0.42295 | 1.640 | 0.55826 | 0.1353 |
| 9 | 0.15 | 6.0763 | 5.7888 | 0.33208 | 1.155 | 0.70165 | 0.41418 | 1.694 | 0.55792 | 0.14373 |
| 10 | 0.17 | 6.0905 | 5.7888 | 0.34026 | 1.128 | 0.70772 | 0.406 | 1.743 | 0.55686 | 0.15086 |
| 11 | 0.19 | 6.1035 | 5.7888 | 0.34669 | 1.102 | 0.71423 | 0.39957 | 1.787 | 0.5569 | 0.15733 |
| 12 | 0.21 | 6.1157 | 5.7888 | 0.35254 | 1.078 | 0.72067 | 0.39372 | 1.830 | 0.5572 | 0.16347 |
| 13 | 0.23 | 6.128 | 5.7888 | 0.3578 | 1.055 | 0.72769 | 0.38846 | 1.873 | 0.55808 | 0.16962 |
| 14 | 0.27 | 6.15 | 5.7888 | 0.36716 | 1.017 | 0.7403 | 0.37911 | 1.953 | 0.5597 | 0.1806 |
| 15 | 0.31 | 6.17 | 5.7888 | 0.37476 | 0.983 | 0.75268 | 0.37151 | 2.026 | 0.56209 | 0.19059 |
| 16 | 0.35 | 6.1874 | 5.7888 | 0.3806 | 0.955 | 0.76421 | 0.36566 | 2.090 | 0.56494 | 0.19928 |
| 17 | 0.39 | 6.2041 | 5.7888 | 0.38586 | 0.929 | 0.77566 | 0.3604 | 2.152 | 0.56803 | 0.20763 |
| 18 | 0.42 | 6.2188 | 5.7888 | 0.39113 | 0.910 | 0.78517 | 0.35514 | 2.211 | 0.57015 | 0.21501 |
| 19 | 0.46 | 6.2329 | 5.7888 | 0.39463 | 0.889 | 0.79576 | 0.35163 | 2.263 | 0.57369 | 0.22206 |
| 20 | 0.50 | 6.2457 | 5.7888 | 0.39814 | 0.871 | 0.80503 | 0.34812 | 2.313 | 0.57658 | 0.22846 |
| 21 | 0.54 | 6.2585 | 5.7888 | 0.40106 | 0.854 | 0.81488 | 0.3452 | 2.361 | 0.58004 | 0.23484 |
| 22 | 0.58 | 6.27 | 5.7888 | 0.40282 | 0.837 | 0.8246 | 0.34344 | 2.401 | 0.58402 | 0.24058 |
| 23 | 0.62 | 6.2808 | 5.7888 | 0.40516 | 0.824 | 0.83308 | 0.3411 | 2.442 | 0.58709 | 0.24599 |
| 24 | 0.66 | 6.2916 | 5.7888 | 0.40691 | 0.809 | 0.84214 | 0.33935 | 2.482 | 0.59075 | 0.25139 |
| 25 | 0.69 | 6.3024 | 5.7888 | 0.40866 | 0.796 | 0.85119 | 0.3376 | 2.521 | 0.59439 | 0.2568 |
| 26 | 0.73 | 6.3125 | 5.7888 | 0.41042 | 0.784 | 0.85957 | 0.33584 | 2.559 | 0.59771 | 0.26187 |
| 27 | 0.77 | 6.3201 | 5.7888 | 0.41159 | 0.775 | 0.86596 | 0.33467 | 2.587 | 0.60032 | 0.26565 |
| 28 | 0.81 | 6.3289 | 5.7888 | 0.41276 | 0.764 | 0.87363 | 0.3335 | 2.620 | 0.60357 | 0.27006 |
| 29 | 0.85 | 6.3378 | 5.7888 | 0.41393 | 0.754 | 0.8813 | 0.33233 | 2.652 | 0.60682 | 0.27448 |
| 30 | 0.89 | 6.3485 | 5.7888 | 0.41393 | 0.740 | 0.89206 | 0.33233 | 2.684 | 0.6122 | 0.27986 |
| 31 | 1.04 | 6.3838 | 5.7888 | 0.4151 | 0.698 | 0.92612 | 0.33117 | 2.797 | 0.62864 | 0.29748 |
| 32 | 1.16 | 6.4069 | 5.7888 | 0.4151 | 0.672 | 0.94925 | 0.33117 | 2.866 | 0.64021 | 0.30904 |
| 33 | 1.27 | 6.43 | 5.7888 | 0.41393 | 0.646 | 0.97349 | 0.33233 | 2.929 | 0.65291 | 0.32058 |
| 34 | 1.39 | 6.4498 | 5.7888 | 0.41276 | 0.624 | 0.99447 | 0.3335 | 2.982 | 0.66398 | 0.33048 |
| 35 | 1.50 | 6.4702 | 5.7888 | 0.41042 | 0.602 | 1.0172 | 0.33584 | 3.029 | 0.67653 | 0.34069 |
| 36 | 1.62 | 6.4899 | 5.7888 | 0.40808 | 0.582 | 1.0393 | 0.33818 | 3.073 | 0.68872 | 0.35054 |
| 37 | 1.73 | 6.507 | 5.7888 | 0.40399 | 0.563 | 1.0604 | 0.34227 | 3.098 | 0.70136 | 0.35909 |
| 38 | 1.85 | 6.5259 | 5.7888 | 0.40106 | 0.544 | 1.0823 | 0.3452 | 3.135 | 0.71377 | 0.36857 |
| 39 | 1.97 | 6.5449 | 5.7888 | 0.39814 | 0.527 | 1.1042 | 0.34812 | 3.172 | 0.72615 | 0.37803 |
| 40 | 2.08 | 6.5637 | 5.7888 | 0.39405 | 0.509 | 1.1271 | 0.35221 | 3.200 | 0.73967 | 0.38746 |
| 41 | 2.20 | 6.5806 | 5.7888 | 0.39054 | 0.493 | 1.1475 | 0.35572 | 3.226 | 0.75163 | 0.39591 |
| 42 | 2.32 | 6.5969 | 5.7888 | 0.38586 | 0.478 | 1.1685 | 0.3604 | 3.242 | 0.76443 | 0.40403 |
| 43 | 2.44 | 6.6143 | 5.7888 | 0.3806 | 0.461 | 1.1912 | 0.36566 | 3.258 | 0.77842 | 0.41276 |
| 44 | 2.55 | 6.6311 | 5.7888 | 0.37709 | 0.448 | 1.2115 | 0.36917 | 3.282 | 0.79031 | 0.42114 |
| 45 | 2.67 | 6.6459 | 5.7888 | 0.37183 | 0.434 | 1.2315 | 0.37443 | 3.289 | 0.80299 | 0.42856 |
| 46 | 2.79 | 6.6613 | 5.7888 | 0.36657 | 0.420 | 1.2522 | 0.37969 | 3.298 | 0.81596 | 0.43627 |
| 47 | 2.91 | 6.6767 | 5.7888 | 0.36131 | 0.407 | 1.2729 | 0.38495 | 3.307 | 0.82893 | 0.44397 |
| 48 | 3.02 | 6.6921 | 5.7888 | 0.35663 | 0.395 | 1.2929 | 0.38963 | 3.318 | 0.84128 | 0.45165 |
| 49 | 3.14 | 6.7043 | 5.7888 | 0.35137 | 0.384 | 1.3104 | 0.39489 | 3.318 | 0.85263 | 0.45774 |
| 50 | 3.25 | 6.719 | 5.7888 | 0.34611 | 0.372 | 1.3303 | 0.40015 | 3.324 | 0.86523 | 0.46508 |
| 51 | 3.37 | 6.733 | 5.7888 | 0.34026 | 0.360 | 1.3502 | 0.406 | 3.326 | 0.87808 | 0.47208 |
| 52 | 3.48 | 6.7476 | 5.7888 | 0.33558 | 0.350 | 1.3694 | 0.41068 | 3.335 | 0.89006 | 0.47938 |
| 53 | 3.59 | 6.7609 | 5.7888 | 0.33032 | 0.340 | 1.388 | 0.41594 | 3.337 | 0.90197 | 0.48603 |
| 54 | 3.71 | 6.7735 | 5.7888 | 0.32389 | 0.329 | 1.4071 | 0.42237 | 3.331 | 0.91473 | 0.49236 |
| 55 | 3.82 | 6.7886 | 5.7888 | 0.3198 | 0.320 | 1.4263 | 0.42646 | 3.344 | 0.92638 | 0.49991 |
| 56 | 3.94 | 6.8018 | 5.7888 | 0.31337 | 0.309 | 1.4459 | 0.43289 | 3.340 | 0.93941 | 0.50652 |
| 57 | 4.05 | 6.815 | 5.7888 | 0.30928 | 0.301 | 1.4632 | 0.43699 | 3.348 | 0.95008 | 0.5131 |
| 58 | 4.17 | 6.8256 | 5.7888 | 0.30343 | 0.293 | 1.4797 | 0.44283 | 3.341 | 0.96124 | 0.51841 |
| 59 | 4.29 | 6.8387 | 5.7888 | 0.29875 | 0.285 | 1.4974 | 0.44751 | 3.346 | 0.97246 | 0.52495 |
| 60 | 4.40 | 6.8492 | 5.7888 | 0.29349 | 0.277 | 1.5132 | 0.45277 | 3.342 | 0.983 | 0.53022 |
| 61 | 4.52 | 6.8616 | 5.7888 | 0.28823 | 0.269 | 1.5309 | 0.45803 | 3.342 | 0.99445 | 0.53642 |
| 62 | 4.64 | 6.874 | 5.7888 | 0.2818 | 0.260 | 1.5497 | 0.46446 | 3.336 | 1.0071 | 0.5426 |
| 63 | 4.75 | 6.8863 | 5.7888 | 0.27595 | 0.251 | 1.5678 | 0.47031 | 3.334 | 1.0191 | 0.54876 |
| 64 | 4.87 | 6.8973 | 5.7888 | 0.2701 | 0.244 | 1.5847 | 0.47616 | 3.328 | 1.0304 | 0.55427 |
| 65 | 4.99 | 6.9083 | 5.7888 | 0.26309 | 0.235 | 1.6027 | 0.48317 | 3.317 | 1.0429 | 0.55977 |
| 66 | 5.11 | 6.9218 | 5.7888 | 0.25841 | 0.228 | 1.6208 | 0.48785 | 3.322 | 1.0543 | 0.56649 |
| 67 | 5.22 | 6.9315 | 5.7888 | 0.25198 | 0.221 | 1.637 | 0.49428 | 3.312 | 1.0656 | 0.57135 |
| 68 | 5.34 | 6.9431 | 5.7888 | 0.24555 | 0.213 | 1.655 | 0.50071 | 3.305 | 1.0778 | 0.57713 |
| 69 | 5.46 | 6.9533 | 5.7888 | 0.24087 | 0.207 | 1.6699 | 0.50539 | 3.304 | 1.0877 | 0.58227 |
| 70 | 5.57 | 6.9636 | 5.7888 | 0.23444 | 0.200 | 1.6866 | 0.51182 | 3.295 | 1.0992 | 0.5874 |
| 71 | 5.68 | 6.9745 | 5.7888 | 0.22743 | 0.192 | 1.7045 | 0.51884 | 3.285 | 1.1117 | 0.59285 |
| 72 | 5.80 | 6.9829 | 5.7888 | 0.22333 | 0.187 | 1.717 | 0.52293 | 3.283 | 1.12 | 0.59703 |
| 73 | 5.91 | 6.9949 | 5.7888 | 0.21749 | 0.180 | 1.7349 | 0.52877 | 3.281 | 1.1318 | 0.60304 |
| 74 | 6.03 | 7.002 | 5.7888 | 0.20989 | 0.173 | 1.7496 | 0.53637 | 3.262 | 1.143 | 0.6066 |
| 75 | 6.14 | 7.0115 | 5.7888 | 0.20521 | 0.168 | 1.7638 | 0.54105 | 3.260 | 1.1524 | 0.61135 |
| 76 | 6.26 | 7.0222 | 5.7888 | 0.19878 | 0.161 | 1.7809 | 0.54748 | 3.253 | 1.1642 | 0.61671 |
| 77 | 6.37 | 7.0311 | 5.7888 | 0.19293 | 0.155 | 1.7956 | 0.55333 | 3.245 | 1.1745 | 0.62114 |
| 78 | 6.49 | 7.0381 | 5.7888 | 0.18767 | 0.150 | 1.8079 | 0.55859 | 3.236 | 1.1832 | 0.62463 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 6.60 | 7.0469 | 5.7888 | 0.18124 | 0.144 | 1.8231 | 0.56502 | 3.227 | 1.1941 | 0.62903 |
| 80 | 6.72 | 7.0574 | 5.7888 | 0.17598 | 0.139 | 1.8389 | 0.57028 | 3.225 | 1.2046 | 0.6343 |
| 81 | 6.84 | 7.0679 | 5.7888 | 0.17013 | 0.133 | 1.8553 | 0.57613 | 3.220 | 1.2157 | 0.63957 |
| 82 | 6.96 | 7.076 | 5.7888 | 0.16312 | 0.127 | 1.8704 | 0.58315 | 3.207 | 1.2268 | 0.64361 |
| 83 | 7.08 | 7.0829 | 5.7888 | 0.15727 | 0.122 | 1.8831 | 0.58899 | 3.197 | 1.236 | 0.64703 |
| 84 | 7.19 | 7.0915 | 5.7888 | 0.15259 | 0.117 | 1.8964 | 0.59367 | 3.194 | 1.245 | 0.65135 |
| 85 | 7.31 | 7.0989 | 5.7888 | 0.14616 | 0.112 | 1.9102 | 0.6001 | 3.183 | 1.2551 | 0.65504 |
| 86 | 7.43 | 7.1056 | 5.7888 | 0.14148 | 0.107 | 1.9216 | 0.60478 | 3.177 | 1.2632 | 0.65842 |
| 87 | 7.55 | 7.1136 | 5.7888 | 0.13505 | 0.102 | 1.936 | 0.61121 | 3.168 | 1.2736 | 0.66241 |
| 88 | 7.66 | 7.121 | 5.7888 | 0.12979 | 0.097 | 1.9487 | 0.61647 | 3.161 | 1.2826 | 0.6661 |
| 89 | 7.78 | 7.1265 | 5.7888 | 0.12394 | 0.093 | 1.96 | 0.62232 | 3.150 | 1.2912 | 0.66886 |
| 90 | 7.90 | 7.1339 | 5.7888 | 0.11868 | 0.088 | 1.9726 | 0.62758 | 3.143 | 1.3001 | 0.67253 |
| 91 | 8.01 | 7.14 | 5.7888 | 0.11225 | 0.083 | 1.9852 | 0.63401 | 3.131 | 1.3096 | 0.67561 |
| 92 | 8.12 | 7.1479 | 5.7888 | 0.10757 | 0.079 | 1.9978 | 0.63869 | 3.128 | 1.3182 | 0.67956 |
| 93 | 8.24 | 7.1552 | 5.7888 | 0.10173 | 0.074 | 2.0109 | 0.64453 | 3.120 | 1.3277 | 0.68319 |
| 94 | 8.35 | 7.1618 | 5.7888 | 0.096466 | 0.070 | 2.0228 | 0.6498 | 3.113 | 1.3363 | 0.68651 |
| 95 | 8.46 | 7.1679 | 5.7888 | 0.090035 | 0.065 | 2.0353 | 0.65623 | 3.102 | 1.3458 | 0.68954 |
| 96 | 8.58 | 7.1751 | 5.7888 | 0.085358 | 0.062 | 2.0472 | 0.6609 | 3.098 | 1.354 | 0.69314 |
| 97 | 8.69 | 7.1799 | 5.7888 | 0.081265 | 0.058 | 2.0561 | 0.665 | 3.092 | 1.3605 | 0.69554 |
| 98 | 8.81 | 7.1894 | 5.7888 | 0.076003 | 0.054 | 2.0709 | 0.67026 | 3.090 | 1.3706 | 0.70031 |
| 99 | 8.93 | 7.1947 | 5.7888 | 0.070157 | 0.050 | 2.082 | 0.6761 | 3.079 | 1.3791 | 0.70297 |
| 100 | 9.04 | 7.1988 | 5.7888 | 0.064895 | 0.046 | 2.0914 | 0.68137 | 3.069 | 1.3864 | 0.70502 |
| 101 | 9.16 | 7.2053 | 5.7888 | 0.059634 | 0.042 | 2.1031 | 0.68663 | 3.063 | 1.3949 | 0.70826 |
| 102 | 9.28 | 7.2106 | 5.7888 | 0.055541 | 0.039 | 2.1125 | 0.69072 | 3.058 | 1.4016 | 0.71088 |
| 103 | 9.40 | 7.2152 | 5.7888 | 0.049695 | 0.035 | 2.123 | 0.69657 | 3.048 | 1.4098 | 0.71321 |
| 104 | 9.51 | 7.2199 | 5.7888 | 0.045602 | 0.032 | 2.1317 | 0.70066 | 3.042 | 1.4162 | 0.71553 |
| 105 | 9.63 | 7.2245 | 5.7888 | 0.04034 | 0.028 | 2.1416 | 0.70592 | 3.034 | 1.4238 | 0.71783 |
| 106 | 9.75 | 7.232 | 5.7888 | 0.035663 | 0.025 | 2.1538 | 0.7106 | 3.031 | 1.4322 | 0.72158 |
| 107 | 9.87 | 7.2371 | 5.7888 | 0.030986 | 0.021 | 2.1636 | 0.71528 | 3.025 | 1.4394 | 0.72416 |
| 108 | 9.98 | 7.2406 | 5.7888 | 0.026309 | 0.018 | 2.1717 | 0.71995 | 3.016 | 1.4458 | 0.72588 |
| 109 | 10.10 | 7.2463 | 5.7888 | 0.022216 | 0.015 | 2.1815 | 0.72404 | 3.013 | 1.4528 | 0.72874 |
| 110 | 10.22 | 7.2491 | 5.7888 | 0.017539 | 0.012 | 2.189 | 0.72872 | 3.004 | 1.4589 | 0.73013 |
| 111 | 10.33 | 7.2542 | 5.7888 | 0.013447 | 0.009 | 2.1982 | 0.73281 | 3.000 | 1.4655 | 0.73271 |
| 112 | 10.45 | 7.2593 | 5.7888 | 0.0099389 | 0.007 | 2.2069 | 0.73632 | 2.997 | 1.4716 | 0.73527 |
| 113 | 10.56 | 7.2656 | 5.7888 | 0.0035079 | 0.002 | 2.2196 | 0.74275 | 2.988 | 1.4812 | 0.73841 |
| 114 | 10.68 | 7.2719 | 5.7888 | -0.0011693 | -0.001 | 2.2305 | 0.74743 | 2.984 | 1.489 | 0.74153 |
| 115 | 10.79 | 7.2728 | 5.7888 | -0.0052618 | -0.004 | 2.2356 | 0.75152 | 2.975 | 1.4935 | 0.74202 |
| 116 | 10.91 | 7.2755 | 5.7888 | -0.0087696 | -0.006 | 2.2418 | 0.75503 | 2.969 | 1.4984 | 0.74337 |
| 117 | 11.02 | 7.2794 | 5.7888 | -0.012862 | -0.009 | 2.2497 | 0.75912 | 2.964 | 1.5044 | 0.74531 |
| 118 | 11.14 | 7.2839 | 5.7888 | -0.015785 | -0.011 | 2.2571 | 0.76205 | 2.962 | 1.5096 | 0.74753 |
| 119 | 11.26 | 7.2894 | 5.7888 | -0.021632 | -0.014 | 2.2685 | 0.76789 | 2.954 | 1.5182 | 0.7503 |
| 120 | 11.37 | 7.2932 | 5.7888 | -0.026309 | -0.017 | 2.277 | 0.77257 | 2.947 | 1.5248 | 0.7522 |
| 121 | 11.49 | 7.2987 | 5.7888 | -0.029817 | -0.020 | 2.286 | 0.77608 | 2.946 | 1.531 | 0.75495 |
| 122 | 11.61 | 7.3007 | 5.7888 | -0.03274 | -0.022 | 2.2909 | 0.779 | 2.941 | 1.535 | 0.75595 |
| 123 | 11.73 | 7.305 | 5.7888 | -0.036248 | -0.024 | 2.2987 | 0.78251 | 2.938 | 1.5406 | 0.75808 |
| 124 | 11.85 | 7.311 | 5.7888 | -0.040925 | -0.027 | 2.3094 | 0.78719 | 2.934 | 1.5483 | 0.7611 |
| 125 | 11.97 | 7.313 | 5.7888 | -0.044433 | -0.029 | 2.3149 | 0.79069 | 2.928 | 1.5528 | 0.76209 |
| 126 | 12.08 | 7.3172 | 5.7888 | -0.04911 | -0.032 | 2.3238 | 0.79537 | 2.922 | 1.5596 | 0.76421 |
| 127 | 12.20 | 7.3221 | 5.7888 | -0.051449 | -0.034 | 2.331 | 0.79771 | 2.922 | 1.5643 | 0.76663 |
| 128 | 12.32 | 7.3252 | 5.7888 | -0.058464 | -0.038 | 2.3411 | 0.80473 | 2.909 | 1.5729 | 0.76818 |
| 129 | 12.43 | 7.3266 | 5.7888 | -0.059634 | -0.039 | 2.3437 | 0.80589 | 2.908 | 1.5748 | 0.76888 |
| 130 | 12.55 | 7.3325 | 5.7888 | -0.062557 | -0.041 | 2.3525 | 0.80882 | 2.909 | 1.5806 | 0.77183 |
| 131 | 12.67 | 7.3395 | 5.7888 | -0.066649 | -0.043 | 2.3636 | 0.81291 | 2.908 | 1.5883 | 0.77536 |
| 132 | 12.78 | 7.3438 | 5.7888 | -0.070157 | -0.045 | 2.3714 | 0.81642 | 2.905 | 1.5939 | 0.77748 |
| 133 | 12.89 | 7.3468 | 5.7888 | -0.073665 | -0.047 | 2.378 | 0.81993 | 2.900 | 1.5989 | 0.77902 |
| 134 | 13.01 | 7.3493 | 5.7888 | -0.076588 | -0.049 | 2.3834 | 0.82285 | 2.896 | 1.6031 | 0.78025 |
| 135 | 13.12 | 7.3512 | 5.7888 | -0.080096 | -0.051 | 2.3888 | 0.82636 | 2.891 | 1.6076 | 0.7812 |
| 136 | 13.24 | 7.3542 | 5.7888 | -0.083019 | -0.053 | 2.3947 | 0.82928 | 2.888 | 1.612 | 0.78272 |
| 137 | 13.35 | 7.3561 | 5.7888 | -0.087112 | -0.056 | 2.4006 | 0.83337 | 2.881 | 1.617 | 0.78364 |
| 138 | 13.47 | 7.3613 | 5.7888 | -0.09062 | -0.058 | 2.4094 | 0.83688 | 2.879 | 1.6231 | 0.78625 |
| 139 | 13.59 | 7.3654 | 5.7888 | -0.092958 | -0.059 | 2.4158 | 0.83922 | 2.879 | 1.6275 | 0.78828 |
| 140 | 13.71 | 7.3666 | 5.7888 | -0.097051 | -0.062 | 2.4211 | 0.84331 | 2.871 | 1.6322 | 0.78889 |
| 141 | 13.82 | 7.3678 | 5.7888 | -0.10056 | -0.064 | 2.4258 | 0.84682 | 2.865 | 1.6363 | 0.78951 |
| 142 | 13.94 | 7.3719 | 5.7888 | -0.10407 | -0.066 | 2.4334 | 0.85033 | 2.862 | 1.6419 | 0.79153 |
| 143 | 14.06 | 7.3775 | 5.7888 | -0.10699 | -0.067 | 2.442 | 0.85325 | 2.862 | 1.6476 | 0.79435 |
| 144 | 14.17 | 7.3804 | 5.7888 | -0.10874 | -0.068 | 2.4466 | 0.855 | 2.861 | 1.6508 | 0.79579 |
| 145 | 14.29 | 7.3821 | 5.7888 | -0.11225 | -0.070 | 2.4518 | 0.85851 | 2.856 | 1.6552 | 0.79666 |
| 146 | 14.41 | 7.3799 | 5.7888 | -0.11459 | -0.072 | 2.4519 | 0.86085 | 2.848 | 1.6564 | 0.79555 |
| 147 | 14.53 | 7.3805 | 5.7888 | -0.11693 | -0.073 | 2.4549 | 0.86319 | 2.844 | 1.659 | 0.79584 |
| 148 | 14.64 | 7.3867 | 5.7888 | -0.11985 | -0.075 | 2.464 | 0.86611 | 2.845 | 1.6651 | 0.79894 |
| 149 | 14.76 | 7.3956 | 5.7888 | -0.12336 | -0.077 | 2.4764 | 0.86962 | 2.848 | 1.673 | 0.80341 |
| 150 | 14.88 | 7.3973 | 5.7888 | -0.1257 | -0.078 | 2.4805 | 0.87196 | 2.845 | 1.6762 | 0.80426 |
| 151 | 14.99 | 7.3985 | 5.7888 | -0.12921 | -0.080 | 2.4851 | 0.87547 | 2.839 | 1.6803 | 0.80484 |
| 152 | 15.10 | 7.4018 | 5.7888 | -0.13154 | -0.082 | 2.4909 | 0.87781 | 2.838 | 1.6843 | 0.80652 |
| 153 | 15.22 | 7.4035 | 5.7888 | -0.1333 | -0.083 | 2.4943 | 0.87956 | 2.836 | 1.6869 | 0.80737 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3 " ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.41 in
Specimen Area: 6.29 in^2
Specimen Volume: 34.03 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 6.2898 | 0 | 0 | 5.0399 | 6.2928 | 6.2928 |
| 2 | 5.0042 | 0.0151 | 6.2908 | 12.364 | 0.14151 | 5.111 | 6.2928 | 6.4343 |
| 3 | 10 | 0.035234 | 6.292 | 19.701 | 0.22544 | 5.1588 | 6.2928 | 6.5182 |
| 4 | 15 | 0.057045 | 6.2934 | 25.408 | 0.29068 | 5.1965 | 6.2928 | 6.5835 |
| 5 | 20 | 0.078856 | 6.2948 | 29.756 | 0.34035 | 5.2265 | 6.2928 | 6.6331 |
| 6 | 25 | 0.10067 | 6.2962 | 33.696 | 0.38533 | 5.2526 | 6.2928 | 6.6781 |
| 7 | 30 | 0.12248 | 6.2975 | 23.234 | 0.26563 | 5.2232 | 6.2928 | 6.5584 |
| 8 | 35.001 | 0.14261 | 6.2988 | 33.628 | 0.38439 | 5.2704 | 6.2928 | 6.6772 |
| 9 | 40.001 | 0.16442 | 6.3002 | 37.976 | 0.434 | 5.2948 | 6.2928 | 6.7268 |
| 10 | 45.001 | 0.18623 | 6.3016 | 28.533 | 0.32601 | 5.2676 | 6.2928 | 6.6188 |
| 11 | 50.001 | 0.20637 | 6.3028 | 37.297 | 0.42606 | 5.307 | 6.2928 | 6.7189 |
| 12 | 55.001 | 0.23154 | 6.3044 | 21.332 | 0.24362 | 5.2565 | 6.2928 | 6.5364 |
| 13 | 60.001 | 0.24999 | 6.3056 | 34.375 | 0.39251 | 5.3098 | 6.2928 | 6.6853 |
| 14 | 70.001 | 0.29529 | 6.3085 | 30.163 | 0.34426 | 5.3065 | 6.2928 | 6.6371 |
| 15 | 80.001 | 0.33724 | 6.3111 | 23.845 | 0.27204 | 5.2959 | 6.2928 | 6.5648 |
| 16 | 90.002 | 0.37583 | 6.3136 | 43.751 | 0.49893 | 5.377 | 6.2928 | 6.7917 |
| 17 | 100 | 0.42113 | 6.3164 | 42.12 | 0.48012 | 5.3792 | 6.2928 | 6.7729 |
| 18 | 110 | 0.46475 | 6.3192 | 37.636 | 0.42882 | 5.3715 | 6.2928 | 6.7216 |
| 19 | 120 | 0.51005 | 6.3221 | 27.582 | 0.31412 | 5.3459 | 6.2928 | 6.6069 |
| 20 | 130 | 0.55032 | 6.3246 | 48.098 | 0.54756 | 5.4242 | 6.2928 | 6.8404 |
| 21 | 140 | 0.59394 | 6.3274 | 42.052 | 0.47851 | 5.4087 | 6.2928 | 6.7713 |
| 22 | 150 | 0.64092 | 6.3304 | 29.552 | 0.33612 | 5.3737 | 6.2928 | 6.6289 |
| 23 | 160 | 0.67951 | 6.3329 | 51.971 | 0.59087 | 5.4514 | 6.2928 | 6.8837 |
| 24 | 170 | 0.72481 | 6.3357 | 42.935 | 0.48792 | 5.4248 | 6.2928 | 6.7807 |
| 25 | 180 | 0.76507 | 6.3383 | 56.794 | 0.64515 | 5.477 | 6.2928 | 6.938 |
| 26 | 190 | 0.8087 | 6.3411 | 50.612 | 0.57467 | 5.4603 | 6.2928 | 6.8675 |
| 27 | 200 | 0.85567 | 6.3441 | 30.979 | 0.35158 | 5.4031 | 6.2928 | 6.6444 |
| 28 | 210 | 0.89594 | 6.3467 | 55.639 | 0.6312 | 5.4864 | 6.2928 | 6.924 |
| 29 | 220 | 0.94124 | 6.3496 | 38.723 | 0.4391 | 5.4364 | 6.2928 | 6.7319 |
| 30 | 230 | 0.98151 | 6.3522 | 59.376 | 0.67301 | 5.5064 | 6.2928 | 6.9658 |
| 31 | 240 | 1.0268 | 6.3551 | 41.984 | 0.47566 | 5.4553 | 6.2928 | 6.7685 |
| 32 | 270 | 1.1543 | 6.3633 | 62.637 | 0.70873 | 5.5347 | 6.2928 | 7.0015 |
| 33 | 300 | 1.2835 | 6.3716 | 68.751 | 0.77689 | 5.5636 | 6.2928 | 7.0697 |
| 34 | 330 | 1.4161 | 6.3802 | 52.854 | 0.59645 | 5.5253 | 6.2928 | 6.8893 |
| 35 | 360 | 1.5436 | 6.3884 | 72.691 | 0.81926 | 5.5963 | 6.2928 | 7.1121 |
| 36 | 390 | 1.6728 | 6.3968 | 77.515 | 0.87247 | 5.6152 | 6.2928 | 7.1653 |
| 37 | 420 | 1.8053 | 6.4055 | 80.504 | 0.90489 | 5.6297 | 6.2928 | 7.1977 |
| 38 | 450 | 1.9362 | 6.414 | 83.425 | 0.93648 | 5.643 | 6.2928 | 7.2293 |
| 39 | 480 | 2.0654 | 6.4225 | 87.229 | 0.9779 | 5.6547 | 6.2928 | 7.2707 |
| 40 | 510 | 2.1962 | 6.4311 | 90.218 | 1.0101 | 5.6647 | 6.2928 | 7.3029 |
| 41 | 540 | 2.3254 | 6.4396 | 92.936 | 1.0391 | 5.6735 | 6.2928 | 7.3319 |
| 42 | 570 | 2.4563 | 6.4482 | 95.925 | 1.0711 | 5.6819 | 6.2928 | 7.3639 |
| 43 | 600 | 2.5855 | 6.4568 | 98.439 | 1.0977 | 5.6885 | 6.2928 | 7.3905 |
| 44 | 630 | 2.7163 | 6.4654 | 100.27 | 1.1167 | 5.6957 | 6.2928 | 7.4095 |
| 45 | 660 | 2.8489 | 6.4743 | 102.18 | 1.1363 | 5.7013 | 6.2928 | 7.4291 |
| 46 | 690 | 2.9781 | 6.4829 | 104.15 | 1.1567 | 5.7057 | 6.2928 | 7.4495 |
| 47 | 720 | 3.1089 | 6.4916 | 105.84 | 1.1739 | 5.7102 | 6.2928 | 7.4667 |
| 48 | 750 | 3.2381 | 6.5003 | 107.75 | 1.1934 | 5.7141 | 6.2928 | 7.4862 |
| 49 | 780 | 3.369 | 6.5091 | 109.72 | 1.2136 | 5.7169 | 6.2928 | 7.5064 |
| 50 | 810 | 3.4982 | 6.5178 | 111.55 | 1.2323 | 5.7191 | 6.2928 | 7.5251 |
| 51 | 840 | 3.6307 | 6.5268 | 112.37 | 1.2396 | 5.7202 | 6.2928 | 7.5324 |
| 52 | 870 | 3.7616 | 6.5357 | 112.91 | 1.2439 | 5.7213 | 6.2928 | 7.5367 |
| 53 | 900 | 3.8925 | 6.5446 | 114.34 | 1.2579 | 5.7218 | 6.2928 | 7.5507 |
| 54 | 930 | 4.0233 | 6.5535 | 115.56 | 1.2696 | 5.7218 | 6.2928 | 7.5624 |
| 55 | 960 | 4.1525 | 6.5623 | 116.99 | 1.2835 | 5.7213 | 6.2928 | 7.5763 |
| 56 | 990 | 4.2817 | 6.5712 | 118.21 | 1.2952 | 5.7207 | 6.2928 | 7.588 |
| 57 | 1020 | 4.4143 | 6.5803 | 118.96 | 1.3016 | 5.7196 | 6.2928 | 7.5944 |
| 58 | 1050 | 4.5418 | 6.5891 | 120.31 | 1.3147 | 5.7202 | 6.2928 | 7.6075 |
| 59 | 1080 | 4.6726 | 6.5981 | 121.13 | 1.3218 | 5.7202 | 6.2928 | 7.6146 |
| 60 | 1110 | 4.8018 | 6.6071 | 122.56 | 1.3355 | 5.7196 | 6.2928 | 7.6283 |
| 61 | 1140 | 4.931 | 6.6161 | 123.71 | 1.3463 | 5.7174 | 6.2928 | 7.6391 |
| 62 | 1170 | 5.0619 | 6.6252 | 125 | 1.3585 | 5.7146 | 6.2928 | 7.6513 |
| 63 | 1200 | 5.1928 | 6.6343 | 126.09 | 1.3684 | 5.7113 | 6.2928 | 7.6612 |
| 64 | 1230 | 5.322 | 6.6434 | 127.18 | 1.3783 | 5.708 | 6.2928 | 7.6711 |
| 65 | 1260 | 5.4545 | 6.6527 | 128.06 | 1.3859 | 5.7052 | 6.2928 | 7.6787 |
| 66 | 1290 | 5.5837 | 6.6618 | 128.81 | 1.3921 | 5.7019 | 6.2928 | 7.6849 |
| 67 | 1320 | 5.7129 | 6.6709 | 129.89 | 1.4019 | 5.6991 | 6.2928 | 7.6947 |
| 68 | 1350 | 5.8437 | 6.6802 | 130.71 | 1.4088 | 5.6957 | 6.2928 | 7.7016 |
| 69 | 1380 | 5.9746 | 6.6895 | 131.73 | 1.4178 | 5.6924 | 6.2928 | 7.7106 |
| 70 | 1410 | 6.1055 | 6.6988 | 133.15 | 1.4312 | 5.6896 | 6.2928 | 7.724 |
| 71 | 1440 | 6.2363 | 6.7082 | 134.85 | 1.4474 | 5.6869 | 6.2928 | 7.7402 |
| 72 | 1470 | 6.3655 | 6.7174 | 136.14 | 1.4592 | 5.683 | 6.2928 | 7.752 |
| 73 | 1500 | 6.4947 | 6.7267 | 138.38 | 1.4812 | 5.6796 | 6.2928 | 7.774 |
| 74 | 1530 | 6.6239 | 6.736 | 140.02 | 1.4966 | 5.6774 | 6.2928 | 7.7894 |
| 75 | 1560 | 6.7531 | 6.7453 | 140.15 | 1.496 | 5.6735 | 6.2928 | 7.7888 |
| 76 | 1590 | 6.884 | 6.7548 | 140.9 | 1.5018 | 5.6696 | 6.2928 | 7.7946 |
| 77 | 1620 | 7.0132 | 6.7642 | 141.24 | 1.5034 | 5.6669 | 6.2928 | 7.7962 |
| 78 | 1650 | 7.1407 | 6.7735 | 143.21 | 1.5223 | 5.6647 | 6.2928 | 7.8151 |
| 79 | 1680 | 7.2682 | 6.7828 | 142.94 | 1.5173 | 5.6624 | 6.2928 | 7.8101 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1710 | 7.3991 | 6.7924 | 144.57 | 1.5324 | 5.6597 | 6.2928 | 7.8252 |
| 81 | 1740 | 7.5299 | 6.802 | 144.91 | 1.5339 | 5.6585 | 6.2928 | 7.8267 |
| 82 | 1770 | 7.6641 | 6.8119 | 145.45 | 1.5374 | 5.6563 | 6.2928 | 7.8302 |
| 83 | 1800 | 7.7984 | 6.8218 | 144.97 | 1.5301 | 5.6547 | 6.2928 | 7.8229 |
| 84 | 1830 | 7.9292 | 6.8315 | 146.13 | 1.5401 | 5.6524 | 6.2928 | 7.8329 |
| 85 | 1860 | 8.0618 | 6.8414 | 147.01 | 1.5472 | 5.6497 | 6.2928 | 7.84 |
| 86 | 1890 | 8.1927 | 6.8511 | 146.81 | 1.5428 | 5.6463 | 6.2928 | 7.8356 |
| 87 | 1920 | 8.3235 | 6.8609 | 148.1 | 1.5542 | 5.6441 | 6.2928 | 7.847 |
| 88 | 1950 | 8.4527 | 6.8706 | 149.8 | 1.5698 | 5.6408 | 6.2928 | 7.8626 |
| 89 | 1980 | 8.5836 | 6.8804 | 149.39 | 1.5633 | 5.6386 | 6.2928 | 7.8561 |
| 90 | 2010 | 8.7128 | 6.8901 | 150.75 | 1.5753 | 5.6358 | 6.2928 | 7.8681 |
| 91 | 2040 | 8.842 | 6.8999 | 150.48 | 1.5702 | 5.6319 | 6.2928 | 7.863 |
| 92 | 2070 | 8.9695 | 6.9096 | 150.82 | 1.5716 | 5.6291 | 6.2928 | 7.8644 |
| 93 | 2100 | 9.0987 | 6.9194 | 151.63 | 1.5778 | 5.6263 | 6.2928 | 7.8706 |
| 94 | 2130 | 9.2295 | 6.9294 | 153.33 | 1.5932 | 5.6241 | 6.2928 | 7.886 |
| 95 | 2160 | 9.3604 | 6.9394 | 154.76 | 1.6057 | 5.6213 | 6.2928 | 7.8985 |
| 96 | 2190 | 9.4913 | 6.9494 | 156.66 | 1.6231 | 5.6191 | 6.2928 | 7.9159 |
| 97 | 2220 | 9.6238 | 6.9596 | 156.32 | 1.6172 | 5.6169 | 6.2928 | 7.91 |
| 98 | 2250 | 9.7547 | 6.9697 | 155.71 | 1.6085 | 5.6152 | 6.2928 | 7.9013 |
| 99 | 2280 | 9.8872 | 6.9799 | 155.5 | 1.6041 | 5.6119 | 6.2928 | 7.8969 |
| 100 | 2310 | 10.02 | 6.9902 | 155.3 | 1.5996 | 5.6097 | 6.2928 | 7.8924 |
| 101 | 2340 | 10.151 | 7.0004 | 155.71 | 1.6015 | 5.6069 | 6.2928 | 7.8943 |
| 102 | 2370 | 10.285 | 7.0109 | 156.18 | 1.604 | 5.6041 | 6.2928 | 7.8968 |
| 103 | 2400 | 10.417 | 7.0213 | 157.2 | 1.612 | 5.6008 | 6.2928 | 7.9048 |
| 104 | 2430 | 10.548 | 7.0315 | 157.75 | 1.6153 | 5.598 | 6.2928 | 7.9081 |
| 105 | 2460 | 10.681 | 7.042 | 157.75 | 1.6129 | 5.5963 | 6.2928 | 7.9057 |
| 106 | 2490 | 10.81 | 7.0522 | 158.22 | 1.6154 | 5.5925 | 6.2928 | 7.9082 |
| 107 | 2520 | 10.939 | 7.0624 | 158.97 | 1.6207 | 5.5886 | 6.2928 | 7.9135 |
| 108 | 2550 | 11.07 | 7.0728 | 159.78 | 1.6266 | 5.5858 | 6.2928 | 7.9194 |
| 109 | 2580 | 11.199 | 7.0831 | 160.26 | 1.6291 | 5.5825 | 6.2928 | 7.9219 |
| 110 | 2610 | 11.328 | 7.0934 | 161.14 | 1.6356 | 5.5797 | 6.2928 | 7.9284 |
| 111 | 2640 | 11.459 | 7.1039 | 159.85 | 1.6202 | 5.578 | 6.2928 | 7.913 |
| 112 | 2670 | 11.59 | 7.1144 | 160.6 | 1.6253 | 5.5752 | 6.2928 | 7.9181 |
| 113 | 2700 | 11.718 | 7.1247 | 164.95 | 1.6669 | 5.573 | 6.2928 | 7.9597 |
| 114 | 2730 | 11.852 | 7.1355 | 159.92 | 1.6137 | 5.5703 | 6.2928 | 7.9065 |
| 115 | 2760 | 11.983 | 7.1461 | 158.56 | 1.5976 | 5.5669 | 6.2928 | 7.8904 |
| 116 | 2790 | 12.112 | 7.1566 | 159.78 | 1.6075 | 5.5647 | 6.2928 | 7.9003 |
| 117 | 2820 | 12.243 | 7.1673 | 159.92 | 1.6065 | 5.5619 | 6.2928 | 7.8993 |
| 118 | 2850 | 12.375 | 7.1781 | 159.85 | 1.6034 | 5.5603 | 6.2928 | 7.8962 |
| 119 | 2880 | 12.506 | 7.1889 | 160.26 | 1.6051 | 5.558 | 6.2928 | 7.8979 |
| 120 | 2910 | 12.639 | 7.1998 | 160.06 | 1.6006 | 5.5541 | 6.2928 | 7.8934 |
| 121 | 2940 | 12.771 | 7.2107 | 160.4 | 1.6016 | 5.5525 | 6.2928 | 7.8944 |
| 122 | 2970 | 12.904 | 7.2217 | 160.19 | 1.5971 | 5.5497 | 6.2928 | 7.8899 |
| 123 | 3000 | 13.035 | 7.2326 | 160.33 | 1.5961 | 5.5475 | 6.2928 | 7.8889 |
| 124 | 3030 | 13.169 | 7.2438 | 160.74 | 1.5976 | 5.5458 | 6.2928 | 7.8904 |
| 125 | 3060 | 13.298 | 7.2545 | 160.87 | 1.5966 | 5.5442 | 6.2928 | 7.8894 |
| 126 | 3090 | 13.427 | 7.2654 | 160.87 | 1.5942 | 5.543 | 6.2928 | 7.887 |
| 127 | 3120 | 13.56 | 7.2765 | 161.62 | 1.5992 | 5.5403 | 6.2928 | 7.892 |
| 128 | 3150 | 13.689 | 7.2874 | 162.43 | 1.6049 | 5.5397 | 6.2928 | 7.8977 |
| 129 | 3180 | 13.818 | 7.2983 | 162.98 | 1.6078 | 5.538 | 6.2928 | 7.9006 |
| 130 | 3210 | 13.947 | 7.3093 | 162.84 | 1.6041 | 5.5369 | 6.2928 | 7.8969 |
| 131 | 3240 | 14.078 | 7.3204 | 163.39 | 1.607 | 5.5353 | 6.2928 | 7.8998 |
| 132 | 3270 | 14.208 | 7.3314 | 163.93 | 1.6099 | 5.5342 | 6.2928 | 7.9027 |
| 133 | 3300 | 14.338 | 7.3426 | 165.02 | 1.6181 | 5.533 | 6.2928 | 7.9109 |
| 134 | 3330 | 14.468 | 7.3537 | 164.4 | 1.6097 | 5.5319 | 6.2928 | 7.9025 |
| 135 | 3360 | 14.598 | 7.365 | 165.02 | 1.6132 | 5.5314 | 6.2928 | 7.906 |
| 136 | 3390 | 14.731 | 7.3765 | 165.15 | 1.612 | 5.5303 | 6.2928 | 7.9048 |
| 137 | 3420 | 14.864 | 7.3879 | 165.49 | 1.6128 | 5.5292 | 6.2928 | 7.9056 |
| 138 | 3450 | 14.994 | 7.3993 | 165.56 | 1.611 | 5.5275 | 6.2928 | 7.9038 |
| 139 | 3480 | 15.127 | 7.4109 | 165.42 | 1.6072 | 5.5258 | 6.2928 | 7.9 |
| 140 | 3510 | 15.261 | 7.4226 | 165.9 | 1.6092 | 5.5242 | 6.2928 | 7.902 |
| 141 | 3540 | 15.394 | 7.4342 | 166.31 | 1.6107 | 5.523 | 6.2928 | 7.9035 |
| 142 | 3570 | 15.525 | 7.4457 | 167.12 | 1.6161 | 5.5219 | 6.2928 | 7.9089 |
| 143 | 3600 | 15.655 | 7.4573 | 166.99 | 1.6122 | 5.5197 | 6.2928 | 7.905 |
| 144 | 3630 | 15.788 | 7.469 | 167.19 | 1.6117 | 5.5181 | 6.2928 | 7.9045 |
| 145 | 3660 | 15.916 | 7.4804 | 167.6 | 1.6132 | 5.5169 | 6.2928 | 7.906 |
| 146 | 3690 | 16.048 | 7.4922 | 168.55 | 1.6198 | 5.5153 | 6.2928 | 7.9126 |
| 147 | 3695.9 | 16.073 | 7.4944 | 168.96 | 1.6232 | 5.5158 | 6.2928 | 7.916 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 17.4 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3 " ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.41 in
Specimen Area: 6.29 in^2
Specimen Volume: 34.03 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.2928 | 6.2928 | 0 | 0.000 | 1.2529 | 1.2529 | 1.000 | 1.2529 | 0 |
| 2 | 0.02 | 6.4343 | 6.2928 | 0.071079 | 0.502 | 1.3233 | 1.1818 | 1.120 | 1.2525 | 0.070757 |
| 3 | 0.04 | 6.5182 | 6.2928 | 0.11883 | 0.527 | 1.3595 | 1.134 | 1.199 | 1.2468 | 0.11272 |
| 4 | 0.06 | 6.5835 | 6.2928 | 0.1566 | 0.539 | 1.3869 | 1.0963 | 1.265 | 1.2416 | 0.14534 |
| 5 | 0.08 | 6.6331 | 6.2928 | 0.18658 | 0.548 | 1.4066 | 1.0663 | 1.319 | 1.2365 | 0.17017 |
| 6 | 0.10 | 6.6781 | 6.2928 | 0.21268 | 0.552 | 1.4255 | 1.0402 | 1.370 | 1.2328 | 0.19267 |
| 7 | 0.12 | 6.5584 | 6.2928 | 0.18325 | 0.690 | 1.3352 | 1.0696 | 1.248 | 1.2024 | 0.13282 |
| 8 | 0.14 | 6.6772 | 6.2928 | 0.23045 | 0.600 | 1.4068 | 1.0224 | 1.376 | 1.2146 | 0.1922 |
| 9 | 0.16 | 6.7268 | 6.2928 | 0.25488 | 0.587 | 1.432 | 0.99798 | 1.435 | 1.215 | 0.217 |
| 10 | 0.19 | 6.6188 | 6.2928 | 0.22767 | 0.698 | 1.3512 | 1.0252 | 1.318 | 1.1882 | 0.16301 |
| 11 | 0.21 | 6.7189 | 6.2928 | 0.2671 | 0.627 | 1.4118 | 0.98576 | 1.432 | 1.1988 | 0.21303 |
| 12 | 0.23 | 6.5364 | 6.2928 | 0.21657 | 0.889 | 1.2799 | 1.0363 | 1.235 | 1.1581 | 0.12181 |
| 13 | 0.25 | 6.6853 | 6.2928 | 0.26988 | 0.688 | 1.3755 | 0.98299 | 1.399 | 1.1792 | 0.19626 |
| 14 | 0.30 | 6.6371 | 6.2928 | 0.26655 | 0.774 | 1.3306 | 0.98632 | 1.349 | 1.1585 | 0.17213 |
| 15 | 0.34 | 6.5648 | 6.2928 | 0.25599 | 0.941 | 1.2689 | 0.99687 | 1.273 | 1.1329 | 0.13602 |
| 16 | 0.38 | 6.7917 | 6.2928 | 0.33707 | 0.676 | 1.4147 | 0.9158 | 1.545 | 1.1653 | 0.24947 |
| 17 | 0.42 | 6.7729 | 6.2928 | 0.33929 | 0.707 | 1.3937 | 0.91357 | 1.526 | 1.1536 | 0.24006 |
| 18 | 0.46 | 6.7216 | 6.2928 | 0.33152 | 0.773 | 1.3502 | 0.92135 | 1.465 | 1.1358 | 0.21441 |
| 19 | 0.51 | 6.6069 | 6.2928 | 0.30597 | 0.974 | 1.261 | 0.94689 | 1.332 | 1.104 | 0.15706 |
| 20 | 0.55 | 6.8404 | 6.2928 | 0.38427 | 0.702 | 1.4161 | 0.86859 | 1.630 | 1.1424 | 0.27378 |
| 21 | 0.59 | 6.7713 | 6.2928 | 0.36872 | 0.771 | 1.3627 | 0.88414 | 1.541 | 1.1234 | 0.23926 |
| 22 | 0.64 | 6.6289 | 6.2928 | 0.33374 | 0.993 | 1.2552 | 0.91913 | 1.366 | 1.0872 | 0.16806 |
| 23 | 0.68 | 6.8837 | 6.2928 | 0.41148 | 0.696 | 1.4323 | 0.84138 | 1.702 | 1.1368 | 0.29543 |
| 24 | 0.72 | 6.7807 | 6.2928 | 0.38483 | 0.789 | 1.356 | 0.86804 | 1.562 | 1.112 | 0.24396 |
| 25 | 0.77 | 6.938 | 6.2928 | 0.43702 | 0.677 | 1.461 | 0.81584 | 1.791 | 1.1384 | 0.32258 |
| 26 | 0.81 | 6.8675 | 6.2928 | 0.42036 | 0.731 | 1.4072 | 0.8325 | 1.690 | 1.1198 | 0.28734 |
| 27 | 0.86 | 6.6444 | 6.2928 | 0.36317 | 1.033 | 1.2413 | 0.8897 | 1.395 | 1.0655 | 0.17579 |
| 28 | 0.90 | 6.924 | 6.2928 | 0.44646 | 0.707 | 1.4376 | 0.8064 | 1.783 | 1.122 | 0.3156 |
| 29 | 0.94 | 6.7319 | 6.2928 | 0.39649 | 0.903 | 1.2955 | 0.85638 | 1.513 | 1.0759 | 0.21955 |
| 30 | 0.98 | 6.9658 | 6.2928 | 0.46646 | 0.693 | 1.4594 | 0.78641 | 1.856 | 1.1229 | 0.3365 |
| 31 | 1.03 | 6.7685 | 6.2928 | 0.41537 | 0.873 | 1.3132 | 0.8375 | 1.568 | 1.0753 | 0.23783 |
| 32 | 1.15 | 7.0015 | 6.2928 | 0.49478 | 0.698 | 1.4668 | 0.75809 | 1.935 | 1.1125 | 0.35436 |
| 33 | 1.28 | 7.0697 | 6.2928 | 0.52365 | 0.674 | 1.5061 | 0.72921 | 2.065 | 1.1177 | 0.38845 |
| 34 | 1.42 | 6.8893 | 6.2928 | 0.48534 | 0.814 | 1.364 | 0.76753 | 1.777 | 1.0658 | 0.29823 |
| 35 | 1.54 | 7.1121 | 6.2928 | 0.55641 | 0.679 | 1.5157 | 0.69645 | 2.176 | 1.1061 | 0.40963 |
| 36 | 1.67 | 7.1653 | 6.2928 | 0.57529 | 0.659 | 1.55 | 0.67757 | 2.288 | 1.1138 | 0.43624 |
| 37 | 1.81 | 7.1977 | 6.2928 | 0.58973 | 0.652 | 1.568 | 0.66313 | 2.365 | 1.1156 | 0.45245 |
| 38 | 1.94 | 7.2293 | 6.2928 | 0.60306 | 0.644 | 1.5863 | 0.6498 | 2.441 | 1.118 | 0.46824 |
| 39 | 2.07 | 7.2707 | 6.2928 | 0.61472 | 0.629 | 1.616 | 0.63814 | 2.532 | 1.1271 | 0.48895 |
| 40 | 2.20 | 7.3029 | 6.2928 | 0.62472 | 0.618 | 1.6382 | 0.62815 | 2.608 | 1.1332 | 0.50503 |
| 41 | 2.33 | 7.3319 | 6.2928 | 0.6336 | 0.610 | 1.6584 | 0.61926 | 2.678 | 1.1388 | 0.51955 |
| 42 | 2.46 | 7.3639 | 6.2928 | 0.64193 | 0.599 | 1.682 | 0.61093 | 2.753 | 1.1465 | 0.53554 |
| 43 | 2.59 | 7.3905 | 6.2928 | 0.64859 | 0.591 | 1.702 | 0.60427 | 2.817 | 1.1531 | 0.54885 |
| 44 | 2.72 | 7.4095 | 6.2928 | 0.65581 | 0.587 | 1.7137 | 0.59705 | 2.870 | 1.1554 | 0.55833 |
| 45 | 2.85 | 7.4291 | 6.2928 | 0.66137 | 0.582 | 1.7278 | 0.5915 | 2.921 | 1.1596 | 0.56814 |
| 46 | 2.98 | 7.4495 | 6.2928 | 0.66581 | 0.576 | 1.7437 | 0.58706 | 2.970 | 1.1654 | 0.57833 |
| 47 | 3.11 | 7.4667 | 6.2928 | 0.67025 | 0.571 | 1.7565 | 0.58261 | 3.015 | 1.1696 | 0.58697 |
| 48 | 3.24 | 7.4862 | 6.2928 | 0.67414 | 0.565 | 1.7722 | 0.57873 | 3.062 | 1.1754 | 0.59672 |
| 49 | 3.37 | 7.5064 | 6.2928 | 0.67692 | 0.558 | 1.7896 | 0.57595 | 3.107 | 1.1828 | 0.60681 |
| 50 | 3.50 | 7.5251 | 6.2928 | 0.67914 | 0.551 | 1.806 | 0.57373 | 3.148 | 1.1899 | 0.61613 |
| 51 | 3.63 | 7.5324 | 6.2928 | 0.68025 | 0.549 | 1.8122 | 0.57262 | 3.165 | 1.1924 | 0.61978 |
| 52 | 3.76 | 7.5367 | 6.2928 | 0.68136 | 0.548 | 1.8154 | 0.57151 | 3.176 | 1.1934 | 0.62193 |
| 53 | 3.89 | 7.5507 | 6.2928 | 0.68191 | 0.542 | 1.8288 | 0.57095 | 3.203 | 1.1999 | 0.62893 |
| 54 | 4.02 | 7.5624 | 6.2928 | 0.68191 | 0.537 | 1.8405 | 0.57095 | 3.224 | 1.2057 | 0.63479 |
| 55 | 4.15 | 7.5763 | 6.2928 | 0.68136 | 0.531 | 1.855 | 0.57151 | 3.246 | 1.2133 | 0.64176 |
| 56 | 4.28 | 7.588 | 6.2928 | 0.6808 | 0.526 | 1.8673 | 0.57206 | 3.264 | 1.2197 | 0.6476 |
| 57 | 4.41 | 7.5944 | 6.2928 | 0.67969 | 0.522 | 1.8748 | 0.57317 | 3.271 | 1.224 | 0.65079 |
| 58 | 4.54 | 7.6075 | 6.2928 | 0.68025 | 0.517 | 1.8873 | 0.57262 | 3.296 | 1.23 | 0.65734 |
| 59 | 4.67 | 7.6146 | 6.2928 | 0.68025 | 0.515 | 1.8944 | 0.57262 | 3.308 | 1.2335 | 0.66089 |
| 60 | 4.80 | 7.6283 | 6.2928 | 0.67969 | 0.509 | 1.9087 | 0.57317 | 3.330 | 1.2409 | 0.66777 |
| 61 | 4.93 | 7.6391 | 6.2928 | 0.67747 | 0.503 | 1.9217 | 0.57539 | 3.340 | 1.2485 | 0.67315 |
| 62 | 5.06 | 7.6513 | 6.2928 | 0.67469 | 0.497 | 1.9366 | 0.57817 | 3.350 | 1.2574 | 0.67923 |
| 63 | 5.19 | 7.6612 | 6.2928 | 0.67136 | 0.491 | 1.9499 | 0.5815 | 3.353 | 1.2657 | 0.6842 |
| 64 | 5.32 | 7.6711 | 6.2928 | 0.66803 | 0.485 | 1.9631 | 0.58483 | 3.357 | 1.274 | 0.68915 |
| 65 | 5.45 | 7.6787 | 6.2928 | 0.66525 | 0.480 | 1.9735 | 0.58761 | 3.359 | 1.2806 | 0.69297 |
| 66 | 5.58 | 7.6849 | 6.2928 | 0.66192 | 0.475 | 1.9831 | 0.59094 | 3.356 | 1.287 | 0.69606 |
| 67 | 5.71 | 7.6947 | 6.2928 | 0.65915 | 0.470 | 1.9957 | 0.59372 | 3.361 | 1.2947 | 0.70097 |
| 68 | 5.84 | 7.7016 | 6.2928 | 0.65581 | 0.466 | 2.0058 | 0.59705 | 3.360 | 1.3014 | 0.70439 |
| 69 | 5.97 | 7.7106 | 6.2928 | 0.65248 | 0.460 | 2.0182 | 0.60038 | 3.361 | 1.3093 | 0.7089 |
| 70 | 6.11 | 7.724 | 6.2928 | 0.64971 | 0.454 | 2.0343 | 0.60316 | 3.373 | 1.3187 | 0.71558 |
| 71 | 6.24 | 7.7402 | 6.2928 | 0.64693 | 0.447 | 2.0533 | 0.60594 | 3.389 | 1.3296 | 0.7237 |
| 72 | 6.37 | 7.752 | 6.2928 | 0.64304 | 0.441 | 2.0691 | 0.60982 | 3.393 | 1.3394 | 0.72962 |
| 73 | 6.49 | 7.774 | 6.2928 | 0.63971 | 0.432 | 2.0944 | 0.61315 | 3.416 | 1.3538 | 0.74061 |
| 74 | 6.62 | 7.7894 | 6.2928 | 0.63749 | 0.426 | 2.112 | 0.61538 | 3.432 | 1.3637 | 0.7483 |
| 75 | 6.75 | 7.7888 | 6.2928 | 0.6336 | 0.424 | 2.1152 | 0.61926 | 3.416 | 1.3673 | 0.74799 |
| 76 | 6.88 | 7.7946 | 6.2928 | 0.62971 | 0.419 | 2.125 | 0.62315 | 3.410 | 1.3741 | 0.75092 |
| 77 | 7.01 | 7.7962 | 6.2928 | 0.62694 | 0.417 | 2.1293 | 0.62593 | 3.402 | 1.3776 | 0.75169 |
| 78 | 7.14 | 7.8151 | 6.2928 | 0.62472 | 0.410 | 2.1504 | 0.62815 | 3.423 | 1.3893 | 0.76113 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 7.27 | 7.8101 | 6.2928 | 0.6225 | 0.410 | 2.1476 | 0.63037 | 3.407 | 1.389 | 0.75864 |
| 80 | 7.40 | 7.8252 | 6.2928 | 0.61972 | 0.404 | 2.1656 | 0.63315 | 3.420 | 1.3994 | 0.76621 |
| 81 | 7.53 | 7.8267 | 6.2928 | 0.61861 | 0.403 | 2.1681 | 0.63426 | 3.418 | 1.4012 | 0.76693 |
| 82 | 7.66 | 7.8302 | 6.2928 | 0.61639 | 0.401 | 2.1738 | 0.63648 | 3.415 | 1.4052 | 0.76868 |
| 83 | 7.80 | 7.8229 | 6.2928 | 0.61472 | 0.402 | 2.1683 | 0.63814 | 3.398 | 1.4032 | 0.76506 |
| 84 | 7.93 | 7.8329 | 6.2928 | 0.6125 | 0.398 | 2.1805 | 0.64036 | 3.405 | 1.4104 | 0.77006 |
| 85 | 8.06 | 7.84 | 6.2928 | 0.60972 | 0.394 | 2.1903 | 0.64314 | 3.406 | 1.4167 | 0.7736 |
| 86 | 8.19 | 7.8356 | 6.2928 | 0.60639 | 0.393 | 2.1893 | 0.64647 | 3.387 | 1.4179 | 0.77142 |
| 87 | 8.32 | 7.847 | 6.2928 | 0.60417 | 0.389 | 2.2029 | 0.64869 | 3.396 | 1.4258 | 0.7771 |
| 88 | 8.45 | 7.8626 | 6.2928 | 0.60084 | 0.383 | 2.2218 | 0.65203 | 3.408 | 1.4369 | 0.7849 |
| 89 | 8.58 | 7.8561 | 6.2928 | 0.59862 | 0.383 | 2.2175 | 0.65425 | 3.389 | 1.4359 | 0.78165 |
| 90 | 8.71 | 7.8681 | 6.2928 | 0.59584 | 0.378 | 2.2323 | 0.65702 | 3.398 | 1.4447 | 0.78764 |
| 91 | 8.84 | 7.863 | 6.2928 | 0.59195 | 0.377 | 2.2311 | 0.66091 | 3.376 | 1.446 | 0.78511 |
| 92 | 8.97 | 7.8644 | 6.2928 | 0.58918 | 0.375 | 2.2352 | 0.66369 | 3.368 | 1.4495 | 0.78578 |
| 93 | 9.10 | 7.8706 | 6.2928 | 0.5864 | 0.372 | 2.2443 | 0.66646 | 3.367 | 1.4554 | 0.78891 |
| 94 | 9.23 | 7.886 | 6.2928 | 0.58418 | 0.367 | 2.2619 | 0.66869 | 3.383 | 1.4653 | 0.79659 |
| 95 | 9.36 | 7.8985 | 6.2928 | 0.5814 | 0.362 | 2.2772 | 0.67146 | 3.391 | 1.4743 | 0.80285 |
| 96 | 9.49 | 7.9159 | 6.2928 | 0.57918 | 0.357 | 2.2968 | 0.67368 | 3.409 | 1.4852 | 0.81154 |
| 97 | 9.62 | 7.91 | 6.2928 | 0.57696 | 0.357 | 2.2931 | 0.6759 | 3.393 | 1.4845 | 0.8086 |
| 98 | 9.75 | 7.9013 | 6.2928 | 0.57529 | 0.358 | 2.2861 | 0.67757 | 3.374 | 1.4818 | 0.80427 |
| 99 | 9.89 | 7.8969 | 6.2928 | 0.57196 | 0.357 | 2.285 | 0.6809 | 3.356 | 1.4829 | 0.80204 |
| 100 | 10.02 | 7.8924 | 6.2928 | 0.56974 | 0.356 | 2.2827 | 0.68312 | 3.342 | 1.4829 | 0.79981 |
| 101 | 10.15 | 7.8943 | 6.2928 | 0.56696 | 0.354 | 2.2874 | 0.6859 | 3.335 | 1.4866 | 0.80074 |
| 102 | 10.28 | 7.8968 | 6.2928 | 0.56419 | 0.352 | 2.2926 | 0.68868 | 3.329 | 1.4907 | 0.80198 |
| 103 | 10.42 | 7.9048 | 6.2928 | 0.56086 | 0.348 | 2.3041 | 0.69201 | 3.330 | 1.498 | 0.80602 |
| 104 | 10.55 | 7.9081 | 6.2928 | 0.55808 | 0.346 | 2.31 | 0.69478 | 3.325 | 1.5024 | 0.80763 |
| 105 | 10.68 | 7.9057 | 6.2928 | 0.55641 | 0.345 | 2.3093 | 0.69645 | 3.316 | 1.5029 | 0.80643 |
| 106 | 10.81 | 7.9082 | 6.2928 | 0.55253 | 0.342 | 2.3157 | 0.70034 | 3.307 | 1.508 | 0.80769 |
| 107 | 10.94 | 7.9135 | 6.2928 | 0.54864 | 0.339 | 2.3249 | 0.70422 | 3.301 | 1.5146 | 0.81033 |
| 108 | 11.07 | 7.9194 | 6.2928 | 0.54586 | 0.336 | 2.3336 | 0.707 | 3.301 | 1.5203 | 0.81329 |
| 109 | 11.20 | 7.9219 | 6.2928 | 0.54253 | 0.333 | 2.3394 | 0.71033 | 3.293 | 1.5249 | 0.81453 |
| 110 | 11.33 | 7.9284 | 6.2928 | 0.53976 | 0.330 | 2.3488 | 0.71311 | 3.294 | 1.5309 | 0.81782 |
| 111 | 11.46 | 7.913 | 6.2928 | 0.53809 | 0.332 | 2.3349 | 0.71478 | 3.267 | 1.5249 | 0.81008 |
| 112 | 11.59 | 7.9181 | 6.2928 | 0.53531 | 0.329 | 2.3429 | 0.71755 | 3.265 | 1.5302 | 0.81266 |
| 113 | 11.72 | 7.9597 | 6.2928 | 0.53309 | 0.320 | 2.3867 | 0.71977 | 3.316 | 1.5532 | 0.83346 |
| 114 | 11.85 | 7.9065 | 6.2928 | 0.53031 | 0.329 | 2.3362 | 0.72255 | 3.233 | 1.5294 | 0.80683 |
| 115 | 11.98 | 7.8904 | 6.2928 | 0.52698 | 0.330 | 2.3235 | 0.72588 | 3.201 | 1.5247 | 0.79878 |
| 116 | 12.11 | 7.9003 | 6.2928 | 0.52476 | 0.326 | 2.3356 | 0.7281 | 3.208 | 1.5319 | 0.80376 |
| 117 | 12.24 | 7.8993 | 6.2928 | 0.52199 | 0.325 | 2.3374 | 0.73088 | 3.198 | 1.5341 | 0.80325 |
| 118 | 12.38 | 7.8962 | 6.2928 | 0.52032 | 0.325 | 2.3359 | 0.73255 | 3.189 | 1.5342 | 0.8017 |
| 119 | 12.51 | 7.8979 | 6.2928 | 0.5181 | 0.323 | 2.3398 | 0.73477 | 3.184 | 1.5373 | 0.80254 |
| 120 | 12.64 | 7.8934 | 6.2928 | 0.51421 | 0.321 | 2.3393 | 0.73865 | 3.167 | 1.539 | 0.8003 |
| 121 | 12.77 | 7.8944 | 6.2928 | 0.51255 | 0.320 | 2.3419 | 0.74032 | 3.163 | 1.5411 | 0.80079 |
| 122 | 12.90 | 7.8899 | 6.2928 | 0.50977 | 0.319 | 2.3402 | 0.7431 | 3.149 | 1.5416 | 0.79855 |
| 123 | 13.03 | 7.8889 | 6.2928 | 0.50755 | 0.318 | 2.3414 | 0.74532 | 3.141 | 1.5433 | 0.79803 |
| 124 | 13.17 | 7.8904 | 6.2928 | 0.50588 | 0.317 | 2.3446 | 0.74698 | 3.139 | 1.5458 | 0.79882 |
| 125 | 13.30 | 7.8894 | 6.2928 | 0.50422 | 0.316 | 2.3453 | 0.74865 | 3.133 | 1.547 | 0.79831 |
| 126 | 13.43 | 7.887 | 6.2928 | 0.50311 | 0.316 | 2.344 | 0.74976 | 3.126 | 1.5469 | 0.79712 |
| 127 | 13.56 | 7.892 | 6.2928 | 0.50033 | 0.313 | 2.3517 | 0.75254 | 3.125 | 1.5521 | 0.7996 |
| 128 | 13.69 | 7.8977 | 6.2928 | 0.49977 | 0.311 | 2.3579 | 0.75309 | 3.131 | 1.5555 | 0.80243 |
| 129 | 13.82 | 7.9006 | 6.2928 | 0.49811 | 0.310 | 2.3626 | 0.75476 | 3.130 | 1.5587 | 0.80391 |
| 130 | 13.95 | 7.8969 | 6.2928 | 0.497 | 0.310 | 2.3599 | 0.75587 | 3.122 | 1.5579 | 0.80203 |
| 131 | 14.08 | 7.8998 | 6.2928 | 0.49533 | 0.308 | 2.3645 | 0.75753 | 3.121 | 1.561 | 0.80349 |
| 132 | 14.21 | 7.9027 | 6.2928 | 0.49422 | 0.307 | 2.3685 | 0.75864 | 3.122 | 1.5636 | 0.80495 |
| 133 | 14.34 | 7.9109 | 6.2928 | 0.49311 | 0.305 | 2.3779 | 0.75975 | 3.130 | 1.5688 | 0.80905 |
| 134 | 14.47 | 7.9025 | 6.2928 | 0.492 | 0.306 | 2.3705 | 0.76087 | 3.116 | 1.5657 | 0.80484 |
| 135 | 14.60 | 7.906 | 6.2928 | 0.49144 | 0.305 | 2.3746 | 0.76142 | 3.119 | 1.568 | 0.80659 |
| 136 | 14.73 | 7.9048 | 6.2928 | 0.49033 | 0.304 | 2.3745 | 0.76253 | 3.114 | 1.5685 | 0.806 |
| 137 | 14.86 | 7.9056 | 6.2928 | 0.48922 | 0.303 | 2.3765 | 0.76364 | 3.112 | 1.57 | 0.80641 |
| 138 | 14.99 | 7.9038 | 6.2928 | 0.48756 | 0.303 | 2.3763 | 0.76531 | 3.105 | 1.5708 | 0.8055 |
| 139 | 15.13 | 7.9 | 6.2928 | 0.48589 | 0.302 | 2.3741 | 0.76697 | 3.095 | 1.5706 | 0.80358 |
| 140 | 15.26 | 7.902 | 6.2928 | 0.48422 | 0.301 | 2.3779 | 0.76864 | 3.094 | 1.5733 | 0.80462 |
| 141 | 15.39 | 7.9035 | 6.2928 | 0.48311 | 0.300 | 2.3804 | 0.76975 | 3.092 | 1.5751 | 0.80533 |
| 142 | 15.52 | 7.9089 | 6.2928 | 0.482 | 0.298 | 2.3869 | 0.77086 | 3.096 | 1.5789 | 0.80803 |
| 143 | 15.66 | 7.905 | 6.2928 | 0.47978 | 0.298 | 2.3853 | 0.77308 | 3.085 | 1.5792 | 0.80612 |
| 144 | 15.79 | 7.9045 | 6.2928 | 0.47812 | 0.297 | 2.3864 | 0.77475 | 3.080 | 1.5806 | 0.80584 |
| 145 | 15.92 | 7.906 | 6.2928 | 0.47701 | 0.296 | 2.389 | 0.77586 | 3.079 | 1.5824 | 0.80658 |
| 146 | 16.05 | 7.9126 | 6.2928 | 0.47534 | 0.293 | 2.3973 | 0.77752 | 3.083 | 1.5874 | 0.80988 |
| 147 | 16.07 | 7.916 | 6.2928 | 0.4759 | 0.293 | 2.4002 | 0.77697 | 3.089 | 1.5886 | 0.81159 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.93 in
Specimen Area: 5.37 in^2
Specimen Volume: 31.88 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

Measured Specific Gravity: 2.66

| | Time min | Vertical Strain % | Corrected Area in^2 | Deviator Load lb | Deviator Stress tsf | Pore Pressure tsf | Horizontal Stress tsf | Vertical Stress tsf |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5.3738 | 0 | 0 | 5.042 | 6.84 | 6.84 |
| 2 | 5 | 0.017296 | 5.3747 | 9.9129 | 0.13279 | 5.1121 | 6.84 | 6.9728 |
| 3 | 10 | 0.036033 | 5.3757 | 12.588 | 0.16859 | 5.1464 | 6.84 | 7.0086 |
| 4 | 15 | 0.054771 | 5.3767 | 13.427 | 0.1798 | 5.167 | 6.84 | 7.0198 |
| 5 | 20 | 0.073508 | 5.3778 | 13.847 | 0.18538 | 5.1822 | 6.84 | 7.0254 |
| 6 | 25 | 0.092245 | 5.3788 | 14.319 | 0.19167 | 5.1958 | 6.84 | 7.0317 |
| 7 | 30.001 | 0.11242 | 5.3799 | 14.843 | 0.19865 | 5.2083 | 6.84 | 7.0386 |
| 8 | 35.001 | 0.13116 | 5.3809 | 15.945 | 0.21335 | 5.2214 | 6.84 | 7.0533 |
| 9 | 40.001 | 0.15134 | 5.3819 | 17.046 | 0.22804 | 5.2344 | 6.84 | 7.068 |
| 10 | 45.001 | 0.17152 | 5.383 | 18.515 | 0.24764 | 5.2485 | 6.84 | 7.0876 |
| 11 | 50.001 | 0.19026 | 5.384 | 19.931 | 0.26653 | 5.2632 | 6.84 | 7.1065 |
| 12 | 55.001 | 0.20899 | 5.3851 | 21.189 | 0.28331 | 5.2768 | 6.84 | 7.1233 |
| 13 | 60.001 | 0.22773 | 5.3861 | 22.553 | 0.30149 | 5.2898 | 6.84 | 7.1415 |
| 14 | 70.001 | 0.26521 | 5.3881 | 29.739 | 0.39739 | 5.3404 | 6.84 | 7.2374 |
| 15 | 80.001 | 0.30124 | 5.39 | 35.088 | 0.46871 | 5.3887 | 6.84 | 7.3087 |
| 16 | 90.002 | 0.34015 | 5.3921 | 39.127 | 0.52245 | 5.4322 | 6.84 | 7.3625 |
| 17 | 100 | 0.37907 | 5.3943 | 42.746 | 0.57055 | 5.4703 | 6.84 | 7.4106 |
| 18 | 110 | 0.41799 | 5.3964 | 45.788 | 0.61092 | 5.5056 | 6.84 | 7.4509 |
| 19 | 120 | 0.45546 | 5.3984 | 48.463 | 0.64637 | 5.5376 | 6.84 | 7.4864 |
| 20 | 130 | 0.49582 | 5.4006 | 51.138 | 0.68177 | 5.5664 | 6.84 | 7.5218 |
| 21 | 140 | 0.53473 | 5.4027 | 53.498 | 0.71295 | 5.5925 | 6.84 | 7.553 |
| 22 | 150 | 0.57365 | 5.4048 | 55.439 | 0.73853 | 5.6175 | 6.84 | 7.5785 |
| 23 | 160 | 0.61401 | 5.407 | 57.274 | 0.76267 | 5.6393 | 6.84 | 7.6027 |
| 24 | 170 | 0.65292 | 5.4091 | 58.9 | 0.78401 | 5.6594 | 6.84 | 7.624 |
| 25 | 180 | 0.69184 | 5.4112 | 60.474 | 0.80464 | 5.6789 | 6.84 | 7.6446 |
| 26 | 190 | 0.7322 | 5.4134 | 61.837 | 0.82245 | 5.6974 | 6.84 | 7.6625 |
| 27 | 200 | 0.77111 | 5.4156 | 63.306 | 0.84166 | 5.7132 | 6.84 | 7.6817 |
| 28 | 210 | 0.81147 | 5.4178 | 63.935 | 0.84968 | 5.7284 | 6.84 | 7.6897 |
| 29 | 220 | 0.85039 | 5.4199 | 65.824 | 0.87443 | 5.7431 | 6.84 | 7.7144 |
| 30 | 230 | 0.8893 | 5.422 | 67.082 | 0.8908 | 5.7566 | 6.84 | 7.7308 |
| 31 | 240 | 0.92966 | 5.4242 | 68.131 | 0.90436 | 5.7697 | 6.84 | 7.7444 |
| 32 | 270 | 1.0493 | 5.4308 | 71.121 | 0.9429 | 5.8034 | 6.84 | 7.7829 |
| 33 | 300 | 1.1689 | 5.4374 | 73.639 | 0.9751 | 5.8306 | 6.84 | 7.8151 |
| 34 | 330 | 1.2871 | 5.4439 | 75.999 | 1.0052 | 5.8545 | 6.84 | 7.8452 |
| 35 | 360 | 1.4053 | 5.4504 | 77.939 | 1.0296 | 5.8746 | 6.84 | 7.8696 |
| 36 | 390 | 1.5235 | 5.4569 | 79.775 | 1.0526 | 5.8925 | 6.84 | 7.8926 |
| 37 | 420 | 1.6417 | 5.4635 | 81.611 | 1.0755 | 5.9083 | 6.84 | 7.9155 |
| 38 | 450 | 1.7599 | 5.4701 | 83.184 | 1.0949 | 5.9219 | 6.84 | 7.9349 |
| 39 | 480 | 1.8781 | 5.4767 | 84.653 | 1.1129 | 5.9333 | 6.84 | 7.9529 |
| 40 | 510 | 1.9977 | 5.4833 | 86.174 | 1.1315 | 5.9441 | 6.84 | 7.9715 |
| 41 | 540 | 2.1159 | 5.49 | 87.538 | 1.148 | 5.9534 | 6.84 | 7.988 |
| 42 | 570 | 2.2326 | 5.4965 | 88.849 | 1.1638 | 5.9615 | 6.84 | 8.0038 |
| 43 | 600 | 2.3494 | 5.5031 | 90.265 | 1.181 | 5.9675 | 6.84 | 8.021 |
| 44 | 630 | 2.4704 | 5.5099 | 91.838 | 1.2001 | 5.974 | 6.84 | 8.0401 |
| 45 | 660 | 2.5872 | 5.5165 | 93.097 | 1.2151 | 5.9805 | 6.84 | 8.0551 |
| 46 | 690 | 2.7068 | 5.5233 | 94.146 | 1.2273 | 5.9843 | 6.84 | 8.0673 |
| 47 | 720 | 2.8236 | 5.5299 | 95.667 | 1.2456 | 5.9876 | 6.84 | 8.0856 |
| 48 | 750 | 2.9418 | 5.5367 | 96.821 | 1.2591 | 5.992 | 6.84 | 8.0991 |
| 49 | 780 | 3.0599 | 5.5434 | 97.818 | 1.2705 | 5.9952 | 6.84 | 8.1105 |
| 50 | 810 | 3.1781 | 5.5502 | 99.129 | 1.2859 | 5.9979 | 6.84 | 8.1259 |
| 51 | 840 | 3.2934 | 5.5568 | 99.968 | 1.2953 | 6.0001 | 6.84 | 8.1353 |
| 52 | 870 | 3.4102 | 5.5635 | 101.02 | 1.3073 | 6.0034 | 6.84 | 8.1473 |
| 53 | 900 | 3.5284 | 5.5703 | 101.86 | 1.3166 | 6.0045 | 6.84 | 8.1566 |
| 54 | 930 | 3.6451 | 5.5771 | 102.96 | 1.3292 | 6.0061 | 6.84 | 8.1692 |
| 55 | 960 | 3.7633 | 5.5839 | 104.01 | 1.3411 | 6.0072 | 6.84 | 8.1811 |
| 56 | 990 | 3.883 | 5.5909 | 104.95 | 1.3516 | 6.0083 | 6.84 | 8.1916 |
| 57 | 1020 | 3.9997 | 5.5977 | 105.95 | 1.3627 | 6.0093 | 6.84 | 8.2027 |
| 58 | 1050 | 4.1179 | 5.6046 | 106.89 | 1.3732 | 6.011 | 6.84 | 8.2132 |
| 59 | 1080 | 4.2346 | 5.6114 | 107.99 | 1.3857 | 6.011 | 6.84 | 8.2257 |
| 60 | 1110 | 4.3514 | 5.6183 | 108.83 | 1.3947 | 6.0126 | 6.84 | 8.2347 |
| 61 | 1140 | 4.4681 | 5.6251 | 109.46 | 1.4011 | 6.0131 | 6.84 | 8.2411 |
| 62 | 1170 | 4.5849 | 5.632 | 110.25 | 1.4094 | 6.0148 | 6.84 | 8.2494 |
| 63 | 1200 | 4.7045 | 5.6391 | 111.14 | 1.419 | 6.0142 | 6.84 | 8.259 |
| 64 | 1230 | 4.8213 | 5.646 | 112.03 | 1.4287 | 6.0126 | 6.84 | 8.2687 |
| 65 | 1260 | 4.9438 | 5.6533 | 112.98 | 1.4388 | 6.0131 | 6.84 | 8.2788 |
| 66 | 1290 | 5.0576 | 5.6601 | 113.81 | 1.4478 | 6.0115 | 6.84 | 8.2878 |
| 67 | 1320 | 5.1744 | 5.667 | 114.97 | 1.4607 | 6.0104 | 6.84 | 8.3007 |
| 68 | 1350 | 5.294 | 5.6742 | 115.81 | 1.4695 | 6.0093 | 6.84 | 8.3095 |
| 69 | 1380 | 5.4093 | 5.6811 | 116.8 | 1.4803 | 6.0088 | 6.84 | 8.3203 |
| 70 | 1410 | 5.5261 | 5.6881 | 117.91 | 1.4924 | 6.0077 | 6.84 | 8.3324 |
| 71 | 1440 | 5.6443 | 5.6953 | 118.95 | 1.5038 | 6.005 | 6.84 | 8.3438 |
| 72 | 1470 | 5.7596 | 5.7022 | 120.06 | 1.5159 | 6.0028 | 6.84 | 8.3559 |
| 73 | 1500 | 5.8763 | 5.7093 | 120.95 | 1.5253 | 6.0023 | 6.84 | 8.3653 |
| 74 | 1530 | 5.9945 | 5.7165 | 121.94 | 1.5359 | 6.0012 | 6.84 | 8.3759 |
| 75 | 1560 | 6.1141 | 5.7238 | 122.84 | 1.5452 | 5.999 | 6.84 | 8.3852 |
| 76 | 1590 | 6.2309 | 5.7309 | 123.94 | 1.5571 | 5.9941 | 6.84 | 8.3971 |
| 77 | 1620 | 6.3491 | 5.7381 | 124.93 | 1.5676 | 5.9914 | 6.84 | 8.4076 |
| 78 | 1650 | 6.4673 | 5.7454 | 125.83 | 1.5768 | 5.9892 | 6.84 | 8.4168 |
| 79 | 1680 | 6.5854 | 5.7526 | 126.87 | 1.588 | 5.9882 | 6.84 | 8.428 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 80 | 1710 | 6.7036 | 5.7599 | 128.13 | 1.6017 | 5.9849 | 6.84 | 8.4417 |
| 81 | 1740 | 6.8204 | 5.7671 | 128.92 | 1.6095 | 5.9816 | 6.84 | 8.4495 |
| 82 | 1770 | 6.9386 | 5.7745 | 130.02 | 1.6212 | 5.9784 | 6.84 | 8.4612 |
| 83 | 1800 | 7.0582 | 5.7819 | 131.33 | 1.6354 | 5.9746 | 6.84 | 8.4754 |
| 84 | 1830 | 7.1793 | 5.7894 | 132.43 | 1.647 | 5.9713 | 6.84 | 8.487 |
| 85 | 1860 | 7.2946 | 5.7966 | 133.48 | 1.658 | 5.9686 | 6.84 | 8.498 |
| 86 | 1890 | 7.4099 | 5.8039 | 134.58 | 1.6696 | 5.9659 | 6.84 | 8.5096 |
| 87 | 1920 | 7.5252 | 5.8111 | 135.27 | 1.676 | 5.9621 | 6.84 | 8.516 |
| 88 | 1950 | 7.6405 | 5.8184 | 136.05 | 1.6836 | 5.9593 | 6.84 | 8.5236 |
| 89 | 1980 | 7.7558 | 5.8256 | 136.84 | 1.6912 | 5.9566 | 6.84 | 8.5312 |
| 90 | 2010 | 7.8726 | 5.833 | 138.05 | 1.704 | 5.9528 | 6.84 | 8.544 |
| 91 | 2040 | 7.9893 | 5.8404 | 139.25 | 1.7167 | 5.949 | 6.84 | 8.5567 |
| 92 | 2070 | 8.1075 | 5.8479 | 140.14 | 1.7255 | 5.9458 | 6.84 | 8.5655 |
| 93 | 2100 | 8.2228 | 5.8553 | 140.98 | 1.7336 | 5.942 | 6.84 | 8.5736 |
| 94 | 2130 | 8.3396 | 5.8627 | 141.87 | 1.7424 | 5.9387 | 6.84 | 8.5824 |
| 95 | 2160 | 8.4577 | 5.8703 | 143.03 | 1.7543 | 5.9338 | 6.84 | 8.5943 |
| 96 | 2190 | 8.5745 | 5.8778 | 144.08 | 1.7649 | 5.93 | 6.84 | 8.6049 |
| 97 | 2220 | 8.6956 | 5.8856 | 145.44 | 1.7792 | 5.9267 | 6.84 | 8.6192 |
| 98 | 2250 | 8.8123 | 5.8931 | 146.81 | 1.7936 | 5.9229 | 6.84 | 8.6336 |
| 99 | 2280 | 8.9305 | 5.9008 | 147.7 | 1.8022 | 5.9191 | 6.84 | 8.6422 |
| 100 | 2310 | 9.0516 | 5.9086 | 148.17 | 1.8055 | 5.9153 | 6.84 | 8.6455 |
| 101 | 2340 | 9.1683 | 5.9162 | 149.11 | 1.8147 | 5.911 | 6.84 | 8.6547 |
| 102 | 2370 | 9.2865 | 5.9239 | 149.79 | 1.8206 | 5.9066 | 6.84 | 8.6606 |
| 103 | 2400 | 9.4033 | 5.9316 | 150.42 | 1.8259 | 5.9028 | 6.84 | 8.6659 |
| 104 | 2430 | 9.5214 | 5.9393 | 151.42 | 1.8356 | 5.899 | 6.84 | 8.6756 |
| 105 | 2460 | 9.6382 | 5.947 | 152.78 | 1.8498 | 5.8958 | 6.84 | 8.6898 |
| 106 | 2490 | 9.7549 | 5.9547 | 153.62 | 1.8575 | 5.892 | 6.84 | 8.6975 |
| 107 | 2520 | 9.8731 | 5.9625 | 154.36 | 1.8639 | 5.8871 | 6.84 | 8.7039 |
| 108 | 2550 | 9.9884 | 5.9701 | 155.56 | 1.8761 | 5.8827 | 6.84 | 8.7161 |
| 109 | 2580 | 10.107 | 5.978 | 156.77 | 1.8882 | 5.8778 | 6.84 | 8.7282 |
| 110 | 2610 | 10.222 | 5.9857 | 158.08 | 1.9015 | 5.8729 | 6.84 | 8.7415 |
| 111 | 2640 | 10.343 | 5.9937 | 158.71 | 1.9065 | 5.8686 | 6.84 | 8.7465 |
| 112 | 2670 | 10.46 | 6.0015 | 159.76 | 1.9166 | 5.8653 | 6.84 | 8.7566 |
| 113 | 2700 | 10.578 | 6.0095 | 160.28 | 1.9204 | 5.8604 | 6.84 | 8.7604 |
| 114 | 2730 | 10.695 | 6.0173 | 161.49 | 1.9323 | 5.8556 | 6.84 | 8.7723 |
| 115 | 2760 | 10.813 | 6.0253 | 162.17 | 1.9379 | 5.8512 | 6.84 | 8.7779 |
| 116 | 2790 | 10.931 | 6.0333 | 163.01 | 1.9453 | 5.8469 | 6.84 | 8.7853 |
| 117 | 2820 | 11.049 | 6.0413 | 163.9 | 1.9534 | 5.8425 | 6.84 | 8.7934 |
| 118 | 2850 | 11.167 | 6.0494 | 164.74 | 1.9608 | 5.8392 | 6.84 | 8.8008 |
| 119 | 2880 | 11.284 | 6.0573 | 165.58 | 1.9682 | 5.8349 | 6.84 | 8.8082 |
| 120 | 2910 | 11.404 | 6.0655 | 166.37 | 1.9749 | 5.8289 | 6.84 | 8.8149 |
| 121 | 2940 | 11.519 | 6.0734 | 167.47 | 1.9854 | 5.8235 | 6.84 | 8.8254 |
| 122 | 2970 | 11.637 | 6.0815 | 168.57 | 1.9957 | 5.8197 | 6.84 | 8.8357 |
| 123 | 3000 | 11.754 | 6.0896 | 169.46 | 2.0036 | 5.8159 | 6.84 | 8.8436 |
| 124 | 3030 | 11.872 | 6.0977 | 170.2 | 2.0096 | 5.8115 | 6.84 | 8.8496 |
| 125 | 3060 | 11.992 | 6.106 | 171.14 | 2.018 | 5.8072 | 6.84 | 8.858 |
| 126 | 3090 | 12.107 | 6.114 | 171.88 | 2.024 | 5.8018 | 6.84 | 8.864 |
| 127 | 3120 | 12.224 | 6.1222 | 172.56 | 2.0294 | 5.7963 | 6.84 | 8.8694 |
| 128 | 3150 | 12.344 | 6.1305 | 173.66 | 2.0395 | 5.792 | 6.84 | 8.8795 |
| 129 | 3180 | 12.46 | 6.1387 | 174.13 | 2.0424 | 5.7865 | 6.84 | 8.8824 |
| 130 | 3210 | 12.577 | 6.1469 | 175.23 | 2.0525 | 5.7827 | 6.84 | 8.8925 |
| 131 | 3240 | 12.694 | 6.1551 | 176.28 | 2.0621 | 5.7778 | 6.84 | 8.9021 |
| 132 | 3270 | 12.813 | 6.1636 | 177.17 | 2.0697 | 5.7729 | 6.84 | 8.9097 |
| 133 | 3300 | 12.932 | 6.1719 | 177.8 | 2.0742 | 5.7681 | 6.84 | 8.9142 |
| 134 | 3330 | 13.05 | 6.1803 | 178.69 | 2.0818 | 5.7632 | 6.84 | 8.9218 |
| 135 | 3360 | 13.172 | 6.189 | 179.59 | 2.0892 | 5.7583 | 6.84 | 8.9292 |
| 136 | 3390 | 13.288 | 6.1973 | 180.27 | 2.0944 | 5.7528 | 6.84 | 8.9344 |
| 137 | 3420 | 13.412 | 6.2061 | 180.84 | 2.098 | 5.7474 | 6.84 | 8.938 |
| 138 | 3450 | 13.527 | 6.2144 | 181.89 | 2.1074 | 5.7414 | 6.84 | 8.9474 |
| 139 | 3480 | 13.644 | 6.2228 | 182.68 | 2.1137 | 5.7371 | 6.84 | 8.9537 |
| 140 | 3510 | 13.763 | 6.2315 | 183.52 | 2.1204 | 5.7316 | 6.84 | 8.9604 |
| 141 | 3540 | 13.88 | 6.2399 | 184.36 | 2.1272 | 5.7273 | 6.84 | 8.9672 |
| 142 | 3570 | 13.998 | 6.2485 | 185.56 | 2.1382 | 5.723 | 6.84 | 8.9782 |
| 143 | 3600 | 14.118 | 6.2572 | 186.14 | 2.1419 | 5.7175 | 6.84 | 8.9819 |
| 144 | 3630 | 14.237 | 6.2659 | 186.93 | 2.1479 | 5.7121 | 6.84 | 8.9879 |
| 145 | 3660 | 14.348 | 6.274 | 188.03 | 2.1578 | 5.7072 | 6.84 | 8.9978 |
| 146 | 3690 | 14.465 | 6.2826 | 188.82 | 2.1639 | 5.7018 | 6.84 | 9.0039 |
| 147 | 3720 | 14.581 | 6.2911 | 189.76 | 2.1718 | 5.6963 | 6.84 | 9.0118 |
| 148 | 3750 | 14.702 | 6.3 | 190.55 | 2.1777 | 5.6925 | 6.84 | 9.0177 |
| 149 | 3780 | 14.814 | 6.3083 | 191.39 | 2.1844 | 5.6871 | 6.84 | 9.0244 |
| 150 | 3810 | 14.934 | 6.3172 | 192.12 | 2.1897 | 5.6817 | 6.84 | 9.0297 |
| 151 | 3840 | 15.046 | 6.3255 | 192.49 | 2.191 | 5.6768 | 6.84 | 9.031 |
| 152 | 3870 | 15.164 | 6.3344 | 193.12 | 2.1951 | 5.6719 | 6.84 | 9.0351 |
| 153 | 3900 | 15.281 | 6.3431 | 193.75 | 2.1992 | 5.667 | 6.84 | 9.0392 |
| 154 | 3930 | 15.402 | 6.3522 | 194.27 | 2.202 | 5.6637 | 6.84 | 9.042 |
| 155 | 3934.9 | 15.419 | 6.3535 | 194.17 | 2.2004 | 5.6626 | 6.84 | 9.0404 |

TRIAXIAL TEST

Project: COLETO CREEK FACILITY
Boring No.: B-4-1 S-13
Sample No.: S-13
Test No.: 24.3 PSI

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/2/11
Sample Type: 3" ST

Project No.: 60225561
Checked By: WPQ
Depth: 24.0'-26.0'
Elevation: ----

AECOM

Soil Description: CLAYEY F-C SAND LITTLE SILT - BROWNISH GRAY SC
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.93 in
Specimen Area: 5.37 in^2
Specimen Volume: 31.88 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 40

Plastic Limit: 24

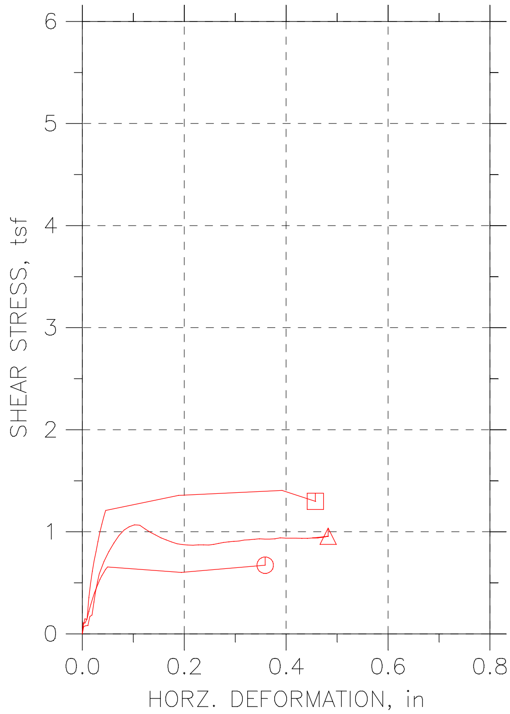
Measured Specific Gravity: 2.66

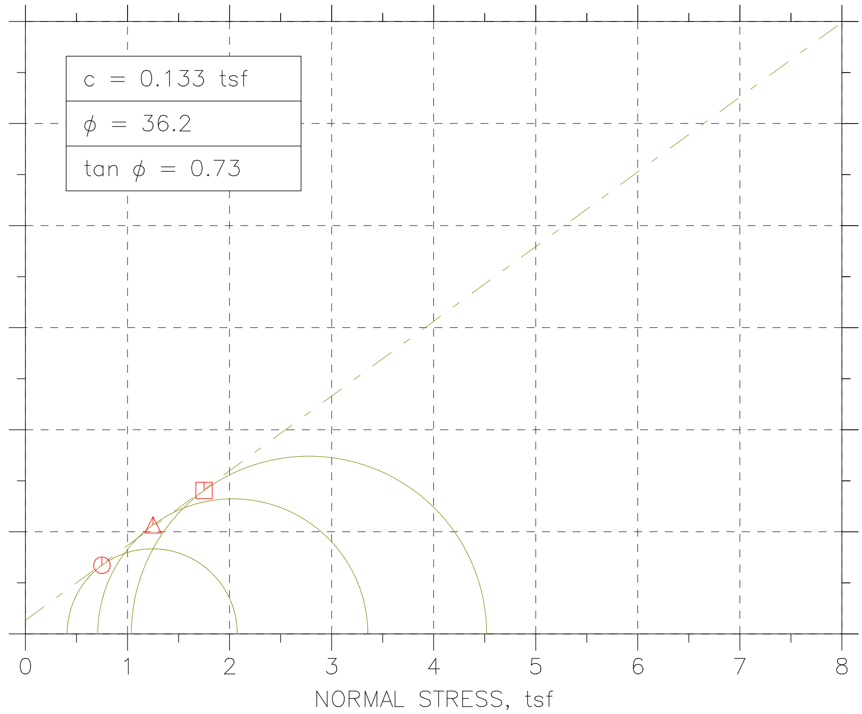
| | Vertical Strain % | Total Vertical Stress tsf | Total Horizontal Stress tsf | Excess Pore Pressure tsf | A Parameter | Effective Vertical Stress tsf | Effective Horizontal Stress tsf | Stress Ratio | Effective p tsf | q tsf |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 6.84 | 6.84 | 0 | 0.000 | 1.798 | 1.798 | 1.000 | 1.798 | 0 |
| 2 | 0.02 | 6.9728 | 6.84 | 0.070104 | 0.528 | 1.8607 | 1.7279 | 1.077 | 1.7943 | 0.066397 |
| 3 | 0.04 | 7.0086 | 6.84 | 0.10434 | 0.619 | 1.8622 | 1.6936 | 1.100 | 1.7779 | 0.084297 |
| 4 | 0.05 | 7.0198 | 6.84 | 0.12499 | 0.695 | 1.8528 | 1.673 | 1.107 | 1.7629 | 0.0899 |
| 5 | 0.07 | 7.0254 | 6.84 | 0.14021 | 0.756 | 1.8432 | 1.6578 | 1.112 | 1.7505 | 0.092692 |
| 6 | 0.09 | 7.0317 | 6.84 | 0.15379 | 0.802 | 1.8359 | 1.6442 | 1.117 | 1.74 | 0.095834 |
| 7 | 0.11 | 7.0386 | 6.84 | 0.16629 | 0.837 | 1.8303 | 1.6317 | 1.122 | 1.731 | 0.099325 |
| 8 | 0.13 | 7.0533 | 6.84 | 0.17933 | 0.841 | 1.832 | 1.6186 | 1.132 | 1.7253 | 0.10667 |
| 9 | 0.15 | 7.068 | 6.84 | 0.19238 | 0.844 | 1.8336 | 1.6056 | 1.142 | 1.7196 | 0.11402 |
| 10 | 0.17 | 7.0876 | 6.84 | 0.20651 | 0.834 | 1.8391 | 1.5915 | 1.156 | 1.7153 | 0.12382 |
| 11 | 0.19 | 7.1065 | 6.84 | 0.22118 | 0.830 | 1.8433 | 1.5768 | 1.169 | 1.7101 | 0.13326 |
| 12 | 0.21 | 7.1233 | 6.84 | 0.23477 | 0.829 | 1.8465 | 1.5632 | 1.181 | 1.7049 | 0.14165 |
| 13 | 0.23 | 7.1415 | 6.84 | 0.24781 | 0.822 | 1.8517 | 1.5502 | 1.194 | 1.7009 | 0.15074 |
| 14 | 0.27 | 7.2374 | 6.84 | 0.29835 | 0.751 | 1.897 | 1.4996 | 1.265 | 1.6983 | 0.1987 |
| 15 | 0.30 | 7.3087 | 6.84 | 0.34671 | 0.740 | 1.92 | 1.4513 | 1.323 | 1.6856 | 0.23436 |
| 16 | 0.34 | 7.3625 | 6.84 | 0.39019 | 0.747 | 1.9302 | 1.4078 | 1.371 | 1.669 | 0.26123 |
| 17 | 0.38 | 7.4106 | 6.84 | 0.42823 | 0.751 | 1.9403 | 1.3697 | 1.417 | 1.655 | 0.28528 |
| 18 | 0.42 | 7.4509 | 6.84 | 0.46355 | 0.759 | 1.9453 | 1.3344 | 1.458 | 1.6399 | 0.30546 |
| 19 | 0.46 | 7.4864 | 6.84 | 0.49562 | 0.767 | 1.9487 | 1.3024 | 1.496 | 1.6255 | 0.32318 |
| 20 | 0.50 | 7.5218 | 6.84 | 0.52442 | 0.769 | 1.9553 | 1.2736 | 1.535 | 1.6144 | 0.34088 |
| 21 | 0.53 | 7.553 | 6.84 | 0.5505 | 0.772 | 1.9604 | 1.2475 | 1.572 | 1.6039 | 0.35648 |
| 22 | 0.57 | 7.5785 | 6.84 | 0.5755 | 0.779 | 1.961 | 1.2225 | 1.604 | 1.5917 | 0.36926 |
| 23 | 0.61 | 7.6027 | 6.84 | 0.59724 | 0.783 | 1.9634 | 1.2007 | 1.635 | 1.5821 | 0.38133 |
| 24 | 0.65 | 7.624 | 6.84 | 0.61735 | 0.787 | 1.9646 | 1.1806 | 1.664 | 1.5726 | 0.39201 |
| 25 | 0.69 | 7.6446 | 6.84 | 0.63691 | 0.792 | 1.9657 | 1.1611 | 1.693 | 1.5634 | 0.40232 |
| 26 | 0.73 | 7.6625 | 6.84 | 0.65539 | 0.797 | 1.965 | 1.1426 | 1.720 | 1.5538 | 0.41123 |
| 27 | 0.77 | 7.6817 | 6.84 | 0.67115 | 0.797 | 1.9685 | 1.1268 | 1.747 | 1.5477 | 0.42083 |
| 28 | 0.81 | 7.6897 | 6.84 | 0.68636 | 0.808 | 1.9613 | 1.1116 | 1.764 | 1.5365 | 0.42484 |
| 29 | 0.85 | 7.7144 | 6.84 | 0.70104 | 0.802 | 1.9714 | 1.0969 | 1.797 | 1.5342 | 0.43721 |
| 30 | 0.89 | 7.7308 | 6.84 | 0.71462 | 0.802 | 1.9742 | 1.0834 | 1.822 | 1.5288 | 0.4454 |
| 31 | 0.93 | 7.7444 | 6.84 | 0.72766 | 0.805 | 1.9747 | 1.0703 | 1.845 | 1.5225 | 0.45218 |
| 32 | 1.05 | 7.7829 | 6.84 | 0.76136 | 0.807 | 1.9795 | 1.0366 | 1.910 | 1.5081 | 0.47145 |
| 33 | 1.17 | 7.8151 | 6.84 | 0.78853 | 0.809 | 1.9845 | 1.0094 | 1.966 | 1.497 | 0.48755 |
| 34 | 1.29 | 7.8452 | 6.84 | 0.81244 | 0.808 | 1.9907 | 0.98553 | 2.020 | 1.4881 | 0.50258 |
| 35 | 1.41 | 7.8696 | 6.84 | 0.83255 | 0.809 | 1.995 | 0.96543 | 2.066 | 1.4802 | 0.51479 |
| 36 | 1.52 | 7.8926 | 6.84 | 0.85048 | 0.808 | 2.0001 | 0.94749 | 2.111 | 1.4738 | 0.52628 |
| 37 | 1.64 | 7.9155 | 6.84 | 0.86624 | 0.805 | 2.0072 | 0.93173 | 2.154 | 1.4695 | 0.53775 |
| 38 | 1.76 | 7.9349 | 6.84 | 0.87983 | 0.804 | 2.0131 | 0.91815 | 2.193 | 1.4656 | 0.54746 |
| 39 | 1.88 | 7.9529 | 6.84 | 0.89124 | 0.801 | 2.0196 | 0.90674 | 2.227 | 1.4632 | 0.55645 |
| 40 | 2.00 | 7.9715 | 6.84 | 0.90211 | 0.797 | 2.0274 | 0.89587 | 2.263 | 1.4616 | 0.56576 |
| 41 | 2.12 | 7.988 | 6.84 | 0.91135 | 0.794 | 2.0347 | 0.88663 | 2.295 | 1.4606 | 0.57402 |
| 42 | 2.23 | 8.0038 | 6.84 | 0.9195 | 0.790 | 2.0423 | 0.87848 | 2.325 | 1.4604 | 0.58192 |
| 43 | 2.35 | 8.021 | 6.84 | 0.92548 | 0.784 | 2.0535 | 0.8725 | 2.354 | 1.463 | 0.59049 |
| 44 | 2.47 | 8.0401 | 6.84 | 0.932 | 0.777 | 2.0661 | 0.86598 | 2.386 | 1.466 | 0.60004 |
| 45 | 2.59 | 8.0551 | 6.84 | 0.93852 | 0.772 | 2.0745 | 0.85946 | 2.414 | 1.467 | 0.60754 |
| 46 | 2.71 | 8.0673 | 6.84 | 0.94232 | 0.768 | 2.0829 | 0.85565 | 2.434 | 1.4693 | 0.61363 |
| 47 | 2.82 | 8.0856 | 6.84 | 0.94558 | 0.759 | 2.098 | 0.85239 | 2.461 | 1.4752 | 0.62279 |
| 48 | 2.94 | 8.0991 | 6.84 | 0.94993 | 0.754 | 2.1071 | 0.84804 | 2.485 | 1.4776 | 0.62954 |
| 49 | 3.06 | 8.1105 | 6.84 | 0.95319 | 0.750 | 2.1153 | 0.84478 | 2.504 | 1.48 | 0.63524 |
| 50 | 3.18 | 8.1259 | 6.84 | 0.95591 | 0.743 | 2.128 | 0.84207 | 2.527 | 1.485 | 0.64297 |
| 51 | 3.29 | 8.1353 | 6.84 | 0.95808 | 0.740 | 2.1352 | 0.83989 | 2.542 | 1.4875 | 0.64765 |
| 52 | 3.41 | 8.1473 | 6.84 | 0.96134 | 0.735 | 2.1439 | 0.83663 | 2.563 | 1.4903 | 0.65365 |
| 53 | 3.53 | 8.1566 | 6.84 | 0.96243 | 0.731 | 2.1521 | 0.83555 | 2.576 | 1.4938 | 0.65828 |
| 54 | 3.65 | 8.1692 | 6.84 | 0.96406 | 0.725 | 2.1631 | 0.83392 | 2.594 | 1.4985 | 0.66459 |
| 55 | 3.76 | 8.1811 | 6.84 | 0.96515 | 0.720 | 2.1739 | 0.83283 | 2.610 | 1.5034 | 0.67054 |
| 56 | 3.88 | 8.1916 | 6.84 | 0.96623 | 0.715 | 2.1833 | 0.83174 | 2.625 | 1.5075 | 0.67578 |
| 57 | 4.00 | 8.2027 | 6.84 | 0.96732 | 0.710 | 2.1934 | 0.83065 | 2.641 | 1.512 | 0.68137 |
| 58 | 4.12 | 8.2132 | 6.84 | 0.96895 | 0.706 | 2.2022 | 0.82902 | 2.656 | 1.5156 | 0.68659 |
| 59 | 4.23 | 8.2257 | 6.84 | 0.96895 | 0.699 | 2.2147 | 0.82902 | 2.671 | 1.5218 | 0.69283 |
| 60 | 4.35 | 8.2347 | 6.84 | 0.97058 | 0.696 | 2.2221 | 0.82739 | 2.686 | 1.5248 | 0.69736 |
| 61 | 4.47 | 8.2411 | 6.84 | 0.97112 | 0.693 | 2.2279 | 0.82685 | 2.694 | 1.5274 | 0.70053 |
| 62 | 4.58 | 8.2494 | 6.84 | 0.97276 | 0.690 | 2.2346 | 0.82522 | 2.708 | 1.5299 | 0.70471 |
| 63 | 4.70 | 8.259 | 6.84 | 0.97221 | 0.685 | 2.2448 | 0.82576 | 2.718 | 1.5353 | 0.70952 |
| 64 | 4.82 | 8.2687 | 6.84 | 0.97058 | 0.679 | 2.2561 | 0.82739 | 2.727 | 1.5417 | 0.71433 |
| 65 | 4.94 | 8.2788 | 6.84 | 0.97112 | 0.675 | 2.2657 | 0.82685 | 2.740 | 1.5463 | 0.71942 |
| 66 | 5.06 | 8.2878 | 6.84 | 0.96949 | 0.670 | 2.2763 | 0.82848 | 2.748 | 1.5524 | 0.7239 |
| 67 | 5.17 | 8.3007 | 6.84 | 0.96841 | 0.663 | 2.2902 | 0.82957 | 2.761 | 1.5599 | 0.73034 |
| 68 | 5.29 | 8.3095 | 6.84 | 0.96732 | 0.658 | 2.3001 | 0.83065 | 2.769 | 1.5654 | 0.73474 |
| 69 | 5.41 | 8.3203 | 6.84 | 0.96678 | 0.653 | 2.3115 | 0.8312 | 2.781 | 1.5714 | 0.74016 |
| 70 | 5.53 | 8.3324 | 6.84 | 0.96569 | 0.647 | 2.3247 | 0.83228 | 2.793 | 1.5785 | 0.74622 |
| 71 | 5.64 | 8.3438 | 6.84 | 0.96297 | 0.640 | 2.3388 | 0.835 | 2.801 | 1.5869 | 0.75192 |
| 72 | 5.76 | 8.3559 | 6.84 | 0.9608 | 0.634 | 2.3531 | 0.83718 | 2.811 | 1.5951 | 0.75795 |
| 73 | 5.88 | 8.3653 | 6.84 | 0.96026 | 0.630 | 2.363 | 0.83772 | 2.821 | 1.6004 | 0.76264 |
| 74 | 5.99 | 8.3759 | 6.84 | 0.95917 | 0.624 | 2.3747 | 0.83881 | 2.831 | 1.6068 | 0.76795 |
| 75 | 6.11 | 8.3852 | 6.84 | 0.957 | 0.619 | 2.3861 | 0.84098 | 2.837 | 1.6136 | 0.77258 |
| 76 | 6.23 | 8.3971 | 6.84 | 0.9521 | 0.611 | 2.403 | 0.84587 | 2.841 | 1.6244 | 0.77854 |
| 77 | 6.35 | 8.4076 | 6.84 | 0.94939 | 0.606 | 2.4162 | 0.84859 | 2.847 | 1.6324 | 0.78381 |
| 78 | 6.47 | 8.4168 | 6.84 | 0.94721 | 0.601 | 2.4276 | 0.85076 | 2.853 | 1.6392 | 0.78841 |

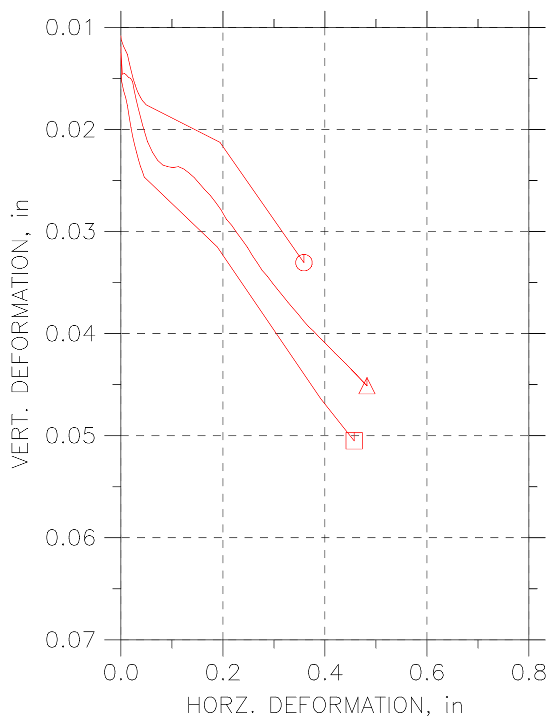
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 6.59 | 8.428 | 6.84 | 0.94613 | 0.596 | 2.4398 | 0.85185 | 2.864 | 1.6458 | 0.79398 |
| 80 | 6.70 | 8.4417 | 6.84 | 0.94287 | 0.589 | 2.4568 | 0.85511 | 2.873 | 1.656 | 0.80084 |
| 81 | 6.82 | 8.4495 | 6.84 | 0.93961 | 0.584 | 2.4679 | 0.85837 | 2.875 | 1.6631 | 0.80475 |
| 82 | 6.94 | 8.4612 | 6.84 | 0.93634 | 0.578 | 2.4828 | 0.86163 | 2.882 | 1.6722 | 0.8106 |
| 83 | 7.06 | 8.4754 | 6.84 | 0.93254 | 0.570 | 2.5009 | 0.86543 | 2.890 | 1.6832 | 0.81772 |
| 84 | 7.18 | 8.487 | 6.84 | 0.92928 | 0.564 | 2.5157 | 0.8687 | 2.896 | 1.6922 | 0.8235 |
| 85 | 7.29 | 8.498 | 6.84 | 0.92656 | 0.559 | 2.5294 | 0.87141 | 2.903 | 1.7004 | 0.82899 |
| 86 | 7.41 | 8.5096 | 6.84 | 0.92385 | 0.553 | 2.5437 | 0.87413 | 2.910 | 1.7089 | 0.8348 |
| 87 | 7.53 | 8.516 | 6.84 | 0.92004 | 0.549 | 2.5539 | 0.87793 | 2.909 | 1.7159 | 0.83798 |
| 88 | 7.64 | 8.5236 | 6.84 | 0.91732 | 0.545 | 2.5643 | 0.88065 | 2.912 | 1.7225 | 0.8418 |
| 89 | 7.76 | 8.5312 | 6.84 | 0.91461 | 0.541 | 2.5746 | 0.88337 | 2.915 | 1.729 | 0.84561 |
| 90 | 7.87 | 8.544 | 6.84 | 0.9108 | 0.535 | 2.5911 | 0.88717 | 2.921 | 1.7392 | 0.85199 |
| 91 | 7.99 | 8.5567 | 6.84 | 0.907 | 0.528 | 2.6077 | 0.89098 | 2.927 | 1.7493 | 0.85834 |
| 92 | 8.11 | 8.5655 | 6.84 | 0.90374 | 0.524 | 2.6197 | 0.89424 | 2.930 | 1.757 | 0.86273 |
| 93 | 8.22 | 8.5736 | 6.84 | 0.89993 | 0.519 | 2.6317 | 0.89804 | 2.930 | 1.7648 | 0.86681 |
| 94 | 8.34 | 8.5824 | 6.84 | 0.89667 | 0.515 | 2.6437 | 0.9013 | 2.933 | 1.7725 | 0.87118 |
| 95 | 8.46 | 8.5943 | 6.84 | 0.89178 | 0.508 | 2.6605 | 0.90619 | 2.936 | 1.7833 | 0.87713 |
| 96 | 8.57 | 8.6049 | 6.84 | 0.88798 | 0.503 | 2.6749 | 0.91 | 2.939 | 1.7924 | 0.88244 |
| 97 | 8.70 | 8.6192 | 6.84 | 0.88472 | 0.497 | 2.6925 | 0.91326 | 2.948 | 1.8029 | 0.88961 |
| 98 | 8.81 | 8.6336 | 6.84 | 0.88091 | 0.491 | 2.7107 | 0.91706 | 2.956 | 1.8139 | 0.8968 |
| 99 | 8.93 | 8.6422 | 6.84 | 0.87711 | 0.487 | 2.723 | 0.92087 | 2.957 | 1.8219 | 0.90108 |
| 100 | 9.05 | 8.6455 | 6.84 | 0.87331 | 0.484 | 2.7302 | 0.92467 | 2.953 | 1.8274 | 0.90276 |
| 101 | 9.17 | 8.6547 | 6.84 | 0.86896 | 0.479 | 2.7437 | 0.92902 | 2.953 | 1.8364 | 0.90735 |
| 102 | 9.29 | 8.6606 | 6.84 | 0.86461 | 0.475 | 2.754 | 0.93336 | 2.951 | 1.8437 | 0.91031 |
| 103 | 9.40 | 8.6659 | 6.84 | 0.86081 | 0.471 | 2.7631 | 0.93717 | 2.948 | 1.8501 | 0.91296 |
| 104 | 9.52 | 8.6756 | 6.84 | 0.857 | 0.467 | 2.7766 | 0.94097 | 2.951 | 1.8588 | 0.91781 |
| 105 | 9.64 | 8.6898 | 6.84 | 0.85374 | 0.462 | 2.794 | 0.94423 | 2.959 | 1.8691 | 0.92488 |
| 106 | 9.75 | 8.6975 | 6.84 | 0.84994 | 0.458 | 2.8055 | 0.94804 | 2.959 | 1.8768 | 0.92876 |
| 107 | 9.87 | 8.7039 | 6.84 | 0.84505 | 0.453 | 2.8169 | 0.95293 | 2.956 | 1.8849 | 0.93197 |
| 108 | 9.99 | 8.7161 | 6.84 | 0.8407 | 0.448 | 2.8334 | 0.95728 | 2.960 | 1.8953 | 0.93806 |
| 109 | 10.11 | 8.7282 | 6.84 | 0.83581 | 0.443 | 2.8503 | 0.96217 | 2.962 | 1.9063 | 0.94409 |
| 110 | 10.22 | 8.7415 | 6.84 | 0.83092 | 0.437 | 2.8686 | 0.96706 | 2.966 | 1.9178 | 0.95076 |
| 111 | 10.34 | 8.7465 | 6.84 | 0.82657 | 0.434 | 2.8779 | 0.97141 | 2.963 | 1.9247 | 0.95326 |
| 112 | 10.46 | 8.7566 | 6.84 | 0.82331 | 0.430 | 2.8913 | 0.97467 | 2.966 | 1.933 | 0.95831 |
| 113 | 10.58 | 8.7604 | 6.84 | 0.81842 | 0.426 | 2.8999 | 0.97956 | 2.960 | 1.9397 | 0.96019 |
| 114 | 10.69 | 8.7723 | 6.84 | 0.81353 | 0.421 | 2.9168 | 0.98445 | 2.963 | 1.9506 | 0.96615 |
| 115 | 10.81 | 8.7779 | 6.84 | 0.80918 | 0.418 | 2.9267 | 0.9888 | 2.960 | 1.9577 | 0.96895 |
| 116 | 10.93 | 8.7853 | 6.84 | 0.80483 | 0.414 | 2.9385 | 0.99314 | 2.959 | 1.9658 | 0.97267 |
| 117 | 11.05 | 8.7934 | 6.84 | 0.80049 | 0.410 | 2.9509 | 0.99749 | 2.958 | 1.9742 | 0.97669 |
| 118 | 11.17 | 8.8008 | 6.84 | 0.79722 | 0.407 | 2.9615 | 1.0008 | 2.959 | 1.9811 | 0.98039 |
| 119 | 11.28 | 8.8082 | 6.84 | 0.79288 | 0.403 | 2.9733 | 1.0051 | 2.958 | 1.9892 | 0.98409 |
| 120 | 11.40 | 8.8149 | 6.84 | 0.7869 | 0.398 | 2.9859 | 1.0111 | 2.953 | 1.9985 | 0.98743 |
| 121 | 11.52 | 8.8254 | 6.84 | 0.78146 | 0.394 | 3.0019 | 1.0165 | 2.953 | 2.0092 | 0.99268 |
| 122 | 11.64 | 8.8357 | 6.84 | 0.77766 | 0.390 | 3.0161 | 1.0203 | 2.956 | 2.0182 | 0.99787 |
| 123 | 11.75 | 8.8436 | 6.84 | 0.77386 | 0.386 | 3.0278 | 1.0241 | 2.956 | 2.0259 | 1.0018 |
| 124 | 11.87 | 8.8496 | 6.84 | 0.76951 | 0.383 | 3.0381 | 1.0285 | 2.954 | 2.0333 | 1.0048 |
| 125 | 11.99 | 8.858 | 6.84 | 0.76516 | 0.379 | 3.0508 | 1.0328 | 2.954 | 2.0418 | 1.009 |
| 126 | 12.11 | 8.864 | 6.84 | 0.75973 | 0.375 | 3.0623 | 1.0382 | 2.949 | 2.0503 | 1.012 |
| 127 | 12.22 | 8.8694 | 6.84 | 0.75429 | 0.372 | 3.0731 | 1.0437 | 2.944 | 2.0584 | 1.0147 |
| 128 | 12.34 | 8.8795 | 6.84 | 0.74995 | 0.368 | 3.0876 | 1.048 | 2.946 | 2.0678 | 1.0198 |
| 129 | 12.46 | 8.8824 | 6.84 | 0.74451 | 0.365 | 3.0958 | 1.0535 | 2.939 | 2.0746 | 1.0212 |
| 130 | 12.58 | 8.8925 | 6.84 | 0.74071 | 0.361 | 3.1098 | 1.0573 | 2.941 | 2.0835 | 1.0263 |
| 131 | 12.69 | 8.9021 | 6.84 | 0.73582 | 0.357 | 3.1242 | 1.0622 | 2.941 | 2.0932 | 1.031 |
| 132 | 12.81 | 8.9097 | 6.84 | 0.73093 | 0.353 | 3.1367 | 1.0671 | 2.940 | 2.1019 | 1.0348 |
| 133 | 12.93 | 8.9142 | 6.84 | 0.72603 | 0.350 | 3.1461 | 1.0719 | 2.935 | 2.109 | 1.0371 |
| 134 | 13.05 | 8.9218 | 6.84 | 0.72114 | 0.346 | 3.1586 | 1.0768 | 2.933 | 2.1177 | 1.0409 |
| 135 | 13.17 | 8.9292 | 6.84 | 0.71625 | 0.343 | 3.1709 | 1.0817 | 2.931 | 2.1263 | 1.0446 |
| 136 | 13.29 | 8.9344 | 6.84 | 0.71082 | 0.339 | 3.1815 | 1.0872 | 2.926 | 2.1343 | 1.0472 |
| 137 | 13.41 | 8.938 | 6.84 | 0.70538 | 0.336 | 3.1906 | 1.0926 | 2.920 | 2.1416 | 1.049 |
| 138 | 13.53 | 8.9474 | 6.84 | 0.69941 | 0.332 | 3.206 | 1.0986 | 2.918 | 2.1523 | 1.0537 |
| 139 | 13.64 | 8.9537 | 6.84 | 0.69506 | 0.329 | 3.2166 | 1.1029 | 2.916 | 2.1598 | 1.0568 |
| 140 | 13.76 | 8.9604 | 6.84 | 0.68962 | 0.325 | 3.2288 | 1.1084 | 2.913 | 2.1686 | 1.0602 |
| 141 | 13.88 | 8.9672 | 6.84 | 0.68528 | 0.322 | 3.2399 | 1.1127 | 2.912 | 2.1763 | 1.0636 |
| 142 | 14.00 | 8.9782 | 6.84 | 0.68093 | 0.318 | 3.2553 | 1.117 | 2.914 | 2.1862 | 1.0691 |
| 143 | 14.12 | 8.9819 | 6.84 | 0.67549 | 0.315 | 3.2644 | 1.1225 | 2.908 | 2.1934 | 1.0709 |
| 144 | 14.24 | 8.9879 | 6.84 | 0.67006 | 0.312 | 3.2759 | 1.1279 | 2.904 | 2.2019 | 1.074 |
| 145 | 14.35 | 8.9978 | 6.84 | 0.66517 | 0.308 | 3.2906 | 1.1328 | 2.905 | 2.2117 | 1.0789 |
| 146 | 14.47 | 9.0039 | 6.84 | 0.65973 | 0.305 | 3.3021 | 1.1382 | 2.901 | 2.2202 | 1.0819 |
| 147 | 14.58 | 9.0118 | 6.84 | 0.6543 | 0.301 | 3.3154 | 1.1437 | 2.899 | 2.2296 | 1.0859 |
| 148 | 14.70 | 9.0177 | 6.84 | 0.6505 | 0.299 | 3.3252 | 1.1475 | 2.898 | 2.2363 | 1.0888 |
| 149 | 14.81 | 9.0244 | 6.84 | 0.64506 | 0.295 | 3.3373 | 1.1529 | 2.895 | 2.2451 | 1.0922 |
| 150 | 14.93 | 9.0297 | 6.84 | 0.63963 | 0.292 | 3.348 | 1.1583 | 2.890 | 2.2532 | 1.0948 |
| 151 | 15.05 | 9.031 | 6.84 | 0.63474 | 0.290 | 3.3542 | 1.1632 | 2.884 | 2.2587 | 1.0955 |
| 152 | 15.16 | 9.0351 | 6.84 | 0.62985 | 0.287 | 3.3632 | 1.1681 | 2.879 | 2.2657 | 1.0975 |
| 153 | 15.28 | 9.0392 | 6.84 | 0.62495 | 0.284 | 3.3722 | 1.173 | 2.875 | 2.2726 | 1.0996 |
| 154 | 15.40 | 9.042 | 6.84 | 0.62169 | 0.282 | 3.3783 | 1.1763 | 2.872 | 2.2773 | 1.101 |
| 155 | 15.42 | 9.0404 | 6.84 | 0.62061 | 0.282 | 3.3777 | 1.1774 | 2.869 | 2.2776 | 1.1002 |

# DIRECT SHEAR TEST REPORT

AECOM




| | Symbol | ○ | △ | □ | |
|---|---|---|---|---|---|
| | Test No. | .75 TSF | 1.25 TSF | 1.75 TSF | |
| | Sample No. | S-16-18 | S-16-18 | S-16-18 | |
| | Shape | Circular | Circular | Circular | |
| Initial | Dimension, in | 2.3504 | 2.3504 | 2.3504 | |
| Initial | Area, in^2 | 4.3388 | 4.3388 | 4.3388 | |
| Initial | Height, in | 1 | 1 | 1 | |
| Initial | Water Content, % | 16.12 | 16.62 | 16.15 | |
| Initial | Dry Density, pcf | 117.9 | 117.1 | 117.9 | |
| Initial | Saturation, % | 99.55 | 100.36 | 99.77 | |
| Initial | Void Ratio | 0.44047 | 0.45053 | 0.44026 | |
| | Consol. Height, in | 0.98989 | 0.9897 | 0.98947 | |
| | Consol. Void Ratio | 0.42591 | 0.43558 | 0.4251 | |
| Final | Water Content, % | 14.02 | 14.02 | 12.51 | |
| Final | Dry Density, pcf | 121.9 | 122.6 | 124.2 | |
| Final | Saturation, % | 97.07 | 99.04 | 92.56 | |
| Final | Void Ratio | 0.39288 | 0.38509 | 0.36752 | |
| | Normal Stress, tsf | 0.75 | 1.25 | 1.75 | |
| | Max. Shear Stress, tsf | 0.67243 | 1.0674 | 1.4045 | |
| | Ult. Shear Stress, tsf | 0.67243 | 0.95657 | 1.2984 | |
| | Time to Failure, min | 180.15 | 62.996 | 198 | |
| | Disp. Rate, in/min | 0.001417 | 0.001417 | 0.001417 | |
| | Estimated Specific Gravity | 2.72 | 2.72 | 2.72 | |
| | Liquid Limit | --- | --- | --- | |
| | Plastic Limit | --- | --- | --- | |
| | Plasticity Index | --- | --- | --- | |

| |
|---|
| Project: COLETO CREEK FACILITY |
| Location: IPR-GDF SUEZ |
| Project No.: 60225561 |
| Boring No.: B-1-1 |
| Sample Type: TRIMMED |
| Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE |
| Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC |

Thu, 22-DEC-2011 13:30:56

DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: .75 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.75 | 0.01082 | 0 | 0 | 0 |
| 2 | 2.00 | 0.75 | 0.01127 | 0.06009 | 0.001129 | 0.001129 |
| 3 | 4.00 | 0.75 | 0.01182 | 0.1469 | 0.004796 | 0.004796 |
| 4 | 6.00 | 0.75 | 0.01225 | 0.143 | 0.008888 | 0.008888 |
| 5 | 8.00 | 0.75 | 0.01266 | 0.2189 | 0.0127 | 0.0127 |
| 6 | 10.00 | 0.75 | 0.0135 | 0.2873 | 0.01651 | 0.01651 |
| 7 | 12.00 | 0.75 | 0.01429 | 0.3483 | 0.02031 | 0.02031 |
| 8 | 14.00 | 0.75 | 0.01498 | 0.4009 | 0.02384 | 0.02384 |
| 9 | 16.00 | 0.75 | 0.01557 | 0.4496 | 0.02751 | 0.02751 |
| 10 | 18.00 | 0.75 | 0.01607 | 0.4908 | 0.03104 | 0.03104 |
| 11 | 20.00 | 0.75 | 0.01648 | 0.5329 | 0.03456 | 0.03456 |
| 12 | 22.00 | 0.75 | 0.01683 | 0.5689 | 0.03809 | 0.03809 |
| 13 | 24.00 | 0.75 | 0.01715 | 0.6005 | 0.0419 | 0.0419 |
| 14 | 26.00 | 0.75 | 0.01735 | 0.6294 | 0.04543 | 0.04543 |
| 15 | 28.00 | 0.75 | 0.01757 | 0.6558 | 0.04938 | 0.04938 |
| 16 | 98.00 | 0.75 | 0.02125 | 0.6014 | 0.1943 | 0.1943 |
| 17 | 180.15 | 0.75 | 0.03304 | 0.6724 | 0.3589 | 0.3589 |

# DIRECT SHEAR TEST DATA

AECOM

Project: COLETO CREEK FACILITY
Boring No.: B-1-1
Sample No.: S-16-18
Test No.: 1.25 TSF

Location: IPR-GDF SUEZ
Tested By: BCM
Test Date: 12/17/11
Sample Type: TRIMMED

Project No.: 60225561
Checked By: WPQ
Depth: ----
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.25 | 0.01189 | 0 | 0 | 0 |
| 2 | 12.00 | 1.25 | 0.01458 | 0.07233 | 0.002821 | 0.002821 |
| 3 | 14.00 | 1.25 | 0.01451 | 0.07971 | 0.006913 | 0.006913 |
| 4 | 16.00 | 1.25 | 0.01467 | 0.08127 | 0.011 | 0.011 |
| 5 | 18.00 | 1.25 | 0.01488 | 0.1684 | 0.01481 | 0.01481 |
| 6 | 20.00 | 1.25 | 0.01499 | 0.1843 | 0.0189 | 0.0189 |
| 7 | 22.00 | 1.25 | 0.0153 | 0.313 | 0.02271 | 0.02271 |
| 8 | 24.00 | 1.25 | 0.01616 | 0.413 | 0.0261 | 0.0261 |
| 9 | 26.00 | 1.25 | 0.01703 | 0.5094 | 0.02963 | 0.02963 |
| 10 | 28.00 | 1.25 | 0.01777 | 0.5879 | 0.03315 | 0.03315 |
| 11 | 33.00 | 1.25 | 0.01959 | 0.7097 | 0.04246 | 0.04246 |
| 12 | 38.00 | 1.25 | 0.02117 | 0.8061 | 0.05206 | 0.05206 |
| 13 | 43.00 | 1.25 | 0.02223 | 0.8912 | 0.06193 | 0.06193 |
| 14 | 48.00 | 1.25 | 0.02302 | 0.9647 | 0.07209 | 0.07209 |
| 15 | 53.00 | 1.25 | 0.02348 | 1.018 | 0.08196 | 0.08196 |
| 16 | 58.00 | 1.25 | 0.02364 | 1.05 | 0.09198 | 0.09198 |
| 17 | 63.00 | 1.25 | 0.02373 | 1.067 | 0.1021 | 0.1021 |
| 18 | 68.00 | 1.25 | 0.02364 | 1.064 | 0.1126 | 0.1126 |
| 19 | 73.00 | 1.25 | 0.02385 | 1.029 | 0.123 | 0.123 |
| 20 | 78.00 | 1.25 | 0.02424 | 0.9962 | 0.1333 | 0.1333 |
| 21 | 83.00 | 1.25 | 0.0247 | 0.969 | 0.1436 | 0.1436 |
| 22 | 88.00 | 1.25 | 0.02532 | 0.941 | 0.1542 | 0.1542 |
| 23 | 93.00 | 1.25 | 0.02591 | 0.9196 | 0.1648 | 0.1648 |
| 24 | 98.00 | 1.25 | 0.02646 | 0.9006 | 0.1754 | 0.1754 |
| 25 | 103.00 | 1.25 | 0.02715 | 0.8831 | 0.1859 | 0.1859 |
| 26 | 108.00 | 1.25 | 0.02788 | 0.8749 | 0.1964 | 0.1964 |
| 27 | 113.00 | 1.25 | 0.02879 | 0.8695 | 0.2068 | 0.2068 |
| 28 | 118.00 | 1.25 | 0.02939 | 0.8679 | 0.2174 | 0.2174 |
| 29 | 123.00 | 1.25 | 0.03015 | 0.871 | 0.2277 | 0.2277 |
| 30 | 128.00 | 1.25 | 0.03082 | 0.8718 | 0.2378 | 0.2378 |
| 31 | 133.00 | 1.25 | 0.03154 | 0.8706 | 0.248 | 0.248 |
| 32 | 138.00 | 1.25 | 0.03235 | 0.8772 | 0.2577 | 0.2577 |
| 33 | 143.00 | 1.25 | 0.03304 | 0.8858 | 0.2673 | 0.2673 |
| 34 | 148.00 | 1.25 | 0.0338 | 0.8955 | 0.2769 | 0.2769 |
| 35 | 153.00 | 1.25 | 0.03439 | 0.9017 | 0.2872 | 0.2872 |
| 36 | 158.00 | 1.25 | 0.03505 | 0.9064 | 0.2972 | 0.2972 |
| 37 | 163.00 | 1.25 | 0.03568 | 0.9091 | 0.3074 | 0.3074 |
| 38 | 168.00 | 1.25 | 0.0363 | 0.9185 | 0.3176 | 0.3176 |
| 39 | 173.00 | 1.25 | 0.03691 | 0.922 | 0.3276 | 0.3276 |
| 40 | 178.00 | 1.25 | 0.03753 | 0.9262 | 0.3377 | 0.3377 |
| 41 | 183.00 | 1.25 | 0.03808 | 0.9321 | 0.3476 | 0.3476 |
| 42 | 188.00 | 1.25 | 0.03874 | 0.9282 | 0.3578 | 0.3578 |
| 43 | 193.00 | 1.25 | 0.0393 | 0.929 | 0.3678 | 0.3678 |
| 44 | 198.00 | 1.25 | 0.03976 | 0.9309 | 0.3779 | 0.3779 |
| 45 | 203.00 | 1.25 | 0.04033 | 0.941 | 0.3884 | 0.3884 |
| 46 | 208.00 | 1.25 | 0.04084 | 0.9383 | 0.399 | 0.399 |
| 47 | 213.00 | 1.25 | 0.04139 | 0.9371 | 0.4095 | 0.4095 |
| 48 | 218.00 | 1.25 | 0.04193 | 0.9379 | 0.42 | 0.42 |
| 49 | 223.00 | 1.25 | 0.04244 | 0.9356 | 0.4307 | 0.4307 |
| 50 | 228.00 | 1.25 | 0.04296 | 0.936 | 0.4413 | 0.4413 |
| 51 | 233.00 | 1.25 | 0.04351 | 0.9391 | 0.4517 | 0.4517 |
| 52 | 238.00 | 1.25 | 0.04403 | 0.9406 | 0.462 | 0.462 |
| 53 | 243.00 | 1.25 | 0.04459 | 0.9476 | 0.4723 | 0.4723 |
| 54 | 248.00 | 1.25 | 0.04511 | 0.9566 | 0.4823 | 0.4823 |

DIRECT SHEAR TEST DATA

Project: COLETO CREEK FACILITY
Location: IPR-GDF SUEZ
Project No.: 60225561
Boring No.: B-1-1
Tested By: BCM
Checked By: WPQ
Sample No.: S-16-18
Test Date: 12/17/11
Depth: ----
Test No.: 1.75 TSF
Sample Type: TRIMMED
Elevation: ----

Soil Description: CALICHE SOIL (CALSIUM CARBONATE) SOME F-C SAND TRACE F GRAVEL - WHITE
Remarks: TEST PERFORMED AS PER ASTM D 3080. SPECIMEN REMOLDED TO 117.0 PCF@ 16.5 WC

Step: 1 of 1

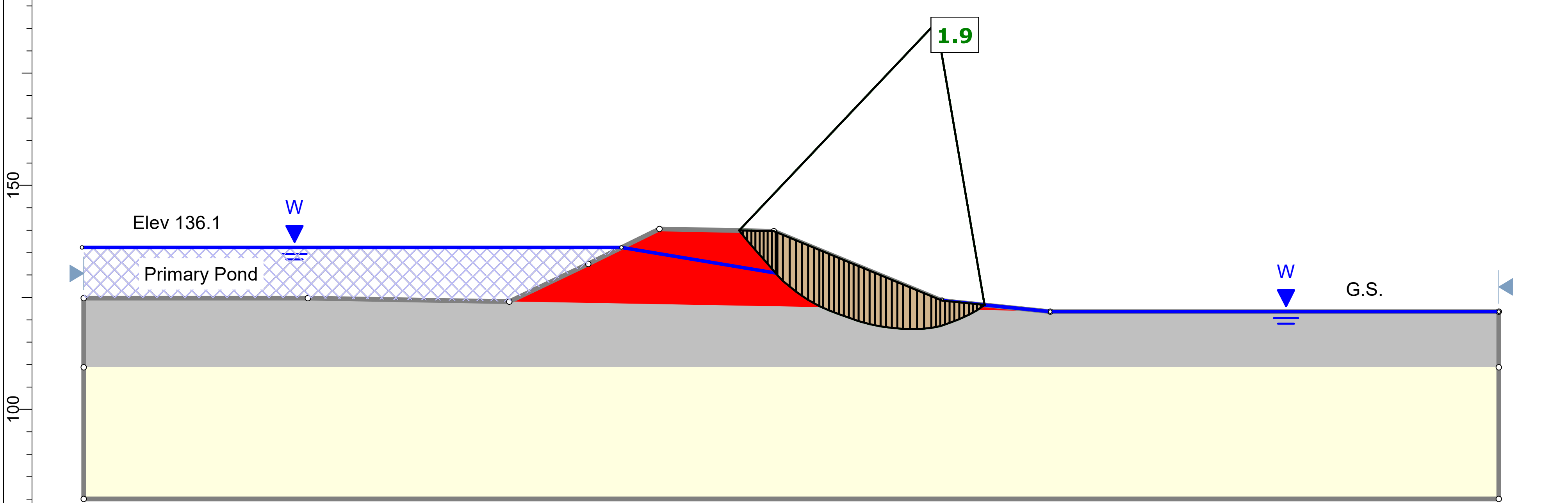
| | Elapsed Time min | Vertical Stress tsf | Vertical Displacement in | Horizontal Stress tsf | Horizontal Displacement in | Cumulative Displacement in |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 1.75 | 0.01256 | 0 | 0 | 0 |
| 2 | 4.00 | 1.75 | 0.01529 | 0.1083 | 0.001552 | 0.001552 |
| 3 | 6.00 | 1.75 | 0.0162 | 0.107 | 0.00522 | 0.00522 |
| 4 | 8.00 | 1.75 | 0.01687 | 0.1474 | 0.009311 | 0.009311 |
| 5 | 10.00 | 1.75 | 0.01767 | 0.3553 | 0.0127 | 0.0127 |
| 6 | 12.00 | 1.75 | 0.01877 | 0.497 | 0.01622 | 0.01622 |
| 7 | 14.00 | 1.75 | 0.01979 | 0.615 | 0.01961 | 0.01961 |
| 8 | 16.00 | 1.75 | 0.0207 | 0.7159 | 0.02328 | 0.02328 |
| 9 | 18.00 | 1.75 | 0.02152 | 0.8062 | 0.02694 | 0.02694 |
| 10 | 20.00 | 1.75 | 0.02223 | 0.904 | 0.03061 | 0.03061 |
| 11 | 22.00 | 1.75 | 0.02289 | 0.9887 | 0.03414 | 0.03414 |
| 12 | 24.00 | 1.75 | 0.02361 | 1.072 | 0.03809 | 0.03809 |
| 13 | 26.00 | 1.75 | 0.02409 | 1.144 | 0.0419 | 0.0419 |
| 14 | 28.00 | 1.75 | 0.02466 | 1.209 | 0.04585 | 0.04585 |
| 15 | 98.00 | 1.75 | 0.0315 | 1.356 | 0.1888 | 0.1888 |
| 16 | 198.00 | 1.75 | 0.04639 | 1.405 | 0.392 | 0.392 |
| 17 | 243.36 | 1.75 | 0.0505 | 1.298 | 0.4572 | 0.4572 |

# APPENDIX C

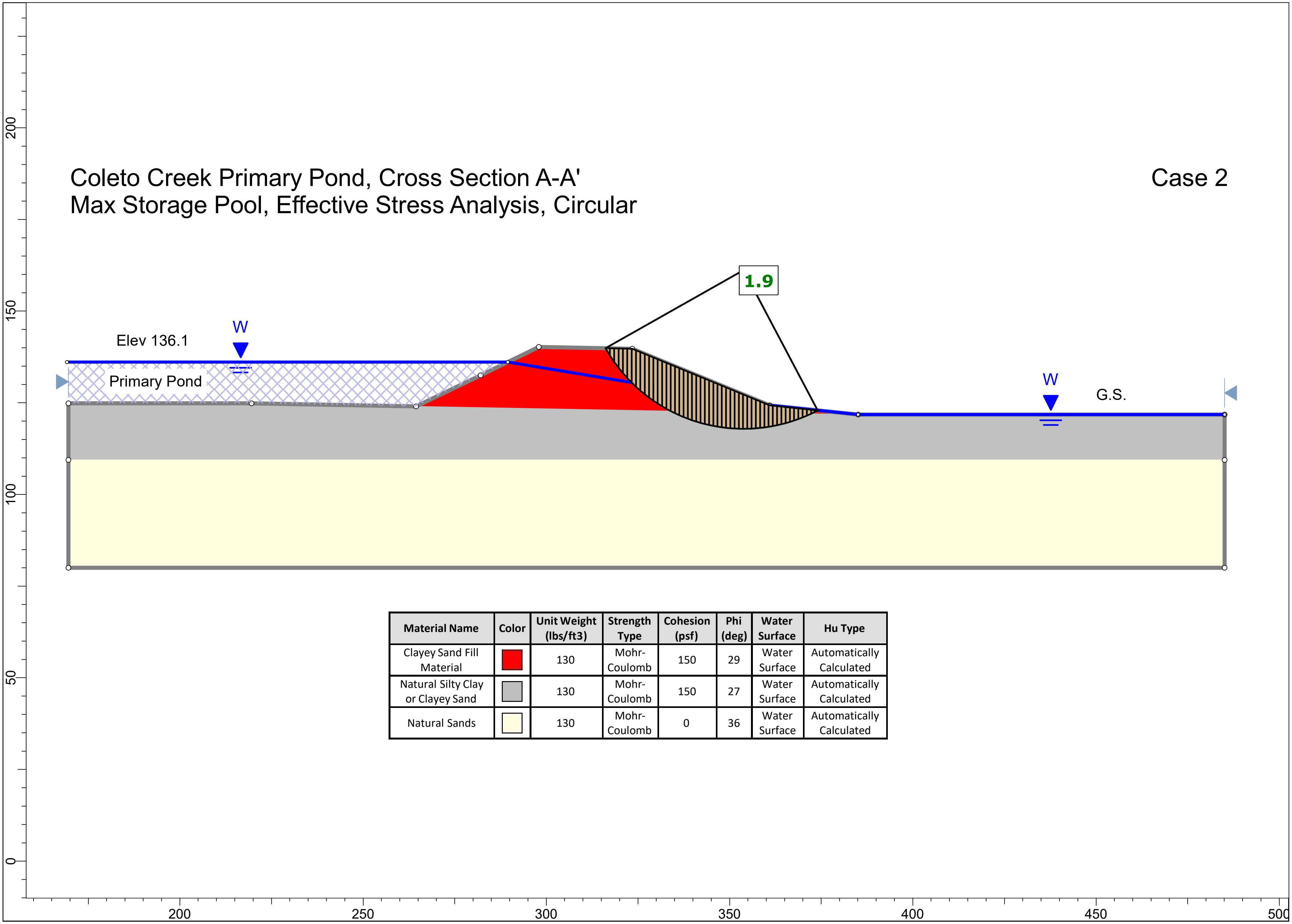
## Slide 7.0 Stability Analysis Models

# Coleto Creek Primary Pond, Cross Section A-A'
# Max Storage Pool, Effective Stress Analysis, Non-circular

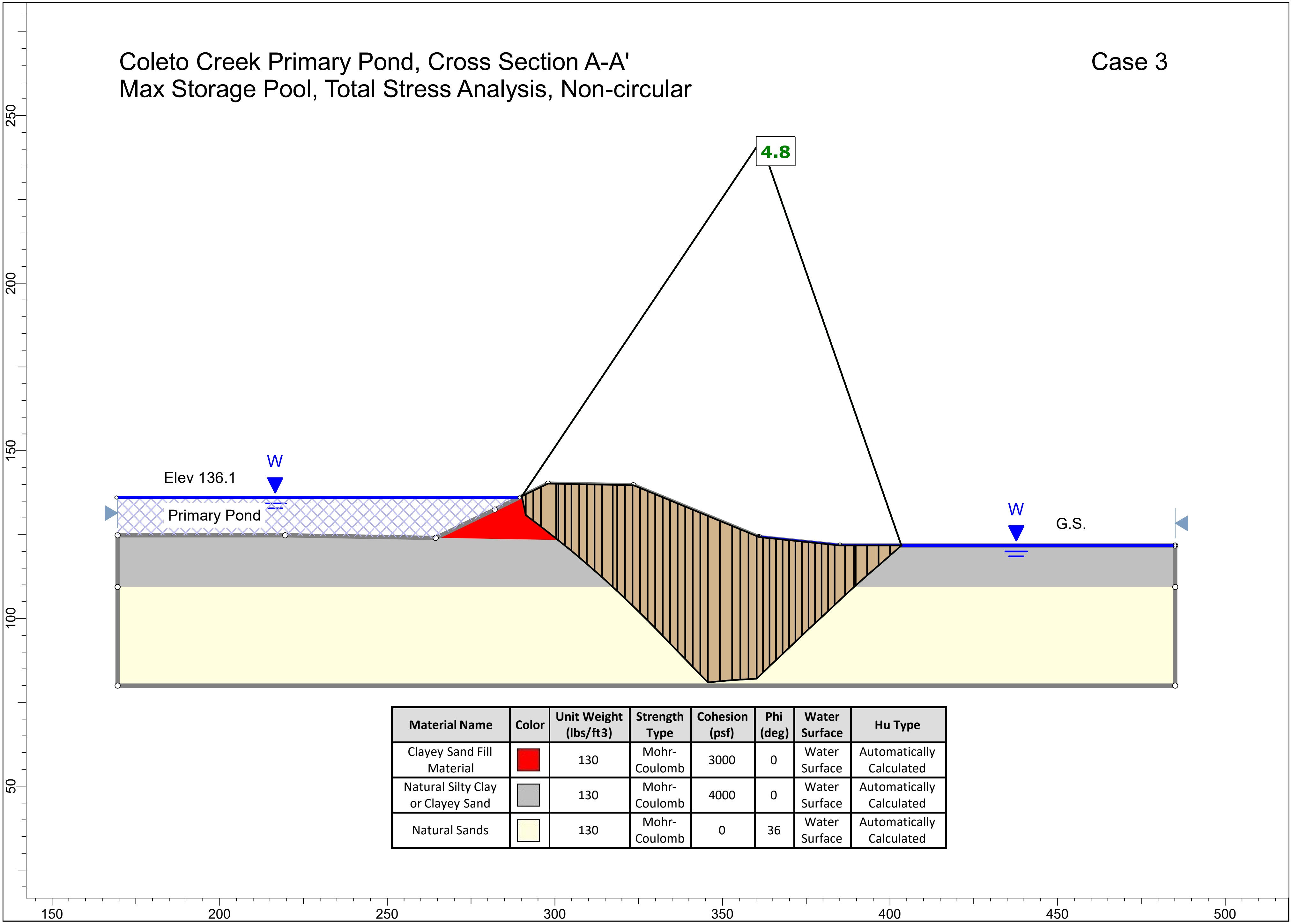
Case 1




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |



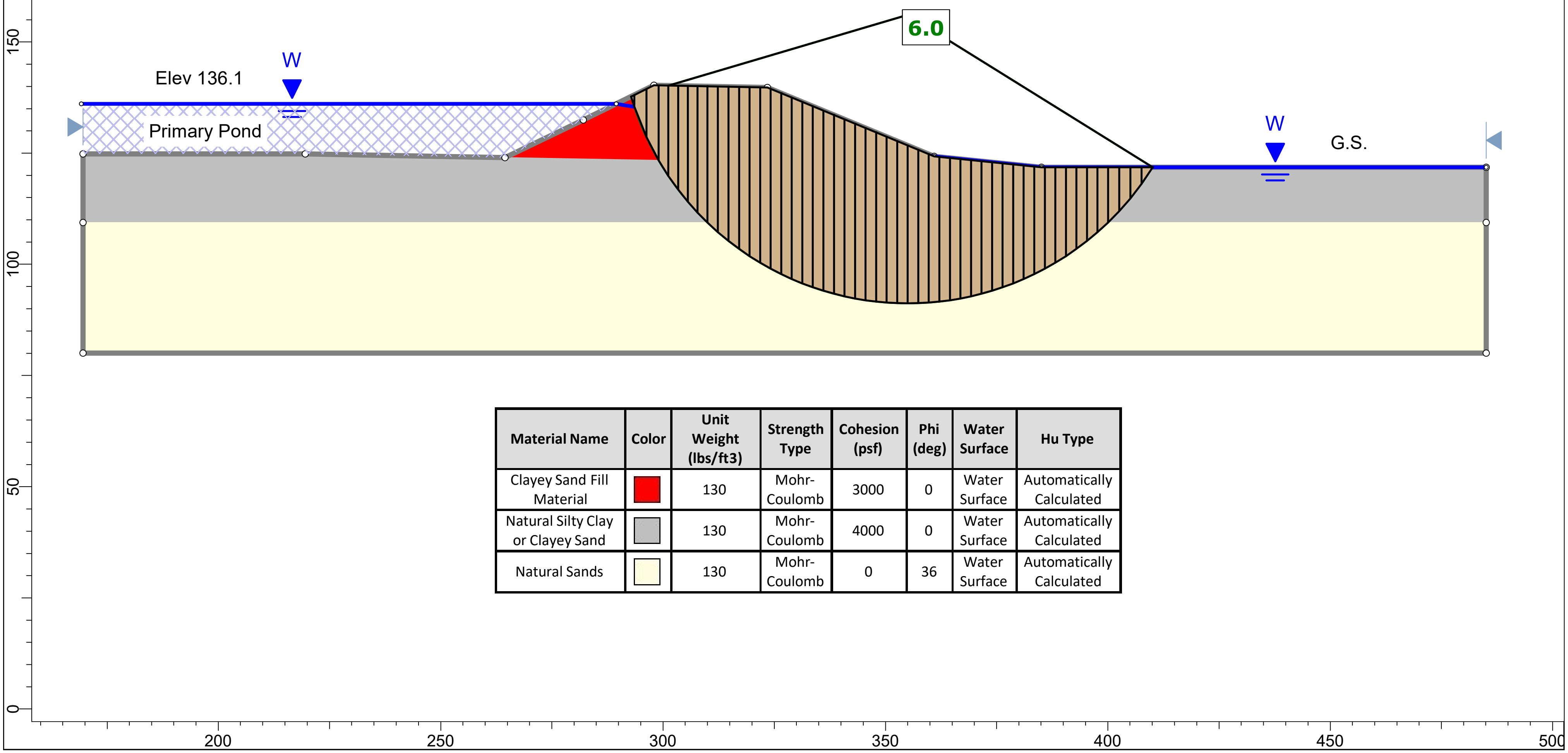

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto Creek Primary Pond, Cross Section A-A'
Max Storage Pool, Total Stress Analysis, Circular

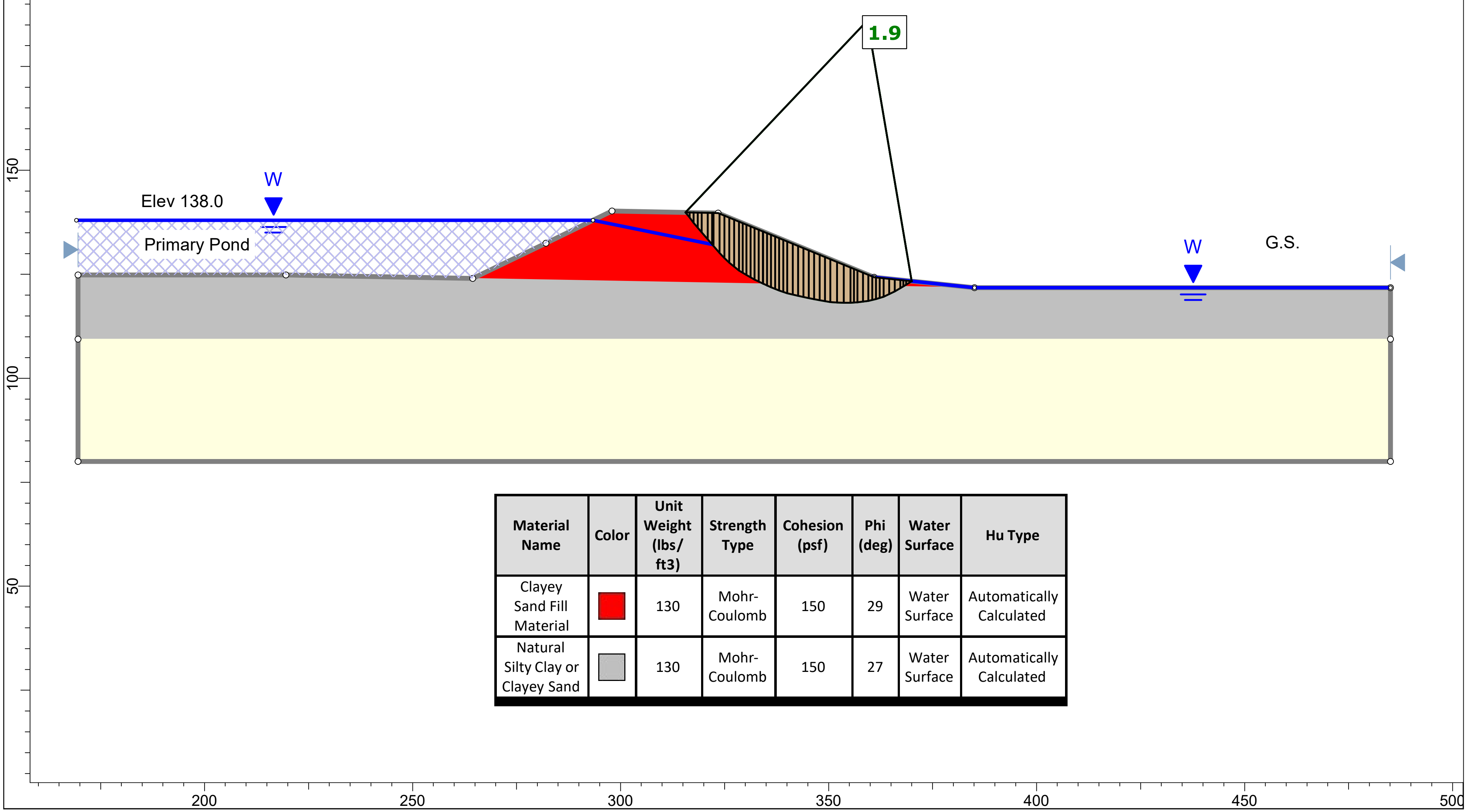
Case 4



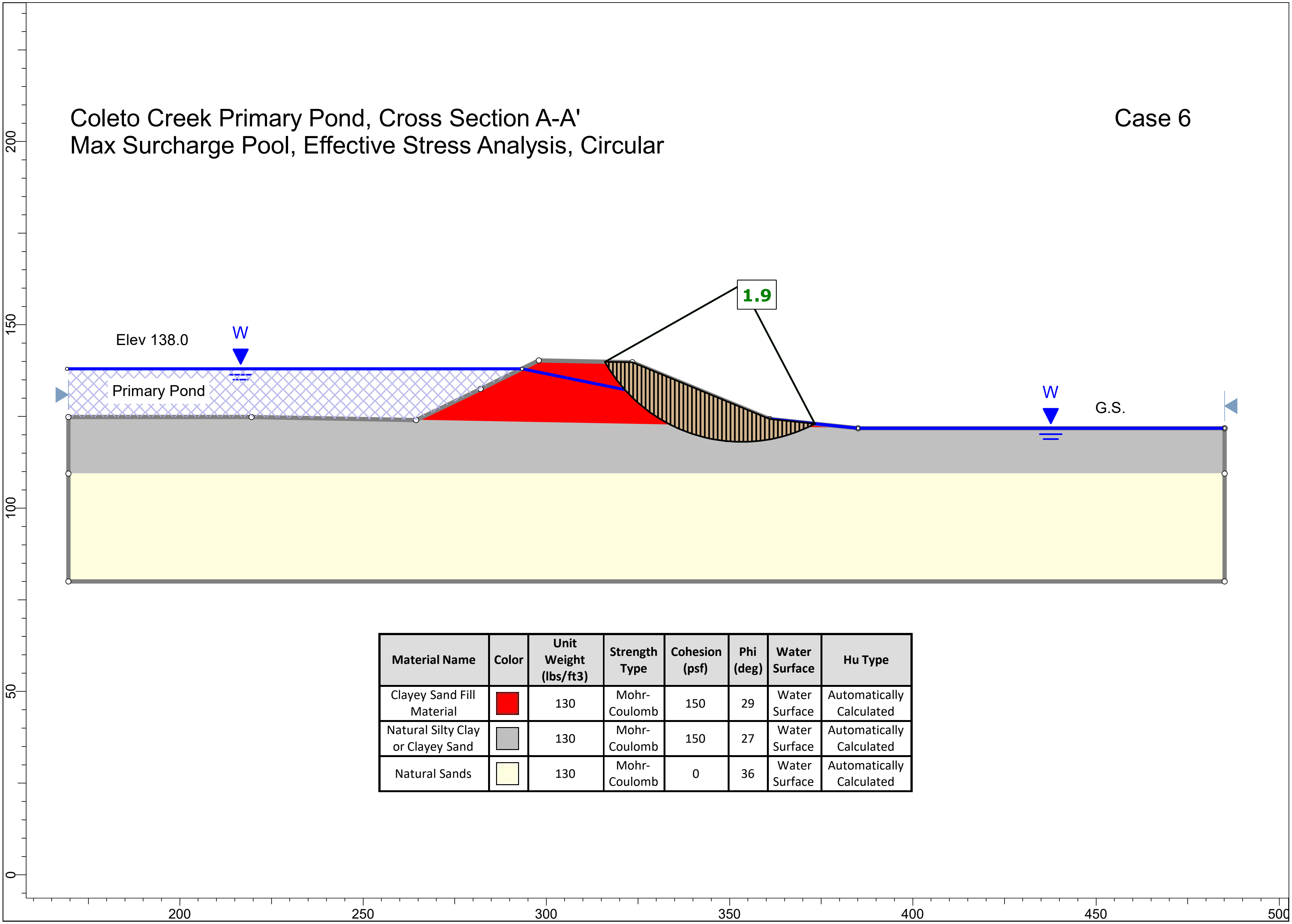

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto Creek Primary Pond, Cross Section A-A'
Max Surcharge Pool, Effective Stress Analysis, Non-circular

Case 5



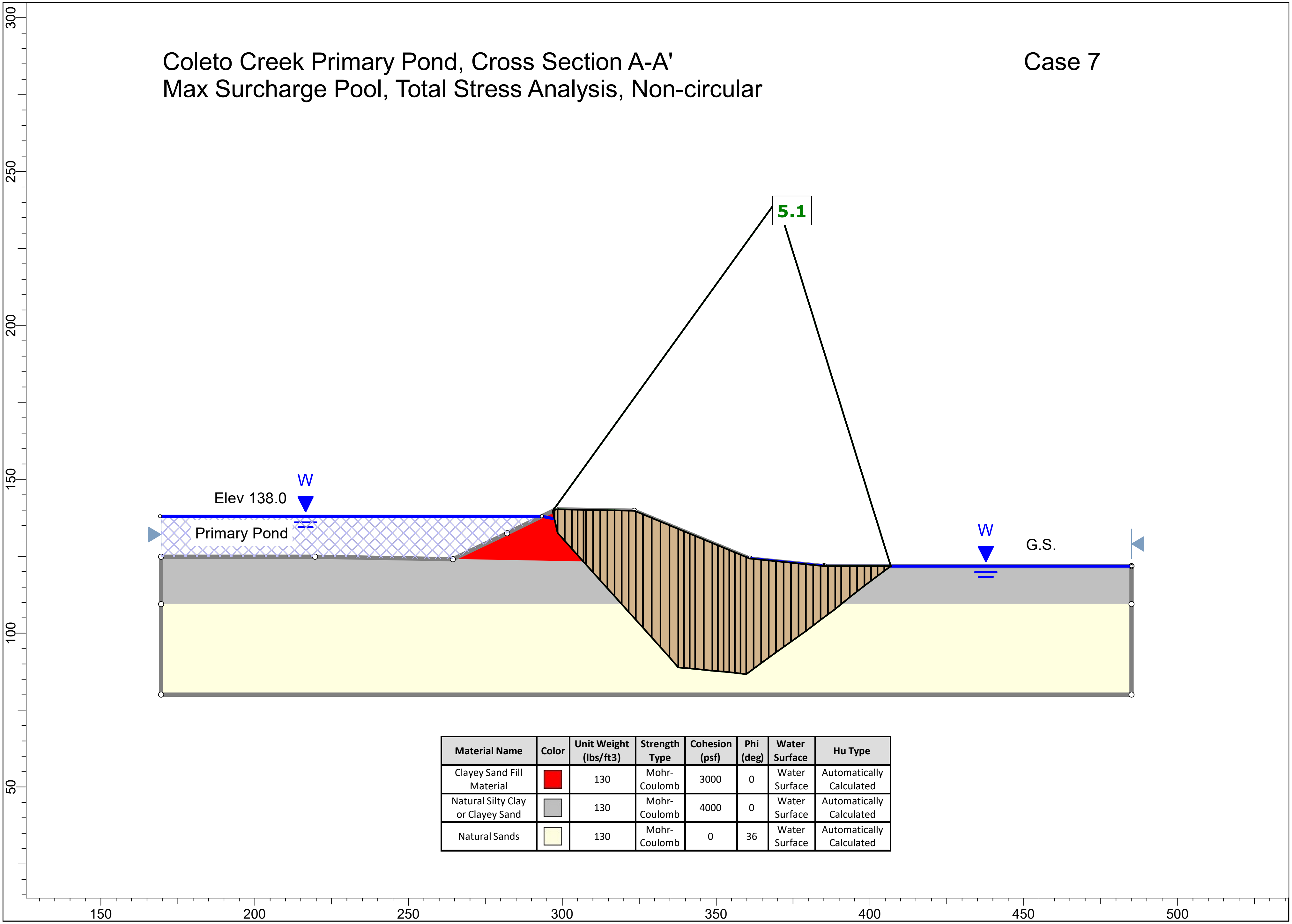

| Material Name | Color | Unit Weight (lbs/ ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 150 | 27 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

## Coleto Creek Primary Pond, Cross Section A-A'
## Max Surcharge Pool, Total Stress Analysis, Non-circular

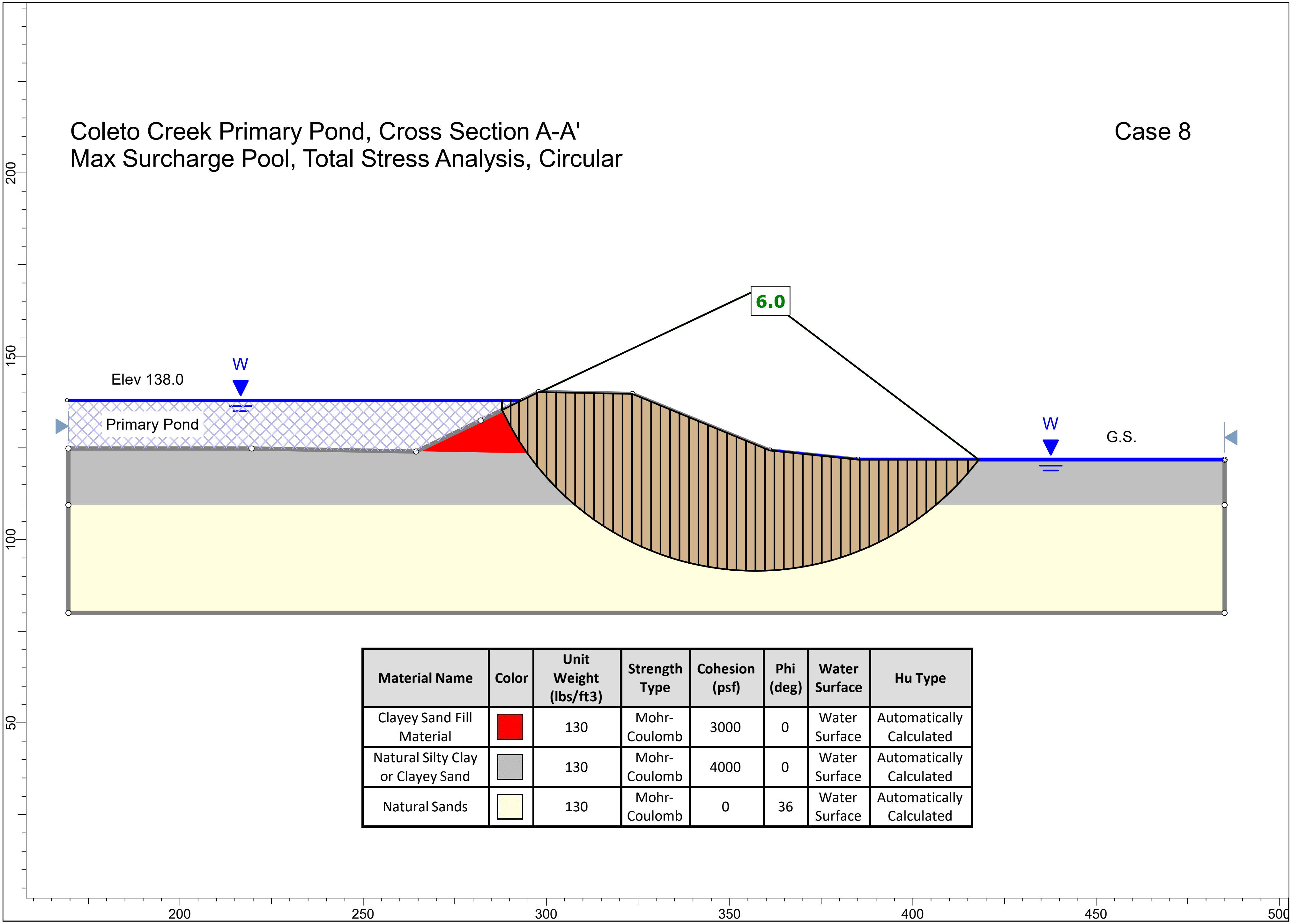
Case 7




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

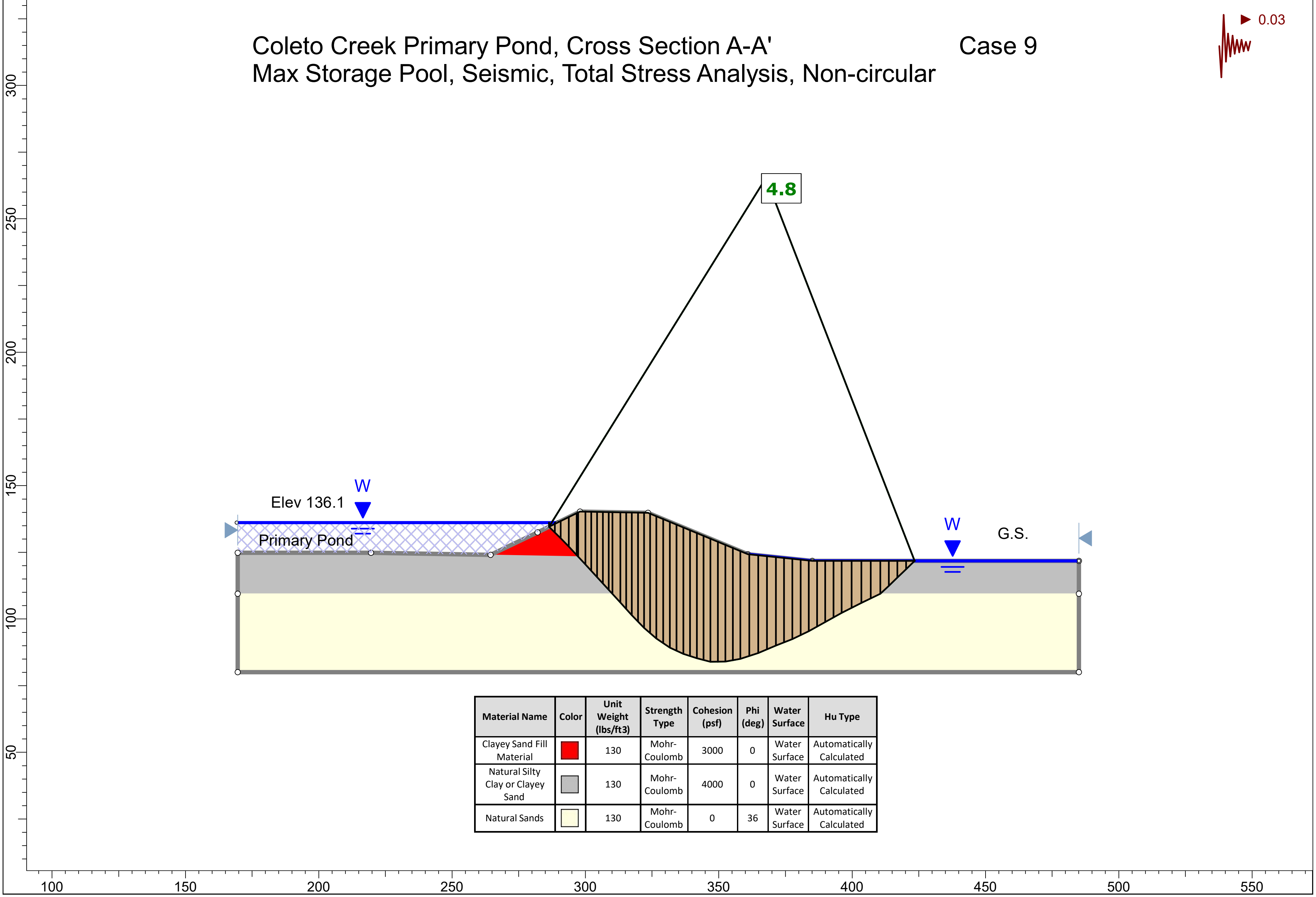
Coleto Creek Primary Pond, Cross Section A-A'
Max Surcharge Pool, Total Stress Analysis, Circular

Case 8

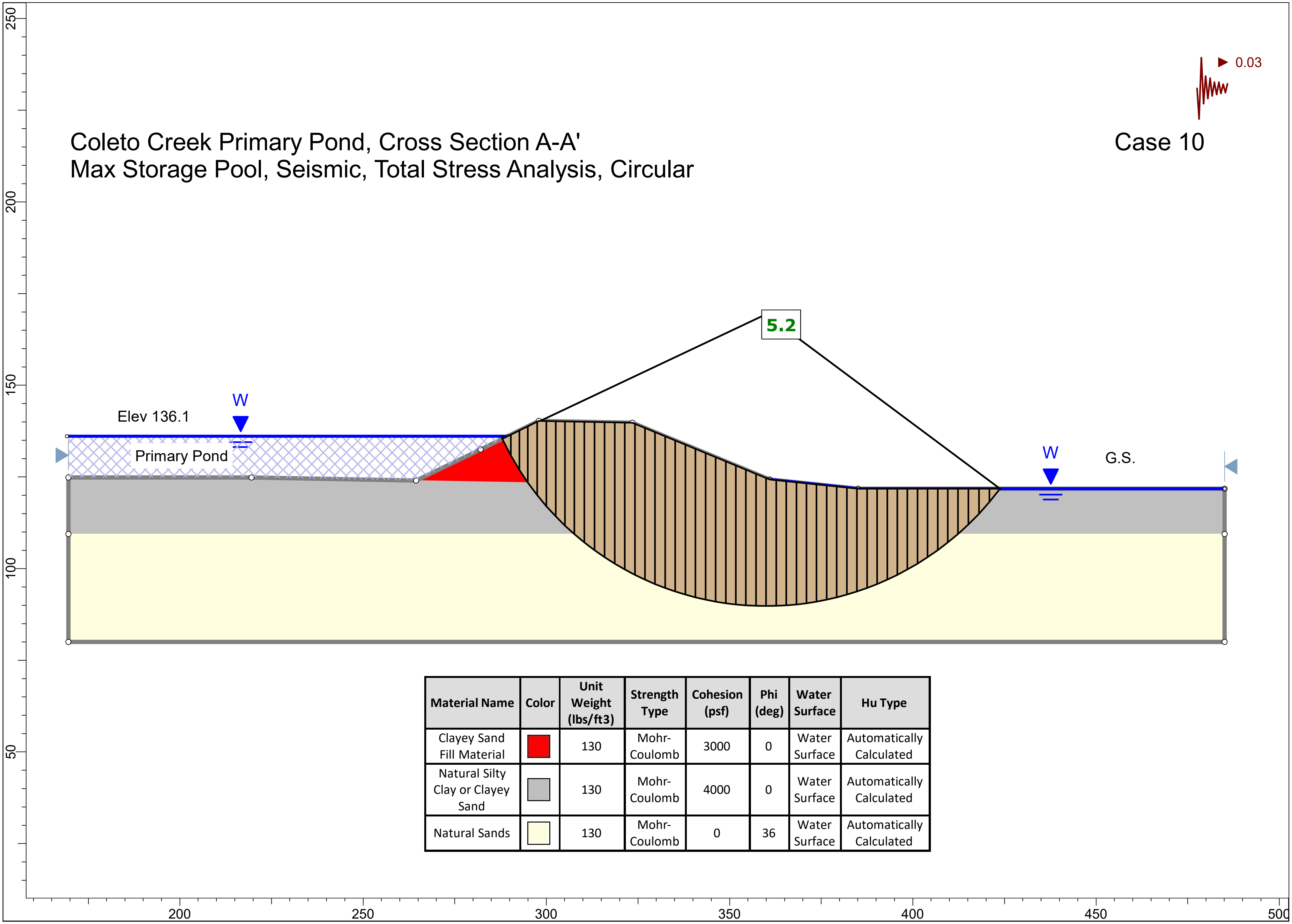



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

Coleto Creek Primary Pond, Cross Section A-A' Case 9
Max Storage Pool, Seismic, Total Stress Analysis, Non-circular



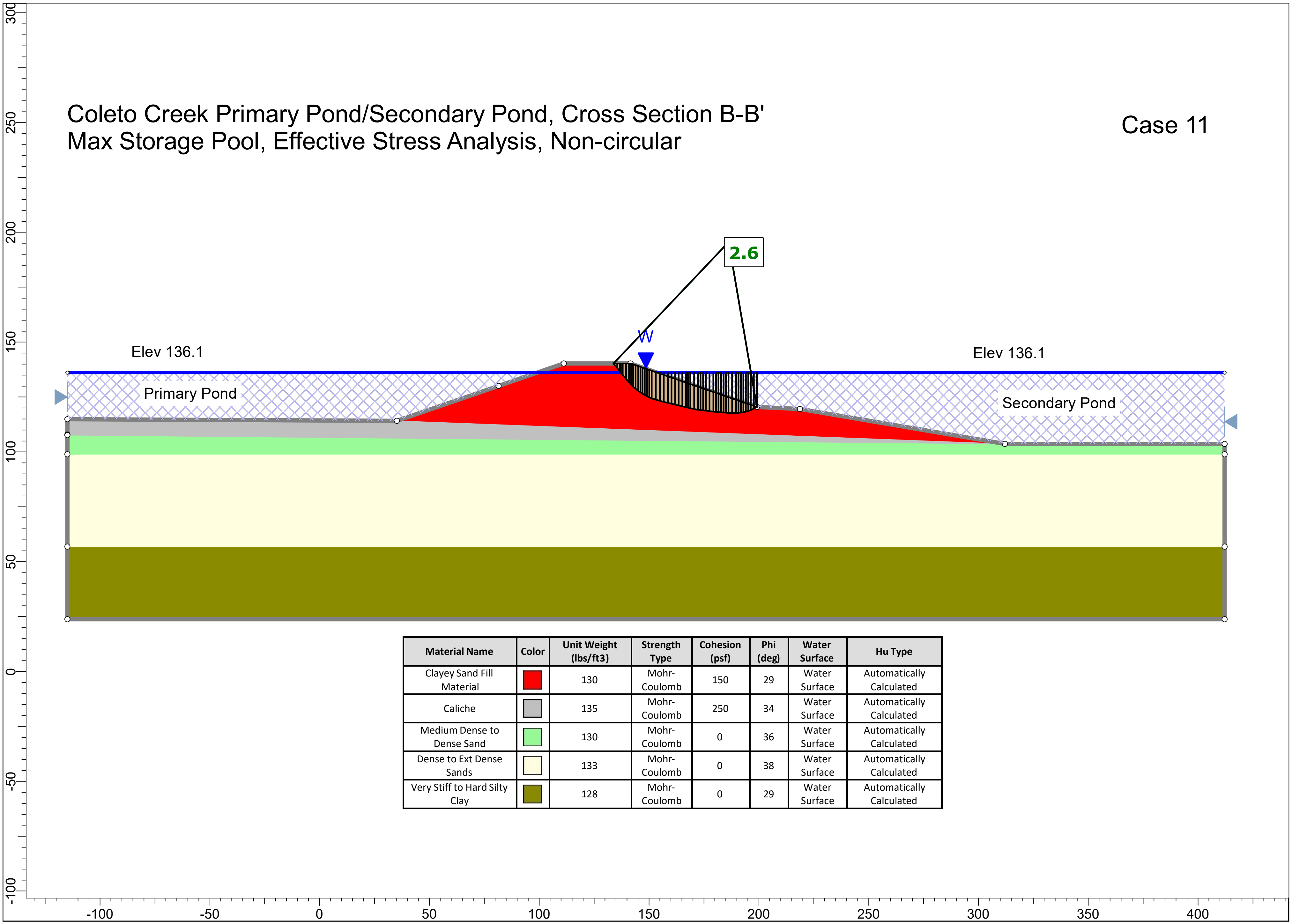

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |



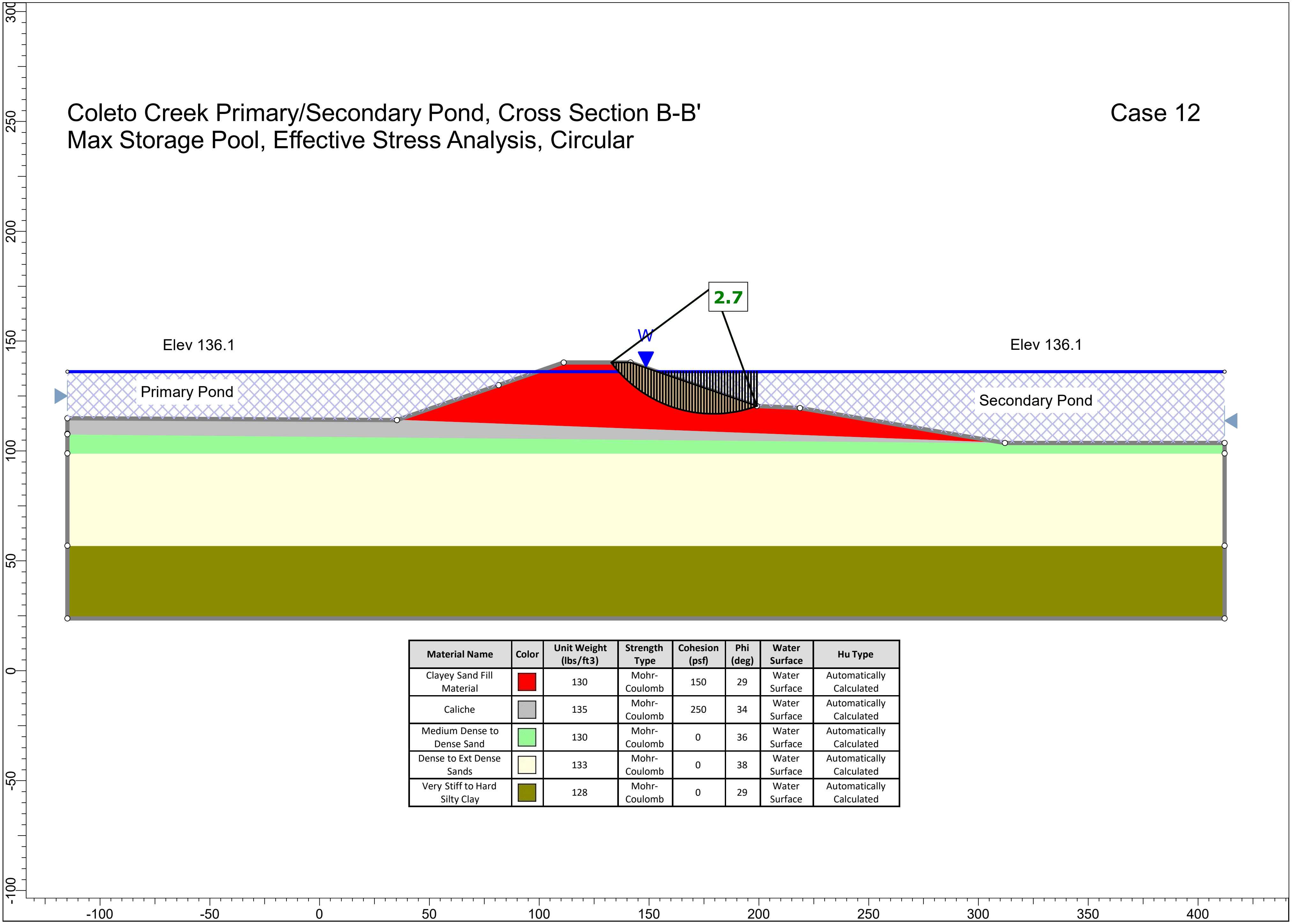

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Natural Silty Clay or Clayey Sand | | 130 | Mohr-Coulomb | 4000 | 0 | Water Surface | Automatically Calculated |
| Natural Sands | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |

# Coleto Creek Primary Pond/Secondary Pond, Cross Section B-B'
# Max Storage Pool, Effective Stress Analysis, Non-circular

Case 11

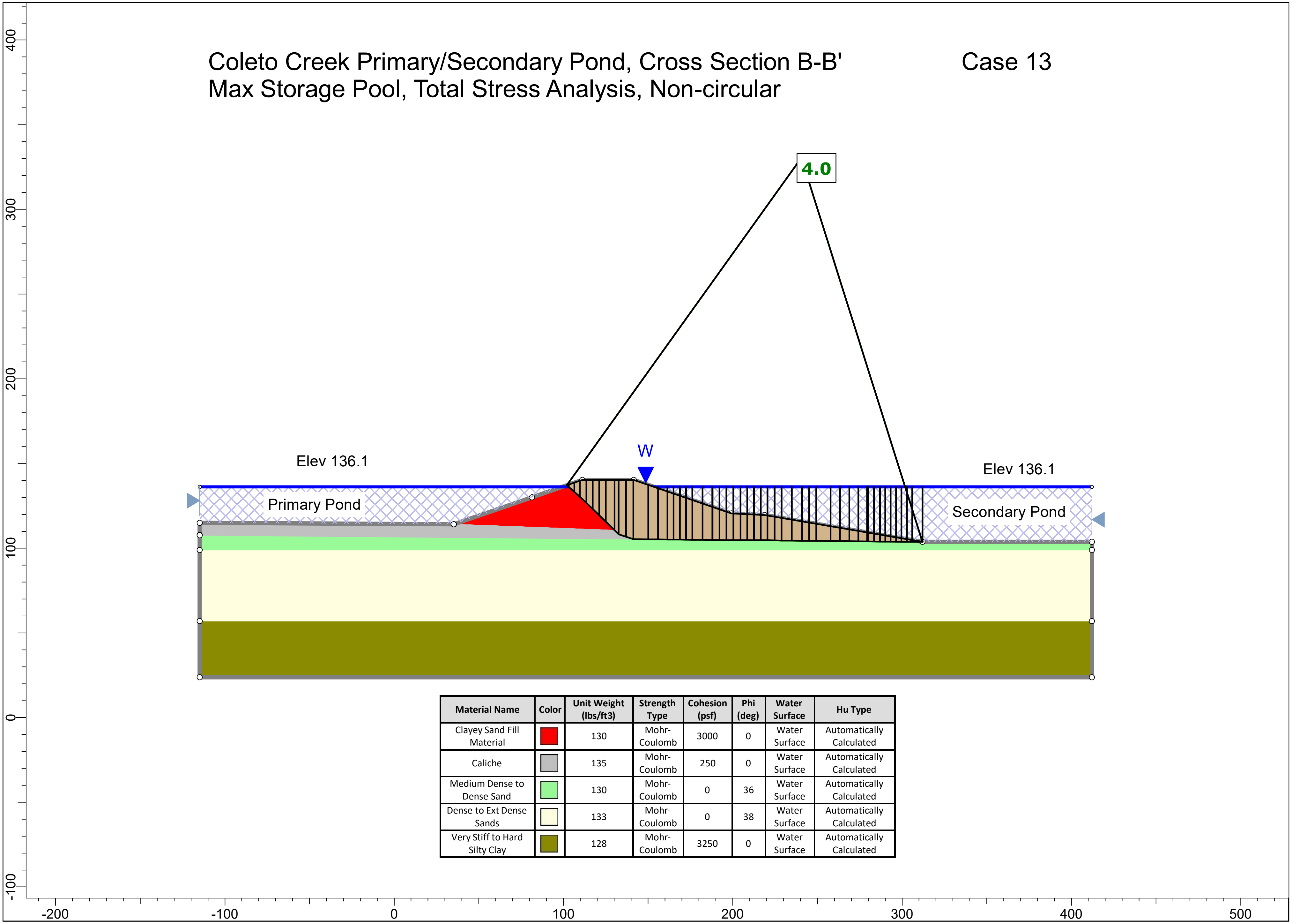



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 34 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 0 | 29 | Water Surface | Automatically Calculated |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 150 | 29 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 34 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 0 | 29 | Water Surface | Automatically Calculated |

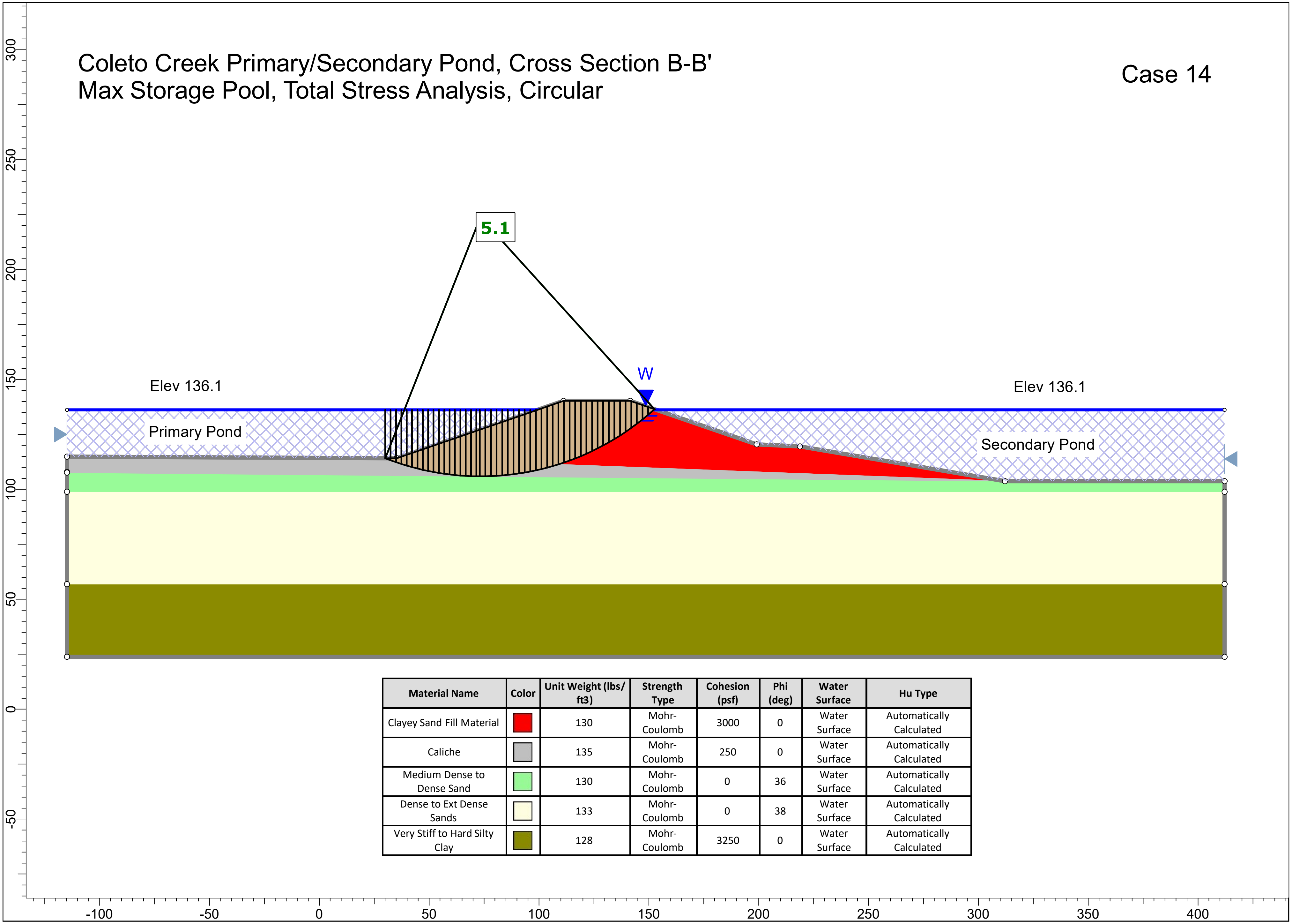
Coleto Creek Primary/Secondary Pond, Cross Section B-B' Case 13
Max Storage Pool, Total Stress Analysis, Non-circular



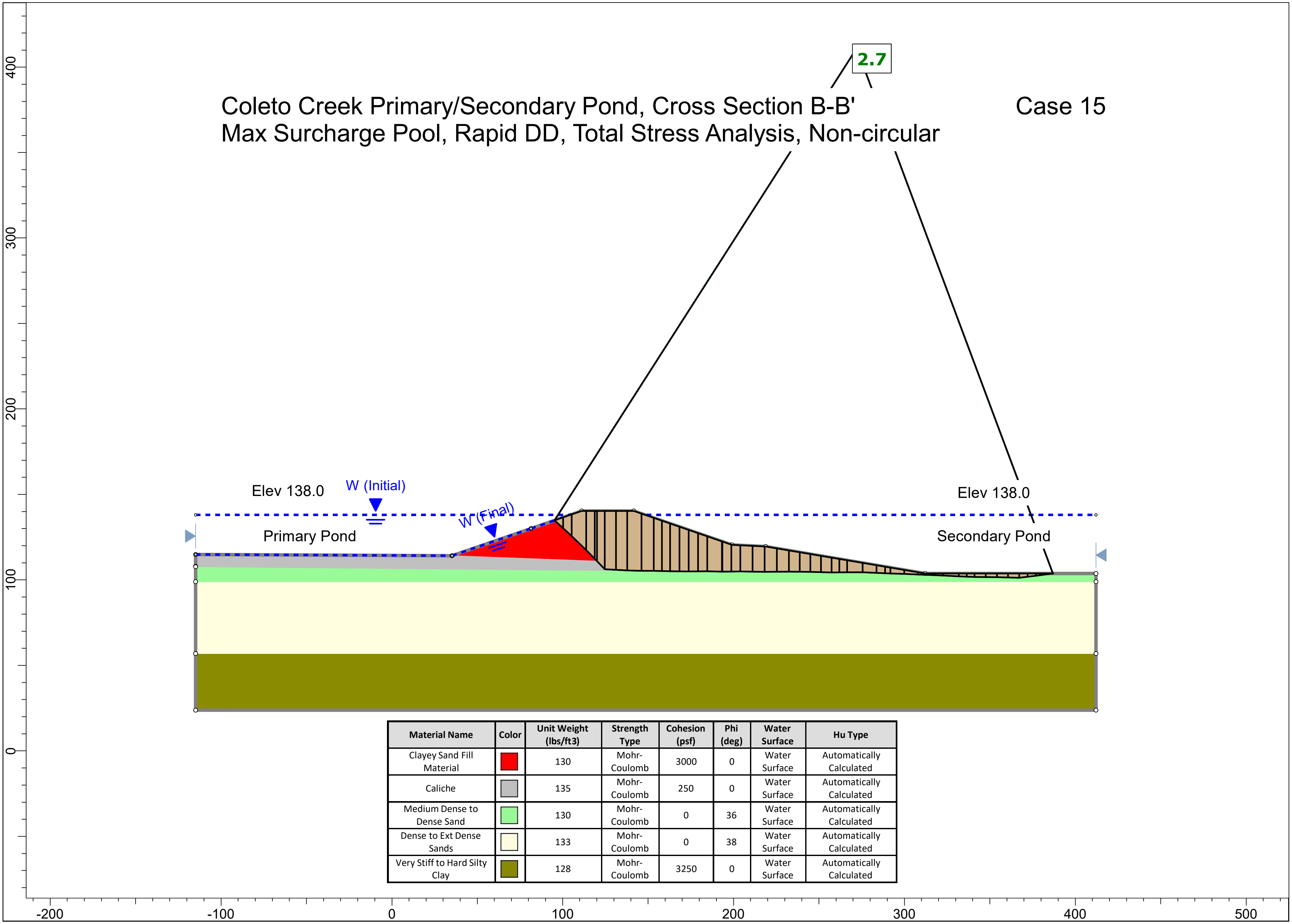

| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

Coleto Creek Primary/Secondary Pond, Cross Section B-B'
Max Storage Pool, Total Stress Analysis, Circular

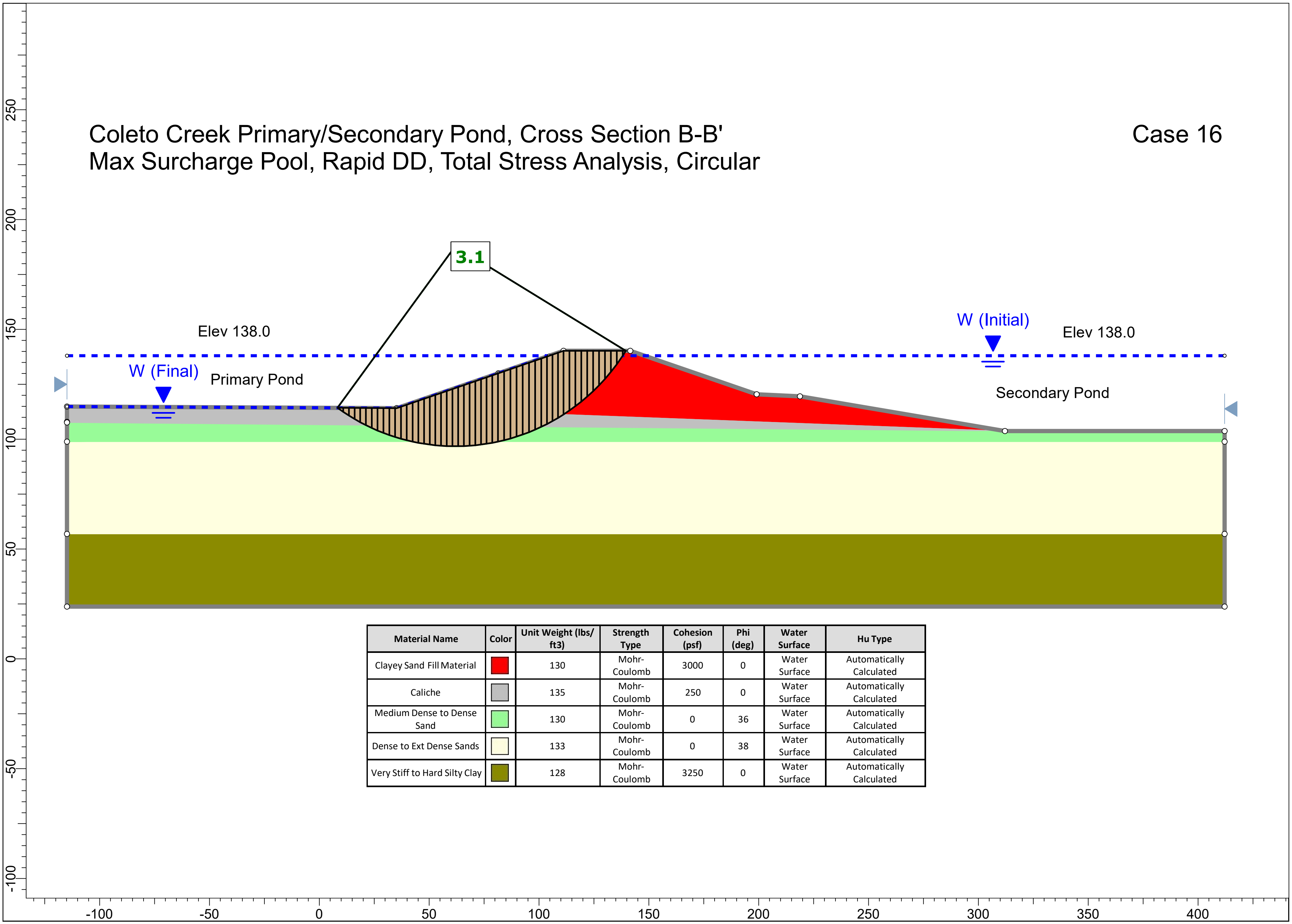
Case 14




| Material Name | Color | Unit Weight (lbs/ ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

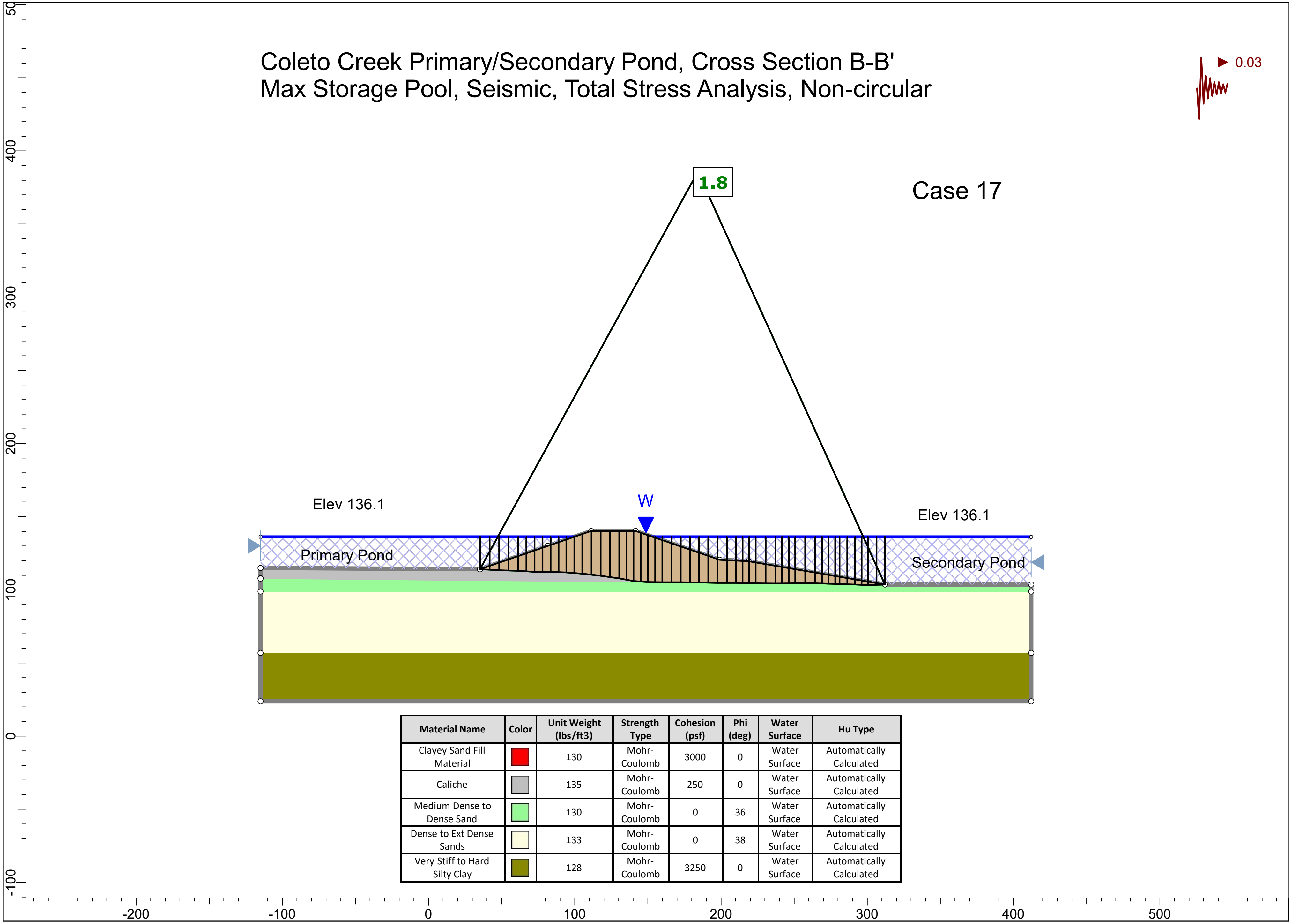



| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

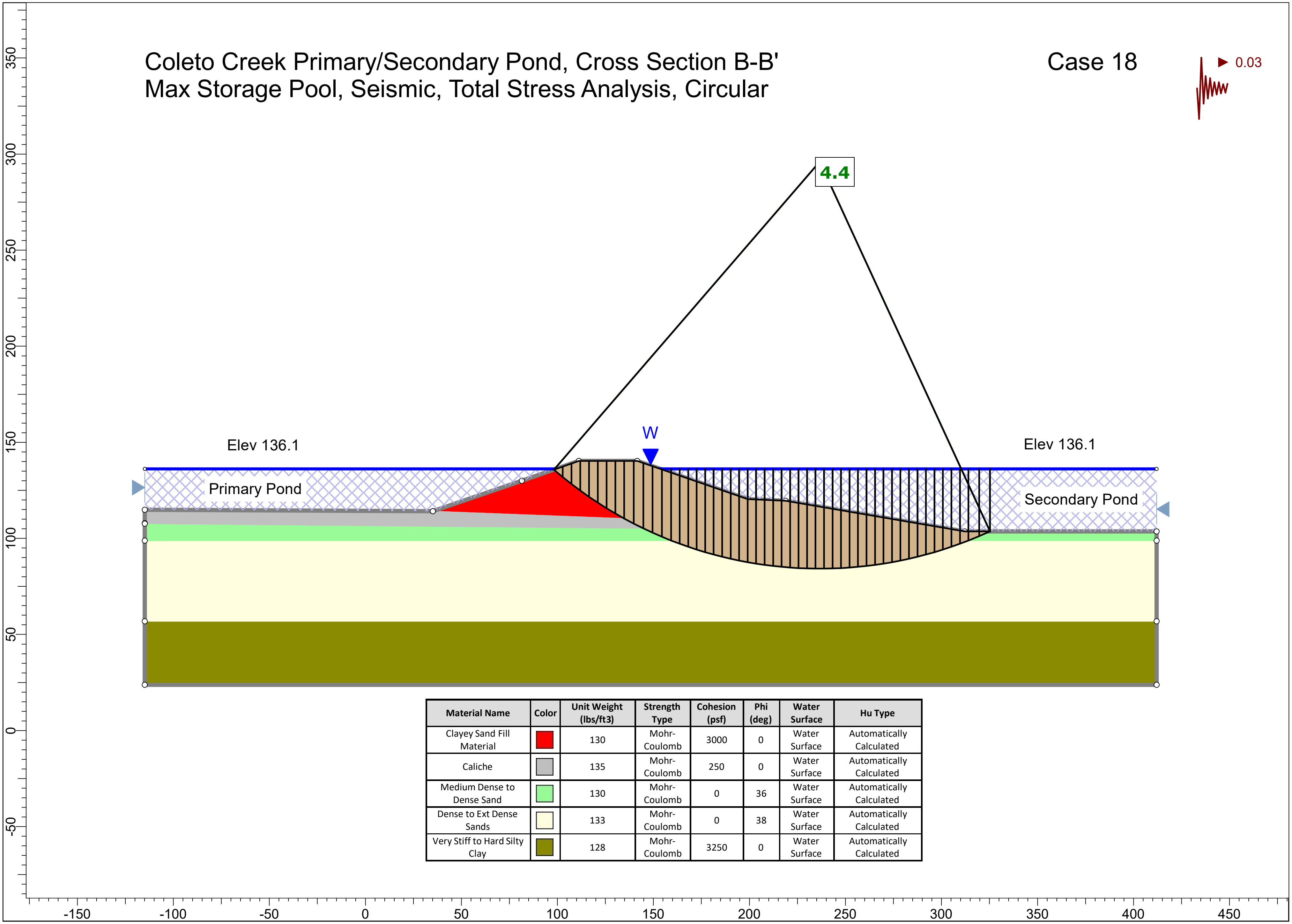
# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
## Max Storage Pool, Seismic, Total Stress Analysis, Non-circular




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

# Coleto Creek Primary/Secondary Pond, Cross Section B-B'
Max Storage Pool, Seismic, Total Stress Analysis, Circular

Case 18




| Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg) | Water Surface | Hu Type |
|---|---|---|---|---|---|---|---|
| Clayey Sand Fill Material | | 130 | Mohr-Coulomb | 3000 | 0 | Water Surface | Automatically Calculated |
| Caliche | | 135 | Mohr-Coulomb | 250 | 0 | Water Surface | Automatically Calculated |
| Medium Dense to Dense Sand | | 130 | Mohr-Coulomb | 0 | 36 | Water Surface | Automatically Calculated |
| Dense to Ext Dense Sands | | 133 | Mohr-Coulomb | 0 | 38 | Water Surface | Automatically Calculated |
| Very Stiff to Hard Silty Clay | | 128 | Mohr-Coulomb | 3250 | 0 | Water Surface | Automatically Calculated |

# APPENDIX D

# Liquefaction Assessment Calculations

# APPENDIX D
# LIQUEFACTION FACTOR OF SAFETY ASSESSMENT METHODOLOGY
## Coleto Creek Power Station

Sources: Coduto, Donald P., Geotechnical Engineering Principles and Practices. Prentice-Hall.

Rauch, Alan F., May 1997. EPOLLS: *An Empiracle Method for Predicting Surface Displacements Due to Liquefaction-Induced Lateral Spreading in Earthquakes.* Dissertation Submitted to Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for degree of Doctor of Philosophy in Civil Engineering.

United States Environmental Protection Agency (USEPA), April 1995. RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities. Office of Research and Development. Washington, DC. EPA/600/R-95/051

Methodology: Standard Penetration Test (SPT)

*Step 1: Compute the standardized value of number of blow counts per foot normalized for overburden stress at the depth of the test*

$$(N_1)_{60} = NSPT \cdot C_N \cdot CE \cdot CB \cdot CS \cdot C_R$$

where:

$(N_1)_{60}$ = Measured blowcount normalized for overburden stress at the depth of the test

$C_N$ = Correction factor to normalize the measured blowcount to an equivalent value under one atmosphere of effective overburden stress

$$C_N = \sqrt{\frac{Pa}{\sigma'_{vo}}} \leq 2.0$$

where:

Pa = one atmosphere of pressure (101.325kPa) in the same units as $\sigma'_{vo}$

$\sigma'_{vo}$ = vertical efffective stress at depth of $N_{SPT}$

$C_E$ =Correction factor of the measured SPT blowcount for level of energy delivered by the SPT hammer, 1.0 for safety hammer type with rope and pulley hammer release

$C_B$ = Correction factor for borehole diameters outside the recommended range of 2.5 to 4.5 inch, 1.0 for borehole inside range

$C_S$ = Correction factor for SPT samplers used without a sample liner, 1.0 for standard sampler

$C_R$ = Correction factor for loss of energy through reflection in short lengths of drill rod:

where:

For z < 3 m; $C_R$ = 0.75

For 3 < z < 9 m; $C_R$ = (15+z)/24

For z > 9 m; $C_R$ = 1.0

where: z = length of drill rod in meters (approximately equal to depth of $N_{SPT}$)

Step 2: Compute a clean-sand equivalent value of $(N_1)_{60}$

$$(N_1)_{60} - cs = (N_1)_{60} + \Delta(N_1)$$

where:

$\Delta(N_1)_{60}$ = correction factor computed as follows:

For FC < 5%, $\Delta(N_1)_{60}$ = 0.0

For 5 < FC < 35%, $\Delta(N_1)_{60}$ = 7*(FC - 5)/30

For FC > 35%, $\Delta(N_1)_{60}$ = 7.0

where:

FC = Fines content (percent finer than 0.075 mm)

Note: Where data was available, those FC were used. Otherwise, representative values from the USGS standard soil classification were used for the soil type observed during drilling.

*Step 3: Compute the cyclic resistance ratio for a standardized magnitude 7.5 earthquake (CRR $_{M7.5}$)*

$$100 \cdot CRR_{M7.5} = \frac{95}{34 - (N_1)_{60} - cs} + \frac{(N_1)_{60} - cs}{1.3} - \frac{1}{2}$$

Note: A value of $(N_1)_{60}$-cs > 30 indicates an unliquefiable soil with an infinite CRR. Designated as UL in the calculation tables.

*Step 4: Adjust the standardized cyclic resistance ratio for the worst-case magnitude of earthquake for the area*

$$CRR = CRRM_{7.5} \cdot MSF \cdot K\sigma \cdot K\alpha$$

where:

MSF = magnitude scaling factor computed as follows:

For $M_w$ < 7.0; MSF = $10^{3.00} * M_w^{-3.46}$

where:

$M_w$ = estimated worst-case magnitude eartquake, 6.1 taken from Figure 3.3 Seismic Source Zones in the Contiguous United States (USGS, 1982) and Table 3.1 Parameters for Seismic Source Zones (USGS, 2982) (USEPA, 1995)

Note: Two additional correction factors are potentially applicable for liquefiable soil deposits subject to significant overburden with a stress factor greater than 1 tsf (2000 psf) ($K\sigma$) or static shear stresses such as significant slopes ($K\alpha$). $K\sigma$ values were interpolated using Figure 5.7 Curves for Estimation of Correction Factor (Harder 1988, and Hynes 1988, as Quoted in Marcuson, et.al., 1990) (USEPA, 1998). No $K\alpha$ factor was applied due to the relatively flat ground surface in the area.

*Step 5: Estimate the average cyclic shear stress (CSR)*

$$CSR = 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_{vo}}{\sigma'_{vo}} \cdot rd$$

where:

$a_{max}/g$ = peak horizonal acceleration that would occur at the ground surface in the absence of excess pore pressures or liquefaction, 0.03 g taken from the 2014 United States Geological Survey National Seismic Hazard Maps found at http://earthquake.usgs.gov/hazards/products/conterminous/2014/2014pga2pct.pdf).

$\sigma_{vo}$ = total vertical overburden stress

g = acceleration due to gravity, 9.81 $m/s^2$

$r_d$ = stress reduction factor calculated as follows for depths up to 30 m:

$r_d = 1.0 + 1.6*10^{-6}(z^4 - 42z^3 + 105z^2 - 4200z)$

Step 6: Calculate the Factor of Safety against liquefaction ($FS_{liq}$)

$$FS_{liq} = \frac{CRR}{CSR}$$

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-1-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 12 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 50' bgs<br>3", 50' to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0.61 | Unsaturated | 40 | SC | 250 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 60.0 | 35 | 7.0 | 67.0 | UL | 1.92 | NA | UL | 0.03 | 250 | 1.00 | UL | UL |
| 2 | 4 | 1.22 | Unsaturated | 13 | SC | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 19.5 | 35 | 7.0 | 26.5 | 0.33 | 1.92 | NA | 0.62 | 0.03 | 500 | 0.99 | 0.019 | 32 |
| 3 | 6 | 1.83 | Unsaturated | 14 | SC | 750 | 1.68 | 1.0 | 1.00 | 1.0 | 0.75 | 17.6 | 35 | 7.0 | 24.6 | 0.29 | 1.92 | NA | 0.55 | 0.03 | 750 | 0.99 | 0.019 | 28 |
| 4 | 8 | 2.44 | Unsaturated | 15 | SC | 1000 | 1.45 | 1.0 | 1.00 | 1.0 | 0.75 | 16.4 | 90.6 | 7.0 | 23.4 | 0.26 | 1.92 | NA | 0.51 | 0.03 | 1000 | 0.98 | 0.019 | 26 |
| 7 | 14 | 4.27 | Saturated | 10 | SC | 1635.4 | 1.14 | 1.0 | 1.00 | 1.0 | 0.80 | 9.1 | 35 | 7.0 | 16.1 | 0.17 | 1.92 | NA | 0.33 | 0.03 | 1760 | 0.97 | 0.020 | 16 |
| 8 | 16 | 4.88 | Saturated | 13 | SC | 1770.8 | 1.09 | 1.0 | 1.00 | 1.0 | 0.83 | 11.8 | 35 | 7.0 | 18.8 | 0.20 | 1.92 | NA | 0.39 | 0.03 | 2020 | 0.96 | 0.021 | 18 |
| 9 | 18 | 5.49 | Saturated | 9 | SC | 1906.2 | 1.05 | 1.0 | 1.00 | 1.0 | 0.85 | 8.1 | 35 | 7.0 | 15.1 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 2280 | 0.96 | 0.022 | 14 |
| 10 | 20 | 6.10 | Saturated | 15 | SC | 2041.6 | 1.02 | 1.0 | 1.00 | 1.0 | 0.88 | 13.4 | 39.5 | 7.0 | 20.4 | 0.22 | 1.92 | 0.93 | 0.40 | 0.03 | 2540 | 0.95 | 0.023 | 17 |
| 12 | 24 | 7.32 | Saturated | 13 | SC | 2312.4 | 0.96 | 1.0 | 1.00 | 1.0 | 0.93 | 11.6 | 35 | 7.0 | 18.6 | 0.20 | 1.92 | 0.92 | 0.35 | 0.03 | 3060 | 0.94 | 0.024 | 15 |
| 13 | 26 | 7.92 | Saturated | 21 | SC | 2447.8 | 0.93 | 1.0 | 1.00 | 1.0 | 0.96 | 18.7 | 35 | 7.0 | 25.7 | 0.31 | 1.92 | 0.92 | 0.54 | 0.03 | 3320 | 0.93 | 0.025 | 22 |
| 14 | 28 | 8.53 | Saturated | 15 | SC | 2583.2 | 0.91 | 1.0 | 1.00 | 1.0 | 0.98 | 13.3 | 35 | 7.0 | 20.3 | 0.22 | 1.92 | 0.91 | 0.39 | 0.03 | 3580 | 0.92 | 0.025 | 16 |
| 15 | 30 | 9.14 | Saturated | 28 | SC | 2718.6 | 0.88 | 1.0 | 1.00 | 1.0 | 1.0 | 24.7 | 35 | 7.0 | 31.7 | UL | 1.92 | 0.91 | UL | 0.03 | 3840 | 0.91 | UL | UL |
| 16 | 32 | 9.75 | Saturated | 12 | SC | 2854 | 0.86 | 1.0 | 1.00 | 1.0 | 1.0 | 10.3 | 35 | 7.0 | 17.3 | 0.19 | 1.92 | 0.90 | 0.32 | 0.03 | 4100 | 0.90 | 0.025 | 13 |
| 18 | 34.7 | 10.58 | Saturated | 6 | SM | 3036.79 | 0.83 | 1.0 | 1.00 | 1.0 | 1.0 | 5.0 | 15 | 2.3 | 7.3 | 0.09 | 1.92 | 0.90 | 0.15 | 0.03 | 4451 | 0.89 | 0.025 | 6 |
| 18A | 36 | 10.97 | Saturated | 15 | SM | 3124.8 | 0.82 | 1.0 | 1.00 | 1.0 | 1.0 | 12.3 | 15 | 2.3 | 14.7 | 0.16 | 1.92 | 0.90 | 0.27 | 0.03 | 4620 | 0.88 | 0.025 | 11 |
| 19 | 36.7 | 11.19 | Saturated | 24 | SP | 3172.19 | 0.82 | 1.0 | 1.00 | 1.0 | 1.0 | 19.6 | 1 | 0.0 | 19.6 | 0.21 | 1.92 | 0.89 | 0.36 | 0.03 | 4711 | 0.88 | 0.025 | 14 |
| 19A | 38 | 11.58 | Saturated | 26 | SP | 3260.2 | 0.81 | 1.0 | 1.00 | 1.0 | 1.0 | 20.9 | 1 | 0.0 | 20.9 | 0.23 | 1.92 | 0.89 | 0.39 | 0.03 | 4880 | 0.87 | 0.025 | 15 |
| 20 | 40 | 12.19 | Saturated | 39 | SP | 3395.6 | 0.79 | 1.0 | 1.00 | 1.0 | 1.0 | 30.8 | 1 | 0.0 | 30.8 | UL | 1.92 | 0.89 | UL | 0.03 | 5140 | 0.86 | UL | UL |
| 21 | 42 | 12.80 | Saturated | 27 | SP | 3531 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 20.9 | 1 | 0.0 | 20.9 | 0.23 | 1.92 | 0.88 | 0.39 | 0.03 | 5400 | 0.84 | 0.025 | 15 |
| 22 | 44 | 13.41 | Saturated | 35 | SM | 3666.4 | 0.76 | 1.0 | 1.00 | 1.0 | 1.0 | 26.6 | 15 | 2.3 | 28.9 | 0.40 | 1.92 | 0.88 | 0.68 | 0.03 | 5660 | 0.83 | UL | UL |
| 23 | 46 | 14.02 | Saturated | 34 | SP | 3801.8 | 0.75 | 1.0 | 1.00 | 1.0 | 1.0 | 25.4 | 1 | 0.0 | 25.4 | 0.30 | 1.92 | 0.87 | 0.50 | 0.03 | 5920 | 0.82 | UL | UL |
| 24 | 48 | 14.63 | Saturated | 66 | SP | 3937.2 | 0.73 | 1.0 | 1.00 | 1.0 | 1.0 | 48.4 | 1 | 0.0 | 48.4 | UL | 1.92 | 0.87 | UL | 0.03 | 6180 | 0.80 | UL | UL |
| 25 | 50 | 15.24 | Saturated | 56 | SP | 4072.6 | 0.72 | 1.0 | 1.00 | 1.0 | 1.0 | 40.4 | 1 | 0.0 | 40.4 | UL | 1.92 | 0.86 | UL | 0.03 | 6440 | 0.79 | UL | UL |
| 26 | 52 | 15.85 | Saturated | 50 | SP | 4208 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 35.5 | 1 | 0.0 | 35.5 | UL | 1.92 | 0.86 | UL | 0.03 | 6700 | 0.77 | UL | UL |
| 27 | 57 | 17.37 | Saturated | 50 | SP | 4546.5 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 34.1 | 1 | 0.0 | 34.1 | UL | 1.92 | 0.85 | UL | 0.03 | 7350 | 0.73 | UL | UL |
| 28 | 62 | 18.90 | Saturated | 66 | SP | 4885 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 43.4 | 1 | 0.0 | 43.4 | UL | 1.92 | 0.84 | UL | 0.03 | 8000 | 0.68 | UL | UL |
| 29 | 67 | 20.42 | Saturated | 50 | SC | 5223.5 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 31.8 | 35 | 7.0 | 38.8 | UL | 1.92 | 0.83 | UL | 0.03 | 8650 | 0.64 | UL | UL |
| 30 | 72 | 21.95 | Saturated | 92 | SC | 5562 | 0.62 | 1.0 | 1.00 | 1.0 | 1.0 | 56.7 | 35 | 7.0 | 63.7 | UL | 1.92 | 0.81 | UL | 0.03 | 9300 | 0.59 | UL | UL |
| 31 | 75 | 22.86 | Saturated | 50 | SC | 5765.1 | 0.61 | 1.0 | 1.00 | 1.0 | 1.0 | 30.3 | 35 | 7.0 | 37.3 | UL | 1.92 | 0.81 | UL | 0.03 | 9690 | 0.57 | UL | UL |
| 32 | 81 | 24.69 | Saturated | 50 | SP | 6171.3 | 0.59 | 1.0 | 1.00 | 1.0 | 1.0 | 29.3 | 1 | 0.0 | 29.3 | UL | 1.92 | 0.79 | UL | 0.03 | 10470 | 0.52 | UL | UL |
| 33 | 86 | 26.21 | Saturated | 50 | SM | 6509.8 | 0.57 | 1.0 | 1.00 | 1.0 | 1.0 | 28.5 | 15 | 2.3 | 30.8 | UL | 1.92 | 0.78 | UL | 0.03 | 11120 | 0.48 | UL | UL |
| 34 | 91 | 27.74 | Saturated | 50 | CL | 6848.3 | 0.56 | 1.0 | 1.00 | 1.0 | 1.0 | 27.8 | 77.9 | 7.0 | 34.8 | UL | 1.92 | 0.77 | UL | 0.03 | 11770 | 0.46 | UL | UL |
| 35 | 96 | 29.26 | Saturated | 50 | CL | 7186.8 | 0.54 | 1.0 | 1.00 | 1.0 | 1.0 | 27.1 | 90 | 7.0 | 34.1 | UL | 1.92 | 0.76 | UL | 0.03 | 12420 | 0.44 | UL | UL |
| 36 | 100 | 30.48 | Saturated | 50 | SC | 7457.6 | 0.53 | 1.0 | 1.00 | 1.0 | 1.0 | 26.6 | 35 | 7.0 | 33.6 | UL | 1.92 | 0.75 | UL | 0.03 | 12940 | 0.43 | UL | UL |
| 37 | 107 | 32.61 | Saturated | 93 | CH | 7931.5 | 0.52 | 1.0 | 1.00 | 1.0 | 1.0 | 48.0 | 90 | 7.0 | 55.0 | UL | 1.92 | 0.74 | UL | 0.03 | 13850 | 0.44 | UL | UL |
| 38 | 112 | 34.14 | Saturated | 51 | CH | 9516 | 0.47 | 1.0 | 1.00 | 1.0 | 1.0 | 24.1 | 90 | 7.0 | 31.1 | UL | 1.92 | 0.68 | UL | 0.03 | 14500 | 0.47 | UL | UL |
| 39 | 117 | 35.66 | Saturated | 38 | CH | 9854.5 | 0.46 | 1.0 | 1.00 | 1.0 | 1.0 | 17.6 | 90 | 7.0 | 24.6 | 0.29 | 1.92 | 0.67 | 0.37 | 0.03 | 15150 | 0.51 | 0.015 | 24 |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

## LIQUEFACTION FACTOR OF SAFETY ASSESSMENT
## TEST BORING B-2-1[1]
## Coleto Creek Power Plant

| | | |
|---|---|---|
| Depth to Water = | 32 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 50' bgs<br>3", 50' to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | Kσ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 0.61 | Unsaturated | 17 | SC | 250 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 35 | 7.0 | 32.5 | UL | 1.92 | NA | UL | 0.03 | 250 | 1.00 | UL | UL |
| 2 | 4 | 1.22 | Unsaturated | 21 | SC | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 31.5 | 35 | 7.0 | 38.5 | UL | 1.92 | NA | UL | 0.03 | 500 | 0.99 | UL | UL |
| 3 | 6 | 1.83 | Unsaturated | 15 | SC | 750 | 1.68 | 1.0 | 1.00 | 1.0 | 0.75 | 18.9 | 35 | 7.0 | 25.9 | 0.31 | 1.92 | NA | 0.60 | 0.03 | 750 | 0.99 | 0.019 | 31 |
| 4 | 8 | 2.44 | Unsaturated | 13 | SC | 1000 | 1.45 | 1.0 | 1.00 | 1.0 | 0.75 | 14.2 | 35 | 7.0 | 21.2 | 0.23 | 1.92 | NA | 0.45 | 0.03 | 1000 | 0.98 | 0.019 | 23 |
| 5 | 10 | 3.05 | Unsaturated | 15 | SC | 1250 | 1.30 | 1.0 | 1.00 | 1.0 | 0.75 | 14.6 | 37.3 | 7.0 | 21.6 | 0.24 | 1.92 | NA | 0.46 | 0.03 | 1250 | 0.98 | 0.019 | 24 |
| 7 | 14 | 4.27 | Unsaturated | 12 | SC | 1750 | 1.10 | 1.0 | 1.00 | 1.0 | 0.80 | 10.6 | 35 | 7.0 | 17.6 | 0.19 | 1.92 | NA | 0.36 | 0.03 | 1750 | 0.97 | 0.019 | 19 |
| 8 | 16 | 4.88 | Unsaturated | 21 | SC | 2000 | 1.03 | 1.0 | 1.00 | 1.0 | 0.83 | 17.9 | 35 | 7.0 | 24.9 | 0.29 | 1.92 | NA | 0.56 | 0.03 | 2000 | 0.96 | 0.019 | 30 |
| 9 | 18 | 5.49 | Unsaturated | 9 | SC | 2250 | 0.97 | 1.0 | 1.00 | 1.0 | 0.85 | 7.4 | 42.3 | 7.0 | 14.4 | 0.15 | 1.92 | NA | 0.30 | 0.03 | 2250 | 0.96 | 0.019 | 16 |
| 11 | 22 | 6.71 | Unsaturated | 14 | SC | 2750 | 0.88 | 1.0 | 1.00 | 1.0 | 0.90 | 11.1 | 35 | 7.0 | 18.1 | 0.19 | 1.92 | 0.91 | 0.34 | 0.03 | 2750 | 0.95 | 0.018 | 18 |
| 12 | 24 | 7.32 | Unsaturated | 17 | SC | 3000 | 0.84 | 1.0 | 1.00 | 1.0 | 0.93 | 13.3 | 35 | 7.0 | 20.3 | 0.22 | 1.92 | 0.90 | 0.38 | 0.03 | 3000 | 0.94 | 0.018 | 21 |
| 13 | 26 | 7.92 | Unsaturated | 18 | SC | 3250 | 0.81 | 1.0 | 1.00 | 1.0 | 0.96 | 13.9 | 35.2 | 7.0 | 20.9 | 0.23 | 1.92 | 0.89 | 0.39 | 0.03 | 3250 | 0.93 | 0.018 | 22 |
| 15 | 30 | 9.14 | Unsaturated | 16 | SC | 3750 | 0.75 | 1.0 | 1.00 | 1.0 | 1.0 | 12.0 | 35 | 7.0 | 19.0 | 0.20 | 1.92 | 0.88 | 0.34 | 0.03 | 3750 | 0.91 | 0.018 | 19 |
| 16 | 32 | 9.75 | Saturated | 22 | SC | 4000 | 0.73 | 1.0 | 1.00 | 1.0 | 1.0 | 16.0 | 38.4 | 7.0 | 23.0 | 0.26 | 1.92 | 0.87 | 0.43 | 0.03 | 4000 | 0.90 | 0.018 | 24 |
| 18 | 36 | 10.97 | Saturated | 15 | SC | 4270.8 | 0.70 | 1.0 | 1.00 | 1.0 | 1.0 | 10.6 | 35 | 7.0 | 17.6 | 0.19 | 1.92 | 0.86 | 0.31 | 0.03 | 4520 | 0.88 | 0.018 | 17 |
| 19 | 38 | 11.58 | Saturated | 8 | SC | 4406.2 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 5.5 | 35 | 7.0 | 12.5 | 0.14 | 1.92 | 0.85 | 0.22 | 0.03 | 4780 | 0.87 | 0.018 | 12 |
| 20 | 40 | 12.19 | Saturated | 16 | SC | 4541.6 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 10.9 | 35 | 7.0 | 17.9 | 0.19 | 1.92 | 0.85 | 0.31 | 0.03 | 5040 | 0.86 | 0.019 | 17 |
| 21A | 42 | 12.80 | Saturated | 14 | SP | 4677 | 0.67 | 1.0 | 1.00 | 1.0 | 1.0 | 9.4 | 1 | 0.0 | 9.4 | 0.11 | 1.92 | 0.84 | 0.17 | 0.03 | 5300 | 0.84 | 0.019 | 9 |
| 22 | 44 | 13.41 | Saturated | 27 | SP | 4812.4 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 17.9 | 1 | 0.0 | 17.9 | 0.19 | 1.92 | 0.84 | 0.31 | 0.03 | 5560 | 0.83 | 0.019 | 17 |
| 23 | 46 | 14.02 | Saturated | 25 | SP | 4947.8 | 0.65 | 1.0 | 1.00 | 1.0 | 1.0 | 5.0 | 1 | 0.0 | 5.0 | 0.07 | 1.92 | 0.84 | 0.11 | 0.03 | 5820 | 0.82 | 0.019 | 6 |
| 24 | 48 | 14.63 | Saturated | 37 | SP | 5083.2 | 0.65 | 1.0 | 1.00 | 1.0 | 1.0 | 23.9 | 1 | 0.0 | 23.9 | 0.27 | 1.92 | 0.83 | 0.43 | 0.03 | 6080 | 0.80 | 0.019 | 23 |
| 25 | 50 | 15.24 | Saturated | 35 | SP | 5218.6 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 22.3 | 1 | 0.0 | 22.3 | 0.25 | 1.92 | 0.83 | 0.39 | 0.03 | 6340 | 0.79 | 0.019 | 21 |
| 26 | 52 | 15.85 | Saturated | 33 | SM | 5354 | 0.63 | 1.0 | 1.00 | 1.0 | 1.0 | 20.7 | 35 | 7.0 | 27.7 | 0.36 | 1.92 | 0.82 | 0.57 | 0.03 | 6600 | 0.77 | 0.018 | 31 |
| 27 | 56 | 17.07 | Saturated | 39 | SC | 5624.8 | 0.61 | 1.0 | 1.00 | 1.0 | 1.0 | 23.9 | 45.7 | 7.0 | 30.9 | UL | 1.92 | 0.81 | UL | 0.03 | 7120 | 0.74 | UL | UL |
| 28 | 61 | 18.59 | Saturated | 43 | SC | 5963.3 | 0.60 | 1.0 | 1.00 | 1.0 | 1.0 | 25.6 | 35 | 7.0 | 32.6 | UL | 1.92 | 0.80 | UL | 0.03 | 7770 | 0.69 | UL | UL |
| 29 | 66 | 20.12 | Saturated | 40 | SP-SM | 6301.8 | 0.58 | 1.0 | 1.00 | 1.0 | 1.0 | 23.2 | 10 | 1.2 | 24.3 | 0.28 | 1.92 | 0.79 | 0.43 | 0.03 | 8420 | 0.65 | 0.017 | 25 |
| 30 | 71 | 21.64 | Saturated | 39 | SP | 6640.3 | 0.56 | 1.0 | 1.00 | 1.0 | 1.0 | 22.0 | 1 | 0.0 | 22.0 | 0.24 | 1.92 | 0.78 | 0.36 | 0.03 | 9070 | 0.60 | 0.016 | 23 |
| 31 | 76 | 23.16 | Saturated | 50 | SM | 6978.8 | 0.55 | 1.0 | 1.00 | 1.0 | 1.0 | 27.5 | 35 | 7.0 | 34.5 | UL | 1.92 | 0.77 | UL | 0.03 | 9720 | 0.56 | UL | UL |
| 32 | 81 | 24.69 | Saturated | 60 | CL-ML-S | 7317.3 | 0.54 | 1.0 | 1.00 | 1.0 | 1.0 | 32.3 | 50 | 0.0 | 32.3 | UL | 1.92 | 0.76 | UL | 0.03 | 10370 | 0.52 | UL | UL |
| 33 | 86 | 26.21 | Saturated | 34 | CH | 7655.8 | 0.53 | 1.0 | 1.00 | 1.0 | 1.0 | 17.9 | 92.4 | 7.0 | 24.9 | 0.29 | 1.92 | 0.74 | 0.41 | 0.03 | 11020 | 0.48 | 0.014 | 31 |
| 34 | 91 | 27.74 | Saturated | 41 | CH | 7994.3 | 0.51 | 1.0 | 1.00 | 1.0 | 1.0 | 21.1 | 90 | 7.0 | 28.1 | 0.37 | 1.92 | 0.73 | 0.52 | 0.03 | 11670 | 0.46 | 0.013 | 40 |
| 36 | 101 | 30.78 | Saturated | 50 | SC | 8671.3 | 0.49 | 1.0 | 1.00 | 1.0 | 1.0 | 24.7 | 35 | 7.0 | 31.7 | UL | 1.92 | 0.71 | UL | 0.03 | 12970 | 0.43 | UL | UL |
| 37 | 107 | 32.61 | Saturated | 70 | CH | 9077.5 | 0.48 | 1.0 | 1.00 | 1.0 | 1.0 | 33.8 | 90 | 7.0 | 40.8 | UL | 1.92 | 0.70 | UL | 0.03 | 13750 | 0.44 | UL | UL |
| 38 | 111 | 33.83 | Saturated | 68 | CH | 9348.3 | 0.48 | 1.0 | 1.00 | 1.0 | 1.0 | 32.4 | 90 | 7.0 | 39.4 | UL | 1.92 | 0.69 | UL | 0.03 | 14270 | 0.46 | UL | UL |
| 39 | 116 | 35.36 | Saturated | 58 | CH | 9686.8 | 0.47 | 1.0 | 1.00 | 1.0 | 1.0 | 27.1 | 90 | 7.0 | 34.1 | UL | 1.92 | 0.68 | UL | 0.03 | 14920 | 0.50 | UL | UL |
| 40 | 119 | 36.27 | Saturated | 77 | CH | 9889.9 | 0.46 | 1.0 | 1.00 | 1.0 | 1.0 | 35.6 | 90 | 7.0 | 42.6 | UL | 1.92 | 0.67 | UL | 0.03 | 15310 | 0.54 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

# LIQUEFACTION FACTOR OF SAFETY ASSESSMENT
## TEST BORING B-2-2[1]
## Coleto Creek Power Plant

| | | |
|---|---|---|
| Depth to Water = | 3.5 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 5 | OL | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 7.5 | 50 | 7.0 | 14.5 | 0.16 | 1.92 | NA | 0.30 | 0.03 | 125 | 1.00 | 0.019 | UL |
| 2 | 3 | 0.91 | Unsaturated | 16 | OL | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 24.0 | 50 | 7.0 | 31.0 | 0.55 | 1.92 | NA | 1.05 | 0.03 | 375 | 0.99 | 0.019 | UL |
| 3 | 5 | 1.52 | Saturated | 15 | SC | 510.4 | 2.04 | 1.0 | 1.00 | 1.0 | 0.75 | 22.9 | 35 | 7.0 | 29.9 | 0.46 | 1.92 | NA | 0.88 | 0.03 | 635 | 0.99 | 0.024 | 37 |
| 4 | 7 | 2.13 | Saturated | 16 | SP | 645.8 | 1.81 | 1.0 | 1.00 | 1.0 | 0.75 | 21.7 | 1 | 0.0 | 21.7 | 0.24 | 1.92 | NA | 0.46 | 0.03 | 895 | 0.99 | 0.027 | 17 |
| 5 | 9 | 2.74 | Saturated | 15 | SP | 781.2 | 1.65 | 1.0 | 1.00 | 1.0 | 0.75 | 18.5 | 1 | 0.0 | 18.5 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1155 | 0.98 | 0.028 | 13 |
| 6 | 10 | 3.05 | Saturated | 18 | SP | 848.9 | 1.58 | 1.0 | 1.00 | 1.0 | 0.75 | 21.3 | 1 | 0.0 | 21.3 | 0.23 | 1.92 | NA | 0.45 | 0.03 | 1285 | 0.98 | 0.029 | 16 |
| 6A | 11 | 3.35 | Saturated | 15 | SP | 916.6 | 1.52 | 1.0 | 1.00 | 1.0 | 0.75 | 17.1 | 1 | 0.0 | 17.1 | 0.18 | 1.92 | NA | 0.35 | 0.03 | 1415 | 0.98 | 0.029 | 12 |
| 7 | 14 | 4.27 | Saturated | 26 | ML | 1119.7 | 1.37 | 1.0 | 1.00 | 1.0 | 0.80 | 28.6 | 50 | 7.0 | 35.6 | UL | 1.92 | NA | UL | 0.03 | 1805 | 0.97 | UL | UL |
| 7A | 15 | 4.57 | Saturated | 32 | CL | 1187.4 | 1.34 | 1.0 | 1.00 | 1.0 | 0.75 | 32.0 | 50 | 7.0 | 39.0 | UL | 1.92 | NA | UL | 0.03 | 1935 | 0.97 | UL | UL |
| 8 | 20 | 6.10 | Saturated | 21 | ML | 1525.9 | 1.18 | 1.0 | 1.00 | 1.0 | 0.88 | 21.8 | 50 | 7.0 | 28.8 | 0.40 | 1.92 | NA | 0.76 | 0.03 | 2585 | 0.95 | 0.031 | 24 |
| 9 | 25 | 7.62 | Saturated | 35 | SP | 1864.4 | 1.07 | 1.0 | 1.00 | 1.0 | 0.94 | 35.1 | 1 | 0.0 | 35.1 | UL | 1.92 | NA | UL | 0.03 | 3235 | 0.93 | UL | UL |
| 10 | 31 | 9.45 | Saturated | 41 | SP | 2270.6 | 0.97 | 1.0 | 1.00 | 1.0 | 1.02 | 40.4 | 1 | 0.0 | 40.4 | UL | 1.92 | 0.92 | UL | 0.03 | 4015 | 0.91 | UL | UL |
| 11 | 35 | 10.67 | Saturated | 45 | SC | 2541.4 | 0.91 | 1.0 | 1.00 | 1.0 | 1.07 | 43.9 | 35 | 7.0 | 50.9 | UL | 1.92 | 0.92 | UL | 0.03 | 4535 | 0.89 | UL | UL |
| 12 | 39 | 11.89 | Saturated | 50 | SC | 2812.2 | 0.87 | 1.0 | 1.00 | 1.0 | 1.12 | 48.6 | 35 | 7.0 | 55.6 | UL | 1.92 | 0.91 | UL | 0.03 | 5055 | 0.86 | UL | UL |
| 13 | 45 | 13.72 | Saturated | 42 | SP | 3218.4 | 0.81 | 1.0 | 1.00 | 1.0 | 1.20 | 40.9 | 1 | 0.0 | 40.9 | UL | 1.92 | 0.89 | UL | 0.03 | 5835 | 0.82 | UL | UL |
| 14 | 50 | 15.24 | Saturated | 26 | CL | 3556.9 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 20.1 | 50 | 7.0 | 27.1 | 0.34 | 1.92 | 0.88 | 0.57 | 0.03 | 6485 | 0.79 | 0.028 | 21 |
| 15 | 54 | 16.46 | Saturated | 56 | SP | 3827.7 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 41.6 | 1 | 0.0 | 41.6 | UL | 1.92 | 0.87 | UL | 0.03 | 7005 | 0.75 | UL | UL |
| 15A | 55 | 16.76 | Saturated | 120 | SP | 3895.4 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 88.4 | 1 | 0.0 | 88.4 | UL | 1.92 | 0.87 | UL | 0.03 | 7135 | 0.74 | UL | UL |
| 16 | 59 | 17.98 | Saturated | 83 | CL | 4166.2 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 59.2 | 50 | 7.0 | 66.2 | UL | 1.92 | 0.86 | UL | 0.03 | 7655 | 0.71 | UL | UL |
| 17 | 65 | 19.81 | Saturated | 50 | SM | 4572.4 | 0.68 | 1.0 | 1.00 | 1.0 | 1.0 | 34.0 | 35 | 7.0 | 41.0 | UL | 1.92 | 0.85 | UL | 0.03 | 8435 | 0.66 | UL | UL |
| 18 | 70 | 21.34 | Saturated | 56 | CH | 4910.9 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 36.8 | 90 | 7.0 | 43.8 | UL | 1.92 | 0.84 | UL | 0.03 | 9085 | 0.61 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-3-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 28 | ft (Only saturated strata was found between 28.0 and 28.5 ft bgs) |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 4", to 30'<br>3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 19 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 28.5 | 35 | 7.0 | 35.5 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 17 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 35 | 7.0 | 32.5 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 26 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 35.9 | 35 | 7.0 | 42.9 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 26 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 30.3 | 35 | 7.0 | 37.3 | UL | 1.92 | NA | UL | 0.03 | 875 | 0.99 | UL | UL |
| 5 | 9 | 2.74 | Unsaturated | 9 | SC | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 9.3 | 35 | 7.0 | 16.3 | 0.17 | 1.92 | NA | 0.33 | 0.03 | 1125 | 0.98 | 0.019 | 17 |
| 6 | 11 | 3.35 | Unsaturated | 15 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.75 | 14.0 | 35 | 7.0 | 21.0 | 0.23 | 1.92 | NA | 0.44 | 0.03 | 1375 | 0.98 | 0.019 | 23 |
| 7 | 13 | 3.96 | Unsaturated | 12 | SC | 1625 | 1.14 | 1.0 | 1.00 | 1.0 | 0.79 | 10.8 | 35 | 7.0 | 17.8 | 0.19 | 1.92 | NA | 0.37 | 0.03 | 1625 | 0.97 | 0.019 | 19 |
| 8 | 15 | 4.57 | Unsaturated | 11 | SC | 1875 | 1.06 | 1.0 | 1.00 | 1.0 | 0.75 | 8.8 | 35 | 7.0 | 15.8 | 0.17 | 1.92 | NA | 0.32 | 0.03 | 1875 | 0.97 | 0.019 | 17 |
| 8A | 16 | 4.88 | Unsaturated | 24 | SC | 2000 | 1.03 | 1.0 | 1.00 | 1.0 | 0.83 | 20.5 | 40 | 7.0 | 27.5 | 0.35 | 1.92 | NA | 0.68 | 0.03 | 2000 | 0.96 | 0.019 | 36 |
| 11 | 21 | 6.40 | Unsaturated | 18 | SC | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.89 | 14.4 | 34.8 | 7.0 | 21.4 | 0.23 | 1.92 | 0.91 | 0.41 | 0.03 | 2625 | 0.95 | 0.019 | 22 |
| 12 | 23 | 7.01 | Unsaturated | 21 | CL | 2875 | 0.86 | 1.0 | 1.00 | 1.0 | 0.92 | 16.6 | 50 | 7.0 | 23.6 | 0.27 | 1.92 | 0.90 | 0.46 | 0.03 | 2875 | 0.94 | 0.018 | 25 |
| 14 | 27 | 8.23 | Unsaturated | 19 | SC | 3375 | 0.79 | 1.0 | 1.00 | 1.0 | 1.0 | 15.0 | 35 | 7.0 | 22.0 | 0.24 | 1.92 | 0.89 | 0.42 | 0.03 | 3375 | 0.93 | 0.018 | 23 |
| 15 | 28.5 | 8.69 | Saturated | 16 | SC | 3533.85 | 0.77 | 1.0 | 1.00 | 1.0 | 1.0 | 12.4 | 35 | 7.0 | 19.4 | 0.21 | 1.92 | 0.88 | 0.35 | 0.03 | 3565 | 0.92 | 0.018 | 20 |
| 15A | 29 | 8.84 | Unsaturated | 20 | SM | 3627.5 | 0.76 | 1.0 | 1.00 | 1.0 | 1.0 | 15.3 | 35 | 7.0 | 22.3 | 0.25 | 1.92 | 0.88 | 0.42 | 0.03 | 3627.5 | 0.92 | 0.018 | 23 |
| 16 | 31 | 9.45 | Unsaturated | 17 | SM | 3877.5 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 12.6 | 35 | 7.0 | 19.6 | 0.21 | 1.92 | 0.87 | 0.35 | 0.03 | 3877.5 | 0.91 | 0.018 | 20 |
| 17 | 36 | 10.97 | Unsaturated | 65 | SM | 4502.5 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 44.6 | 35 | 7.0 | 51.6 | UL | 1.92 | 0.85 | UL | 0.03 | 4502.5 | 0.88 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-3-2[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 14 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 12 | SM | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 18.0 | 35 | 7.0 | 25.0 | 0.29 | 1.92 | NA | 0.56 | 0.03 | 125 | 1.00 | 0.019 | 29 |
| 2 | 3 | 0.91 | Unsaturated | 14 | CL | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 21.0 | 50 | 7.0 | 28.0 | 0.37 | 1.92 | NA | 0.71 | 0.03 | 375 | 0.99 | 0.019 | 36 |
| 2A | 4 | 1.22 | Unsaturated | 18 | CL | 500 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 27.0 | 50 | 7.0 | 34.0 | UL | 1.92 | NA | UL | 0.03 | 500 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 18 | CL | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 24.8 | 50 | 7.0 | 31.8 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 18 | CL | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 21.0 | 50 | 7.0 | 28.0 | 0.37 | 1.92 | NA | 0.71 | 0.03 | 875 | 0.99 | 0.019 | 37 |
| 5 | 9 | 2.74 | Unsaturated | 19 | CL | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 19.5 | 50 | 7.0 | 26.5 | 0.33 | 1.92 | NA | 0.63 | 0.03 | 1125 | 0.98 | 0.019 | 33 |
| 6 | 11 | 3.35 | Unsaturated | 47 | SM | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 44.3 | 35 | 7.0 | 51.3 | UL | 1.92 | NA | UL | 0.03 | 1375 | 0.98 | UL | UL |
| 7 | 15 | 4.57 | Saturated | 23 | SP | 1817.7 | 1.08 | 1.0 | 1.00 | 1.0 | 0.82 | 20.3 | 1 | 0.0 | 20.3 | 0.22 | 1.92 | NA | 0.42 | 0.03 | 1880 | 0.97 | 0.020 | 22 |
| 8 | 20 | 6.10 | Saturated | 42 | SM | 2156.2 | 0.99 | 1.0 | 1.00 | 1.0 | 0.75 | 31.2 | 35 | 7.0 | 38.2 | UL | 1.92 | NA | UL | 0.03 | 2530 | 0.95 | UL | UL |
| 9 | 24 | 7.32 | Saturated | 50 | SP | 2427 | 0.93 | 1.0 | 1.00 | 1.0 | 0.93 | 43.4 | 1 | 0.0 | 43.4 | UL | 1.92 | 0.92 | UL | 0.03 | 3050 | 0.94 | UL | UL |
| 10 | 29 | 8.84 | Saturated | 52 | SP | 2765.5 | 0.87 | 1.0 | 1.00 | 1.0 | 0.99 | 45.0 | 1 | 0.0 | 45.0 | UL | 1.92 | 0.91 | UL | 0.03 | 3700 | 0.92 | UL | UL |

Source: AECOM, 2012.  (See Appendices A and B for boring logs and laboratory testing results)

# LIQUEFACTION FACTOR OF SAFETY ASSESSMENT
## TEST BORING B-4-1[1]
## Coleto Creek Power Plant

| | | |
|---|---|---|
| Depth to Water = | 35.6 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 17 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 25.5 | 12.8 | 1.8 | 27.3 | 0.35 | 1.92 | NA | 0.67 | 0.03 | 125 | 1.00 | 0.019 | 34 |
| 2 | 3 | 0.91 | Unsaturated | 12 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 18.0 | 12.8 | 1.8 | 19.8 | 0.21 | 1.92 | NA | 0.41 | 0.03 | 375 | 0.99 | 0.019 | 21 |
| 3 | 5 | 1.52 | Unsaturated | 12 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 16.6 | 12.8 | 1.8 | 18.4 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 625 | 0.99 | 0.019 | 20 |
| 6 | 11 | 3.35 | Unsaturated | 14 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 13.2 | 12.8 | 1.8 | 15.0 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 1375 | 0.98 | 0.019 | 16 |
| 8 | 14 | 4.27 | Unsaturated | 21 | SC | 1750 | 1.10 | 1.0 | 1.00 | 1.0 | 0.80 | 18.5 | 12.8 | 1.8 | 20.3 | 0.22 | 1.92 | NA | 0.42 | 0.03 | 1750 | 0.97 | 0.019 | 22 |
| 9 | 17 | 5.18 | Unsaturated | 20 | SC | 2125 | 1.00 | 1.0 | 1.00 | 1.0 | 0.84 | 16.8 | 12.8 | 1.8 | 18.6 | 0.20 | 1.92 | 0.93 | 0.38 | 0.03 | 2125 | 0.96 | 0.019 | 20 |
| 10 | 19 | 5.79 | Unsaturated | 29 | SC | 2375 | 0.94 | 1.0 | 1.00 | 1.0 | 0.87 | 23.8 | 12.8 | 1.8 | 25.6 | 0.31 | 1.92 | 0.92 | 0.59 | 0.03 | 2375 | 0.96 | 0.019 | 31 |
| 11 | 20 | 6.10 | Unsaturated | 16 | CL | 2500 | 0.92 | 1.0 | 1.00 | 1.0 | 0.88 | 13.0 | 50 | 7.0 | 20.0 | 0.22 | 1.92 | 0.92 | 0.41 | 0.03 | 2500 | 0.95 | 0.019 | 22 |
| 11A | 21 | 6.40 | Unsaturated | 23 | CL | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.89 | 18.4 | 50 | 7.0 | 25.4 | 0.30 | 1.92 | 0.91 | 0.58 | 0.03 | 2625 | 0.95 | 0.019 | 31 |
| 12 | 22 | 6.71 | Unsaturated | 24 | CL | 2750 | 0.88 | 1.0 | 1.00 | 1.0 | 0.90 | 18.9 | 50 | 7.0 | 25.9 | 0.31 | 1.92 | 0.91 | 0.60 | 0.03 | 2750 | 0.95 | 0.018 | 33 |
| 12A | 23 | 7.01 | Unsaturated | 22 | CL | 2875 | 0.86 | 1.0 | 1.00 | 1.0 | 0.92 | 17.4 | 50 | 7.0 | 24.4 | 0.28 | 1.92 | 0.90 | 0.54 | 0.03 | 2875 | 0.94 | 0.018 | 29 |
| 14 | 27 | 8.23 | Unsaturated | 25 | SC | 3375 | 0.79 | 1.0 | 1.00 | 1.0 | 0.97 | 19.2 | 35 | 7.0 | 26.2 | 0.32 | 1.92 | 0.89 | 0.61 | 0.03 | 3375 | 0.93 | 0.018 | 34 |
| 15 | 29 | 8.84 | Unsaturated | 23 | SC | 3625 | 0.76 | 1.0 | 1.00 | 1.0 | 0.99 | 17.4 | 35 | 7.0 | 24.4 | 0.28 | 1.92 | 0.88 | 0.54 | 0.03 | 3625 | 0.92 | 0.018 | 30 |
| 16 | 31 | 9.45 | Unsaturated | 26 | SM | 3875 | 0.74 | 1.0 | 1.00 | 1.0 | 1.0 | 19.2 | 35 | 7.0 | 26.2 | 0.32 | 1.92 | 0.87 | 0.61 | 0.03 | 3875 | 0.91 | 0.018 | 35 |
| 17 | 34 | 10.36 | Unsaturated | 22 | CL | 4242 | 0.71 | 1.0 | 1.00 | 1.0 | 1.0 | 15.5 | 50 | 7.0 | 22.5 | 0.25 | 1.92 | 0.86 | 0.48 | 0.03 | 4242 | 0.89 | 0.017 | 28 |
| 17A | 36 | 10.97 | Saturated | 28 | SP | 4477.08 | 0.69 | 1.0 | 1.00 | 1.0 | 1.0 | 19.3 | 1 | 0.0 | 19.3 | 0.21 | 1.92 | 0.85 | 0.40 | 0.03 | 4502 | 0.88 | 0.017 | 23 |
| 18 | 41 | 12.50 | Saturated | 35 | SP | 4815.58 | 0.66 | 1.0 | 1.00 | 1.0 | 1.0 | 23.2 | 1 | 0.0 | 23.2 | 0.26 | 1.92 | 0.84 | 0.50 | 0.03 | 5152 | 0.85 | 0.018 | 28 |
| 19 | 46 | 14.02 | Saturated | 35 | SP | 5154.08 | 0.64 | 1.0 | 1.00 | 1.0 | 1.0 | 22.4 | 1 | 0.0 | 22.4 | 0.25 | 1.92 | 0.83 | 0.48 | 0.03 | 5802 | 0.82 | 0.018 | 27 |
| 20 | 51 | 15.54 | Unsaturated | 60 | SP | 6427 | 0.57 | 1.0 | 1.00 | 1.0 | 1.0 | 34.4 | 1 | 0.0 | 34.4 | UL | 1.92 | 0.79 | UL | 0.03 | 6427 | 0.78 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-4-2[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 14 | ft |
| Average Unsaturated Soil Unit Weight, $\gamma_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $\gamma_s$ = | 130 | pcf |
| Average Water Unit Weight, $\gamma_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 23 | SM | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 34.5 | 35 | 7.0 | 41.5 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 33 | SM | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 49.5 | 35 | 7.0 | 56.5 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 28 | OL | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 38.6 | 50 | 7.0 | 45.6 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 22 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 25.7 | 35 | 7.0 | 32.7 | UL | 1.92 | NA | UL | 0.03 | 875 | 0.99 | UL | UL |
| 6 | 11 | 3.35 | Unsaturated | 12 | SM | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.76 | 11.3 | 35 | 7.0 | 18.3 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1375 | 0.98 | 0.019 | 20 |
| 7 | 15 | 4.57 | Saturated | 13 | SP | 1817.7 | 1.08 | 1.0 | 1.00 | 1.0 | 0.82 | 11.5 | 1 | 0.0 | 11.5 | 0.13 | 1.92 | NA | 0.24 | 0.03 | 1880 | 0.97 | 0.020 | 12 |
| 8 | 20 | 6.10 | Saturated | 16 | SP | 2156.2 | 0.99 | 1.0 | 1.00 | 1.0 | 0.75 | 11.9 | 1 | 0.0 | 11.9 | 0.13 | 1.92 | 0.93 | 0.25 | 0.03 | 2530 | 0.95 | 0.022 | 11 |
| 9 | 25 | 7.62 | Saturated | 29 | SP | 2494.7 | 0.92 | 1.0 | 1.00 | 1.0 | 0.94 | 25.1 | 1 | 0.0 | 25.1 | 0.29 | 1.92 | 0.92 | 0.57 | 0.03 | 3180 | 0.93 | 0.023 | 24 |
| 10 | 29 | 8.84 | Saturated | 12 | SM | 2765.5 | 0.87 | 1.0 | 1.00 | 1.0 | 0.99 | 10.4 | 35 | 7.0 | 17.4 | 0.19 | 1.92 | 0.91 | 0.36 | 0.03 | 3700 | 0.92 | 0.024 | 15 |
| 10A | 29.5 | 8.99 | Saturated | 43 | SP | 2799.35 | 0.87 | 1.0 | 1.00 | 1.0 | 1.00 | 37.4 | 1 | 0.0 | 37.4 | UL | 1.92 | 0.91 | UL | 0.03 | 3765 | 0.91 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

**LIQUEFACTION FACTOR OF SAFETY ASSESSMENT**
**TEST BORING B-5-1[1]**
**Coleto Creek Power Plant**

| | | |
|---|---|---|
| Depth to Water = | 32 | ft |
| Average Unsaturated Soil Unit Weight, $y_d$ = | 125 | pcf |
| Average Saturated Soil Unit Weight, $y_s$ = | 130 | pcf |
| Average Water Unit Weight, $y_w$ = | 62.3 | pcf |
| Earthquake Magnitude, $M_W$ = | 6.1 | |
| Borehole Diameter = | 3", to end of boring | |

| Sample Number | Depth (ft) | Depth (m) | Note | $N_{SPT}$ | Soil Type | $\sigma'_{vo}$ (psf) | $C_N$ | $C_E$ | $C_B$ | $C_S$ | $C_R$ | $(N_1)_{60}$ | FC | $\Delta(N_1)_{60}$ | $(N_1)_{60}$-cs | $CRR_{M7.5}$ | MSF | $K\sigma$ | CRR | $a_{max}/g$ | $\sigma_{vo}$ | $r_d$ | CSR | $FS_{liq}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0.30 | Unsaturated | 34 | SC | 125 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 51.0 | 35 | 7.0 | 58.0 | UL | 1.92 | NA | UL | 0.03 | 125 | 1.00 | UL | UL |
| 2 | 3 | 0.91 | Unsaturated | 26 | SC | 375 | 2.00 | 1.0 | 1.00 | 1.0 | 0.75 | 39.0 | 35 | 7.0 | 46.0 | UL | 1.92 | NA | UL | 0.03 | 375 | 0.99 | UL | UL |
| 3 | 5 | 1.52 | Unsaturated | 23 | SC | 625 | 1.84 | 1.0 | 1.00 | 1.0 | 0.75 | 31.7 | 35 | 7.0 | 38.7 | UL | 1.92 | NA | UL | 0.03 | 625 | 0.99 | UL | UL |
| 4 | 7 | 2.13 | Unsaturated | 17 | SC | 875 | 1.56 | 1.0 | 1.00 | 1.0 | 0.75 | 19.8 | 35 | 7.0 | 26.8 | 0.33 | 1.92 | NA | 0.64 | 0.03 | 875 | 0.99 | 0.019 | 33 |
| 5 | 9 | 2.74 | Unsaturated | 11 | SC | 1125 | 1.37 | 1.0 | 1.00 | 1.0 | 0.75 | 11.3 | 35 | 7.0 | 18.3 | 0.20 | 1.92 | NA | 0.38 | 0.03 | 1125 | 0.98 | 0.019 | 20 |
| 6 | 11 | 3.35 | Unsaturated | 17 | SC | 1375 | 1.24 | 1.0 | 1.00 | 1.0 | 0.75 | 15.8 | 35 | 7.0 | 22.8 | 0.26 | 1.92 | NA | 0.49 | 0.03 | 1375 | 0.98 | 0.019 | 26 |
| 7 | 12 | 3.66 | Unsaturated | 12 | SC | 1500 | 1.19 | 1.0 | 1.00 | 1.0 | 0.75 | 10.7 | 35 | 7.0 | 17.7 | 0.19 | 1.92 | NA | 0.36 | 0.03 | 1500 | 0.97 | 0.019 | 19 |
| 7A | 13 | 3.96 | Unsaturated | 18 | SC | 1625 | 1.14 | 1.0 | 1.00 | 1.0 | 0.75 | 15.4 | 35 | 7.0 | 22.4 | 0.25 | 1.92 | NA | 0.48 | 0.03 | 1625 | 0.97 | 0.019 | 25 |
| 8 | 15 | 4.57 | Unsaturated | 10 | SC | 1875 | 1.06 | 1.0 | 1.00 | 1.0 | 0.75 | 8.0 | 35 | 7.0 | 15.0 | 0.16 | 1.92 | NA | 0.31 | 0.03 | 1875 | 0.97 | 0.019 | 16 |
| 9 | 17 | 5.18 | Unsaturated | 15 | SC | 2125 | 1.00 | 1.0 | 1.00 | 1.0 | 0.75 | 11.2 | 35 | 7.0 | 18.2 | 0.20 | 1.92 | 0.93 | 0.37 | 0.03 | 2125 | 0.96 | 0.019 | 20 |
| 10 | 19 | 5.79 | Unsaturated | 32 | SC | 2375 | 0.94 | 1.0 | 1.00 | 1.0 | 0.75 | 22.7 | 35 | 7.0 | 29.7 | 0.44 | 1.92 | 0.92 | 0.85 | 0.03 | 2375 | 0.96 | 0.019 | 45 |
| 11 | 20 | 6.10 | Unsaturated | 20 | SC | 2500 | 0.92 | 1.0 | 1.00 | 1.0 | 0.75 | 13.8 | 35 | 7.0 | 20.8 | 0.23 | 1.92 | 0.92 | 0.44 | 0.03 | 2500 | 0.95 | 0.019 | 23 |
| 11A | 21 | 6.40 | Unsaturated | 28 | CL | 2625 | 0.90 | 1.0 | 1.00 | 1.0 | 0.75 | 18.9 | 83.9 | 7.0 | 25.9 | 0.31 | 1.92 | 0.91 | 0.60 | 0.03 | 2625 | 0.95 | 0.019 | 32 |
| 16 | 31 | 9.45 | Unsaturated | 35 | CL | 3875 | 0.74 | 1.0 | 1.00 | 1.0 | 0.75 | 19.4 | 50 | 7.0 | 26.4 | 0.32 | 1.92 | 0.87 | 0.62 | 0.03 | 3875 | 0.91 | 0.018 | 35 |
| 17 | 33 | 10.06 | Saturated | 33 | SM | 4067.7 | 0.72 | 1.0 | 1.00 | 1.0 | 0.75 | 17.9 | 35 | 7.0 | 24.9 | 0.29 | 1.92 | 0.86 | 0.56 | 0.03 | 4130 | 0.90 | 0.018 | 31 |
| 18 | 36 | 10.97 | Saturated | 80 | SP | 4270.8 | 0.70 | 1.0 | 1.00 | 1.0 | 0.75 | 42.2 | 1 | 0.0 | 42.2 | UL | 1.92 | 0.86 | UL | 0.03 | 4520 | 0.88 | UL | UL |
| 19 | 41 | 12.50 | Saturated | 77 | SP | 4609.3 | 0.68 | 1.0 | 1.00 | 1.0 | 0.75 | 39.1 | 1 | 0.0 | 39.1 | UL | 1.92 | 0.85 | UL | 0.03 | 5170 | 0.85 | UL | UL |
| 20 | 46 | 14.02 | Saturated | 42 | SM | 4947.8 | 0.65 | 1.0 | 1.00 | 1.0 | 0.75 | 20.6 | 35 | 7.0 | 27.6 | 0.36 | 1.92 | 0.84 | 0.68 | 0.03 | 5820 | 0.82 | 0.019 | 36 |
| 21 | 50 | 15.24 | Saturated | 50 | SM | 5218.6 | 0.64 | 1.0 | 1.00 | 1.0 | 0.75 | 23.9 | 35 | 7.0 | 30.9 | UL | 1.92 | 0.83 | UL | 0.03 | 6340 | 0.79 | UL | UL |

Source: AECOM, 2012. (See Appendices A and B for boring logs and laboratory testing results)

## APPENDIX E – GROUNDWATER MONITORING AND CORRECTIVE ACTION

**Groundwater Hydrogeologic Monitoring Plan**
**Groundwater Monitoring Plan**
**Statistical Analysis Plan**
**Statistical Method Certification**
**2020 Groundwater Monitoring and Corrective Action Report**

# GROUNDWATER
# HYDROGEOLOGIC MONITORING PLAN

## COLETO CREEK POWER STATION
### FANNIN, TEXAS

**OCTOBER 17, 2017**

*Prepared for:*

**COLETO CREEK POWER, LP**
Coleto Creek Power Station
Fannin, Texas

*Prepared by:*


**BULLOCK, BENNETT & ASSOCIATES, LLC**
Engineering and Geoscience
Registrations: Engineering F-8542, Geoscience 50127

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BBA Project No. 17258

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## FIGURES



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## APPENDICES

# 1 INTRODUCTION

## 1.1 Background

This Hydrogeologic Monitoring Plan (HMP) was prepared to provide background information necessary to support the selection of the groundwater monitoring system to be used to fulfill the groundwater sampling and analysis program requirements of the United States Environmental Protection Agency (USEPA) Final Rule to regulate the disposal of Coal Combustion Residuals (CCR) as solid waste under Subtitle D of the Resource Conservation and Recovery Act [40 *CFR* 257 Subpart D; published in 80 FR 21302-21501, April 17, 2015, referred to hereafter as the CCR Rule] at Coleto Creek Power, LP's coal-fired power station.

The CCR Rule groundwater monitoring and corrective action criteria require an owner or operator of a CCR unit to install a system of monitoring wells and specify procedures for sampling these wells. The groundwater monitoring network must consist of wells that are installed at appropriate locations and depths to provide representative samples from the uppermost aquifer in the immediate vicinity of the CCR unit. The monitoring well network must include at least one (1) upgradient/background well and a minimum of three (3) downgradient wells that represent groundwater that passes the waste boundary of the CCR unit. The well configurations and locations are determined in consideration of site-specific technical information including potential contaminant pathways, and:

1. Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and
2. Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

This purpose of this HMP is to document the methodologies and rationale behind selection of the Coleto Creek Power Station Primary Ash Pond groundwater monitoring system. The remainder of Section 1 provides a description of the site and a summary of historical investigations. Section 2 details the site geology and hydrogeology. Section 3 provides a discussion of the selected groundwater monitoring network wells and how those wells meet the criteria established in the CCR rules. 40 *CFR* §257.91(f) requires that a qualified professional engineer (PE) certify the groundwater monitoring system. The PE certification is contained in Appendix A.

## 1.2 Site Location and Description

The Coleto Creek Power Station is a pulverized coal-fired power generation plant commissioned in 1980. The facility is located near the city of Fannin, Goliad County, Texas which is approximately 15 miles southwest of Victoria, Texas (Figure 1). The Coleto Creek Power Station provides electric power to South Texas. A 3,100-acre reservoir was constructed by the Guadalupe-Blanco River Authority to provide cooling water for the plant. CCR, consisting of fly ash and bottom ash, are either shipped off-site for beneficial re-use or managed in an on-site surface impoundment named the Primary Ash Pond. The Primary Ash Pond is subject to the CCR rules codified in 40 *CFR* Part 257 and is the subject of the groundwater monitoring system discussed in this HMP.

## 1.3 CCR Unit Description

The Primary Ash Pond is an above ground surface impoundment having an approximate surface area of 190 acres and storage capacity of approximately 2,700 acre-feet (S&L, December 1978). Impoundment dikes range from four (4) to 56 feet high with a total length of approximately 12,855 lineal feet. Fly ash from the coal-fired boiler is pneumatically conveyed to storage silos where it is loaded into hopper trucks and transported off-site for beneficial re-use. Off-spec or excess fly ash is sluiced to the Primary Ash Pond. Bottom ash is sluiced directly to the Primary Ash Pond from the boiler. Accumulated bottom ash is then mined from the pond for off-site beneficial re-use.

In the event the water level in the Primary Ash Pond nears maximum operation levels, treated water can be transferred to the adjacent Secondary Pond where it is either allowed to evaporate or is discharged to the Coleto Creek Reservoir as authorized by the facility's Texas Pollutant Discharge Elimination System (TPDES) permit.

## 1.4 Previous Investigations and Reports

Several groundwater monitoring wells have been installed at the Coleto Creek Power Station for the purpose of evaluating site hydrogeology. Reports that contain well construction details, subsurface geotechnical testing results, and groundwater monitoring data that were reviewed include:

- AECOM, November 2009. Groundwater Quality Assessment Plan, Coleto Creek Power Plant, Fannin, Goliad County, Texas.
- AECOM, March 2012. Geotechnical Stability and Hydraulic Analysis of the Coleto Creek Energy Facility Primary and Secondary Ash Ponds, IPR-GDF SUEZ North America, Coleto Creek Energy Facility, Fannin, Texas.
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# 2 GEOLOGY AND HYDROGEOLOGY

A comprehensive subsurface investigation was implemented prior to construction of the Primary Ash Pond and other industrial elements of the facility. A total of approximately 63 soil borings were advanced to depths ranging to approximately 100 ft below ground surface (bgs) at a relatively dense spacing (S&L, December 1978). Soil boring logs and results of geotechnical sampling and analyses were reviewed to identify the site-specific characteristics of the underlying geological strata.

The pre-CCR rule groundwater monitoring network for the Coleto Creek Power Station consisted of eight (8) monitoring wells (MW-1 through MW-8) that were installed in the vicinity of the Primary Ash Pond as it was constructed in 1978. Subsequent investigations in other areas of the power station included installation of additional groundwater monitoring wells that were evaluated during development of this HMP. These additional wells include BV-1, BV-5, BV-10, BV-15, BV-19, BV-21, and BV-22. Construction details and historical groundwater analytical results from these existing wells were reviewed to establish the site's geologic and hydrogeologic setting. Upon review of this information, BBA determined that an additional three wells would be required to address specific requirements outlined in the CCR rules under 40 *CFR* §251.91. Wells MW-9, MW-10, and MW-11 were installed along the downgradient edge of the Primary Ash Pond. The CCR monitoring well network is shown on Figure 2. Non-CCR monitoring wells used to assist in evaluating groundwater flow are shown on Figures 4 through 7.

Soil boring logs advanced as part of historical investigations are contained in their respective reports and available in the Coleto Creek Power Station Operating Record as required. Boring logs for wells MW-9, MW-10, and MW-11 are contained in Appendix B along with the boring logs for the other monitoring wells selected to be part of the CCR groundwater monitoring system as described in Section 3 of this report.

Geologic and hydrogeologic observations from previous and recent investigations are summarized below.

## 2.1 Geology

### 2.1.1 Regional Setting

The Coleto Creek Power Station is predominately located on an outcrop of the Lissie Formation (Geologic Atlas of Texas, Revised 1987). The Lissie Formation is approximately middle Pleistocene in age and the atlas describes the formation as “sand, silt, clay and minor amount of gravel; iron oxide and iron manganese nodules common in zone of weathering, in upper part locally calcareous, some concretions of calcium carbonate; surface fairly flat and featureless except for numerous rounded shallow depressions and pimple mounds, lower part very gently rolling.”

The Lissie Formation is generally considered a part of the Houston Group. Within the central coastal plain of Texas, the Lissie Formation's outcrop is a belt ranging from approximately 10 to 20 miles wide (Solis, 1981). Located within the western region of the Gulf Coast Basin, Lissie sediments extend into the subsurface, dipping southeast at 5 to 20 ft per mile (Doering, 1935). Maximum outcrop thickness is estimated to be about 600 ft in East Texas and 400 ft in South Texas (Plummer, 1932).

### 2.1.2 Site Geology

Subsurface investigations at the site identified the following three primary geologic units beneath the Primary Ash Pond surface impoundment. The following general unit descriptions are based on those presented in AECOM (2009).

Unit 1 - This lithologic stratum consists of cohesive, lower permeability soils, primarily sandy clay and clayey sand with intermittent layers of silty clay. Caliche and calcareous materials (nodules, streaks) are also present, generally in the lower portion of the unit. Unit 1 appears laterally continuous across the area and extends from the original ground surface to depths of up to 25 ft. This unit varies in thickness depending on site location. Below the Primary Ash Pond, Unit 1 varies in thickness from approximately 11 to 25 ft.

Unit 2 - This unit is the uppermost, permeable water-bearing zone below the Coleto Creek Power Station. It also appears laterally continuous below the site, with a thickness that varies from about 40 to 54 ft. Unit 2 is comprised primarily of sand and silty sand, with intermittent layers of clay bearing soils with varying thickness. The cohesive layers appear discontinuous. The presence of varying silt and clay content within the sandy soils of Unit 2 likely creates variability in the hydraulic conductivity properties of this stratum. Mineralized zones containing caliche and calcareous nodules are prominent within Unit 2.

Unit 3 - Unit 3 underlies Unit 2 forming a basal clay stratum that appears laterally continuous below the area. The soils are primarily clay and silty clay, with some sandy clay zones. Unit 3 is at least 29 ft thick and was not completely penetrated by most geotechnical borings in the area. The thickness and clayey soils of this stratum likely restrict downward migration of groundwater from Unit 2.

The relative positions of the above-described geologic units are illustrated in the generalized geologic cross sections provided in Figure 3. The locations of these cross sections in relation to the Primary Ash Pond are shown on Figure 2.

## 2.2 Hydrogeology

In order to supplement historical hydrogeologic data, BBA performed pneumatic slug testing at several monitoring wells across the site on June 21-22, 2017. Slug tests are single-well aquifer tests used to estimate horizontal hydraulic conductivity ($K_r$) and other characteristics of the uppermost aquifer beneath the Primary Ash Pond (Bennett, 2017). The results of that testing are summarized below.

### 2.2.1 Uppermost Aquifer

40 *CFR* §257.53 defines an aquifer as “a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.” The

uppermost aquifer at the site corresponds to geologic Unit 2. As noted above, Unit 2 is characterized as consisting mostly of sand and silty sand with intermittent discontinuous layers of clay. Mineralized zones containing caliche and calcareous nodules are also prominent throughout this unit. The top of the aquifer is approximately 11 to 25 ft bgs and is 40 to 54 ft thick.

### 2.2.2 Lower Limit of Aquifer

The lower limit of the aquifer is confined by a stratum consisting primarily of clay and silty clay with periodic sandy clay zones corresponding to geologic Unit 3. Although none of the borings fully penetrated this unit, it is a minimum of 29 ft thick in the area of the Primary Ash Pond. The thickness and nature of this basal unit likely restrict potential downward migration of groundwater from the overlying aquifer.

### 2.2.3 Hydraulic Conductivity

Pneumatic slug tests were performed on June 21-22, 2017 at six monitoring wells partially penetrating the uppermost aquifer surrounding the Primary Ash Pond. Groundwater in the uppermost aquifer flows to the east and southeast toward Sulphur Creek and the Coleto Creek Reservoir. Three monitoring wells (BV-5, BV-21, BV-22) upgradient or west of the Primary Ash Pond and three wells (MW-9, MW-10, MW-11) downgradient of the Primary Ash Pond were selected for testing. Results of the slug testing from each well are listed in Table 1 for different units of equivalency.

The geometric mean $K_r$ value from all slug tests is 9.46 ft/day ($3.35 \times 10^{-3}$ cm/sec). The overall minimum $K_r$ of 1.45 ft/day ($5.14 \times 10^{-4}$ cm/sec) was estimated for MW-10 and the overall maximum $K_r$ of 38.7 ft/day ($1.37 \times 10^{-2}$ cm/sec) for BV-22. The $K_r$ values from wells upgradient and west of the primary ash pond are higher than the $K_r$ values estimated downgradient of the primary ash pond. The variability in $K_r$ values is likely due to discontinuous cohesive clay soils and varying silt and clay content within the sandy soils.

The hydraulic conductivities for each of the wells tested are within the expected range typical of unconsolidated sandy aquifers. According to Heath (1983), the expected total and effective porosities for a sandy aquifer are approximately 25% and 20%, respectively.

### 2.2.4 Groundwater Elevations, Flow Direction, and Velocity

Groundwater from wells MW-1 through MW-8 are monitored on a semi-annual basis and reflects seasonal variation of groundwater level and flow trends. Groundwater was originally measured at elevations ranging from 85 to 95 ft when wells MW-1 through MW-8 were first installed in the 1970s. After construction of the Coleto Creek Reservoir, the potentiometric surface rose to near current-day levels which ranged from approximately 100 ft to 115 ft NAVD88 during the most recent groundwater sampling event conducted in May 2017 (BBA, September 2017). The monitoring data indicate minimal seasonal variation of water levels; however, as would be expected water levels fluctuate based on drought conditions with levels ranging to approximately 5 ft lower. Current levels are approximately 2 ft to 5 ft lower than maximums observed in 2010.

The 40 *CFR* Part 257 monitoring well network consists of nine monitoring wells (MW-4, MW-5, MW-6, MW-8, MW-9, MW-10, MW-11, BV-5, and BV-21) installed in the uppermost aquifer as shown on Figure 2. Water levels in the 40 *CFR* Part 257 monitoring well network were measured during eight events from March to July 2017 in order to evaluate seasonal water level fluctuations across the site. A summary of groundwater level measurements for the 40 *CFR* Part 257 monitoring well network is provided in Table 2.

Groundwater flow occurs to the east and southeast across the Primary Ash Pond toward the Coleto Creek Reservoir (Figures 4 through 7). The horizontal hydraulic gradient was determined between wells MW-4 and MW-10 near the northern boundary of the Primary Ash Pond and between wells MW-8 and MW-6 near the southern boundary. The slope of the potentiometric surface between these two well pairs has averaged 0.0027 ft/ft and 0.0029 ft/ft, respectively from March 2017 through July 2017.

Groundwater velocity can be calculated using the following formula:

$$V = K_r\ (dh/dl)/n_e$$

where V is velocity (ft/day), $K_r$ is hydraulic conductivity (ft/day), dh/dl is the hydraulic gradient (ft/ft), and $n_e$ is the effective porosity of the aquifer (Heath, 1983). An effective porosity of 20% will be used in these calculations (based on typical values for clayey sand) and the calculated geometric mean hydraulic conductivity value as determined from monitoring wells surrounding the Primary Ash Pond (Bennett, 2017)

The average linear velocity through the uppermost aquifer between wells MW-4 and MW-10 is determined as follows:

V = 9.46 ft/day (0.0027 ft/ft)/0.20

V = 0.13 ft/day

The average linear velocity through the uppermost aquifer between wells MW-8 and MW-6 was calculated as follows:

V = 9.46 ft/day (0.0029 ft/ft)/0.20

V = 0.14 ft/day

Groundwater potentiometric surface maps for the above-referenced sampling events are included in this report as Figures 4, 5, 6, and 7.

# 3 GROUNDWATER MONITORING

In 2015, BBA began an assessment of the existing monitoring well networks at Coleto Creek Power Station with respect to the existing CCR units. Included in the assessment was a review of the current placement and number of monitoring wells with respect to the Primary Ash Pond as well as potential locations for new monitoring wells, as appropriate. The discussion below summarizes the results of the assessment and defines the CCR groundwater monitoring network.

## 3.1 CCR Monitoring Well Network

The 40 *CFR* Part 257 monitoring well network consists of nine monitoring wells installed in the uppermost aquifer. These wells include three upgradient/background wells (BV-5, BV-21, and MW-8) and six downgradient wells (MW-4, MW-5, MW-6, MW-9, MW-10, and MW-11) as shown on Figure 2. Boring logs and monitoring well construction reports for the groundwater monitoring system are provided in Appendix B. Details regarding the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the *Sampling and Analysis Plan* for the site (BBA, October 2017). Well depths, well screen intervals, depth to groundwater, and monitored units are summarized in Table 3.

## 3.2 Summary of Groundwater Monitoring Systems

The groundwater monitoring system for the Coleto Creek Primary Ash Pond meets the performance standard set in §257.91 of the Final Rule. Three existing monitoring wells (MW-8, BV-5, and BV-21) have been selected that are at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that accurately represent groundwater that has not been affected by leakage from the CCR units or other aspects of plant operations. Use of three background monitoring wells exceeds the minimum of one upgradient/background well required by §257.91(c)(1).

The six downgradient monitoring wells (MW-4, MW-5, MW-6, MW-9, MW-10, and MW-11) are installed as close as possible to the perimeter of the Primary Ash Pond to ensure that samples reflect groundwater quality at the pond boundary. This number exceeds the three wells required in §257.91(c)(1).

All monitoring wells were installed with screens and casing that maintains the integrity of the borehole. Well screens were packed with sand and annular spaces above the screen between the borehole and casing were sealed to minimize potential for cross contamination of groundwater samples. Documentation of the design, installation, and development of monitoring wells included in the groundwater monitoring system are available in the operating record for the Coleto Creek Power Station. The monitoring system for the Primary Ash Pond has been certified by a qualified professional engineer (see Appendix A).

# 4 REFERENCES

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# TABLES

**Table 1. Hydraulic Conductivity Testing Results**
**Hydrogeologic Monitoring Plan**
**Coleto Creek Power, LP CCR Rule Groundwater Monitoring**
**CCR Unit Name: Coleto Creek Primary Ash Pond**
**Unit ID: 141**

| Monitoring Well | $K_r$ (ft/day) | $K_r$ (m/day) | $K_r$ (cm/sec) | $K_r$ (ft/sec) |
|---|---|---|---|---|
| BV-5 | 24.6 | 7.49 | 8.68E-03 | 2.84E-04 |
| BV-21 | 37.8 | 11.5 | 1.34E-02 | 4.38E-04 |
| BV-22 | 38.7 | 11.8 | 1.37E-02 | 4.48E-04 |
| MW-9 | 3.3 | 1.01 | 1.17E-03 | 3.82E-05 |
| MW-10 | 1.45 | 0.443 | 5.14E-04 | 1.68E-05 |
| MW-11 | 4.17 | 1.27 | 1.47E-03 | 4.82E-05 |

**Table 2. Groundwater Levels, March - July, 2017**
**Hydrogeologic Monitoring Plan**
**Coleto Creek Power, LP CCR Rule Groundwater Monitoring**
**CCR Unit Name: Coleto Creek Primary Ash Pond**
**Unit ID: 141**

| Well ID | Top of Casing Well Elevation (ft) (1) | Date Measured | Depth to Water Below Top of Casing (ft) | Water Level Elevation |
|---|---|---|---|---|
| **MW-4** | 137.71 | 3/28/2017 | 29.25 | 108.46 |
| | | 5/9/2017 | 28.94 | 108.77 |
| | | 5/15/2017 | 28.93 | 108.78 |
| | | 6/6/2017 | 28.83 | 108.88 |
| | | 6/20/2017 | 28.94 | 108.77 |
| | | 6/22/2017 | 29.02 | 108.69 |
| | | 7/10/2017 | 29.11 | 108.6 |
| | | 7/18/2017 | 29.15 | 108.56 |
| **MW-5** | 122.31 | 3/30/2017 | 20.94 | 101.37 |
| | | 5/10/2017 | 20.3 | 102.01 |
| | | 5/16/2017 | 20.37 | 101.94 |
| | | 6/8/2017 | 20.61 | 101.7 |
| | | 6/21/2017 | 20.87 | 101.44 |
| | | 6/26/2017 | 21 | 101.31 |
| | | 7/11/2017 | 21.21 | 101.1 |
| | | 7/19/2017 | 21.47 | 100.84 |
| **MW-6** | 119.22 | 3/29/2017 | 15.76 | 103.46 |
| | | 5/11/2017 | 15.7 | 103.52 |
| | | 5/16/2017 | 15.68 | 103.54 |
| | | 6/7/2017 | 15.92 | 103.3 |
| | | 6/22/2017 | 16.34 | 102.88 |
| | | 6/28/2017 | 16.33 | 102.89 |
| | | 7/12/2017 | 16.76 | 102.46 |
| | | 7/20/2017 | 16.92 | 102.3 |
| **MW-8** | 134.72 | 3/28/2017 | 22.6 | 112.12 |
| | | 5/9/2017 | 21.29 | 113.43 |
| | | 5/15/2017 | 21.3 | 113.42 |
| | | 6/6/2017 | 21.25 | 113.47 |
| | | 6/20/2017 | 22.08 | 112.64 |
| | | 6/27/2017 | 22.12 | 112.6 |
| | | 7/10/2017 | 22.5 | 112.22 |
| | | 7/18/2017 | 22.67 | 112.05 |

**Table 2. Groundwater Levels, March - July, 2017**
**Hydrogeologic Monitoring Plan**
**Coleto Creek Power, LP CCR Rule Groundwater Monitoring**
**CCR Unit Name: Coleto Creek Primary Ash Pond**
**Unit ID: 141**

| Well ID | Top of Casing Well Elevation (ft) (1) | Date Measured | Depth to Water Below Top of Casing (ft) | Water Level Elevation |
|---|---|---|---|---|
| **MW-9** | 132.3 | 3/30/2017 | 28.31 | 103.99 |
| | | 5/10/2017 | 27.75 | 104.55 |
| | | 5/17/2017 | 29.87 | 102.43 |
| | | 6/7/2017 | 28.2 | 104.1 |
| | | 6/21/2017 | 28.65 | 103.65 |
| | | 6/26/2017 | 28.83 | 103.47 |
| | | 7/11/2017 | 29.12 | 103.18 |
| | | 7/19/2017 | 29.48 | 102.82 |
| **MW-10** | 130.4 | 3/30/2017 | 27.9 | 102.5 |
| | | 5/9/2017 | 27.5 | 102.9 |
| | | 5/16/2017 | 27.57 | 102.83 |
| | | 6/8/2017 | 27.68 | 102.72 |
| | | 6/21/2017 | 27.84 | 102.56 |
| | | 6/26/2017 | 27.97 | 102.43 |
| | | 7/11/2017 | 28.14 | 102.26 |
| | | 7/19/2017 | 28.26 | 102.14 |
| **MW-11** | 118.66 | 5/10/2017 | 14.3 | 104.36 |
| | | 5/16/2017 | 14.39 | 104.27 |
| | | 6/7/2017 | 14.56 | 104.1 |
| | | 6/21/2017 | 14.85 | 103.81 |
| | | 6/26/2017 | 14.94 | 103.72 |
| | | 7/11/2017 | 15.2 | 103.46 |
| | | 7/19/2017 | 15.31 | 103.35 |
| **BV-5** | 135.8 | 3/29/2017 | 29.35 | 106.45 |
| | | 5/11/2017 | 29.11 | 106.69 |
| | | 5/16/2017 | 29.1 | 106.7 |
| | | 6/7/2017 | 29.92 | 105.88 |
| | | 6/20/2017 | 29.18 | 106.62 |
| | | 6/27/2017 | 29.25 | 106.55 |
| | | 7/12/2017 | 29.32 | 106.48 |
| | | 7/18/2017 | 29.41 | 106.39 |

**Table 2. Groundwater Levels, March - July, 2017**
**Hydrogeologic Monitoring Plan**
**Coleto Creek Power, LP CCR Rule Groundwater Monitoring**
**CCR Unit Name: Coleto Creek Primary Ash Pond**
**Unit ID: 141**

| Well ID | Top of Casing Well Elevation (ft) (1) | Date Measured | Depth to Water Below Top of Casing (ft) | Water Level Elevation |
|---|---|---|---|---|
| **BV-21** | 131.17 | 3/28/2017 | 19.25 | 111.92 |
| | | 5/9/2017 | 18.54 | 112.63 |
| | | 5/17/2017 | 18.52 | 112.65 |
| | | 6/6/2017 | 18.44 | 112.73 |
| | | 6/20/2017 | 18.76 | 112.41 |
| | | 6/27/2017 | 18.71 | 112.46 |
| | | 7/10/2017 | 18.86 | 112.31 |
| | | 7/18/2017 | 18.9 | 112.27 |

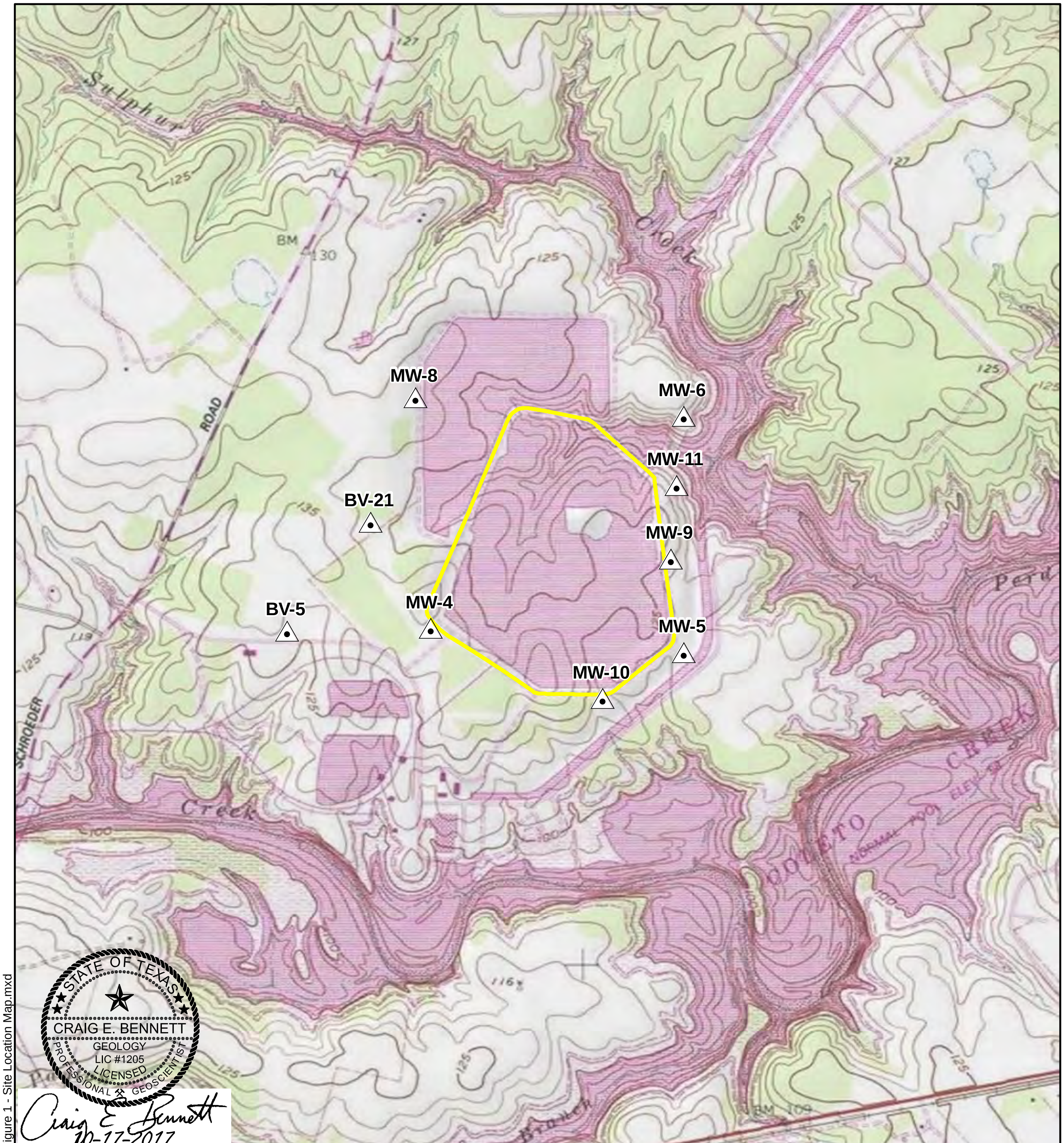
Notes:
ft = feet
1. Top of Casing Elevations are referenced to NAVD88.

**Table 3. CCR Monitoring Well Construction Details**
**Hydrogeologic Monitoring Plan**
**Coleto Creek Power, LP CCR Rule Groundwater Monitoring**
**CCR Unit Name: Coleto Creek Primary Ash Pond**
**Unit ID: 141**

| Well ID | MW-4 | MW-5 | MW-6 | MW-8 | MW-9 | MW-10 | MW-11 | BV-5 | BV-21 |
|---|---|---|---|---|---|---|---|---|---|
| Well Location Latitude | 28° 43' 17.29" N | 28° 43' 13.97" N | 28° 43' 46.56" N | 28° 43' 49.07" N | 28° 43' 26.90" N | 28° 43' 07.64" N | 28° 43' 37.01" N | 28° 43' 16.89" N | 28° 43' 31.90" N |
| Well Location Longitude | 97° 12' 52.27" W | 97° 12' 17.38" W | 97° 12' 17.38" W | 97° 12' 54.39" W | 97° 12' 19.18" W | 97° 12' 28.54" W | 97° 12' 18.36" W | 97° 13' 12.03" W | 97° 13' 00.55" W |
| Well Construction Material | PVC | PVC | PVC | PVC | PVC | PVC | PVC | PVC | PVC |
| Well Diameter (inches) | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 |
| Top of Casing Well Elevation (ft) (1) | 137.71 | 122.31 | 119.22 | 134.72 | 132.3 | 130.4 | 118.66 | 135.8 | 131.17 |
| Well Depth Below Ground Surface (ft) (2) | 70.1 | 59.27 | 61.15 | 56.88 | 60 | 60 | 49 | 40 | 40 |
| Screen Length (ft) | 19.6 | 19.8 | 19.9 | 19.9 | 20 | 20 | 20 | 10 | 10 |
| Top of Screen Elevation (ft) (3) | 83.8 | 80.1 | 75.1 | 94.8 | 89.3 | 87.6 | 86.8 | 103 | 98.4 |
| Bottom of Screen Elevation (ft) (3) | 64.2 | 60.3 | 55.2 | 74.9 | 69.3 | 67.6 | 66.8 | 93 | 88.4 |
| Well Stick-up Above Ground Surface (ft) | 3.41 | 2.74 | 2.87 | 2.94 | 3 | 2.8 | 2.86 | 2.8 | 2.77 |
| Hydraulic Position of Well (4) | D | D | D | U | D | D | D | B | U |

Notes:
PVC = polyvinyl chloride
ft = feet
1. Top of Casing Elevations are referenced to NAVD88.
2. Well Depth Below Ground Surface referenced to ground surface at time of well construction.
3. Top and Bottom of Screen Elevations reported as listed on well construction forms.
4. Background (B), upgradient (U), or downgradient (D)

# FIGURES

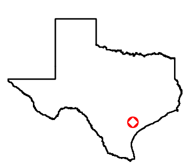



**Explanation**

Monitoring Well

CCR Monitored Unit

Refs/Notes:
DRG of USGS topo quad from ArcGIS Online Server.



Index Map

Feet
0 2,000
1:24,000

## Coleto Creek Power, LP

## Figure 1
## Site Location Map

| | | |
|---|---|---|
| PROJECT: 17251A | BY: EEF | REVISIONS |
| DATE: Sept 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/12/2017 - 6:55:07 AM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 1 - Site Location Map.mxd


**Explanation**

- Downgradient CCR Monitoring Well
- Upgradient/Backround CCR Monitoring Well
- CCR Monitored Unit

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-17-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

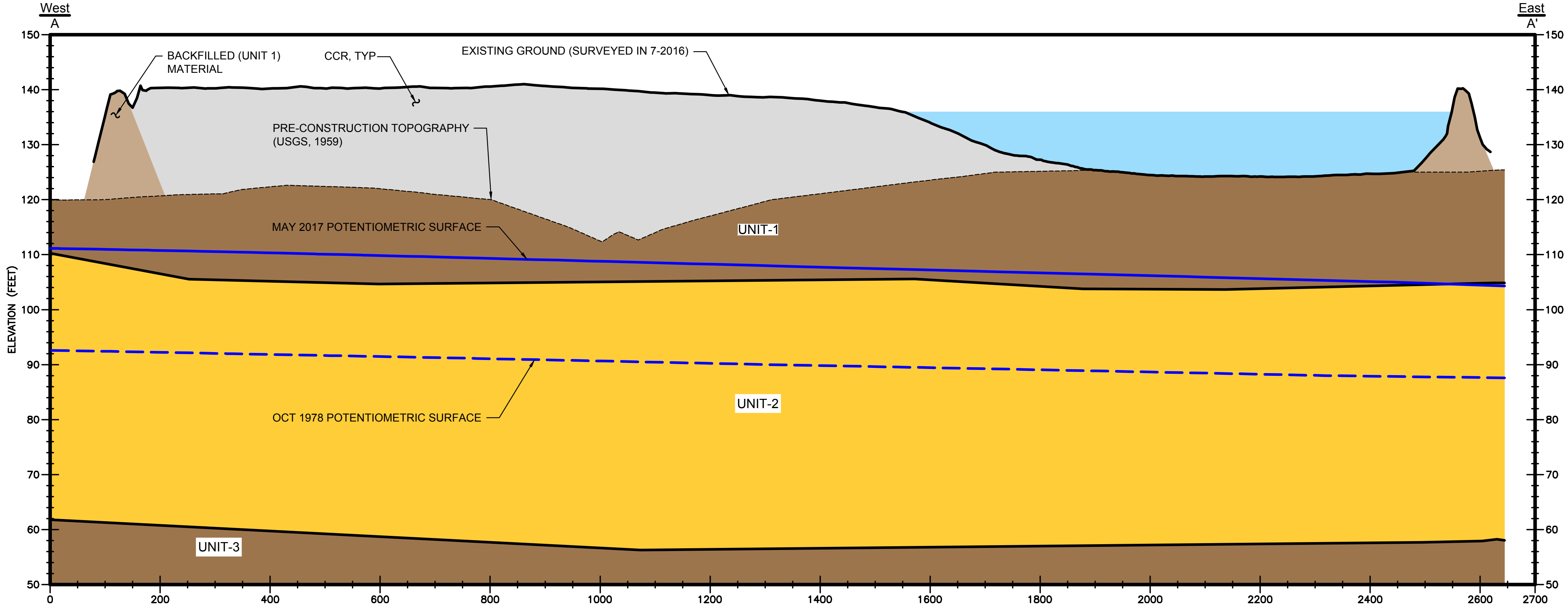
**Coleto Creek Power, LP**

**Figure 2**
**Monitoring Well Locations**

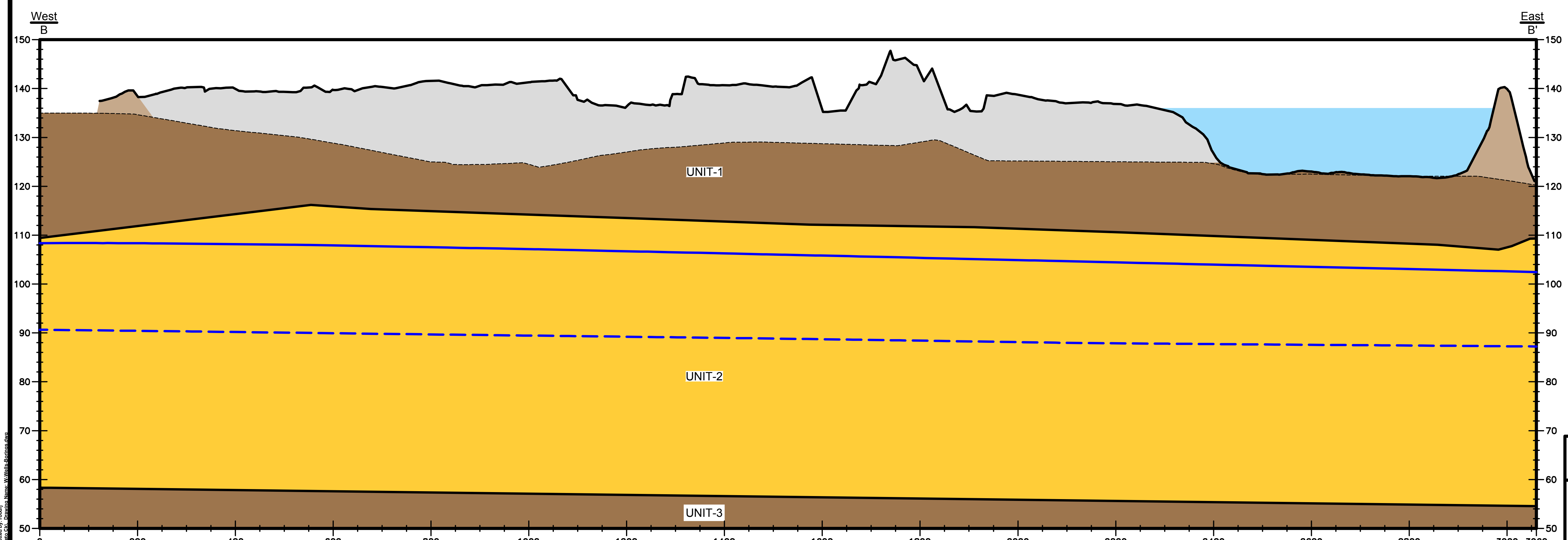
| | | |
|---|---|---|
| PROJECT: 17258 | BY: EEF | REVISIONS |
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/13/2017 - 6:10:57 PM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 2 - Monitoring Well Locations.mxd




PROFILE A-A' (LOOKING NORTH)
SCALE:1"=120'(H), 1"=12'(V)




PROFILE B-B' (LOOKING NORTH)
SCALE:1"=120'(H), 1"=12'(V)

NOTES:

July 2016 bathymetry and topographic surface data collected by Naismith Marine Services of Corpus Christi, Texas.

Unit 1 thickness based on EXHIBIT 3: BORING LOCATION PLAN AND THICKNESS CONTOURS OF INSITU COHESIVE SOILS from Sargent & Lundy (1978).

Original pond bottom depths and site stratigraphy are estimated and interpolated based on data in Sargent & Lundy (1978), 1959 USGS pre-construction topographic data, AECOM (2009), and various post-construction borings located outside of pond footprint.

October 1978 potentiometric surface estimated from data in Sargent & Lundy (1978).

May 2017 potentiometric surface based on groundwater data collected by Coleto Creek Power.

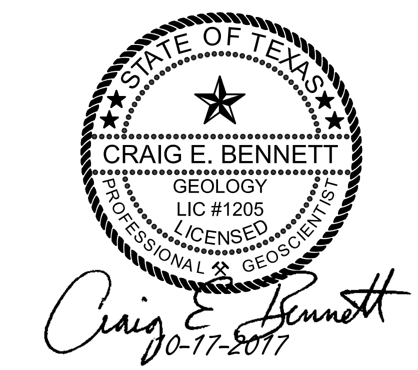
UNIT DESCRIPTIONS:

Unit 1 - Sandy CLAY and Silty CLAY. Surficial unit.

Unit 2 - Sand and Silty SAND with caliche and CLAY/Sandy CLAY lenses. First groundwater-bearing unit.

Unit 3 - CLAY and Silty CLAY. Basal unit.

Unit descriptions based on AECOM (2009).



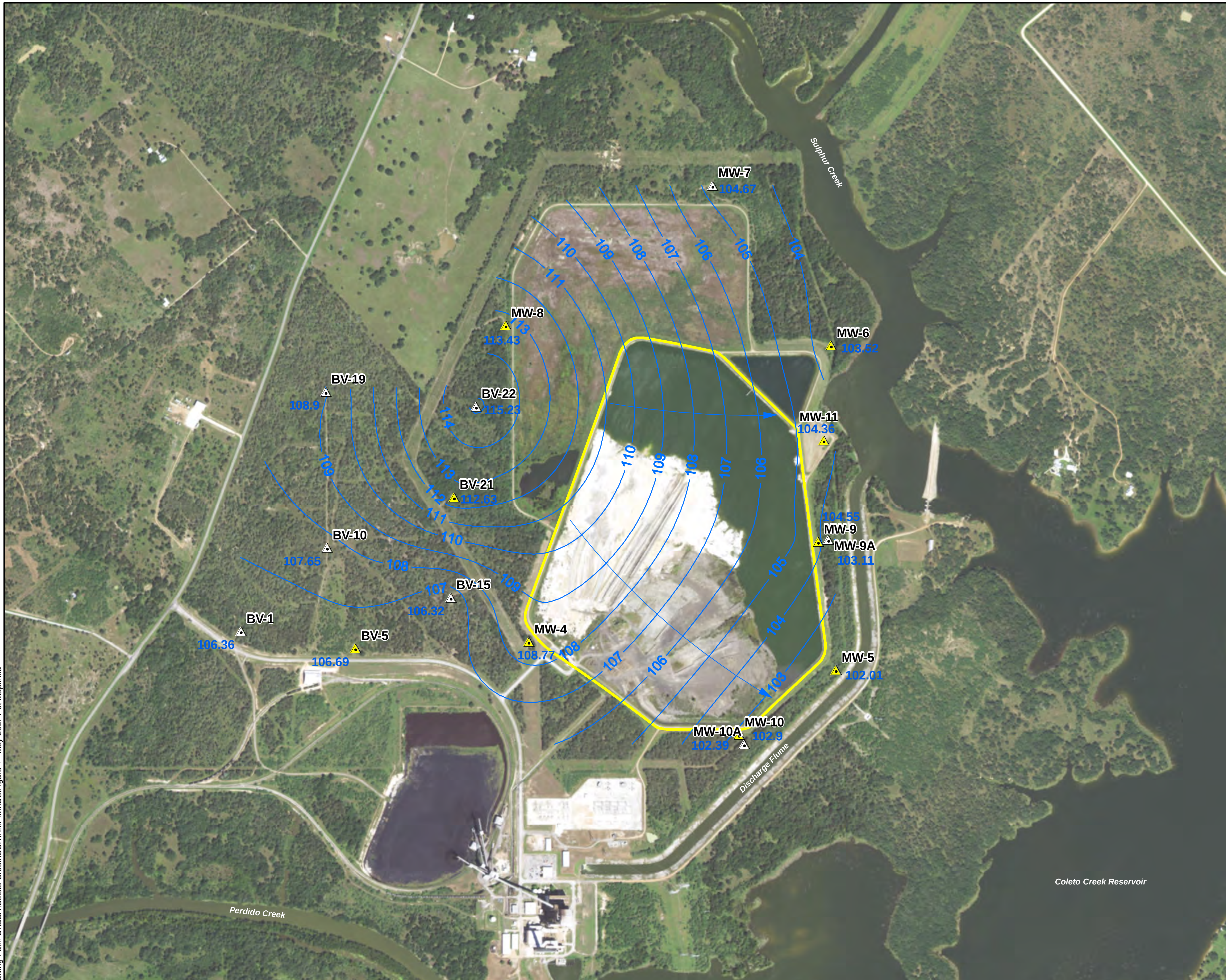

**Coleto Creek Power, LP**

**FIGURE 3**

GENERALIZED GEOLOGIC CROSS SECTIONS A-A' AND B-B'

| PROJECT: 17258 | DATE: OCT 2017 | BY: RCAD-RR | CHECKED: CBB |
|---|---|---|---|

Bullock, Bennett & Associates, LLC
ENGINEERING AND GEOSCIENCE
Texas Registrations: Engineering F-8542, Geoscience 50127




**Explanation**

- CCR Rule Monitoring Well
- Non-CCR Rule Monitoring Well
- 105 May 2017 Potentiometric Surface Elevation Contour (ft. MSL)
- CCR Monitored Unit
- Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-17-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

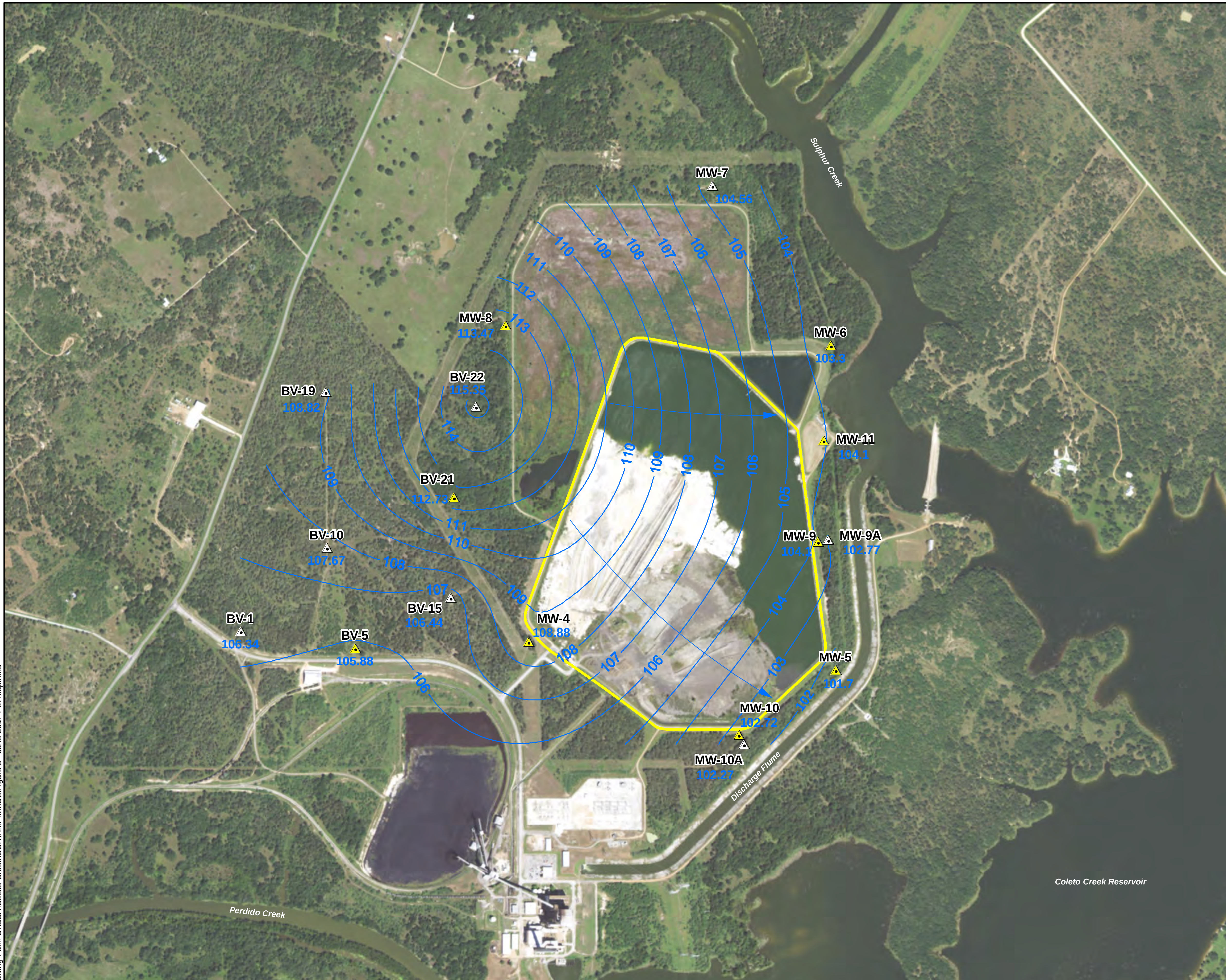
**Coleto Creek Power, LP**

**Figure 4**
**May 9-11, 2017**
**Potentiometric Surface Map**
**Uppermost Aquifer Unit**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/12/2017 - 7:02:05 AM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 4 - May 2017 Pot Map.mxd




**Explanation**

CCR Rule Monitoring Well

Non-CCR Rule Monitoring Well

105 June 2017 Potentiometric Surface Elevation Contour (ft. MSL)

CCR Monitored Unit

Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett 10-17-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

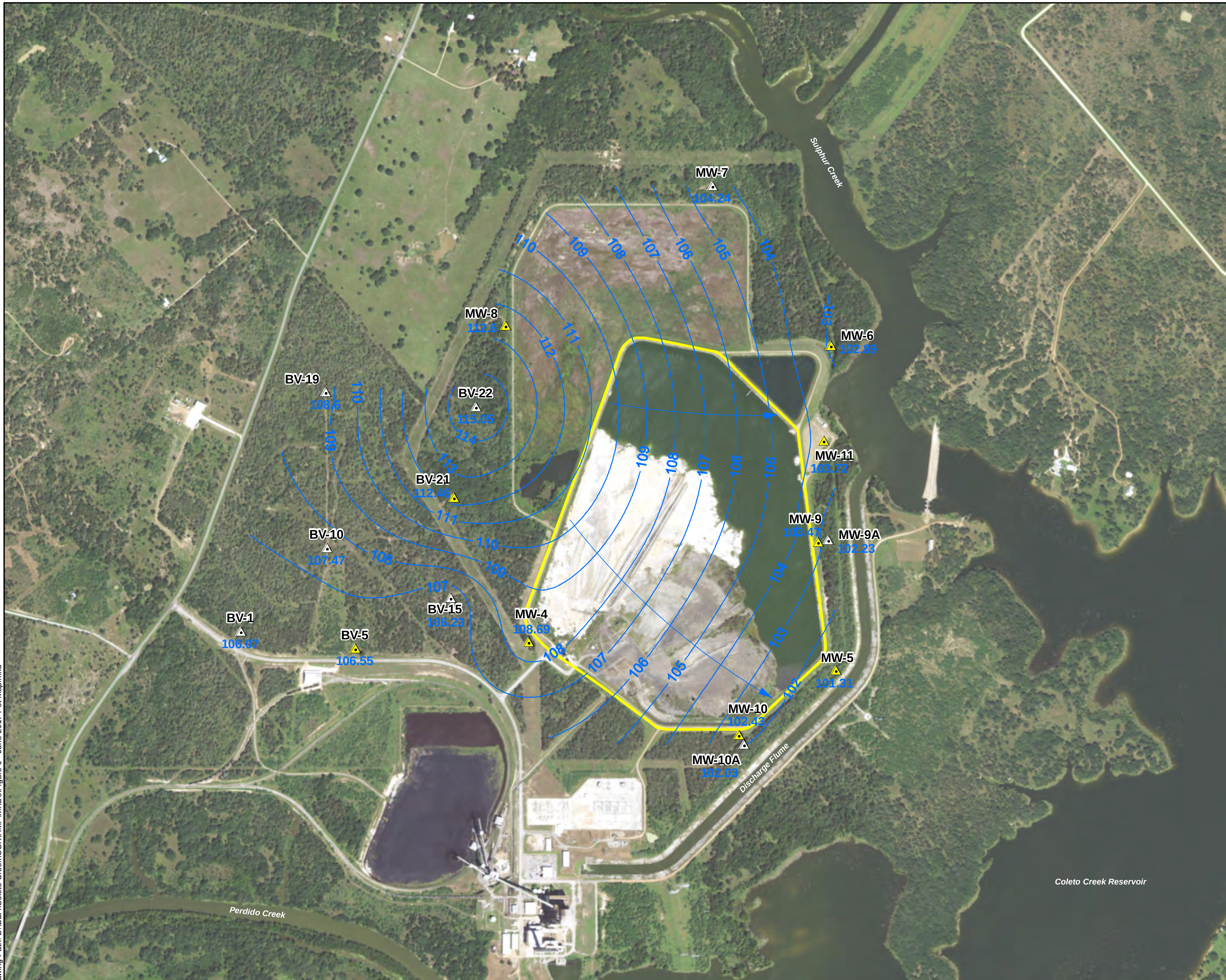
**Coleto Creek Power, LP**

**Figure 5**
**June 6-8, 2017**
**Potentiometric Surface Map**
**Uppermost Aquifer Unit**

| | | |
|---|---|---|
| PROJECT: 17258 | BY: EEF | REVISIONS |
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/12/2017 - 7:02:34 AM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 5 - June 2017 Pot Map.mxd




**Explanation**

CCR Rule Monitoring Well

Non-CCR Rule Monitoring Well

105 June 2017 Potentiometric Surface Elevation Contour (ft. MSL)

CCR Monitored Unit

Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett 10-17-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 — 1:12,000 — 2,000 Feet

**Coleto Creek Power, LP**

**Figure 6**
**June 26-28, 2017**
**Potentiometric Surface Map**
**Uppermost Aquifer Unit**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/12/2017 - 7:02:59 AM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 6 - June 2017 Pot Map.mxd


**Explanation**

CCR Rule Monitoring Well

Non-CCR Rule Monitoring Well

105 July 2017 Potentiometric Surface Elevation Contour (ft. MSL)

CCR Monitored Unit

Groundwater Flow Direction

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
10-17-2017

Ref: Orthoimagery from ArGIS World Imagery Server

N

0 1:12,000 2,000 Feet

**Coleto Creek Power, LP**

**Figure 7**
**July 18-20, 2017**
**Potentiometric Surface Map**
**Uppermost Aquifer Unit**

| PROJECT: 17258 | BY: EEF | REVISIONS |
|---|---|---|
| DATE: Oct 2017 | CHECKED: CEB | |

**Bullock, Bennett & Associates, LLC**
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 10/12/2017 - 7:03:30 AM, Plotted by: E.Ficker
Drawing Path: D:\BBA\Coleto Creek\CCR\HMP\MXDs\Figure 7 - July 2017 Pot Map.mxd

# APPENDIX A

## Monitoring Well System Certification

## By A Qualified Professional Engineer

**40 CFR Part 257.91(f) Groundwater Monitoring System Certification**
**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

In accordance with Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, Section 257.91(f), the owner or operator of a coal combustion residual (CCR) unit must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system at the CCR unit has been designed and constructed to meet the requirements of 40 CFR § 257.91. If the groundwater monitoring system includes the minimum number of monitoring wells specified in 40 CFR § 257.91(c)(1), the certification must document the basis supporting use of the minimum number of monitoring wells. Further, in accordance with 40 CFR § 257.91(e)(1), when completing the groundwater monitoring system certification, the qualified professional engineer must be given access to documentation regarding the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices.

The groundwater monitoring system designed and constructed for the Coleto Creek Primary Ash Pond includes more than the minimum number of monitoring wells specified in 40 CFR § 257.91(c)(1). The undersigned has been given access to documentation regarding the design, installation, development, and decommissioning of monitoring wells, piezometers and other measurement, sampling, and analytical devices concerning the Coleto Creek Primary Ash Pond.

*I, Daniel B. Bullock, a qualified professional engineer in good standing in the State of Texas, certify that the groundwater monitoring system at the Coleto Creek Primary Ash Pond has been designed and constructed to meet the requirements of 40 CFR § 257.91.*

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

10-17-2017

________________________________
Daniel B. Bullock, P.E.
Qualified Professional Engineer
#82596
Texas
October 17, 2017

*I, Craig E. Bennett, a licensed professional geologist in good standing in the State of Texas, certify that the groundwater monitoring system at the Coleto Creek Primary Ash Pond has been designed and constructed to meet the requirements of 40 CFR § 257.91.*

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

10-17-2017

________________________________
Craig E. Bennett, P.G.
Licensed Professional Geologist
#1205
Texas
October 17, 2017

# APPENDIX B

## CCR Groundwater Monitoring Well

## System Boring Logs

Appendix B: CCR Groundwater Monitoring Well System Boring Logs

Wells W-4 to W-6 and Well W-8
by Sargent & Lundy Engineers (March and April 1978). These monitoring wells are also designated as MW-4 to MW-6 and MW-8, respectively.

Wells W-9 and W-10
by Bullock, Bennett & Associates, LLC (May 2016). These monitoring wells are also designated as MW-9 and MW-10, respectively.

Well MW-11
by Bullock, Bennett & Associates, LLC (April 2017)

Wells BV-5 and BV-21
by Black & Veatch (August and September 2008)

# BORING NO. W-4

| | |
|---|---|
| PROJECT: Calais Creek Power Station | |
| CLIENT: Central Power & Light Co. | |
| FEATURE: Monitoring Well W-4 | |
| SURFACE ELEVATION: 134.32Ft | TOTAL DEPTH: 86.5 Ft |
| LOCATION: N 33400 E0490 | |
| DEPTH TO WATER DURING DRILLING: 42.0Ft | DATE: 6-3-78 |
| DRILLED BY: Trinity Testing Laboratories, Inc. | |
| LOGGED BY: Sargent & Lundy | |
| TESTED BY: Trinity Testing Laboratories, Inc. | |

| Depth (Ft.) | Sample Number and Type | Blows/Ft or Samples (Recovery, %) | Pocket Penetrometer (tsf) | Field Moisture Content (%) | Liquid Limit (%) | Plastic Limit (%) | Other Tests | Core Recovery (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | ST1 | (70) | | 16.0 | 40 | 21 | SA | | |
| 5 | ST2 | (80) | | | | | | | |
| | ST3 | (100) | | 13.2 | | | | | |
| 10 | ST4 | (80) | | 21.3 | 43 | 19 | SA | | |
| 15 | ST5 | (61) | | 13.5 | | | SA | | |
| 20 | SS6 | 7-33-40 (100) | | | | | | | |
| 25 | SS7 | 14-20-4 (100) | | | | | | | |
| 30 | SS8 | 38-35-39 (100) | | | | | SA | | |
| 35 | SS9 | 10-20-10 (100) | | | | | | | |
| 40 | SS10 | 41-30-2 | | | | | | | |
| 45 | SS11 | 37-24-47 (100) | | | | | SA | | |
| 50 | SS12 | 106/4 (100) | | | | | | | |
| 55 | SS13 | 32-40-20 (100) | | | | | | | |
| 60 | SS14 | 33-30-34 (100) | | | | | SA | | |
| 65 | SS15 | 60-100/2 (100) | | | | | | | |
| 70 | SS16 | 10-37-100/5 (100) | | | | | SA | | |
| 75 | SS17 | 37-46-66 (100) | | | | | SA | | |
| 80 | SS18 | 19-41-56 (100) | | | 46 | 23 | SA | | |
| 85 | SS19 | 37-53-84 (100) | | | | | | | |
| 90 | | | | | | | | | |

| Symbols | Description | Elevation (Ft., MSL) |
|---|---|---|
| SM | SAND, silty, brown. | 134.32 |
| SC | SAND, clayey, medium to fine, brown and yellow. | 132.32 |
| | - seams of cemented sand between 21 Ft and 25 Ft. | 113.32 |
| SP-SM | SAND, medium to fine, trace silt, yellow. | 108.32 |
| CL | CLAY, silty, some medium to fine sand, calcareous, yellow. | 103.32 |
| SP | SAND, medium to fine, yellow. | 100.32 |
| CL | CLAY, silty and sandy, yellow. | 99.32 |
| SM | SAND, silty, coarse to fine, trace gravel, yellow. | 98.32 |
| | - cemented layer. | 94.32 |
| | - grades to no gravel, white | 93.32 / 92.32 |
| | - grades to medium to fine. - grades to coarse to fine with gravel & caliche. | 89.32 / 88.02 |
| SM | | 86.32 |
| CL | CLAY, sandy, yellow and gray. | 78.02 |
| SC-GC | SAND and Gravel, clayey, gray, with cemented layers. | 74.32 |
| CL | CLAY, sandy, gray. - grades to yellow | 69.32 / 66.02 |
| SM | SAND, silty, coarse to fine, yellow. | 63.32 / 63.02 |
| ML | Caliche, (Chalk) | 60.02 |
| SM | SAND, silty, coarse to fine, yellow. | |
| CL | CLAY, silty, little medium to fine sand, gray and brown with pockets of Caliche. | 58.32 |
| | END OF BORING - 86.5 Ft | 47.82 |
| | Groundwater encountered at 42.0 Ft. | |

ATTACHMENT 11

## BORING NO. W-5

SHEET 1 OF 2

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-5
SURFACE ELEVATION: 119.57 Ft | TOTAL DEPTH: 71.5Ft
LOCATION: N 30+07.7 E 31+50.6
DEPTH TO WATER DURING DRILLING: 40.0 Ft | DATE: 3-30-78
DRILLED BY: Trinity Testing Laboratories, Inc.
LOGGED BY: Sargent & Lundy
TESTED BY: Trinity Testing Laboratories, Inc.

| DEPTH (ft.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf.) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) | SYMBOLS | DESCRIPTION | DEPTH (ft.) | ELEVATION (ft., MSL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | SM | SAND, silty, brown (Topsoil) | 0 | 119.57 |
| | | | | | | | | | | SC | SAND, clayey, medium to fine, brown. | | 119.07 |
| | ST1 | (75) | | 12.8 | | | SA | | | | | | |
| 5 | ST2 | (83) | | | | | | | | CL | CLAY, silty, gray, with Caliche. | 5 | 114.07 |
| | ST3 | (83) | | | | | | | | SC | SAND, clayey, brown, with layers of Caliche. | | 111.57 |
| 10 | ST4 | (83) | | | | | | | | CL | CLAY, silty, yellow and white, with lenses and pockets of Caliche. | 10 | 108.57 |
| 15 | ST5 | (78) | | 3.1 | | | SA | | | SP-SM | SAND, medium to fine, white. | 15 | 104.57 |
| 20 | SS6 | 8-13-20 (100) | | | | | SA | | | | | 20 | |
| 25 | SS7 | 7-47-100/4.5 (100) | | | | | | | | SC | SAND, clayey, calcareous, white. (Caliche) | 25 | 93.57 |
| 30 | SS8 | 6-13-31 (100) | | | | | | | | SM-SC | SAND, silty and clayey, white, with lenses and seems of Caliche - grades to gray. | 30 | 90.57 |
| 35 | SS9 | 14-36-31 (100) | | | | | SA | | | | | 35 | |
| 40 | SS10 | 1-27-31 (100) | | | | | | | | SM | SAND, silty, coarse to fine, white | 40 (water level) | 79.57 / 79.07 |
| 45 | SS11 | 16-67-100/5.5 (100) | | 34 | 15 | | | | | CL | CLAY, silty, gray, with seems of Caliche. | 45 | 73.57 |
| 50 | | | | | | | | | | | | 50 | |

| REVISION | DATE / APPROVED BY | DESCRIPTION |
|---|---|---|
| 0 | 10-24-78 D.G. Burlein | For Use |
| | | |
| | | |
| | | |

COLETO CREEK POWER STATION
LOG OF BORING W-5

CENTRAL POWER & LIGHT CO.

SARGENT & LUNDY ENGINEERS

PROJECT NUMBER 4857

| DEPTH (ft.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) | SYMBOLS | DESCRIPTION | DEPTH (ft.) / ELEVATION (ft., MSL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | SS12 | 72-100/1 (100) | | | | | SA | | | SM-SC | SAND, silty and clayey, calcareous, white, very dense. (Caliche) | 69.57 |
| | | | | | | | | | | SM | SAND, silty, white. | 66.57 |
| 55 | SS13 | 50-74-130/5.5 (100) | | | | | | | | | | |
| | | | | | | | | | | SM-SC | SAND, silty and clayey, calcareous, white and brown, very dense. (Caliche) | 62.57 |
| 60 | SS14 | 100/3.5 (100) | | | 18 | 14 | SA | | | | | |
| 65 | SS15 | 18-78-100/4.5 (100) | | | | | | | | CL | CLAY, silty, brown. | 53.57 |
| 70 | SS16 | 9-17-21 (100) | | | | | | | | | END OF BORING - 71.5 Ft<br>Groundwater encountered at 40.0 Ft. and rose to 32.5 Ft. | 48.07 |
| 75 | | | | | | | | | | | | |

| REVISION | DATE / APPROVED BY | DESCRIPTION |
|---|---|---|
| 0 | 10-24-78 / R.E. Bolin | For Use |

COLETO CREEK POWER STATION
LOG OF BORING W-5 (cont'd)

CENTRAL POWER & LIGHT CO.

SARGENT & LUNDY ENGINEERS

PROJECT NUMBER 4857

S-10

## BORING NO. W-6

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-6
SURFACE ELEVATION: 111.35 Ft | TOTAL DEPTH: 66.1 Ft
DRILLED BY: Trinity Testing Laboratories, Inc.
LOGGED BY: Trinity Testing Laboratories, Inc.
TESTED BY: Trinity Testing Laboratories, Inc.

| SYMBOLS | DESCRIPTION |
| --- | --- |
| SC | SAND, clayey, brown. |
| | - grades to yellow-brown. |
| | - grades to yellow with Caliche. |
| CL | CLAY, sandy, yellow-brown. |
| SM-SC | SAND, silty and clayey, yellow and white with Caliche. |
| SC | SAND, clayey, yellow-gray. |
| SP-SM | SAND, coarse to fine, white to yellow. |
| SM | SAND, silty, trace gravel, white with layer of clayey sand. |
| CL-ML | CLAY, silty and sandy, yellow gray. |
| SC | SAND, clayey, gray, with Caliche. |
| | - grades to yellow-gray. |
| SM-SC | SAND, silty and clayey, white. |
| CL | CLAY, silty, gray-pink. |
| | END OF BORING - 66.1 Ft. Groundwater encountered at 35.0 Ft |

## BORING NO. W-7

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-7
SURFACE ELEVATION: 124.99 Ft | TOTAL DEPTH: 73.13 Ft
DRILLED BY: Trinity Testing Laboratories, Inc.
LOGGED BY: Trinity Testing Laboratories, Inc.
TESTED BY: Trinity Testing Laboratories, Inc.

| SYMBOLS | DESCRIPTION |
| --- | --- |
| SC | SAND, clayey, medium to fine, brown |
| | - grades to yellow with layers of Caliche. |
| | - grades to brown. |
| | - grades to yellow. |
| SM | SAND, silty, coarse to fine, trace gravel, white. |
| SC | SAND, clayey, yellow, with Caliche. |
| SM | SAND, silty, coarse to fine, yellow. |
| SC | SAND, clayey, gray, with Caliche. |
| SM | SAND, silty, medium to fine, white. |
| SC | SAND, clayey. |
| SM | SAND, silty, coarse to fine, with and without little gravel, white. |
| | - cemented layer. |
| CL | CLAY, silty, gray, very hard. |
| | END OF BORING - 73.13 Ft. Groundwater encountered at 33.0 Ft. |

## BORING NO. W-8

PROJECT: Coleto Creek Power Station
CLIENT: Central Power & Light Co.
FEATURE: Monitoring Well W-8
DRILLED BY: Trinity Testing Laboratories, Inc.
LOGGED BY: Sargent & Lundy
TESTED BY: Trinity Testing Laboratories, Inc.

| SYMBOLS | DESCRIPTION |
| --- | --- |
| SC | SAND, clayey, medium to fine, brown. |
| CL | CLAY, silty, and sandy, calcareous, white, (Caliche) |
| SC | SAND, clayey, medium to fine, calcareous, light brown to white. |
| SM | SAND, silty, medium to fine, light brown to gray. |
| CL | CLAY, silty, brown. |
| SC | SAND, clayey calcareous, white. (Caliche) |
| SP | SAND, coarse to fine, brown |
| SC | SAND, clayey, coarse to fine, gray. |
| SM | SAND, silty, gray, with clayey sand layers. |
| SC | SAND, clayey, gray, very hard. |
| CL | CLAY, silty, light brown to white with Caliche, very hard. |
| | END OF BORING - 81.3 Ft. Groundwater encountered at 42.0 Ft |

## NOTES

## REFERENCE DRAWINGS

S-2 SOILS BORINGS LOCATION PLAN

FOR REFERENCE ONLY
SPEC. CC2-513.20
11-21-80

DRAWING RELEASE RECORD

| REV. | DATE REL'D | PREPARED | REVIEWED | APPROVED | PURPOSE |
| --- | --- | --- | --- | --- | --- |
| A | | | | | FOR RECORD |

SCALE: NONE
PROJECT NUMBER: 4567

LOG OF BORINGS
W-6 THROUGH W-8
COLETO CREEK POWER STATION UNIT 1
CENTRAL POWER & LIGHT COMPANY
GOLIAD COUNTY, TEXAS

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO. S-10 | REV. A
SHEET 3 OF 3

| Bullock, Bennett & Associates, LLC<br>165 N. Lampasas Street<br>Bertram, TX 78605 | LOG OF BORING W-9<br>(Page 1 of 1) |
|---|---|

COLETO CREEK POWER STATION
FANNIN, TX

Project No. 15215

Date : 9/15/2015
Easting : 2543670.9
Northing : 13451651.2
Top of Casing Elevation 132.3 ft NAVD 88
Logger : EEF

Drilling Company : EnviroCore
Driller : Craig Schena (Lic. #4694)
Drill Rig : CME75
Drilling Method : Hollow Stem Auger - 6"
Sampling Method : Split-Spoon

| DEPTH (feet) | Surface Elevation 129.3 | DESCRIPTION | USCS | GRAPHIC | Recovery (ft/ft) | WELL DIAGRAM/REMARKS |
|---|---|---|---|---|---|---|
| 0.0 | 128 | (0-2.0) - Fill Material: CLAYEY SAND, mottled light gray and reddish brown, moist | SC | | 1.5/2 | |
| 5.0 | 124 | (2.0-5.5) - Fill Material: Silty CLAY/Clayey SAND, brownish gray to white, soft to firm, Sand is fine to coarse grained, common caliche gravel, moist | SC/CL | | 2/2<br>2/2 | |
| 10.0 | 120 | (5.5-10.0) - Silty CLAY, dark gray to gray with orangish brown mottling, firm to hard, medium plasticity, common caliche gravel, minor roots, moist | CL | | 2/2<br>2/2 | Well Construction:<br>Riser -3.0' AGL - 40.0' BGL<br>Neat Cement: 0' - 2.0' BGL<br>Bentonite chips seal: 2.0' - 38.0' BGL<br>Sand Pack: 38.0' - 60.0' BGL<br>Screen: 40.0' - 60.0' BGL |
| 15.0 | 116<br>112 | (10.0-20.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low plasticity, dry | ML/CL | | 2/2<br>2/2<br>2/2<br>2/2<br>2/2 | |
| 20.0 | 108 | (20.5-22.0) - SILTY SAND, very light brownish gray, fine to coarse grained, trace of gravel, moist | SM | | 2/2 | |
| 25.0<br>30.0<br>35.0<br>40.0 | 104<br>100<br>96<br>92<br>88 | (22.0-44.0) - SAND, very light orangish brownish to very light gray, fine to coarse grained, slightly silty, wet | SW | | 2/2<br>2/2<br>2/2<br>2/2<br>2/2<br>2/2<br>2/2<br>2/2<br>2/2<br>2/2<br>2/2 | Water Level: 25.2' BGL |
| 45.0 | 84 | (44.0-47.0) - SILTY SAND, light gray, fine to coarse grained, wet | SM | | 2/2<br>2/2 | |
| 50.0 | 80<br>76 | (47.0-54.0) - Silty CLAY/Clayey SAND, light gray, soft to firm, Sand is fine to coarse grained, wet | SC/CL | | 2/2<br>2/2<br>2/2 | |
| 55.0<br>60.0 | 72 | (54.0-60.0) - Silty, Clayey SAND, gray, fine to coarse grained, wet | SC/SM | | 2/2<br>2/2<br>2/2 | |

Craig E. Bennett
STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC. # 1205
LICENSED
PROFESSIONAL GEOSCIENTIST
5-26-16

Total Boring Depth = 60 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING W-10



COLETO CREEK POWER STATION
FANNIN, TX

Project No. 15215

| | |
|---|---|
| Date | : 9/17/2015 |
| Easting | : 2542864.5 |
| Northing | : 13449694.0 |
| Top of Casing Elevation | 130.4 ft NAVD 88 |
| Logger | : EEF |
| Drilling Company | : EnviroCore |
| Driller | : Craig Schena (Lic. #4694) |
| Drill Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger - 6" |
| Sampling Method | : Split-Spoon |

Surface Elevation 127.6

| DEPTH (feet) | DESCRIPTION | USCS |
|---|---|---|
| 0.0–2.0 | (0-2.0) - Fill Material: SILTY SAND, fine to coarse grained, brown, clayey, common roots, moist | SM |
| 2.0–8.0 | (2.0-8.0) - Silty,Sandy CLAY,mottled organish brown and light gray, firm, medium plasticity, moist | CL |
| 8.0–11.0 | (8.0-11.0) - Silty CLAY/Clayey SAND, light gray, Sand is medium grained, moist | SC/CL |
| 11.0–19.0 | (11.0-19.0) - SILTY SAND, very light gray, medium to coarse grained, abundant caliche, moist | SM |
| 19.0–30.0 | (19.0-30.0) - SAND, light gray, medium to coase grained, occasional gravel, moist | SP |
| 30.0–32.0 | (30.0-32.0) - Silty CLAY/Clayey SAND, light gray, soft to firm, occasional gravel and caliche, medium plasticity, wet | CL/SC |
| 32.0–34.0 | (32.0-34.0) - CLAYEY SAND, brownish grey, soft, very fine, wet | SC |
| 34.0–36.0 | (34.0-36.0) - SILTY SAND, light gray, fine to medium grained, wet | SM |
| 36.0–52.0 | (36.0-52.0) - Silty, Clayey SAND, light gray, fine to coarse grained, wet | SC/SM |
| 52.0–60.0 | (52.0-60.0) - SILTY SAND, light gray, fine to coarse grained, clayey, wet | SM |

Depth scale: 0.0, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, 50.0, 55.0, 60.0
Elevation scale: 124, 120, 116, 112, 108, 104, 100, 96, 92, 88, 84, 80, 76, 72, 68

Recovery (ft/ft), top to bottom:

| | |
|---|---|
| 1 | 2/2 |
| 2 | 1.8/2 |
| 3 | 0/2 |
| 4 | 1.7/2 |
| 5 | 2/2 |
| 6 | 1.7/2 |
| 7 | 1.8/2 |
| 8 | 1.8/2 |
| 9 | 1.8/2 |
| 10 | 1.8/2 |
| 11 | 1.8/2 |
| 12 | 1.8/2 |
| 13 | 1.8/2 |
| 14 | 1.8/2 |
| 15 | 1.8/2 |
| 16 | 1.8/2 |
| 17 | 1.8/2 |
| 18 | 1.5/2 |
| 19 | 1.8/2 |
| 20 | 1.8/2 |
| 21 | 1.8/2 |
| 22 | 1.8/2 |
| 23 | 1.8/2 |
| 24 | 2/2 |
| 25 | 2/2 |
| 26 | 1.8/2 |
| 27 | 1.8/2 |
| 28 | 1.8/2 |
| 29 | 2/2 |
| 30 | 1.5/2 |

## WELL DIAGRAM/REMARKS

Well Construction:
Riser ~3.0' AGL - 40.0' BGL
Neat Cement: 0' - 2.0' BGL
Bentonite chips seal: 2.0' - 38.0' BGL
Sand Pack: 38.0' - 60.0' BGL
Screen: 40.0' - 60.0' BGL

Water Level: 24.8' BGL

Craig E. Bennett
STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC. # 1205
LICENSED
PROFESSIONAL GEOSCIENTIST
5-26-16

Total Boring Depth = 60 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING MW-11



COLETO CREEK POWER STATION
FANNIN, TX

Project No. 17252

| | | | |
|---|---|---|---|
| Date | : 4/25/2017 | Drilling Company | : EnviroCore |
| Easting | : 2543727.0 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13452676.5 | Drill Rig | : CME75 |
| Top of Casing Elevation | 118.66 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

| DEPTH (feet) | Surface Elevation 115.8 | DESCRIPTION | USCS |
|---|---|---|---|
| 0.0 | | (0-1.0) - Silty CLAY, dark brown, soft to firm, medium plasticity, minor roots, moist | CL |
| 5.0 | 112 | (1.0-6.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low to medium plascticity, wet | CL/ML |
| 10.0 | 108, 104 | (6.5-13.8) - Silty, Clayey SAND, light gray to white, very fine to medium grained, wet | SM |
| 15.0, 20.0, 25.0 | 100, 96, 92, 88 | (13.8-28.5) - SAND, very light orangish brownish to very light gray, fine to coarse grained, abundant gravel, slightly silty, wet | SW |
| 30.0, 35.0 | 84, 80 | (28.5-38.0) - Silty, Clayey SAND, gray to light brownish gray, very fine to medium grained, wet | SM/SC |
| 40.0 | 76 | (38.0-40.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | CL/SC |
| 45.0 | 72 | (40.0-46.0) - Silty, Clayey SAND, gray, fine to medium grained, wet | SM/SC |
| | 68 | (46.0-49.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | SC |

Recovery (ft/ft), in order with depth: 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 0/2, 2/2, 1.5/2, 0.5/1

## WELL DIAGRAM/REMARKS

Water Level: 11.2' BGL

Well Construction:
Riser ~2.7' AGL - 29.0' BGL
Neat Cement: 0' - 1.0' BGL
Bentonite chips seal: 1.0' - 27.0' BGL
Sand Pack: 27.0' - 49.0' BGL
Screen: 29.0' - 49.0' BGL

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
04-28-2017

Total Boring Depth = 49 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE / SAMPLE NUMBER / SET 6 INCHES / 2ND 6 INCHES / 3RD 6 INCHES / N VALUE / SAMPLE RECOVERY

ROCK CORING: CORE SIZE / RUN NUMBER / RUN LENGTH / RUN RECOVERY / RQD RECOVERY / PERCENT RECOVERY / RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| SPT | 1 | 3 | 7 | 11 | 18 | 1.0 | 0 | 132 | Clayey SAND; brownish gray; medium dense; moist; fine grained; poorly graded; some roots | Boring advanced w/ 3-1/4" ID hollow stem auger. SPT performed w/ auto hammer. Sand partings are vertical and dry. |
| SPT | 2 | 13 | 11 | 10 | 21 | 1.2 | 2 | 130 | @ 3.0'-3.2' yellowish brown fine to medium sand partings; roots grade out | |
| SPT | 3 | 6 | 10 | 13 | 23 | 1.2 | 4 | 128 | grading light gray w/ some black mottling | |
| SPT | 4 | 6 | 10 | 13 | 23 | 1.1 | 6, 8 | 126, 124 | | |
| CA | 5 | 6 | 14 | 19 | 33 | 1.4 | 10 | 122 | grading w/some light brown staining | |
| | | | | | | | 12.5 | | CLAY; white; hard; moist; low plasticity; frequent pockets of gray fine grained clayey sand | |
| SPT | 6 | 13 | 16 | 20 | 36 | 1.5 | 12, 14, 16 | 120, 118, 116 | | |
| CA | 7 | 19 | 30 | 28 | 58 | 1.5 | 18 | 114 | grading w/ frequent pockets of gray & light brown clay | |
| | | | | | | | 20.0 | 112 | SAND; grayish white; moist; fine to medium grained; poorly graded | |
| SPT | 8 | 6 | 8 | 8 | 16 | 1.5 | 22, 24 | 110, 108 | grading medium dense w/trace angular gravel<br>@ 24.0' gravel grades out | |
| | | | | | | | 26 | 106 | | Encountered water @ 25.5' during drilling |
| SPT | 9 | 50/5" | - | - | >50 | 0.3 | 28, 30 | 104 | grading very dense<br>@29.2' calcareous sand nodules; some white silt w/ | Sand in augers. Augers being |

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG

BORING NO. BV-5



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE, SAMPLE NUMBER, SET 6 INCHES, 2ND 6 INCHES, 3RD 6 INCHES, N VALUE, SAMPLE RECOVERY
ROCK CORING: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 30 | | chalk nodules | driven along w/ spoon. Below 28.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid. Driller reported trace gravel from 28.5'-38.5'. |
| SPT | 10 | 6 | 8 | 10 | 18 | 0.9 | 34 | | grading medium dense; wet; fine to medium grained; well graded | |
| SPT | 11 | 14 | 33 | 38 | 71 | 1.5 | 39 | | grading very dense<br>@ 38.5'-39.3' yellow silty clay layer<br>@ 39.3' grading grayish white w/ fine grained sand & some silt | |
| | | | | | | | 40.0 | | Clayey SAND; light gray; dense; moist; fine grained; poorly graded | Based on driller's comments. |
| SPT | 12 | 12 | 16 | 21 | 37 | 1.5 | 44 | | | |
| SPT | 13 | 12 | 17 | 20 | 37 | 1.5 | 49 | | grading light brown; silt grades out | |
| SPT | 14 | 17 | 40 | 33 | 73 | 0.9 | 54 | | grading fine to medium grained<br>some angular gravel | |
| SPT | 15 | 7 | 50/3" | - | >50 | 0.3 | 59 | | grading w/ white fine sand; some clay cementation | Driller reported alternating hard and soft drilling efforts. |

Depth scale: 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60
Elevation scale: 102, 100, 98, 96, 94, 92, 90, 88, 86, 84, 82, 80, 78, 76, 74

BLACK & VEATCH

# *PRELIMINARY* BORING LOG

BORING NO. BV-5



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60.0 | Silty SAND; white; very dense; moist; fine grained; poorly graded; some pockets of light brown clay; highly cemented | Based on driller's comments & cuttings from rotary wash. |
| SPT | 16 | 50/4" | - | - | >50 | 0.2 | 64 | | |
| SPT | 17 | 50/3" | - | - | >50 | 0.3 | 69 | grading w/ trace angular to subangular gravel; clay pockets grade to trace | |
| SPT | 18 | 12 | 17 | 22 | 39 | 1.5 | 73.5 | CLAY; dark tan; hard; moist; low plasticity; some sand<br>@ 74.5' yellowish gray | No clay cuttings in drilling fluid return. |
| SPT | 19 | 13 | 17 | 22 | 39 | 1.5 | 80 | | Bottom of boring @ 80.0'. Water level recorded @ 24.6' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/17/08. Piezometer PZ-5 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

ROCK CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

SAMPLE TYPE | ELEVATION (FEET) | GRAPHIC LOG

Depth scale: 60–90 ft; Elevation scale: 72–44 ft

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# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| | | | |
|---|---|---|---|
| CLIENT: International Power America, Inc | | PROJECT: Coleto Creek Unit Two | PROJECT NO.: 149116 |
| PROJECT LOCATION: Victoria, Texas | COORDINATES: N 328659.7' E 2571578.7' | GROUND ELEVATION (DATUM): 128.4 ft (MSL) | TOTAL DEPTH: 80.0 (feet) |
| SURFACE CONDITIONS: Level, loose, silty sand | COORDINATE SYSTEM: State | DATE START: 9/8/08 | DATE FINISHED: 9/8/08 |
| LOGGED BY: V. Bhadriraju | CHECKED BY: V Bhadriraju | APPROVED BY: | |

SOIL SAMPLING

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY |
|---|---|---|---|---|---|---|
| SPT | 1 | 1 | 2 | 5 | 7 | 0.9 |
| SPT | 2 | 5 | 5 | 6 | 11 | 1.5 |
| SPT | 3 | 4 | 6 | 9 | 15 | 1.5 |
| SPT | 4 | 5 | 6 | 8 | 14 | 1.1 |
| CA | 5 | 3 | 3 | 4 | 7 | 1.5 |
| SPT | 6 | 22 | 50/3 | - | >50 | 0.7 |
| SPT | 7 | 24 | 50 | 50/4 | >50 | 0.9 |
| SPT | 8 | 5 | 6 | 14 | 20 | 1.5 |
| SPT | 9 | 20 | 48 | 48 | 96 | 1.5 |

ROCK CORING: CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD

DEPTH (FEET) | SAMPLE TYPE | ELEVATION (FEET) | GRAPHIC LOG

## CLASSIFICATION OF MATERIALS

- 0–1.2: SAND; dark brown; loose; moist; fine grained; poorly graded
- 1.2–9.5: Clayey SAND; light brown; medium dense; moist; fine grained; poorly graded
  - grading light gray; some black mottling & trace roots
  - grading w/trace chalk nodules; roots grade out
  - grading w/frequent seams of chalk nodules
- 9.5–12.0: Clayey SAND; light gray; moist; fine to medium grained; poorly graded; trace gravel
  - grading w/highly cemented calcareous sand
- 12.0–23.5: Silty SAND; grayish white; very dense; moist; fine grained; poorly graded
  - grading orange; wet; fine to medium grained; trace calcareous sand nodules
- 23.5–25.0: CLAY; light gray; very stiff; moist; high plasticity; some light brown clay pockets
- 25.0–: SAND; light gray; very dense; wet; fine to coarse grained; well graded; w/trace gravel

## REMARKS

Boring advanced w/3-1/4" ID hollow stem auger. SPT performed w/auto hammer.

Water encountered during drilling @ 17.6'.
Driller reports softer drilling. Below 18.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid.
White silt & fine sand in bottom of SPT-8

**BLACK & VEATCH**

# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE / CORE SIZE | SAMPLE NUMBER / RUN NUMBER | SET 6 INCHES / RUN LENGTH | 2ND 6 INCHES / RUN RECOVERY | 3RD 6 INCHES / RQD RECOVERY | N VALUE / PERCENT RECOVERY | SAMPLE RECOVERY / RQD | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 30 | 98 | grading grayish white; fine grained; poorly graded; w/ trace clay & some gravel | |
| SPT | 10 | 33 | 50/4" | - | >50 | 0.4 | 34 | 94 | grading fine to medium grained; clay & gravel grade out | @ 34.0'-35.0' boulder encountered. Hard drilling. Drilled through w/ 4" tricone driller bit. Driller reported limestone in cuttings. Continued w/4" paddle bit. |
| SPT | 11 | 9 | 24 | 40 | 64 | 1.4 | 39.5 | | grading w/occasional light brown clay pockets<br>@ 40.5' white clayey silt & some chalk nodules | 39.0'- 43.2' driller reported clay like drilling. |
| | | | | | | | 40.5 | | Silty CLAY; grayish white; hard; moist; low plasticity; w/ some light gray fine sand pockets | |
| SPT | 12 | 13 | 39 | 50/4" | >50 | 1.1 | 44 | 84 | | |
| CA | 13 | 30 | 45 | 50/5" | >50 | 1.0 | 46 | 82 | grading w/limestone nodules | |
| | | | | | | | 47.1 | | SAND; light gray; wet; fine grained; poorly graded; highly cemented<br>@ 47.2' grading light brown; fine to medium grained; cementation grades out | |
| SPT | 14 | 36 | 50/5" | - | >50 | 1.0 | 49 | | | |
| | | | | | | | 49.0 | | Sandy CLAY; grayish white; hard; dry; low plasticity | |
| SPT | 15 | 17 | 30 | 32 | 62 | 1.5 | 54.0 | 74 | SAND; light brown; very dense; wet; fine to medium grained; poorly graded; some gravel & coarse sand sized chalk nodules; occasional light brown clay pockets | |
| SPT | 16 | 50/4" | - | - | >50 | 0.3 | 59 | | | |

BLACK & VEATCH

# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE, SAMPLE NUMBER, SET 6 INCHES, 2ND 6 INCHES, 3RD 6 INCHES, N VALUE, SAMPLE RECOVERY
ROCK CORING: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60 | 68 | @ 60.0' white chalk layer | |
| | | | | | | | 61.0 | | CLAY; yellowish gray; hard; moist; high plasticity | Clay cuttings from rotary wash |
| SPT | 17 | 11 | 20 | 25 | 45 | 1.5 | 64 | 64 | | |
| SPT | 18 | 18 | 25 | 25 | 50 | 1.5 | 69 | | grading w/frequent partings of grayish white fine sand w/gravel sized chalk nodules | |
| SPT | 19 | 14 | 27 | 27 | 54 | 1.5 | 74 | 54 | @ 73.5'-74.0' light brown<br>fine sand partings grade to occasional | |
| SPT | 20 | 18 | 18 | 29 | 47 | 1.5 | 79.0 | | SAND; grayish white; dense; moist; fine grained; poorly graded; trace clay | |
| | | | | | | | 80 | 48 | | Bottom of boring @ 80.0'. Water level recorded @ 16.3' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/09/08. Piezometer PZ-21 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

Depth scale: 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90
Elevation scale: 68, 66, 64, 62, 60, 58, 56, 54, 52, 50, 48, 46, 44, 42, 40

**COAL COMBUSTION RESIDUAL RULE**
**GROUNDWATER MONITORING PLAN**

**COLETO CREEK POWER STATION**
**PRIMARY ASH POND**
**FANNIN, TEXAS**

**JANUARY 7, 2022**

***Prepared For:***

Coleto Creek Power

***Prepared By:***


Golder Associates, Inc.
2201 Double Creek Drive, Suite 4004
Round Rock, Texas 78664

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## LIST OF FIGURES



## LIST OF APPENDICES

# 1.0 INTRODUCTION

Coleto Creek Power operates the Coleto Creek Power Station (Coleto Creek), a lignite-fired power plant located in Fannin, Goliad County, Texas (the Site) (Figure 1). CCRs including fly ash and bed ash are generated as part of power plant operations. The CCRs are managed/disposed in the Primary Ash Pond onsite or are transported offsite for disposal/beneficial reuse by third-parties.

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the EPA to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. The final CCR Rule was published in the Federal Register on April 17, 2015. The effective date of the CCR Rule is October 19, 2015. The CCR Rule establishes national minimum criteria for existing and new CCR landfills, existing and new CCR surface impoundments, and lateral expansions to landfills/impoundments.

## 1.1 CCR Unit Groundwater Monitoring Applicability

Section 257.90 of the CCR Rule requires that existing CCR landfills and surface impoundments be in compliance with the following groundwater monitoring requirements no later than October 17, 2017:

- Install a groundwater monitoring system as required under Section 257.91;
- Develop a groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as required under Section 257.93;
- Initiate a detection monitoring program to include obtaining a minimum of eight independent samples for each background and downgradient monitoring well as required under Section 257.94; and
- Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in Appendix III of this part as required under Section 257.94.

Once a groundwater monitoring system and groundwater monitoring program has been established at the CCR unit, the owner or operator must conduct groundwater monitoring and, if necessary, corrective action throughout the active life and post-closure care period of the CCR unit. In the event of a release from a CCR unit, the owner or operator must take all necessary measures to control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of contaminants into the environment.

For existing CCR landfills and surface impoundments, the owner or operator must prepare an annual groundwater monitoring and corrective action report to document the status of the groundwater monitoring and corrective action program for the CCR unit for the previous calendar year. The first annual report must be prepared no later than January 31, 2018.

## 1.2 Groundwater Sampling and Analysis Requirements

The CCR Rule establishes groundwater sampling and analysis criteria that are designed to create consistency and ensure that monitoring results provide accurate representations of groundwater quality at the CCR groundwater monitoring wells. A sampling and analysis program must be developed for each unit that includes procedures and techniques for sample collection, sample preservation and shipment, analytical procedures, chain of custody control, and quality assurance and quality control. Depending on the constituents and concentrations detected, groundwater monitoring at each CCR unit may consist of detection monitoring (Section 257.94) only or a combination of detection monitoring and assessment monitoring (Section 257.95). Selected technical groundwater sampling and analysis criteria are described in detail below; however, the complete CCR Rule should be referenced for notification requirements and other criteria.

### 1.2.1 Groundwater Elevations

Groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled.

### 1.2.2 General Groundwater Analytical Requirements

The CCR groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. The EPA publication *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*, is EPA'S official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with the RCRA regulations (EPA, 2015).

Groundwater monitoring under the CCR Rule includes analyses for inorganic parameters and metals. All metals analyses must be reported as "total recoverable metals" to capture both the particulate fraction and dissolved fraction of metals in the groundwater. The CCR Rule stipulates that groundwater samples cannot be field filtered prior to analysis.

#### 1.2.3 Background Groundwater Quality Determination

Background groundwater quality must be established in a hydraulically upgradient or background well(s) for each of the groundwater constituents required in the detection monitoring or assessment monitoring program that applies to the CCR unit. Background groundwater quality may be established at wells that are not located hydraulically upgradient from the CCR unit if the samples accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit.

#### 1.2.4 Detection Monitoring Requirements

Groundwater detection monitoring must be performed at each CCR unit (CCR Rule Section 257.94). The following constituents must be included in the detection monitoring program (from Appendix III to the CCR Rule):

- Boron
- Calcium
- Chloride
- Fluoride
- pH
- Sulfate
- Total Dissolved Solids (TDS)

The monitoring frequency for these constituents must be at least semi-annual during the active life of the CCR unit and post-closure period. The reported concentrations of the detection monitoring constituents must be compared to the respective CCR unit background concentration developed for each constituent. If a statistically significant increase over background levels is determined for one or more of the constituents listed above at any monitoring well at the CCR unit waste boundary, within 90 days the owner or operator must:

- Establish an assessment monitoring program as described in Section 257.95 of the Rule, or

- Demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with the detection monitoring program.

### 1.2.5 Assessment Monitoring Requirements

Assessment monitoring is required under the CCR Rule whenever a statistically significant increase over background levels has been detected for one or more of the detection monitoring constituents listed above (CCR Rule Section 257.95). The following constituents must be included in the assessment monitoring program (from Appendix IV to the CCR Rule):

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Fluoride
- Lead
- Lithium
- Mercury
- Molybdenum
- Selenium
- Thallium
- Radium 226 and 228 combined

Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator of the CCR unit must sample and analyze the groundwater for all assessment monitoring constituents (Appendix IV) listed above. At least one sample must be collected from each well associated with the CCR unit.

Within 90 days of obtaining the results from the initial assessment monitoring sampling event, the owner or operator of the CCR unit must resample all wells associated with the CCR unit, conduct analyses for all detection monitoring parameters (Appendix III) and for those assessment monitoring constituents (Appendix IV) that have been detected as part of assessment monitoring. At least one sample must be collected from each well associated with the CCR unit. This monitoring must be performed on at least a semi-annual basis thereafter. The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for these constituents during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semi-annually, the alternative frequency shall be no less than annual.

Within 90 days of obtaining the results from the initial assessment monitoring sampling event, groundwater protection standards must be established for all assessment monitoring constituents (Appendix IV) detected in the CCR unit monitoring wells. The groundwater protection standard shall be:

- For constituents for which a federal maximum contaminant level (MCL) has been established under 40 CFR 141.62 and 141.66, the MCL for that constituent; or
- For constituents for which an MCL has not been established, the background concentration or approved regional screening level for the constituent established in accordance with CCR Rule Section 257.91; or
- For constituents for which the background level is higher than the MCL, the background concentration.

Following are the federal MCLs that have been established for the assessment monitoring constituents (Appendix IV) identified in the Rule:

| **Constituent** | **MCL (mg/L)** |
|---|---|
| Antimony | 0.006 |
| Arsenic | 0.01 |
| Barium | 2.0 |
| Beryllium | 0.004 |
| Cadmium | 0.005 |
| Chromium | 0.1 |
| Cobalt | None |
| Fluoride | 4.0 |
| Lead | 0.015* |
| Lithium | None |
| Mercury | 0.002 |
| Molybdenum | None |
| Selenium | 0.05 |
| Thallium | 0.002 |
| Radium 226/228 Combined | 5 pCi/L** |

* The drinking water action level for lead is 0.015 mg/L.
** pCi/L = picocuries per liter

If the concentrations of all detection monitoring constituents (Appendix III) and assessment monitoring constituents (Appendix IV) are shown to be statistically at or below background values for two consecutive sampling events, the owner or operator may return to performing only detection monitoring of the CCR unit. If the concentrations of any detection monitoring constituents (Appendix III) and assessment monitoring constituents (Appendix IV) are shown to be statistically above background values, but all concentrations are below their respective groundwater protection standards, the owner or operator must continue assessment monitoring of the CCR Unit.

Within 90 days of finding that any of the assessment monitoring constituents (Appendix IV) have been detected at a statistically significant level exceeding their respective groundwater protection standards, the owner or operator of the CCR unit must either:

- Initiate an assessment of corrective measures for the CCR unit (CCR Rule Section 257.96); or
- Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. If a successful demonstration is made, the owner or operator must continue assessment monitoring. If a successful demonstration has not been made at the end of the 90 day period, the owner or operator of the CCR unit must initiate an assessment of corrective measures for the CCR unit.

If one or more assessment monitoring constituents (Appendix IV) are detected at statistically significant levels above their respective groundwater protection standards, the owner or operator of the CCR unit must characterize the nature and extent of the release. Characterization of the release includes the following minimum measures:

- Install additional monitoring wells necessary to define the contaminant plume(s);
- Collect data on the nature and estimated quantity of material released including specific information on the assessment monitoring constituents (Appendix IV) and the levels at which they are present in the material released;
- Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well for all detection monitoring parameters (Appendix III) and for those assessment monitoring constituents (Appendix IV) that have been detected as part of assessment monitoring. This monitoring must be performed on at least a semi-annual basis thereafter.

- Sample all CCR unit wells for all detection monitoring parameters (Appendix III) and for those assessment monitoring constituents (Appendix IV) that have been detected as part of assessment monitoring. This monitoring must be performed on at least a semi-annual basis thereafter.

If an assessment of corrective measures is required as a result of assessment monitoring, and if the CCR unit being monitored is considered an existing unlined CCR surface impoundment under the CCR Rule, then the CCR unit is required to retrofit or close in accordance with the applicable parts of the CCR Rule.

## 1.3 Groundwater Statistical Evaluation Procedures

Statistical analysis of the groundwater monitoring data is required as part of detection monitoring and assessment monitoring under the CCR Rule. One of the following statistical methods must be used to evaluate groundwater monitoring data for each monitored constituent:

- A parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent; or

- An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent; or

- A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data. The level of each constituent in each compliance well is compared to the upper tolerance or prediction limit established from the background data; or

- A control chart approach that gives control limits for each constituent; or

- Another statistical test method that meets the performance standards.

Any statistical method chosen must comply with the following performance standards:

- The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of constituents. Probability distributions of data values shall use parametric methods, and non-probability distributions of data values shall use non-parametric methods. If the distribution of the constituents is shown to be inappropriate for a probability theory test, the data must be transformed or a distribution-free (non-parametric) theory test must be used. If the distributions for the constituents differ, more than one statistical method may be needed;

- If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparison procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparison must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts;

- If a control chart approach is used to evaluate groundwater monitoring data, the specific type of chart and its associated parameter values shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. The parameter values shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each constituent of concern;

- If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. These parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each constituent of concern;

- The statistical method must account for data below the limit of detection with one or more statistical procedures that shall be at least as effective as any other approach in this section for evaluating groundwater data. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility; and

- If necessary, the statistical method must include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

The owner/operator of the CCR unit must determine if there has been a statistically significant increase over background (detection monitoring) or MCLs/background (assessment monitoring) for each constituent required in the particular groundwater monitoring program that applies to the CCR unit. The determination of statistical increase over background/MCLs for each constituent at each monitoring well must be made within 90 days after completing sampling and analysis.

## 2.0 GROUNDWATER MONITORING PROCEDURES

This section describes groundwater sampling and analysis procedures for monitoring the CCR unit wells to comply with the requirements of 40 CFR 257.90 - 257.95 of the CCR Rule.

### 2.1 Primary Ash Pond Groundwater Monitoring System

The CCR groundwater monitoring system at the Primary Ash Pond consists of the following monitoring wells:

| Upgradient/Background Wells | Downgradient Wells |
|---|---|
| BV-5 | MW-4 |
| BV-8 | MW-5 |
| BV-21 | MW-6 |
| | MW-9 |
| | MW-10 |
| | MW-11 |

A detailed Site Plan showing the locations of the CCR monitoring wells is provided on Figure 2. Boring logs for the wells are provided in Appendix A.

### 2.2 Groundwater Sampling Procedures

#### 2.2.1 Equipment Assembly and Preparation

Activities that occur during groundwater sampling are summarized as follows:

- pre-arrangement of sample analytical requests with analytical testing laboratory;
- assembly and preparation of sampling equipment and supplies;
- groundwater sampling;
- water-level measurements;
- well purging;
- field parameter measurements;
- sample collection;
- sample preservation;
- sample labeling;
- completion of sample records;
- completion of chain-of-custody records; and
- sample shipment.

Prior to each sampling event, equipment to be used is assembled, properly cleaned and its operating condition verified. In addition, all record-keeping materials are prepared. Sampling procedures are conducted in general accordance with EPA SW-846 methods.

Decontamination of all non-disposable or non-dedicated field measurement, purging, and sampling equipment are performed for each sampling event before any purging/sampling activities begin, after each well is sampled, and at the end of the sampling event. Decontamination procedures are summarized below:

(1) Wash equipment with low-residue soap and/or detergent solution.
(2) Rinse with distilled water; and
(3) Repeat steps (1) and (2) above, as necessary.

### 2.2.2 General Groundwater Sampling Procedures

Prior to collecting samples, each well is inspected for signs of damage to the well protective casing and well pad. Each field instrument is calibrated according to the manufacturer's instructions prior to use.

Special care should be exercised to prevent contamination of the groundwater and extracted samples during the sampling activities. The primary way in which such contamination can occur is contact with improperly cleaned equipment. To prevent such contamination, all non-dedicated sampling equipment is thoroughly cleaned before and between uses at different sampling locations. In addition to the use of properly cleaned equipment, a new pair of disposable latex (or similar) gloves is worn for each well.

### 2.2.3 Groundwater Level Measurements

Groundwater levels are measured prior to purging the wells. Using a pre-cleaned water level meter, the groundwater surface is measured from the casing datum to the nearest 0.01-foot. Total depth measurements are also collected on, at least, an annual basis.

### 2.2.4 Well Purging and Sampling

Well purging and sampling is conducted using either a submersible pump or peristaltic pump in accordance with standard low flow sampling procedures. The sampler withdraws water in a manner that minimized stress (drawdown) to the system to the extent practicable. When the pump intake is located within the screened interval, the water pumped is drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. Thus, sample results are more representative of the constituents present in the groundwater.

Purging rates during sample collection are generally performed at 0.5 liters per minute (L/min) or less. Field parameters (pH, temperature, conductivity and turbidity) are measured to evaluate when the well is adequately purged. Turbidity in the samples should be minimized as much as possible. By using minimal pumping rates, dedicated equipment whenever possible, and positioning the intake for the sample tubing or submersible pump off of the bottom of the well.

For groundwater samples, at least three field measurements should be taken during the course of purging the well. If the parameters have not stabilized at that time, field measurements and purging will continue until two consecutive readings have stabilized to within the following limits:

- Temperature: +/-1° C
- pH: +/-0.1 pH units
- Specific conductance: +/-10%
- Turbidity: +/- 10%

Sample extraction is accomplished by using the pump that was previously used to purge the well. The sample bottle is filled directly from the pump line. The pumping rate and parameter measurements are recorded on groundwater sampling forms in the field. If a well goes dry during purging, sampling is performed after the well has sufficiently recharged to allow sample collection.

Groundwater samples <u>will not</u> be filtered in the field prior to collection in accordance with Section 257.93(i) of the CCR Rule.

#### 2.2.5 Container and Labels

Samples are collected in laboratory-supplied containers. The following information is legibly and indelibly written on the label:

- project identification;
- sample identification;
- name or initials of collector;
- date and time of collection;
- analysis requested; and
- sample preservative, if applicable.

#### 2.2.6 Chain-of-Custody Control

After samples are collected, chain-of-custody procedures are followed to establish a written record concerning sample movement between the sampling site and the testing laboratory. Each shipping container has a chain-of-custody form completed by the sampling personnel packing the samples. The chain-of-custody form for each container is completed and sealed in the shipping container.

### 2.3 Analytical Procedures

The laboratory analytical methods utilized for the analysis of detection monitoring and assessment monitoring programs are appropriate and commonly utilized EPA methodologies, or other similar standard methodologies. Typical methodologies used to analyze the detection and assessment program constituents are presented below:

<u>Detection Monitoring Program (Appendix III Constituents)</u>

- Boron and calcium by EPA Method SW6020;
- Chloride, fluoride, and sulfate by EPA Method E300;
- pH by Standard Method M4500-H + B (field measurement); and
- TDS by Standard Method M2540.

<u>Assessment Monitoring Program (Appendix IV Constituents)</u>

- Antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, molybdenum, selenium, and thallium by EPA Method SW6020;
- Fluoride EPA Method E300;
- Mercury by EPA Method SW7470; and
- Radium 226 and 228 by EPA Methods 904.0/SW9320 Modified and 903.1 Modified.

All metals analyses shall be reported as "total recoverable metals" in accordance with Section 257.93(1) of the CCR Rule. Filtering of samples prior to analysis is not permitted.

## 3.0 STATISTICAL EVALUATION PROCEDURES

Statistical analysis of groundwater monitoring data is required as part of detection monitoring and assessment monitoring under Section 257.93 of the CCR Rule. Section 257.93 of the CCR Rule provides several options for statistically evaluating the groundwater data. The owner or operator of the CCR unit must select one of the following statistical methods specified in paragraphs (f)(1) through (5) of Section 257.93 to be use in evaluating groundwater monitoring data for each specified constituent:

(1) A parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of paragraph (g) of this section.

The following statistical evaluation approaches were selected to demonstrate groundwater compliance under the CCR Rule:

- Use of interwell data evaluations, which compare new sample data to data from upgradient or background monitoring wells.

- Use of prediction limits for data comparisons. This approach is a common statistical method used to evaluate groundwater compliance for Subtitle D landfill facilities and is one of the approved options for groundwater quality data statistical evaluation under the CCR Rule.

The statistical evaluation procedures proposed for the groundwater data conforms with the Rule requirements shown above, as well as EPA's *Unified Guidance: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* (EPA, 2009) and the American Society for Testing and Materials (ASTM) standard D6312-17, *Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at waste Disposal Facilities* (ASTM, 2017).

Eight independent groundwater samples were evaluated for each Appendix III parameter at each well to statistically establish detection monitoring prediction limits. Eight independent groundwater samples were also evaluated for each Appendix IV parameter at each well to establish assessment monitoring groundwater protection standards.

- For constituents for which a federal maximum contaminant level (MCL) has been established, the MCL for that constituent; or

- For constituents for which an MCL has not been established, the background concentration (prediction limit) or approved regional screening standard for the constituent; or

- For constituents for which the background level (prediction limit) is higher than the MCL, the background concentration (prediction limit) for the constituent.

## 4.0 DETECTION MONITORING DATA EVALUATION

CCR groundwater detection monitoring will be performed on a semi-annual basis during the active life of the CCR units and during the post-closure period. Each CCR monitoring well will be sampled for the following Appendix III constituents as part of the detection monitoring program:

- Boron
- Calcium
- Chloride
- Fluoride
- pH
- Sulfate
- Total Dissolved Solids (TDS)

Sampling and analytical procedures will be as described in previous sections of this plan.

After each detection monitoring event, the reported concentrations of the detection monitoring constituents at each well will be compared to the background concentration prediction limits developed for each constituent as described in Section 3 of this plan to ascertain if a statistically significant increase above background concentrations does or no does not exist. Possible outcomes from comparing the detection monitoring constituent concentrations in each well to their respective background concentration prediction limits are as follows:

- All detection monitoring constituent concentrations in each well are less than or equal to their respective background concentration prediction limits in the well; or

- One or more detection monitoring constituent concentrations in each well are above their respective background concentration prediction limits in the well.

### 4.1 No Statistically Significant Increase Over Background Concentrations

The background concentration prediction limits were developed based on a one-of-two resampling approach, meaning that if concentrations in at least one sample in a series of two independent samples collected from a well do not exceed their prediction limits, then a statistically significant increase over background concentrations has not occurred. This conclusion will be reached if the data indicate either of the following:

- All detection monitoring constituent concentrations in each well are less than or equal to their respective background concentration prediction limits; or

- One or more detection monitoring constituent concentration in any well is above the respective background concentration prediction limits. If this occurs, the well or wells with concentrations above the prediction limits will be resampled and analyzed for the detection monitoring constituent or constituents that exceed the prediction limits. If the resample indicates that the target detection monitoring constituent concentrations in the well or wells are less than or equal to their respective background concentration prediction limits, then it can be concluded that a statistically significant increase over background concentrations for all detection monitoring constituents does not exist, since concentrations in one sample of the two independent samples do not exceed their prediction limits.

If the groundwater monitoring data indicate that a statistically significant increase over background does not exist at the CCR wells, detection monitoring at all CCR wells will continue on a semi-annual basis.

### 4.2 Statistically Significant Increase Over Background Concentrations

If one or more detection monitoring constituent concentrations in any well is above the respective background concentration prediction limit in both the original detection monitoring sample and the resample, then a statistically significant increase over background concentrations for the target detection monitoring constituents can be concluded. If a statistically significant increase is indicated, within 90 days the owner/operator must:

- Establish an assessment monitoring program as described in this plan, or

- Demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with the detection monitoring program.

## 5.0 ASSESSMENT MONITORING DATA EVALUATION

CCR groundwater assessment monitoring will be performed at the groundwater monitoring system whenever a statistically significant increase over background levels has been confirmed for one or more of the detection monitoring constituents listed in this plan. Within 90 days of triggering the assessment monitoring program, and annually thereafter, each CCR monitoring well in the groundwater monitoring system will be sampled for the following Appendix IV parameters as part of the assessment monitoring program:

- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Fluoride
- Lead
- Lithium
- Mercury
- Molybdenum
- Selenium
- Thallium
- Radium 226 and 228 combined

Sampling and analytical procedures will be as described in previous sections of this plan.

Within 90 days of obtaining the results from the initial assessment monitoring sampling event, all wells in the groundwater monitoring system will be resampled and analyzed for:

- All Appendix III detection monitoring parameters; and

- The Appendix IV assessment monitoring parameters that were detected as part of the assessment monitoring event.

This monitoring will be performed on at least a semi-annual basis thereafter, unless the owner/operator can demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for these constituents during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semi-annually, the alternative frequency shall be no less than annual.

Within 90 days of obtaining the results from the initial assessment monitoring sampling event, groundwater protection standards will be established for all Appendix IV assessment monitoring constituents that were detected in the groundwater monitoring system wells as follows:

- For constituents for which a federal maximum contaminant level (MCL) has been established, the MCL for that constituent; or
- For constituents for which an MCL has not been established, the background concentration or approved regional background levels for the constituent; or
- For constituents for which the background level is higher than the MCL, the background concentration for the constituent.

The reported concentrations of the assessment monitoring constituents at each well will be compared to the groundwater protection standards established for each constituent to ascertain if a statistically significant increase above the groundwater protection standards does or does not exist. Compliance with the groundwater protection standards will be evaluated based on a one-of-two resampling approach.

### 5.1 No Statistically Significant Increase Over Groundwater Protection Standards

If the groundwater monitoring data indicate that a statistically significant increase over groundwater protection standards does not exist at the CCR wells, all wells in the groundwater monitoring system will be sampled on a semi-annual basis and analyzed for:

- All Appendix III detection monitoring parameters; and
- The Appendix IV assessment monitoring parameters that were detected as part of the initial assessment monitoring event.

This monitoring will be performed on at least a semi-annual basis unless the owner/operator can demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for these constituents during the active life and the post-closure care period based on the availability of groundwater.

If the concentrations of all Appendix III detection monitoring constituents and Appendix IV assessment monitoring constituents are shown to be statistically at or below background values for two consecutive assessment monitoring sampling events, assessment monitoring will be terminated and detection monitoring as described in this plan will resume. If the concentrations of any Appendix III detection monitoring constituents and Appendix IV assessment monitoring constituents are shown to be statistically above background values, but all concentrations are below their respective groundwater protection standards, assessment monitoring will continue.

### 5.2 Statistically Significant Increase Over Groundwater Protection Standards

If a statistically significant increase over groundwater protection standards for any Appendix IV assessment monitoring constituent is confirmed, within 90 days of the initial assessment monitoring event, the owner/operator will either:

- Initiate an assessment of corrective measures for the CCR unit in accordance with CCR Rule Section 257.96; or
- Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. If a successful demonstration is made, the owner or operator must continue assessment monitoring. If a successful demonstration has not been made at the end of the 90 day period, the owner or operator of the CCR unit must initiate an assessment of corrective measures for the CCR unit.

If one or more Appendix IV assessment monitoring constituents are detected at statistically significant levels above their respective groundwater protection standards in any sampling event, and if a source other than the CCR unit cannot be demonstrated to have caused the contamination, a release from the CCR unit is likely and the nature and extent of the release will be further characterized as follows:

- Install additional monitoring wells necessary to define the contaminant plume(s);
- Collect data on the nature and estimated quantity of material released including specific information on the Appendix IV assessment monitoring constituents and the levels at which they are present in the material released;
- Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well for all Appendix III detection monitoring parameters and for those Appendix IV assessment monitoring constituents that have been detected as part of assessment monitoring. This monitoring must be performed on at least a semi-annual basis thereafter.
- Sample all CCR unit wells for all Appendix III detection monitoring parameters and for those Appendix IV assessment monitoring constituents hat have been detected as part of assessment monitoring. This monitoring must be performed on at least a semi-annual basis thereafter.

## 6.0 REPORTING REQUIREMENTS

The results of the CCR groundwater monitoring program will be reported each year in an Annual Groundwater Monitoring and Corrective Action Report. The annual report will document the status of the groundwater monitoring and corrective action program, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. At a minimum, the Annual Groundwater Monitoring and Corrective Action Report will contain the following information:

- A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;
- In addition to all the monitoring data obtained under CCR Rule Sections 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;
- A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and
- Other information required to be included in the annual report as specified in CCR Rule Sections 257.90 through 257.98.

The Groundwater Monitoring and Corrective Action Report for the 2017 monitoring program must be placed in the facility operating record no later than January 31, 2018. Subsequent reports must be placed in the facility operating record no later than January 31 of the year following completion of the groundwater monitoring program from the preceding calendar year.

## 7.0 REFERENCES

ASTM, 2017. Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs at Waste Disposal Facilities - D6312-17.

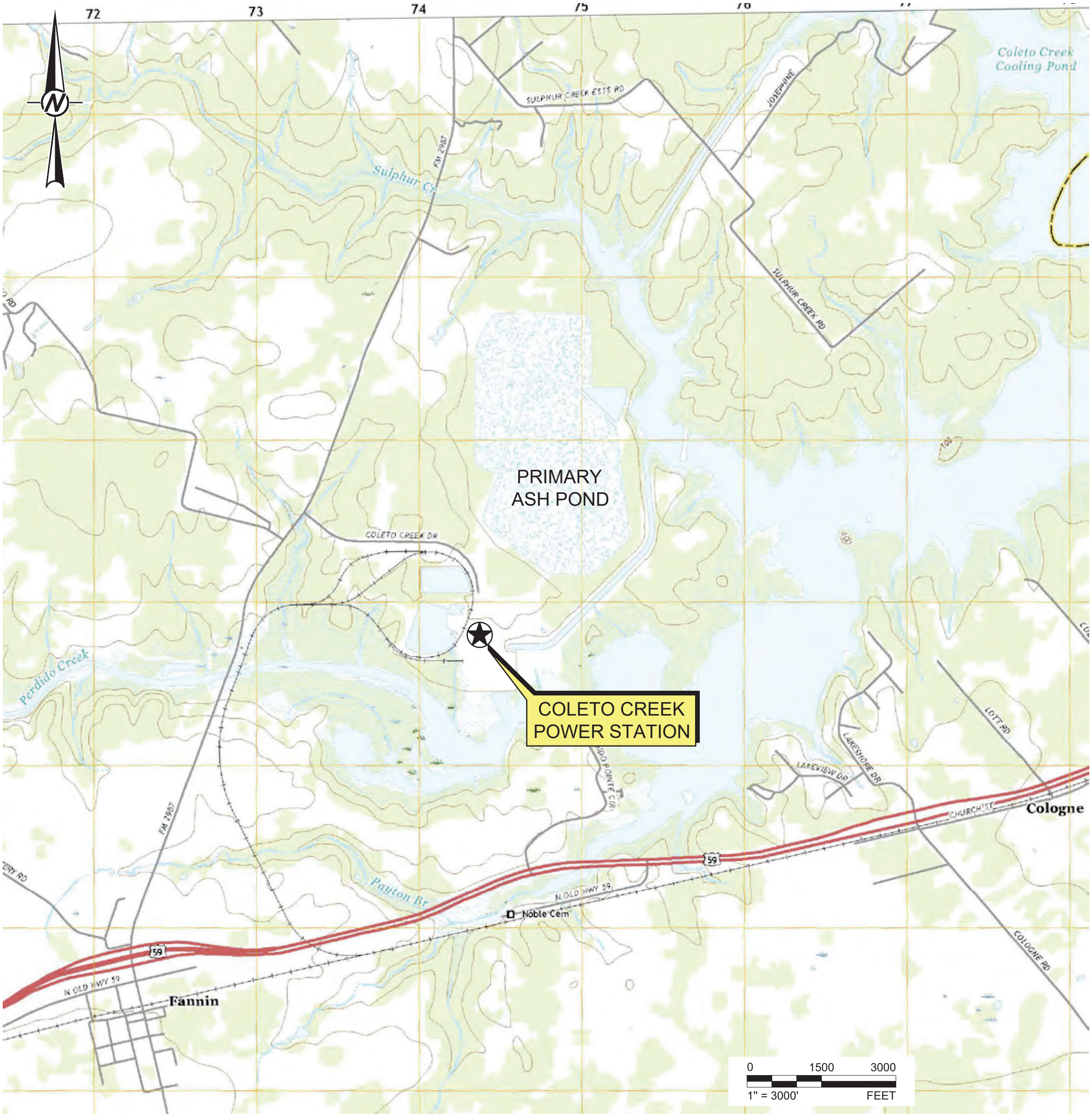
EPA, 2017. ProUCL Version 5.1 User Guide, https://www.epa.gov/sites/production/files/2016-05/documents/proucl_5.1_user-guide.pdf . February 1.

EPA, 2015. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). On-Line.

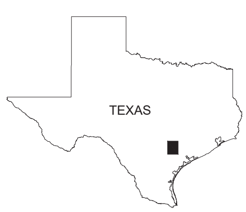
EPA, 2009. Unified Guidance Document: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, EPA 530/R-09-007, March.

SWDIV and EFA West of Naval Facilities Engineering Command, 1998. Procedural Guidance for Statistically Analyzing Environmental Background Data. September.

# Figures




**REFERENCE(S)**
BASE MAP TAKEN FROM USGS.GOV, FANNIN, TX 7.5 MIN. USGS QUADRANGLE DATED 2019.




QUADRANGLE LOCATION

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**SITE LOCATION MAP**

CONSULTANT
GOLDER MEMBER OF WSP

| YYYY-MM-DD | 2021-12-07 |
|---|---|
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 20142034 | | 0 | 1 |

Last Edited By: adiamond Date: 2021-12-08 Time:11:06:46 AM | Printed By: TBookout Date: 2021-12-13 Time:2:57:34 PM
Path: \\golder.gds\complexdata\office\texarkana\projects - round rock_2020\20142034 - luminant\production\C - COLETO CREEK\ | File Name: 1-Topographic Map.dwg

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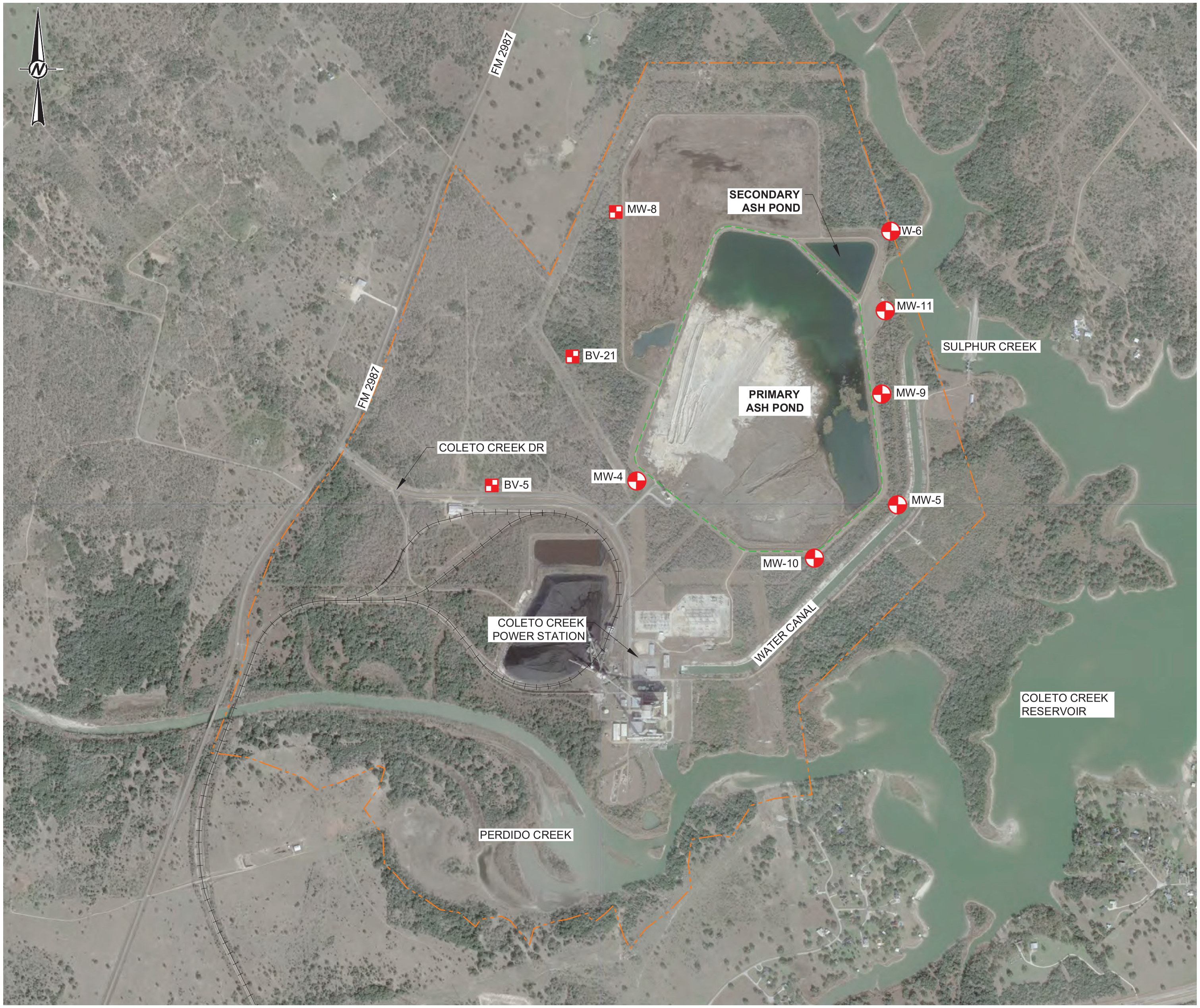
0 1 in




**LEGEND**

- PROPERTY BOUNDARY
- CCR MONITORING UNIT
- DOWNGRADIENT CCR MONITORING WELL
- UPGRADIENT CCR MONITORING WELL
- RAILROAD

**REFERENCE(S)**
BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 1/15/21.

0 600 1200
1" = 1200' FEET

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**SITE PLAN**

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-14 |
| DESIGNED | RS |
| PREPARED | RS |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 20142034 | 0 | 2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 1 in

Path: \\golder.gds\complexdata\office\texarkana\projects - round rock_2020\20142034 - luminant\production\C - COLETO CREEK\ | File Name: 2 - Facility Layout Map.dwg | Last Edited By: rsalazar Date: 2021-12-10 Time:12:38:55 PM | Printed By: RSalazar Date: 2021-12-14 Time:4:55:59 PM

# Appendix A

## CCR Monitoring Well Logs

BLACK & VEATCH

# PRELIMINARY BORING LOG

BORING NO. BV-5


| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE / CORE SIZE | SAMPLE NUMBER / RUN NUMBER | SET 6 INCHES / RUN LENGTH | 2ND 6 INCHES / RUN RECOVERY | 3RD 6 INCHES / RQD RECOVERY | N VALUE / PERCENT RECOVERY | SAMPLE RECOVERY / RQD | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| SPT | 1 | 3 | 7 | 11 | 18 | 1.0 | 0 | 132 | Clayey SAND; brownish gray; medium dense; moist; fine grained; poorly graded; some roots | Boring advanced w/ 3-1/4" ID hollow stem auger. SPT performed w/ auto hammer. Sand partings are vertical and dry. |
| SPT | 2 | 13 | 11 | 10 | 21 | 1.2 | 2 | 130 | @ 3.0'-3.2' yellowish brown fine to medium sand partings; roots grade out | |
| SPT | 3 | 6 | 10 | 13 | 23 | 1.2 | 4–6 | 128 | grading light gray w/ some black mottling | |
| SPT | 4 | 6 | 10 | 13 | 23 | 1.1 | 8 | 126–124 | | |
| CA | 5 | 6 | 14 | 19 | 33 | 1.4 | 10 | 122 | grading w/some light brown staining | |
| | | | | | | | 12.5 | 120 | CLAY; white; hard; moist; low plasticity; frequent pockets of gray fine grained clayey sand | |
| SPT | 6 | 13 | 16 | 20 | 36 | 1.5 | 14 | 118 | | |
| | | | | | | | 16–18 | 116 | | |
| CA | 7 | 19 | 30 | 28 | 58 | 1.5 | 18–20 | 114 | grading w/ frequent pockets of gray & light brown clay | |
| | | | | | | | 20.0 | 112 | SAND; grayish white; moist; fine to medium grained; poorly graded | |
| SPT | 8 | 6 | 8 | 8 | 16 | 1.5 | 24 | 108 | grading medium dense w/trace angular gravel @ 24.0' gravel grades out | |
| | | | | | | | 26 | 106 | | Encountered water @ 25.5' during drilling |
| SPT | 9 | 50/5" | - | - | >50 | 0.3 | 28–30 | 104 | grading very dense @29.2' calcareous sand nodules; some white silt w/ | Sand in augers. Augers being |

BLACK & VEATCH

# PRELIMINARY BORING LOG



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE, SAMPLE NUMBER, SET 6 INCHES, 2ND 6 INCHES, 3RD 6 INCHES, N VALUE, SAMPLE RECOVERY
ROCK CORING: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 30 | | chalk nodules | driven along w/ spoon. Below 28.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid. Driller reported trace gravel from 28.5'-38.5'. |
| SPT | 10 | 6 | 8 | 10 | 18 | 0.9 | 34 | 98 | grading medium dense; wet; fine to medium grained; well graded | |
| SPT | 11 | 14 | 33 | 38 | 71 | 1.5 | 39 | 94 | grading very dense<br>@ 38.5'-39.3' yellow silty clay layer<br>@ 39.3' grading grayish white w/ fine grained sand & some silt | |
| | | | | | | | 40.0 | | Clayey SAND; light gray; dense; moist; fine grained; poorly graded | Based on driller's comments. |
| SPT | 12 | 12 | 16 | 21 | 37 | 1.5 | 44 | 88 | | |
| SPT | 13 | 12 | 17 | 20 | 37 | 1.5 | 49 | 84 | grading light brown; silt grades out | |
| SPT | 14 | 17 | 40 | 33 | 73 | 0.9 | 54 | 78 | grading fine to medium grained<br>some angular gravel | |
| | | | | | | | 57 | | | Driller reported alternating hard and soft drilling efforts. |
| SPT | 15 | 7 | 50/3" | - | >50 | 0.3 | 59 | 74 | grading w/ white fine sand; some clay cementation | |

| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 327129.3' | E 2570579.3' | 133.0 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Grassy, level, tan clayey sand | State Plane | 9/16/08 | 9/17/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V Bhadriraju | V Bhadriraju | |

| SAMPLE TYPE / CORE SIZE | SAMPLE NUMBER / RUN NUMBER | SET 6 INCHES / RUN LENGTH | 2ND 6 INCHES / RUN RECOVERY | 3RD 6 INCHES / RQD RECOVERY | N VALUE / PERCENT RECOVERY | SAMPLE RECOVERY / RQD | DEPTH (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60.0 | Silty SAND; white; very dense; moist; fine grained; poorly graded; some pockets of light brown clay; highly cemented | Based on driller's comments & cuttings from rotary wash. |
| SPT | 16 | 50/4" | - | - | >50 | 0.2 | 64 | | |
| SPT | 17 | 50/3" | - | - | >50 | 0.3 | 69 | grading w/ trace angular to subangular gravel; clay pockets grade to trace | |
| | | | | | | | 73.5 | CLAY; dark tan; hard; moist; low plasticity; some sand<br>@ 74.5' yellowish gray | No clay cuttings in drilling fluid return. |
| SPT | 18 | 12 | 17 | 22 | 39 | 1.5 | 74 | | |
| SPT | 19 | 13 | 17 | 22 | 39 | 1.5 | 79 | | |
| | | | | | | | 80.0 | | Bottom of boring @ 80.0'. Water level recorded @ 24.6' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/17/08. Piezometer PZ-5 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

Depth scale (feet): 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90
Elevation scale (feet): 72, 70, 68, 66, 64, 62, 60, 58, 56, 54, 52, 50, 48, 46, 44

BLACK & VEATCH

# *PRELIMINARY* BORING LOG

BORING NO. BV-21



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

**SOIL SAMPLING** / **ROCK CORING**

| SAMPLE TYPE (CORE SIZE) | SAMPLE NUMBER (RUN NUMBER) | SET 6 INCHES (RUN LENGTH) | 2ND 6 INCHES (RUN RECOVERY) | 3RD 6 INCHES (RQD RECOVERY) | N VALUE (PERCENT RECOVERY) | SAMPLE RECOVERY (RQD) |
|---|---|---|---|---|---|---|
| SPT | 1 | 1 | 2 | 5 | 7 | 0.9 |
| SPT | 2 | 5 | 5 | 6 | 11 | 1.5 |
| SPT | 3 | 4 | 6 | 9 | 15 | 1.5 |
| SPT | 4 | 5 | 6 | 8 | 14 | 1.1 |
| CA | 5 | 3 | 3 | 4 | 7 | 1.5 |
| SPT | 6 | 22 | 50/3 | - | >50 | 0.7 |
| SPT | 7 | 24 | 50 | 50/4 | >50 | 0.9 |
| SPT | 8 | 5 | 6 | 14 | 20 | 1.5 |
| SPT | 9 | 20 | 48 | 48 | 96 | 1.5 |

DEPTH (FEET) 0–30; ELEVATION (FEET) 128–100; SAMPLE TYPE; GRAPHIC LOG

| Depth (ft) | CLASSIFICATION OF MATERIALS |
|---|---|
| 0 | <u>SAND</u>; dark brown; loose; moist; fine grained; poorly graded |
| 1.2 | Clayey <u>SAND</u>; light brown; medium dense; moist; fine grained; poorly graded |
| | grading light gray; some black mottling & trace roots |
| | grading w/trace chalk nodules; roots grade out |
| | grading w/frequent seams of chalk nodules |
| 9.5 | Clayey <u>SAND</u>; light gray; moist; fine to medium grained; poorly graded; trace gravel |
| | grading w/highly cemented calcareous sand |
| 12.0 | Silty <u>SAND</u>; grayish white; very dense; moist; fine grained; poorly graded |
| | grading orange; wet; fine to medium grained; trace calcareous sand nodules |
| 23.5 | <u>CLAY</u>; light gray; very stiff; moist; high plasticity; some light brown clay pockets |
| 25.0 | <u>SAND</u>; light gray; very dense; wet; fine to coarse grained; well graded; w/trace gravel |

**REMARKS**

Boring advanced w/3-1/4" ID hollow stem auger. SPT performed w/auto hammer.

Water encountered during drilling @ 17.6'. Driller reports softer drilling. Below 18.5' continued w/ rotary wash method using 4" drag bit & bentonite slurry as drilling fluid.

White silt & fine sand in bottom of SPT-8

BLACK & VEATCH

*PRELIMINARY*
# BORING LOG



| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

SOIL SAMPLING

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY |
|---|---|---|---|---|---|---|
| SPT | 10 | 33 | 50/4" | - | >50 | 0.4 |
| SPT | 11 | 9 | 24 | 40 | 64 | 1.4 |
| SPT | 12 | 13 | 39 | 50/4" | >50 | 1.1 |
| CA | 13 | 30 | 45 | 50/5" | >50 | 1.0 |
| SPT | 14 | 36 | 50/5" | - | >50 | 1.0 |
| SPT | 15 | 17 | 30 | 32 | 62 | 1.5 |
| SPT | 16 | 50/4" | - | - | >50 | 0.3 |

ROCK CORING

| CORE SIZE | RUN NUMBER | RUN LENGTH | RUN RECOVERY | RQD RECOVERY | PERCENT RECOVERY | RQD |
|---|---|---|---|---|---|---|

DEPTH (FEET) 30–60; ELEVATION (FEET) 98–70

SAMPLE TYPE | GRAPHIC LOG

## CLASSIFICATION OF MATERIALS

grading grayish white; fine grained; poorly graded; w/ trace clay & some gravel

grading fine to medium grained; clay & gravel grade out

grading w/occasional light brown clay pockets

@ 40.5' white clayey silt & some chalk nodules

40.5

Silty CLAY; grayish white; hard; moist; low plasticity; w/ some light gray fine sand pockets

grading w/limestone nodules

47.1

SAND; light gray; wet; fine grained; poorly graded; highly cemented

@ 47.2' grading light brown; fine to medium grained; cementation grades out

49.0

Sandy CLAY; grayish white; hard; dry; low plasticity

54.0

SAND; light brown; very dense; wet; fine to medium grained; poorly graded; some gravel & coarse sand sized chalk nodules; occasional light brown clay pockets

## REMARKS

@ 34.0'-35.0' boulder encountered. Hard drilling. Drilled through w/ 4" tricone driller bit. Driller reported limestone in cuttings. Continued w/4" paddle bit.

39.0'- 43.2' driller reported clay like drilling.

BLACK & VEATCH

*PRELIMINARY*
# BORING LOG

BORING NO. BV-21


| CLIENT | PROJECT | PROJECT NO. |
|---|---|---|
| International Power America, Inc | Coleto Creek Unit Two | 149116 |

| PROJECT LOCATION | COORDINATES | | GROUND ELEVATION (DATUM) | TOTAL DEPTH |
|---|---|---|---|---|
| Victoria, Texas | N 328659.7' | E 2571578.7' | 128.4 ft (MSL) | 80.0 (feet) |

| SURFACE CONDITIONS | COORDINATE SYSTEM | DATE START | DATE FINISHED |
|---|---|---|---|
| Level, loose, silty sand | State | 9/8/08 | 9/8/08 |

| LOGGED BY | CHECKED BY | APPROVED BY |
|---|---|---|
| V. Bhadriraju | V Bhadriraju | |

SOIL SAMPLING: SAMPLE TYPE, SAMPLE NUMBER, SET 6 INCHES, 2ND 6 INCHES, 3RD 6 INCHES, N VALUE, SAMPLE RECOVERY

ROCK CORING: CORE SIZE, RUN NUMBER, RUN LENGTH, RUN RECOVERY, RQD RECOVERY, PERCENT RECOVERY, RQD

| SAMPLE TYPE | SAMPLE NUMBER | SET 6 INCHES | 2ND 6 INCHES | 3RD 6 INCHES | N VALUE | SAMPLE RECOVERY | DEPTH (FEET) | ELEVATION (FEET) | CLASSIFICATION OF MATERIALS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60 | 68 | @ 60.0' white chalk layer | |
| | | | | | | | 61.0 | | CLAY; yellowish gray; hard; moist; high plasticity | Clay cuttings from rotary wash |
| SPT | 17 | 11 | 20 | 25 | 45 | 1.5 | 64 | 64 | | |
| SPT | 18 | 18 | 25 | 25 | 50 | 1.5 | 69 | | grading w/frequent partings of grayish white fine sand w/gravel sized chalk nodules | |
| SPT | 19 | 14 | 27 | 27 | 54 | 1.5 | 74 | 54 | @ 73.5'-74.0' light brown<br>fine sand partings grade to occasional | |
| | | | | | | | 79.0 | | SAND; grayish white; dense; moist; fine grained; poorly graded; trace clay | |
| SPT | 20 | 18 | 18 | 29 | 47 | 1.5 | 80 | 48 | | Bottom of boring @ 80.0'. Water level recorded @ 16.3' after 24 hours. Boring backfilled w/ bentonite pallets to 42.5' on 09/09/08. Piezometer PZ-21 set from 30.0' to 40.0'. Boring backfilled with cement bentonite grout to ground surface. |

Depth scale: 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90
Elevation scale: 68, 66, 64, 62, 60, 58, 56, 54, 52, 50, 48, 46, 44, 42, 40

# BORING NO. W-4

| | |
|---|---|
| PROJECT: | Coleto Creek Power Station |
| CLIENT: | Central Power & Light Co. |
| FEATURE: | Monitoring Well W-4 |
| SURFACE ELEVATION: 134.32Ft | TOTAL DEPTH: 86.5 Ft |
| LOCATION: | S 33+00 E0+00 |
| DEPTH TO WATER DURING DRILLING: 42.0Ft | DATE: 6-3-78 |
| DRILLED BY: | Trinity Testing Laboratories, Inc. |
| LOGGED BY: | Sargent & Lundy |
| TESTED BY: | Trinity Testing Laboratories, Inc. |

| DEPTH (FT.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER RECOVERY, (%) | TORVANE POCKET PENETROMETER READING (tsf) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | ST1 | (78) | | 16.0 | 40 | 23 | SA | | |
| 5 | ST2 | (89) | | | | | | | |
| | ST3 | (100) | | 13.2 | | | | | |
| 10 | ST4 | (80) | | 11.3 | 43 | 20 | SA | | |
| 15 | ST5 | (09) | | 13.5 | | | SA | | |
| 20 | SS6 | 7-33-40 (100) | | | | | | | |
| 25 | SS7 | 14-29-41 (100) | | | | | | | |
| 30 | SS8 | 38-30-39 (100) | | | | | SA | | |
| 35 | SS9 | 10-20-1[illegible] (100) | | | | | | | |
| 40 | SS10 | 61-29-2[illegible] | | | | | | | |
| 45 | SS11 | 37-24-42 (100) | | | | | SA | | |
| 50 | SS12 | 105/6 (100) | | | | | | | |
| 55 | SS13 | 32-40-20 (100) | | | | | | | |
| 60 | SS14 | 23-30-34 (100) | | | | | SA | | |
| 65 | SS15 | 40-100/2 (100) | | | | | | | |
| 70 | SS16 | 10-37-109/5 (100) | | | | | SA | | |
| 75 | SS17 | 22-46-66 (100) | | | | | SA | | |
| 80 | SS18 | 19-42-56 (100) | | 46 | 23 | | SA | | |
| 85 | SS19 | 32-53-84 (100) | | | | | | | |
| 90 | | | | | | | | | |

| SYMBOLS | DESCRIPTION | DEPTH (FT.) | ELEVATION (FT., MSL) |
|---|---|---|---|
| SM | SAND, silty, brown. | 0 | 134.32 |
| SC | SAND, clayey, medium to fine, brown and yellow. - seams of cemented sand between 21 Ft and 25 Ft. | 2 | 132.32 |
| SP-SM | SAND, medium to fine, trace silt, yellow. | 25 | 109.32 |
| CL | CLAY, silty, some medium to fine sand, calcareous, yellow. | 31 | 103.32 |
| SP | SAND, medium to fine, yellow. | | 100.32 |
| CL | CLAY, silty and sandy, yellow. | | 99.32 |
| SM | SAND, silty, coarse to fine, trace gravel, yellow. - cemented layer. - grades to no gravel, white - grades to medium to fine. - grades to coarse to fine with gravel & caliche. | 36 | 98.32 |
| CL | CLAY, sandy, yellow and gray. | | 78.02 |
| SC-GC | SAND and Gravel, clayey, gray, with cemented layers. | | 74.32 |
| CL | CLAY, sandy, gray. - grades to yellow | | 69.32 |
| SM | SAND, silty, coarse to fine, yellow. | | 63.32 |
| ML | Caliche, (Chalk) | | 60.02 |
| SM | SAND, silty, coarse to fine, yellow. | | |
| CL | CLAY, silty, little medium to fine sand, gray and brown with pockets of Caliche. | | 58.32 |
| | END OF BORING - 86.5 Ft. Groundwater encountered at 42.0 Ft. | 86.5 | 47.82 |

86.5

ATTACHMENT 11

# BORING NO. W-5

SHEET 1 OF 2

| | |
|---|---|
| PROJECT: | Coleto Creek Power Station |
| CLIENT: | Central Power & Light Co. |
| FEATURE: | Monitoring Well W-5 |
| SURFACE ELEVATION: 119.57 Ft | TOTAL DEPTH: 71.5Ft |
| LOCATION: | N 30+07.7 E 31+50.6 |
| DEPTH TO WATER DURING DRILLING: 40.0 Ft | DATE: 3-30-78 |
| DRILLED BY: | Trinity Testing Laboratories, Inc. |
| LOGGED BY: | Sargent & Lundy |
| TESTED BY: | Trinity Testing Laboratories, Inc. |

| DEPTH (ft.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf.) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | ST1 | (75) | | 12.8 | | | SA | | |
| 5 | ST2 | (83) | | | | | | | |
| 7 | ST3 | (83) | | | | | | | |
| 10 | ST4 | (83) | | | | | | | |
| 15 | ST5 | (78) | | 3.1 | | | SA | | |
| 20 | SS6 | 8-13-20 (100) | | | | | SA | | |
| 25 | SS7 | 7-47-100/4.5 (100) | | | | | | | |
| 30 | SS8 | 6-13-31 (100) | | | | | | | |
| 35 | SS9 | 14-36-31 (100) | | | | | SA | | |
| 40 | SS10 | 1-27-31 (100) | | | | | | | |
| 45 | SS11 | 16-67-100/5.5 (100) | | 34 | 15 | | | | |

| SYMBOLS | DESCRIPTION | DEPTH (ft.) | ELEVATION (ft., MSL) |
|---|---|---|---|
| SM | SAND, silty, brown (Topsoil) | 0 | 119.57 |
| SC | SAND, clayey, medium to fine, brown. | | 119.07 |
| CL | CLAY, silty, gray, with Caliche. | 5 | 114.07 |
| SC | SAND, clayey, brown, with layers of Caliche. | | 111.57 |
| CL | CLAY, silty, yellow and white, with lenses and pockets of Caliche. | 10 | 108.57 |
| SP-SM | SAND, medium to fine, white. | 15 | 104.57 |
| SC | SAND, clayey, calcareous, white. (Caliche) | 25 | 93.57 |
| SM-SC | SAND, silty and clayey, white, with lenses and seems of Caliche - grades to gray. | 30 | 90.57 |
| | ▽ (water level) | 40 | 79.57 |
| SM | SAND, silty, coarse to fine, white | | 79.07 |
| CL | CLAY, silty, gray, with seems of Caliche. | 45 | 73.57 |
| | | 50 | |

| REVISION | DATE / APPROVED BY | DESCRIPTION |
|---|---|---|
| 0 | 10-24-78 D.G. Bartlett | For Use |
| | | |
| | | |
| | | |
| | | |

COLETO CREEK POWER STATION

LOG OF BORING W-5

CENTRAL POWER & LIGHT CO.

SARGENT & LUNDY ENGINEERS

PROJECT NUMBER 4857

| DEPTH (ft.) | SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) | SYMBOLS | DESCRIPTION | DEPTH (ft.) / ELEVATION (ft., MSL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | SS12 | 72-100/1 (100) | | | | | SA | | | SM-SC | SAND, silty and clayey, calcareous, white, very dense. (Caliche) | 69.57 |
| | | | | | | | | | | SM | SAND, silty, white. | 66.57 |
| 55 | SS13 | 50-74-130/5.5 (100) | | | | | | | | | | |
| | | | | | | | | | | SM-SC | SAND, silty and clayey, calcareous, white and brown, very dense. (Caliche) | 62.57 |
| 60 | SS14 | 100/3.5 (100) | | | 18 | 14 | SA | | | | | |
| 65 | SS15 | 18-78-100/4.5 (100) | | | | | | | | CL | CLAY, silty, brown. | 53.57 |
| 70 | SS16 | 9-17-21 (100) | | | | | | | | | END OF BORING - 71.5 Ft | 48.07 |
| | | | | | | | | | | | Groundwater encountered at 40.0 Ft. and rose to 32.5 Ft. | |
| 75 | | | | | | | | | | | | |

| REVISION | DATE / APPROVED BY | DESCRIPTION |
|---|---|---|
| 0 | 10-24-78 / D.G. Bodie | For Use |

COLETO CREEK POWER STATION
LOG OF BORING W-5 (cont'd)

CENTRAL POWER & LIGHT CO.

SARGENT & LUNDY ENGINEERS

PROJECT NUMBER 4857

## MW-6

| PROJECT: Coleto Creek Power Station | |
|---|---|
| CLIENT: Central Power & Light Co. | |
| FEATURE: Monitoring Well W-6 | |
| SURFACE ELEVATION: 116.35 Ft | TOTAL DEPTH: 66.5 Ft |
| LOCATION: N 63+00 E 31+00 | |
| DEPTH TO WATER DURING DRILLING: 38.0Ft | DATE: -31-78 |
| DRILLED BY: Trinity Testing Laboratories, Inc. | |
| LOGGED BY: Trinity Testing Laboratories, Inc. | |
| TESTED BY: Trinity Testing Laboratories, Inc. | |

| SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf.) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|
| ST1 | (64) | | 13.6 | 60 | 29 | SA | | |
| ST2 | (86) | | | | | | | |
| ST3 | (81) | | 13.2 | 32 | 21 | SA | | |
| ST4 | (78) | | | | | | | |
| ST5 | (69) | | 3.4 | | SA | | | |
| SS6 | 14-20-20 (100) | | | | | | | |
| SS7 | 9-22-28 (100) | | | | | | | |
| SS8 | 8-16-26 (100) | | | | | | | |
| SS9 | 9-41-100/5 (100) | | | | | | | |
| SS10 | 13-55-44 (100) | | | | | | | |
| SS11 | 76-100/5 (100) | | | 18 | 12 | | | |
| SS12 | 11-21-57 (100) | | | | | SA | | |
| SS13 | 21-100/55 (100) | | | | | | | |
| SS14 | 37-100 (100) | | | | | | | |
| SS15 | 7-16-26 (100) | | | | | | | |

| SYMBOLS | DESCRIPTION |
|---|---|
| SC | SAND, clayey, brown. |
| | - grades to yellow-brown. |
| | - grades to yellow with Caliche. |
| CL | CLAY, sandy, yellow-brown. |
| SM-SC | SAND, silty and clayey, yellow and white with Caliche. |
| SC | SAND, clayey, yellow-gray. |
| SP-SM | SAND, coarse to fine, white to yellow. |
| SM | SAND, silty, trace gravel, white with layer of clayey sand. |
| CL-ML | CLAY, silty and sandy, yellow gray. |
| SC | SAND, clayey, gray, with Caliche. |
| SC | - grades to yellow-gray. |
| SM-SC | SAND, silty and clayey, white. |
| CL | CLAY, silty, gray-pink. |
| | END OF BORING- 66.5 Ft<br>Groundwater encountered at 38.0 Ft |

ELEVATION (ft., MSL): 116.35, 112.35, 109.85, 108.85, 105.35, 92.35, 90.35, 87.35, 78.35, 73.85, 68.85, 66.35, 58.85, 55.35, 53.85, 49.85

## BORING NO. W-7

| PROJECT: Coleto Creek Power Station | |
|---|---|
| CLIENT: Central Power & Light Co. | |
| FEATURE: Monitoring Well W-7 | |
| SURFACE ELEVATION: 126.99 Ft | TOTAL DEPTH: 75.13 Ft |
| LOCATION: N 79+20 E 19+00 | |
| DEPTH TO WATER DURING DRILLING: 35.0 Ft | DATE: 4-4-78 |
| DRILLED BY: Trinity Testing Laboratories, Inc. | |
| LOGGED BY: Trinity Testing Laboratories, Inc. | |
| TESTED BY: Trinity Testing Laboratories, Inc. | |

| SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf.) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|
| ST1 | (89) | | 10.9 | 45 | 21 | SA | | |
| ST2 | (96) | | | | | | | |
| ST3 | (78) | | 12.8 | 41 | 20 | SA | | |
| ST4 | (86) | | | | | | | |
| ST5 | | | 9.1 | | | SA | | |
| SS6 | 3-6-26 (100) | | | | | SA | | |
| SS7 | 14-51-64 (100) | | | | | | | |
| SS8 | 8-37-52 (100) | | | | | | | |
| SS9 | 8-13-19 (100) | | | 28 | 15 | SA | | |
| SS10 | 7-37-43 (100) | | | | | | | |
| SS11 | 12-26-26 (100) | | | | | SA | | |
| SS12 | 15-16-50 (100) | | | | | | | |
| SS13 | 10-21-29 (100) | | | | | | | |
| SS14 | 19-42-73 (100) | | | | | SA | | |
| SS15 | 17-100/5 (0) | | | | | | | |
| SS16 | 100/2.5 (0) | | | | | | | |
| SS17 | 100/1.5 (0) | | | | | | | |

| SYMBOLS | DESCRIPTION |
|---|---|
| SC | SAND, clayey, medium to fine, brown |
| | - grades to yellow with layers of Caliche. |
| | - grades to brown. |
| | - grades to yellow. |
| SM | SAND, silty, coarse to fine, trace gravel, white. |
| SC | SAND, clayey, yellow, with Caliche. |
| SM | SAND, silty, coarse to fine, yellow. |
| SC | SAND, clayey, gray, with Caliche. |
| SM | SAND, silty, medium to fine, white. |
| SC | SAND, clayey. |
| SM | SAND, silty, coarse to fine, with and without little gravel, white. |
| | - cemented layer. |
| CL | CLAY, silty, gray, very hard. |
| | END OF BORING - 75.13 Ft<br>Groundwater encountered at 35.0 Ft. |

ELEVATION (ft., MSL): 126.99, 123.49, 119.99, 117.49, 110.99, 108.99, 105.99, 103.99, 91.99, 84.49, 76.99, 76.49, 71.49, 61.49, 55.99, 51.86

## MW-8

| PROJECT: Coleto Creek Power Station | |
|---|---|
| CLIENT: Central Power & Light Co. | |
| FEATURE: Monitoring Well W-8 | |
| SURFACE ELEVATION: 131.78 Ft | TOTAL DEPTH: 81.5 Ft |
| LOCATION: N 65+00 W 2+00 | |
| DEPTH TO WATER DURING DRILLING: 42.0Ft | DATE: 3-30-78 |
| DRILLED BY: Trinity Testing Laboratories, Inc. | |
| LOGGED BY: Sargent & Lundy | |
| TESTED BY: Trinity Testing Laboratories, Inc. | |

| SAMPLE NUMBER AND TYPE | BLOWS/6" ON SAMPLER (RECOVERY, %) | POCKET PENETROMETER MEASUREMENT (tsf.) | FIELD MOISTURE CONTENT (%) | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | OTHER TESTS | CORE RECOVERY (%) | RQD (%) |
|---|---|---|---|---|---|---|---|---|
| ST1 | (92) | | 7.2 | 33 | 15 | SA | | |
| ST2 | (97) | | | | | | | |
| ST3 | (77) | | 16.8 | 48 | 18 | SA | | |
| ST4 | (94) | | | | | | | |
| ST5 | (96) | | 8.4 | | | SA | | |
| SS6 | 6-9-12 (100) | | | | | | | |
| SS7 | 11-28-42 (100) | | | | | | | |
| SS8 | 100/6.5 (100) | | | | | SA | | |
| SS9 | 30-25-86 (100) | | | | | | | |
| SS10 | 6-14-22 (100) | | | | | SA | | |
| SS11 | -23-26 (100) | | | | | SA | | |
| SS12 | 43-100/1 (100) | | | | | | | |
| SS13 | 30-47-96 (100) | | | | | | | |
| SS14 | 100/3 (100) | | | | | SA | | |
| SS15 | 100/1 (100) | | | | | | | |
| SS16 | 28-47-52 (100) | | | 45 | 20 | SA | | |
| SS17 | 17-54-41 (100) | | | | | | | |
| SS18 | 14-36-50 (100) | | | | | | | |

| SYMBOLS | DESCRIPTION |
|---|---|
| SC | SAND, clayey, medium to fine, brown. |
| CL | CLAY, silty, and sandy, calcareous, white, (Caliche) |
| SC | SAND, clayey, medium to fine, calcureous light brown to white. |
| SM | SAND, silty, medium to fine, light brown to gray. |
| CL | CLAY, silty, brown. |
| SC | SAND, clayey calcareous, white. (Caliche) |
| SP-SM | SAND, coarse to fine, brown |
| SC | SAND, clayey, coarse to fine, gray. |
| SM | SAND, silty, gray, with clayey sand layers. |
| SM | |
| SC | SAND, clayey, gray, vary hard. |
| CL | CLAY, silt, light brown to white with Caliche, very hard. |
| | END OF BORING - 81.5 Ft<br>Groundwater encountered at 42.0 Ft |

ELEVATION (ft., MSL): 131.78, 124.78, 116.78, 111.78, 95.78, 95.28, 94.78, 91.78, 89.78, 87.78, 81.78, 74.78, 64.78, 50.28

## NOTES

## REFERENCE DRAWINGS

| | |
|---|---|
| S-2 | SOILS BORINGS LOCATION PLAN |

FOR REFERENCE ONLY
SPEC. CC2-513.20
11-21-80

## DRAWING RELEASE RECORD

| REV. | DATE REL'D. | PREPARED | REVIEWED | APPROVED | PURPOSE | FILM |
|---|---|---|---|---|---|---|
| | | | | | | |

## DRAWING RELEASE RECORD

| REV. | DATE REL'D. | PREPARED | REVIEWED | APPROVED | PURPOSE | FILM |
|---|---|---|---|---|---|---|
| A | 09-08-80 | [signature] | R.B. [signature] | [signature] | FOR RECORD | ✓ |

| SCALE | NONE |
|---|---|
| PROJECT NUMBER | 4857 |

LOG OF BORINGS
W-6 THROUGH W-8
COLETO CREEK POWER STATION UNIT 1
CENTRAL POWER & LIGHT COMPANY
GOLIAD COUNTY, TEXAS

SARGENT & LUNDY ENGINEERS CHICAGO

| DRAWING NO. | REV. |
|---|---|
| S-10 | A |

SHEET 3 OF 3

COC51055

S-10 SHEET 3 OF 3

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING W-9

(Page 1 of 1)

COLETO CREEK POWER STATION
FANNIN, TX

Project No. 15215

| | | | |
|---|---|---|---|
| Date | : 9/15/2015 | Drilling Company | : EnviroCore |
| Easting | : 2543670.9 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13451651.2 | Drill Rig | : CME75 |
| Top of Casing Elevation | 132.3 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

Surface Elevation: 129.3

| DEPTH (feet) | DESCRIPTION | USCS |
|---|---|---|
| 0.0–2.0 | (0-2.0) - Fill Material: CLAYEY SAND, mottled light gray and reddish brown, moist | SC |
| 2.0–5.5 | (2.0-5.5) - Fill Material: Silty CLAY/Clayey SAND, brownish gray to white, soft to firm, Sand is fine to coarse grained, common caliche gravel, moist | SC/CL |
| 5.5–10.0 | (5.5-10.0) - Silty CLAY, dark gray to gray with orangish brown mottling, firm to hard, medium plasticity, common caliche gravel, minor roots, moist | CL |
| 10.0–20.5 | (10.0-20.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low plasticity, dry | ML/CL |
| 20.5–22.0 | (20.5-22.0) - SILTY SAND, very light brownish gray, fine to coarse grained, trace of gravel, moist | SM |
| 22.0–44.0 | (22.0-44.0) - SAND, very light orangish brownish to very light gray, fine to coarse grained, slightly silty, wet | SW |
| 44.0–47.0 | (44.0-47.0) - SILTY SAND, light gray, fine to coarse grainad, wet | SM |
| 47.0–54.0 | (47.0-54.0) - Silty CLAY/Clayey SAND, light gray, soft to firm, Sand is fine to coarse grained, wet | SC/CL |
| 54.0–60.0 | (54.0-60.0) - Silty, Clayey SAND, gray, fine to coarse grained, wet | SC/SM |

Depth scale (feet): 0.0, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, 50.0, 55.0, 60.0

Elevation scale: 128, 124, 120, 116, 112, 108, 104, 100, 96, 92, 88, 84, 80, 76, 72

Recovery (ft/ft): 1.5/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2

## WELL DIAGRAM/REMARKS

Well Construction:
Riser -3.0' AGL - 40.0' BGL
Neat Cement: 0' - 2.0' BGL
Bentonite chips seal: 2.0' - 38.0' BGL
Sand Pack: 38.0' - 60.0' BGL
Screen: 40.0' - 60.0' BGL

Water Level: 25.2' BGL

Craig E. Bennett
STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC. # 1205
LICENSED
PROFESSIONAL GEOSCIENTIST
5-26-16

Total Boring Depth = 60 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING W-10

(Page 1 of 1)

COLETO CREEK POWER STATION
FANNIN, TX

Project No. 15215

| | | | |
|---|---|---|---|
| Date | : 9/17/2015 | Drilling Company | : EnviroCore |
| Easting | : 2542864.5 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13449694.0 | Drill Rig | : CME75 |
| Top of Casing Elevation | 130.4 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

Surface Elevation: 127.6

| DEPTH (feet) | DESCRIPTION | USCS |
|---|---|---|
| 0.0–2.0 | (0-2.0) - Fill Material: SILTY SAND, fine to coarse grained, brown, clayey, common roots, moist | SM |
| 2.0–8.0 | (2.0-8.0) - Silty,Sandy CLAY,mottled organish brown and light gray, firm, medium plasticity, moist | CL |
| 8.0–11.0 | (8.0-11.0) - Silty CLAY/Clayey SAND, light gray, Sand is medium grained, moist | SC/CL |
| 11.0–19.0 | (11.0-19.0) - SILTY SAND, very light gray, medium to coarse grained, abundant caliche, moist | SM |
| 19.0–30.0 | (19.0-30.0) - SAND, light gray, medium to coase grained, occasional gravel, moist | SP |
| 30.0–32.0 | (30.0-32.0) - Silty CLAY/Clayey SAND, light gray, soft to firm, occasional gravel and caliche, medium plasticity, wet | CL/SC |
| 32.0–34.0 | (32.0-34.0) - CLAYEY SAND, brownish grey, soft, very fine, wet | SC |
| 34.0–36.0 | (34.0-36.0) - SILTY SAND, light gray, fine to medium grained, wet | SM |
| 36.0–52.0 | (36.0-52.0) - Silty, Clayey SAND, light gray, fine to coarse grained, wet | SC/SM |
| 52.0–60.0 | (52.0-60.0) - SILTY SAND, light gray, fine to coarse grained, clayey, wet | SM |

Recovery (ft/ft):

| Depth (ft) | Recovery | Depth (ft) | Recovery | Depth (ft) | Recovery |
|---|---|---|---|---|---|
| 0–2 | 2/2 | 20–22 | 1.8/2 | 40–42 | 1.8/2 |
| 2–4 | 1.8/2 | 22–24 | 1.8/2 | 42–44 | 1.8/2 |
| 4–6 | 0/2 | 24–26 | 1.8/2 | 44–46 | 1.8/2 |
| 6–8 | 1.7/2 | 26–28 | 1.8/2 | 46–48 | 2/2 |
| 8–10 | 2/2 | 28–30 | 1.8/2 | 48–50 | 2/2 |
| 10–12 | 1.7/2 | 30–32 | 1.8/2 | 50–52 | 1.8/2 |
| 12–14 | 1.8/2 | 32–34 | 1.8/2 | 52–54 | 1.8/2 |
| 14–16 | 1.8/2 | 34–36 | 1.5/2 | 54–56 | 1.8/2 |
| 16–18 | 1.8/2 | 36–38 | 1.8/2 | 56–58 | 2/2 |
| 18–20 | 1.8/2 | 38–40 | 1.8/2 | 58–60 | 1.5/2 |

Elevation scale: 124, 120, 116, 112, 108, 104, 100, 96, 92, 88, 84, 80, 76, 72, 68

WELL DIAGRAM/REMARKS

Well Construction:
Riser ~3.0' AGL - 40.0' BGL
Neat Cement: 0' - 2.0' BGL
Bentonite chips seal: 2.0' - 38.0' BGL
Sand Pack: 38.0' - 60.0' BGL
Screen: 40.0' - 60.0' BGL

Water Level: 24.8' BGL

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC. # 1205
LICENSED
PROFESSIONAL GEOSCIENTIST
5-26-16

Total Boring Depth = 60 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

Bullock, Bennett & Associates, LLC
165 N. Lampasas Street
Bertram, TX 78605

# LOG OF BORING MW-11



COLETO CREEK POWER STATION
FANNIN, TX

Project No. 17252

| | | | |
|---|---|---|---|
| Date | : 4/25/2017 | Drilling Company | : EnviroCore |
| Easting | : 2543727.0 | Driller | : Craig Schena (Lic. #4694) |
| Northing | : 13452676.5 | Drill Rig | : CME75 |
| Top of Casing Elevation | 118.66 ft NAVD 88 | Drilling Method | : Hollow Stem Auger - 6" |
| Logger | : EEF | Sampling Method | : Split-Spoon |

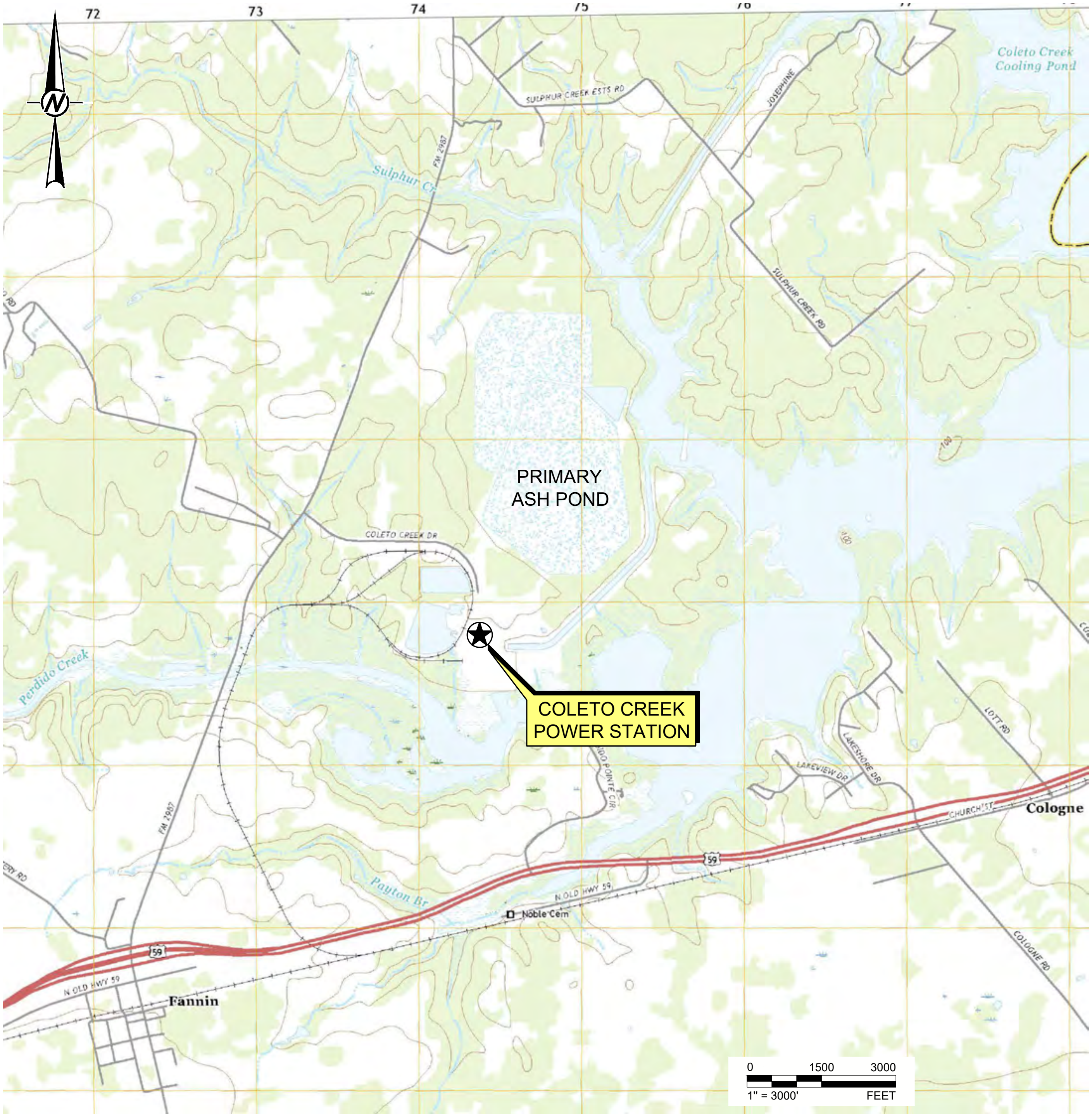
| DEPTH (feet) | Surface Elevation 115.8 | DESCRIPTION | USCS | Recovery (ft/ft) | WELL DIAGRAM/REMARKS |
|---|---|---|---|---|---|
| 0.0 | | (0-1.0) - Silty CLAY, dark brown, soft to firm, medium plasticity, minor roots, moist | CL | 2/2 | |
| 5.0 | 112 | (1.0-6.5) - Predominantly Caliche and Silty CLAY, light gray to white, Caliche is weakly cemented, low to medium plascticity, wet | CL/ML | 2/2, 2/2 | |
| 10.0 | 108, 104 | (6.5-13.8) - Silty, Clayey SAND, light gray to white, very fine to medium grained, wet | SM | 2/2, 2/2, 2/2, 2/2 | Water Level: 11.2' BGL |
| 15.0, 20.0, 25.0 | 100, 96, 92 | (13.8-28.5) - SAND, very light orangish brownish to very light gray, fine to coarse grained, abundant gravel, slightly silty, wet | SW | 2/2, 2/2, 2/2, 2/2, 2/2, 2/2, 2/2 | Well Construction: Riser ~2.7' AGL - 29.0' BGL; Neat Cement: 0' - 1.0' BGL; Bentonite chips seal: 1.0' - 27.0' BGL; Sand Pack: 27.0' - 49.0' BGL; Screen: 29.0' - 49.0' BGL |
| 30.0, 35.0 | 88, 84, 80 | (28.5-38.0) - Silty, Clayey SAND, gray to light brownish gray, very fine to medium grained, wet | SM/SC | 2/2, 2/2, 2/2, 2/2, 2/2 | |
| | 76 | (38.0-40.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | CL/SC | 2/2 | |
| 40.0, 45.0 | 72 | (40.0-46.0) - Silty, Clayey SAND, gray, fine to medium grained, wet | SM/SC | 2/2, 0/2, 2/2 | |
| | 68 | (46.0-49.0) - Silty CLAY/Clayey SAND, light gray, weakly caliche cemented, Sand is fine to medium grained, wet | SC | 1.5/2, 0.5/1 | |

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E. Bennett
04-28-2017

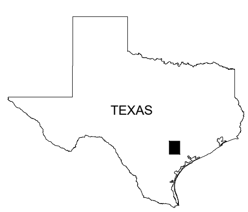
Total Boring Depth = 49 ft Below Ground Level; North and Easting Coordinates from NAD-83, South Central Zone

**Figures**




**REFERENCE(S)**

BASE MAP TAKEN FROM USGS.GOV, FANNIN, TX 7.5 MIN. USGS QUADRANGLE DATED 2019.




QUADRANGLE LOCATION

CLIENT

COLETO CREEK POWER LP

PROJECT

COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE

**SITE LOCATION MAP**

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-07 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 20142034 | | 0 | 1 |


**LEGEND**

- PROPERTY BOUNDARY
- CCR MONITORING UNIT
- DOWNGRADIENT CCR MONITORING WELL
- UPGRADIENT CCR MONITORING WELL
- RAILROAD

**REFERENCE(S)**

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 1/15/21.

0 600 1200

1" = 1200' FEET

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**SITE PLAN**

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-12-14 |
| DESIGNED | RS |
| PREPARED | RS |
| REVIEWED | WFV |
| APPROVED | WFV |

| PROJECT NO. | REV. | FIGURE |
|---|---|---|
| 20142034 | 0 | 2 |

OBG

# Statistical Analysis Plan

## Coleto Creek Power Station

**Coleto Creek Power, LP**

October 17, 2017

Natural Resource Technology
AN OBG COMPANY

# TABLE OF CONTENTS

## LIST OF TABLES

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Annual Report | Annual Groundwater Monitoring and Corrective Action Report |
| ANOVA | analysis of variance |
| ASD | alternative source demonstration |
| CCR | Coal Combustion Residuals |
| CUSUM | cumulative sum |
| COCs | constituents of concern |
| GWPS | groundwater protection standard |
| LCL | lower confidence limit |
| LPL | lower prediction limit |
| MCL | maximum contaminant level |
| MSE | mean squared error |
| RCRA | Resource Conservation and Recovery Act |
| RL | reporting limit |
| ROS | regression on order statistics |
| SSI | statistically significant increase |
| SSL | statistically significant level |
| SWFPR | site-wide false positive rate |
| Unified Guidance | Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (USEPA, 2009) |
| UPL | upper prediction limit |
| USEPA | United States Environmental Protection Agency |
| UTL | upper tolerance limit |

## 1. INTRODUCTION

In April 2015, the United States Environmental Protection Agency (USEPA) issued a final rule for the regulation and management of Coal Combustion Residuals (CCR) in certain landfills and impoundments under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 CFR 257 Subpart D; published in 80 FR 21302-21501, April 17, 2015, referred to hereafter as the CCR Rule]. Facilities regulated under the CCR Rule are required to develop and sample a groundwater monitoring well network to evaluate if landfilled (including within an impoundment) CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used by a qualified professional engineer. The procedures described in the evaluation will be used to establish background conditions and implement detection, assessment, and corrective action monitoring as necessary and required by 40 CFR §257.93-257.95. This Statistical Analysis Plan was prepared in accordance with the requirements of 40 CFR §257.93, with reference to the acceptable statistical procedures provided in USEPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring.

This Statistical Analysis Plan does not include procedures for groundwater sample collection and analysis, as these activities are conducted in accordance with the Sampling and Analysis Plan prepared for each CCR unit in accordance with 40CFR 257.93. This Statistical Analysis Plan will be used as the primary reference for evaluating groundwater quality before and after closure of CCR landfills and surface impoundments.

### 1.1 STATISTICAL ANALYSIS OBJECTIVES

This Statistical Analysis Plan is intended to provide a framework for conducting the statistical analyses of data obtained during groundwater monitoring conducted in accordance with the Sampling and Analysis Plan for each CCR unit. The Statistical Analysis Plan will enable a qualified professional engineer to certify that the selected statistical methods are appropriate for evaluating the groundwater monitoring data for CCR management areas.

### 1.2 STATISTICAL ANALYSIS PLAN APPROACH

The main sections of this Statistical Analysis Plan should be viewed as a "generic" outline of statistical methods for each CCR unit and required constituent. The statistical analysis of the groundwater monitoring data however, will be conducted on an individual-constituent basis, and may involve the use of appropriate statistical procedures depending on multiple factors such as detection frequency and normality distributions.

The CCR Rule outlines four phases of groundwater monitoring:

- Background Monitoring in accordance with 40 CFR 257.90(b)(iii) and 257.94(b)
- Detection Monitoring in accordance with 40 CFR 257.94
- Assessment Monitoring in accordance with 40 CFR 257.95
- Corrective Action Monitoring in accordance with 40 CFR 257.95(g) and 257.98.

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the first phase, background groundwater quality will be established, utilizing upgradient and background wells. Detection Monitoring is then initiated through the evaluation of the downgradient groundwater monitoring data for statistically significant increases (SSI) over background levels for seven selected constituents. If an SSI is confirmed for any constituent at any downgradient well, Assessment Monitoring must be conducted. In addition to continued monitoring of the seven constituents used in Detection Monitoring, Assessment Monitoring will then evaluate whether exceedances occur for 15 additional constituents relative to the groundwater protection standard (GWPS). If an exceedance is confirmed, Corrective Action

Monitoring will then be initiated to respond to and control a release. The developed statistical analysis plan will be implemented for each monitoring phase, following the requirements of the CCR Rule, and in accordance with the statistical procedures.

## 2. BACKGROUND MONITORING AND DATA PREPARATION

At least one upgradient or background monitoring well, and three downgradient monitoring wells (located at the edge of the CCR unit boundary) were sampled and analyzed for constituents, as listed in Appendix III (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids) and Appendix IV (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, radium 226 and 228 combined) of Part 257, during the first phase of the groundwater monitoring program.

The upgradient or background monitoring well(s) were placed upgradient of the CCR unit, or at an alternative background location, where they are not affected by potential leakage from the CCR unit. Downgradient monitoring wells were placed at the waste boundary of the CCR unit, along the same groundwater flow path. As the CCR Rule 257.91(a)(2) specifies, the location of these wells ensures that wells in the uppermost aquifer accurately represent the quality of groundwater, while downgradient wells monitor potential contaminant pathways.

To account for both seasonal and spatial variability in groundwater quality, eight independent sampling events were completed on a quarterly or greater frequency between November 2015 and August 2017. As outlined, groundwater sampling procedures included sampling of the upgradient, background, and downgradient wells using low-flow sampling methods, the collection of one field quality control sample per event, and groundwater samples that were not field-filtered before laboratory analysis of total recoverable metals.

Following completion of the eight baseline (quarterly) sampling events, background groundwater quality will be established for Appendix III and IV constituents. Groundwater monitoring will then be conducted at least semiannually for the life of the facility unless there is inadequate groundwater flow and a longer interval is required between sample events.

The following subsections outline the statistical tests and procedures (methods) that will be utilized to evaluate data collected for each constituent in both background and downgradient wells for Background, Detection, Assessment, and Corrective Action Monitoring. When necessary and contingent upon equivalent statistical power, an alternative test not included in this Statistical Analysis Plan may be chosen due to site-specific data requirements.

### 2.1 SAMPLE INDEPENDENCE

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. Therefore, the minimum time interval between sampling events is a function of the groundwater velocity and well bore volume (diameter of the well and surrounding filter pack).

### 2.2 NON-DETECT DATA PROCESSING

The reporting limit (RL) will be used as the lower level for the reporting of non-detected groundwater quality data. For all statistical test procedures, if the frequency of non-detect data are less than or equal to 15%, half of the RL will be substituted for these data. If the non-detect frequency is greater than 15%, up to 50% non-detect, either the Kaplan-Meier or robust regression on order statistics (ROS) will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values. However, the Kaplan-Meier method will not be utilized if the RL is identical for all non-detects, as no variance in the data would result in simply RL substitution for each non-detect result. In this case, half the RL will be substituted for the non-detects. If the detection frequency is greater than 50%, a non-parametric test will be used. If only one background result is detected, that value will be used as the non-parametric upper prediction limit (UPL).

## 2.3 TESTING FOR NORMALITY

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently non-normally distributed (nonparametric). The CCR Rule requires the knowledge of the background data distribution for comparison to downgradient results. The Unified Guidance document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50. When possible, transformation of datasets to achieve normal distributions is preferred. Control charts (with the exception of XmR-charts) produced under the assumption of normality are also a valuable tool when datasets are parametric. They are used for detection monitoring and typically used for intrawell testing, though they can be structured for interwell. There is no non-parametric version of control charts.

## 2.4 TESTING FOR OUTLIERS

Appendix III and IV constituents will be screened for the existence of outliers using a method described by the Unified Guidance. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

When necessary, a confirmatory sample will be collected to allow the facility to distinguish between an outlier and a true release from the facility. If re-sampling is necessary, this sample will be collected within 60 days following outlier identification. If the confirmatory sample indicates the original result as an outlier, it will be reported as such, and not as a release from the CCR unit. Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. Professional judgement will be used to exclude extreme outliers from further statistical analyses.

## 2.5 TREND ANALYSIS

Statistical analyses confirming the lack of trend are a fundamental step to confirm the assumption that groundwater quality values (constituent means) are stationary or constant over time at a CCR unit. These analyses allow for evaluation of variation in the background and downgradient data for each constituent over time. A statistically significant increasing trend in background data could indicate an existing release from the CCR unit or alternate source, requiring further investigation. In addition, statistically significant trending background data can result in increased standard deviation and, therefore, greater prediction or control limits. Consequently, the increased prediction or control limit will have less power or ability to identify a release from a CCR unit.

A linear regression, coupled with a t-test for slope significance, may be used on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test for slope significance, will be used for datasets with frequent non-detects or non-normal variance. Similarly, trend analyses could also be used on downgradient data to evaluate a possible release from the CCR unit.

## 2.6 SPATIAL VARIATION

Assuming no significant spatial trends exist, sample results may be compared between background wells for each constituent to confirm a lack of spatial variation. Box-and-whisker plots or an analytical evaluation, such as

Levene's test (α = 0.01), will be used to assure equality of variances across background wells. If variances are equal, a one-way analysis of variance (ANOVA, α = 0.05) will be computed across background wells. The Kruskall-Wallis test may be used to determine spatial variability for those constituents where at least 50% of the background data are non-detects. Similar to spatial trends, the occurrence of statistically significant spatial variation between background wells could indicate an existing release from a CCR unit. If the spatial variability is not due to an existing release, intrawell comparisons in downgradient wells may be used to more appropriately determine the occurrence of a future release from a CCR unit. Analyses may differ by constituents and wells, depending on spatial variability. For example, if spatial variability exists between background wells for boron but not for calcium, then intrawell comparisons may be used for boron and interwell comparisons may be used for calcium. Intrawell comparisons may be used as an appropriate alternative for existing CCR units that have not been in operation or for new CCR units that are being designed to put into service.

## 2.7 UPDATING BACKGROUND

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The Unified Guidance recommends updating statistical limits (background) when at least four to eight new measurements (every 2 to 4 years under a semi-annual monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or medians (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to verify that the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the assumption that they have equal means or medians. In addition, time series graphs or other trend evaluation statistics will be conducted on the new background dataset to verify the absence of a release, or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a release (if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. In accordance with the Unified Guidance, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison. Spatial variability among background wells will also be assessed when background datasets are updated to whether pooling data and interwell comparisons are appropriate.

For intrawell evaluations, once an SSI has been identified for a constituent at a particular well, no additional updates of the baseline (background) datasets (for any parameter) will be allowed, unless the SSI is determined to be caused by something other than a release from the CCR unit. The baseline (background) dataset can only be updated with new data if the SSI is proven to be from the result of an alternate source.

## 3. DETECTION MONITORING PROGRAM

The second phase of the groundwater monitoring program is Detection Monitoring. Detection Monitoring is designed to monitor groundwater for evidence of a release by comparing Appendix III constituents in downgradient wells to background data to evaluate the possible occurrence of SSIs. Following initial monitoring to evaluate background groundwater quality, Detection Monitoring will begin with the collection of eight independent samples from each background and downgradient well. These samples will be analyzed for Appendix III constituents. Thereafter, samples will be collected and evaluated semi-annually. The selected Detection Monitoring statistical method used to evaluate groundwater data for each constituent, in comparison to the background data, will provide for adequate statistical power, limit the site-wide false positive rate (SWFPR), and be appropriate for the distribution and detection frequency of the background dataset.

Statistical power is the ability of a statistical test to detect a true SSI. For normalized background data, the Unified Guidance recommends that a test have at least 55 to 60% power to detect an increase of three standard deviations over background, or 80% power to detect a four standard deviation increase. Power curves can be used to measure statistical power of the selected statistical method. For Detection Monitoring, the power curve displays the probability of an individual comparison detecting a concentration increase relative to background.

Multiple comparisons inevitably occur during Detection Monitoring due to the seven constituents evaluated at three or more downgradient monitoring wells. This can lead to complications, as each individual comparison increases the SWFPR, or the potential that a statistical test will incorrectly identify an SSI on a site-wide scale. Although decreasing the false positive rate is desirable, all other things being equal, this also decreases the statistical power, which is undesirable. Therefore, the Unified Guidance recommends a statistical program have a SWFPR of 10% or less per year (5% per semi-annual sample event) to limit the occurrence of false positives, while maintaining sufficient statistical power to detect a true release from a CCR unit.

Detection Monitoring statistical analyses will begin within 60 days of receiving laboratory analytical results, and completed within 90 days. Prediction intervals will be calculated using background data for each constituent, unless an alternative site-specific method is utilized to provide increased power or to reduce the SWFPR.

The Double Quantification Rule will be used when all background data are non-detects for a particular constituent. This rule determines an SSI if any constituent in a sample and a verification resample are in exceedance, or two consecutive sampling events are in exceedance. This method reduces SWFPR, and enhances statistical power as downgradient well-constituent pairs analyzed using this rule are not included in comparisons for SWFPR calculations.

### 3.1 SSI DETERMINATION

One-sided upper prediction limits (UPL) will be calculated for each Appendix III constituent using the pooled background samples collected during the initial monitoring samples events. Individual values for each constituent detected in the downgradient monitoring wells will then be compared to the background UPL. An exceedance of the UPL for any constituent measured at any downgradient well constitutes an SSI. An exception to this method is pH, where two-sided (upper and lower) prediction intervals are established from the distribution of the background groundwater quality data. An exceedance of either the UPL or lower prediction limit (LPL) would constitute an SSI for pH.

#### 3.1.1 The Parametric Upper Prediction Limit for Future Values

Parametric UPLs for future values will be utilized when background data contains less than 50% non-detects, and can be normalized. Parametric UPL for individual future values will be calculated from normally-distributed background data as follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\bar{x}$ = sample mean of background data

$s$ = standard deviation of background data

κ = multiplier based on the number of downgradient compliance wells to be tested ($w$), the background sample size ($n$) the number ($c$) of constituents of concern (COCs), the "1-of-$m$" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Tabulated in Table 19-1 in Appendix D of the Unified Guidance.

The number of downgradient compliance wells to be tested ($w$) will vary by CCR unit, with a minimum of three wells. The background sample size ($n$) will equate to 8 multiplied by the number of upgradient or background wells at each CCR unit. The number of constituents of concern ($c$) will be seven, as stated in the Appendix III parameters list. The retesting scheme will be a 1-of-2, whereby an SSI is confirmed if the original sample and the retest or optional verification sample(s) exceed the UPL. Lastly, the evaluation schedule will be semi-annual. When exact κ multiplier values are not specified in Table 19-1 of the Unified Guidance, the desired input points ($w$* and $n$*) that lie between the closest table entries as $w_1 < w^* < w_2$ and $n_1 < n^* < n_2$, will first be calculated as fractional terms.

$$f_w = \frac{(w^* - w_1)}{(w_2 - w_1)} \quad and \quad f_n = \frac{(n^* - n_1)}{(n_2 - n_1)}$$

The interpolated κ multiplier will then be computed as:

$$\kappa_{w^*,n^*} = (1 - f_w)(1 - f_n) \cdot \kappa_{w_1,n_1} + f_w(1 - f_n) \cdot \kappa_{w_2,n_1} + (1 - f_w) \cdot f_n \cdot \kappa_{w_1,n_2} + f_w \cdot f_n \cdot \kappa_{w_2,n_2}$$

### 3.1.2 The Parametric Shewhart-CUSUM Control Chart

Combined Shewhart-CUSUM control charts may also be used when pooled background data contains less than 50% non-detects, and can be normalized. This method can be used to determine whether downgradient data plotted on the control chart follow the same distribution as the background data used to compute the baseline control limit. Combined control charts use both the new individual measurement, and the cumulative sum (CUSUM) of past and current measurements at every sampling event. This technique gives control charts increased sensitivity to detect trends and shifts in concentration levels. The Shewhart portion of the chart is ideal for detecting sudden concentration increases, and the CUSUM portion is preferred for detecting slower, steady increases. Shewhart-CUSUM control charts will be constructed by first computing the standardized concentration ($Z_i$) based on compliance point measurement ($x_i$) collected on sampling event ($T_i$):

$$Z_i = (x_i - \bar{x}_B)/s_B$$

$\bar{x}_B$ = sample mean calculated from $n$ background measurements

$s_B$ = sample standard deviation calculated from $n$ background measurements

The standardized CUSUM ($S_i$) will then be computed for each sampling event ($T_i$) as:

$$S_i = \max[0, (Z_i - k) + S_{i-1}]$$

$k$ = half displacement or shift in standard deviations to be detected on the control chart. Will be set to 1 to rapidly detect upward concentration shifts of at least 2 standard deviations.

To plot the control chart in concentration units, compute the non-standardized CUSUMS ($S_i^c$) as:

$$S_i^c = \bar{x}_B + S_i \cdot s_B$$

The non-standardized control limit ($h_c$) will be computed to assess compliance of both future measurements ($x_i$) and non-standardized CUSUMS ($U_i$) as follows:

$$h_c = \overline{x}_B + h \cdot s_B$$

Control charts will be constructed by plotting both the compliance measurements ($x_i$) and the non-standardized CUSUMs ($S_i^c$) on the y-axis, and sampling events ($T_i$) along the x-axis. From the first plotted sampling event $T_1$, the control chart will be out-of-control if the trace of the non-standardized concentration exceeds $h_c$.

### 3.1.3 The Non-Parametric Upper Prediction Limit for Future Values

Non-parametric UPLs for future values will be utilized when background data cannot be normalized, or contains a large percentage of non-detects. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate ($\alpha_{const}$) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

$\alpha$ = the SWFPR of 0.10

$c$ = the number of monitoring constituents

For a target SWFPR of 10%, and seven monitoring constituents, the target per-constituent false positive rate ($\alpha_{const}$) will be 0.015%.

The number of yearly statistical evaluation ($n_E$) will be multiplied by the number of compliance wells ($w$) to calculate the look-up table entry, $w$*. The background sample size ($n$) and $w$* will be used to select an achievable per-constituent false positive rate value in Table 19-19 of Appendix D in the Unified Guidance that is no greater than the target per-constituent false positive rate (0.015%). The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for individual observations. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-19. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used.

Each initial measurement per compliance well will be compared to the UPL. One to three additional samples will be collected, depending on the retesting scheme chosen, for any constituent that exceeds the UPL. Again, SSI is confirmed if the original sample and the retest or verification sample(s) exceed the UPL.

When a mixture of test methods is needed (e.g., parametric prediction limits for some constituents, and non-parametric limits for other constituents), an annual SWFPR of 10% (equivalent to a semiannual SWFPR of 5%) will be maintained using a target SWFPR that is evenly proportioned across the list of constituents.

### 3.1.4 The Trend Comparison Test

If a significant trend is detected in pooled background data for a given constituent, a trend comparison test will be performed to determine whether the downgradient trend (if present) significantly differs from the trending pooled background data. A linear regression, coupled with a t-test for slope significance will be used to determine slope significance on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test will be used to determine slope significance for datasets with frequent non-detects or non-normal variance. An SSI will be confirmed if the slope is significantly greater in downgradient data.

In the event that statistical analyses identify a SSI for one or more parameters, the constituent-well pairs of concern may be re-sampled within the required timeframe (90 days from receipt of laboratory data). Detection Monitoring statistics will be updated using the downgradient verification resample results within 90 days of receiving laboratory analytical reports. If verification sample(s) confirm a SSI, results will be reported to the state director (and/or appropriate tribal authority, if applicable) and Assessment Monitoring will be initiated in the next scheduled semi-annual event. If applicable, an alternative source demonstration (ASD) indicating that the confirmed SSI was due to natural variability or an alternative release source other than the CCR unit facility will be completed within 90 days of the SSI confirmation. The ASD report must be certified by a qualified professional engineer and included with the annual groundwater monitoring report required by CCR Rule Part 257.90(e). If the ASD for a parameter is successful and there are no other SSIs, Detection Monitoring will continue; otherwise Assessment Monitoring will be initiated, as required by the CCR Rule Part 257.95. If the verification sample(s) do not confirm a SSI however, Detection Monitoring will continue. If an SSI is not identified for any Appendix III constituents in downgradient wells, Detection Monitoring will continue until the post-closure monitoring period. Table 1 below lists the statistical methods for Detection Monitoring.

**Table 1.** Statistical Methods for Detection Monitoring

<table>
<tr><th colspan="5">Detection Monitoring</th></tr>
<tr><th rowspan="2">Significant Trend?</th><th colspan="3">Background</th><th>Downgradient</th></tr>
<tr><th>% Non-Detects</th><th>Distribution</th><th>Test to Determine SSI</th><th>Comparison</th></tr>
<tr><td rowspan="4">No</td><td>≤50%</td><td rowspan="2">Normal</td><td rowspan="2">UPL for Future Values OR The Shewhart-CUSUM Control Chart</td><td rowspan="4">Individual Future Values</td></tr>
<tr><td rowspan="2">>50%</td></tr>
<tr><td>Non-Normal</td><td>The Non-Parametric Upper Prediction Limit for Future Values</td></tr>
<tr><td>100%</td><td>Non-Normal</td><td>Double Quantification Rule</td></tr>
<tr><td rowspan="2">Yes</td><td>≤50%</td><td>Normal</td><td>Linear Regression w/ t-test</td><td>Trend Comparison Test using Linear Regression w/ t-test</td></tr>
<tr><td>>50%</td><td>Non-Normal</td><td>Thiel-Sen trend line w/ Mann-Kendall</td><td>Trend Comparison Test using Thiel-Sen trend line w/ Mann-Kendall</td></tr>
</table>

## 4. ASSESSMENT MONITORING PROGRAM

The third phase of the groundwater monitoring program is Assessment Monitoring. Assessment Monitoring is performed after the confirmation of an SSI to evaluate whether downgradient concentrations are at statistically significant levels (SSL) relative to a GWPS. Groundwater sampling for all Appendix IV constituents will be conducted in the existing monitoring well network within 90 days of an SSI identification. Appendix III constituents, and those Appendix IV that were detected in groundwater will be sampled within 90 days of receiving laboratory results, and semi-annually thereafter. In addition, all Appendix IV constituents will be sampled on an annual basis. This annual sampling will likely coincide with the required semiannual sampling of Appendix III and detected Appendix IV constituents. Additional monitoring wells will be installed if an SSL is identified for any Appendix IV constituent at any downgradient well to evaluate the nature and extent of the plume. All Appendix III and Appendix IV constituents must be at or below background levels for two consecutive semi-annual sampling events for a CCR facility to return from Assessment to Detection Monitoring. If some Appendix III or Appendix IV constituents are at concentrations above background levels, but not statistically exceeding the GWPS, then the CCR facility must remain in Assessment Monitoring.

### 4.1 GWPS ESTABLISHMENT AND SSL DETERMINATION

A GWPS will be established for Appendix IV constituents detected in the downgradient monitoring wells. The GWPS will be the risk-based maximum contaminant level (MCL) established by the USEPA for each constituent. The first exception to this is when the background concentration is greater than the established MCL. The second exception occurs when the constituent does not have an MCL, such as for cobalt, lithium, molybdenum, and lead. For both of these exceptions, the background concentrations will be used to define the GWPS. The GWPS will be calculated using a parametric Upper Tolerance Limit (UTL), a parametric UPL for a future mean, or a non-parametric UPL for a future median.

#### 4.1.1 The Upper Tolerance Limit

The UTL will be used to calculate the GWPS when pooled background data are normally distributed, with a non-detect frequency of 15% or less. When non-detect frequency is 15% or less, half the RL will be substituted for non-detects. The Unified Guidance recommends 95% confidence level and 95% coverage (95/95 tolerance interval). The non-detect data will be replaced with half the RL (simple substitution), and the normal mean and standard deviation will be calculated.

The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15% and 50%. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation. If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95% coverage).

The Kaplan-Meier method will not be utilized if the RL are identical for all non-detects as there is no standard deviation (variance), resulting in simply substitution of the RL for each non-detect result. In this case, half the RL should be substituted for the non-detects.

The parametric UTL on a future mean will be calculated from the background dataset as follows:

$$UTL = \overline{x} + \kappa\,(n, \gamma, \alpha - 1) \cdot s$$

$\overline{x}$ = background sample mean

$s$ = background sample standard deviation

$\kappa\ (n, \gamma, \alpha - 1)$ =one-sided normal tolerance factor based on the chosen coverage ($\gamma$) and confidence level ($\alpha$ -1) and the size of the background dataset ($n$). Values are tabulated in Table 17-3 in Appendix D of the Unified Guidance. If exact values are not provided, then κ values can be estimated by linear interpolation similar to the method described in Section 3.

If the UTL is constructed on the logarithms of original observations to achieve normality, where $\overline{y}$ and $s_y$ are the log-mean and log-standard deviation, the limit will be exponentiated for back-transformation to the concentration scale as follows:

$$TL = \exp\left[\overline{y} + \kappa\ (n, \gamma, \alpha - 1) \cdot s_y\right]$$

$\overline{y}$ = background sample log-mean

$s_y$ = background sample log-standard deviation

When the GWPS is based on the MCL or a UTL derived from the background dataset, the confirmation of a SSL in downgradient compliance wells relative to the GWPS will be evaluated using confidence intervals. A confidence interval defines the upper and lower bound of the true mean of a constituent concentration in groundwater within a specified confidence range. Non-detects in downgradient data will be handled similarly to upgradient analyses, with half the RL substituted for non-detects when the frequency is 15% or less. The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15% and 50% to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. These estimates will then be substituted for the sample mean and standard deviation. Once the GWPS is established for pooled background data using the UTL, either parametric or non-parametric confidence intervals will be computed for each constituent in downgradient wells to determine the occurrence of an SSL.

### 4.1.2 Parametric Confidence Intervals around a Mean

If downgradient data are approximately normal, one-sided parametric confidence intervals around a sample mean will be constructed for each constituent and well pair. The lower confidence limit (LCL) will be calculated as:

$$LCL_{1-\alpha} = \overline{x} - t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

The upper confidence limit (UCL) will be calculated as:

$$UCL_{1-\alpha} = \overline{x} + t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

$\overline{x}$ = downgradient sample mean

$s$ = downgradient sample standard deviation

$n$ = downgradient sample size

$t_{1-\alpha,n-1}$ = obtained from a Student's *t*-table with ($n$–1) degrees of freedom (Table 16-1 in Appendix D of the Unified Guidance)

The chosen *t* value will aim to achieve both a low false-positive rate, and high statistical power. Minimum α values are tabulated in Table 22-2 of Appendix D of the Unified Guidance. The selected minimum α value, from which the *t* value will be derived, will have at least 80% power (1-β = 0.8) when the underlying mean concentration is twice the MCL.

If downgradient data are distributionally lognormal, the LCL will be computed around the lognormal geometric mean as:

$$LCL_{1-\alpha} = \exp\left(\overline{y} + .5s_y^2 + \frac{s_y H_\alpha}{\sqrt{n-1}}\right)$$

The UCL will be computed around the lognormal geometric mean as:

$$UCL_{1-\alpha} = \exp\left(\overline{y} + .5s_y^2 + \frac{s_y H_{1-\alpha}}{\sqrt{n-1}}\right)$$

$\overline{y}$ = downgradient sample log-mean

$s_y$ = downgradient sample log-standard deviation

$H_\alpha$ / $H_{1\text{-}\alpha}$ = bias-correction factor(s) found in Tables 21-1 through 21-8 in Appendix D of the Unified Guidance

### 4.1.3 Non-Parametric Confidence Intervals around a Median

Non-parametric confidence intervals around the median will be computed if the downgradient data contain greater than 50% non-detects or are non-normally distributed. The mathematical algorithm used to construct non-parametric confidence intervals is based on the probability *P* that any randomly-selected measurement in a sample of *n* concentration measurements will be less than an unknown *P* x 100$^{th}$ percentile of interest (where *P* is between 0 and 1). Then the probability that the measurement will exceed the *P* x 100$^{th}$ percentile is (1–*P*). The number of sample values falling below the *P* x 100$^{th}$ percentile out of a set of *n* should follow a binomial distribution with parameters *n* and success probability *P*, where 'success' is defined as the event that a sample measurement is below the *P* x 100$^{th}$ percentile. The probability that the interval formed by a given pair of order statistics will contain the percentile of interest will then be determined by a cumulative binomial distribution *Bin(x;n,p)*, representing the probability of *x* or fewer successes occurring in *n* trials with success probability *p*. *P* will be set to 0.50 for an interval around the median.

The sample size *n* will be ordered from least to greatest. Given *P* = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks as close to product of (*n*+1) x 0.50. If the result of (*n*+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (*n*+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added and subtracted one to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted *L** and *U**. For a one-sided LCL, the confidence level associated with endpoint *L** will be computed as:

$$1 - \alpha = Bin(L^* - 1; n, .50) = \sum_{x=L^*}^{n} \binom{n}{x}\left(\frac{1}{2}\right)^n$$

For a one-sided UCL, the confidence level associated with the endpoint *U** will be computed as:

$$1 - \alpha = Bin(U^* - 1; n, .50) = \sum_{x=0}^{U^*-1} \binom{n}{x}\left(\frac{1}{2}\right)^n$$

If the candidate endpoint(s) do not achieve the desired confidence level, new candidate endpoints (*L**–1) and (*U**+1) and achieved confidence levels will be calculated. If one candidate endpoint equals the data minimum or maximum, only the rank of the other endpoint will be changed. Achievable confidence levels are tabulated using these equations in Table 21-11 in Appendix D of the Unified Guidance.

Both parametric and non-parametric confidence limits will then be compared to the GWPS (MCL or UTL if MCL is not available or background concentrations are above the MCL). The CCR site is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected Appendix IV constituents at all downgradient wells. An SSL is confirmed if the LCL exceeds the GWPS.

### 4.1.4 The Upper Prediction Limit for a Future Mean

The parametric UPL for a future mean will be used to calculate the GWPS if the pooled background data contain 50-70% non-detects and normality can be achieved. The Kaplan-Meier or ROS methods to estimate the mean and standard deviation. The non-parametric UPL for a future median will be calculated as the GWPS if background samples cannot be normalized, or contain greater than 70% non-detects. The background, requirements, and assumptions for a prediction limit on future means of order *p* are essentially identical to those for prediction limits for future individual values used in Detection Monitoring. An order of 2*p* independent samples will be collected during each evaluation period to use a 1-of-2 retesting scheme. The parametric UPL for a future mean will be calculated from the background dataset at follows:

$$UPL_{1-\alpha} = \bar{x} + \kappa s$$

$\bar{x}$ = background sample mean

$s$ = background standard deviation

κ = multiplier based on the order (*p*) of the future mean to be predicted, the number of downgradient compliance wells to be tested (*w*), the background sample size (*n*) the number (*c*) of constituents of concern (COCs), the "1-of-*m*" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Tabulated in 19-5 to 19-9 in Appendix D of the Unified Guidance.

The mean of order *p* will be computed for each well and compared against the UPL. For any compliance point mean that exceeds the limit, *p* additional resamples will be collected at that well for a 1-of-2 retesting scheme. Resample means will then be compared to the UPL. A SSL has been deemed to occur at a compliance well when the initial mean and *all* resample means exceed the UPL.

### 4.1.5 The Non-Parametric Upper Prediction Limit for a Future Median

The non-parametric UPL for a future median will be used to calculate the GWPS if the pooled background data contain greater than 70% non-detects and normality cannot be achieved. This approach is very similar to the method used non-parametric UPL for future values. The number of yearly statistical evaluation ($n_E$) will be multiplied by the number of compliance wells (*w*) to determine the look-up table entry, *w**. The background sample size (*n*) and *w** will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the Unified Guidance that is no greater than the Appendix IV target per-constituent false positive rate (0.007 for 15 constituents). The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used (the RL becomes the GWPS if no MCL exists). The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will be collected from that well. The resample median will be computed and compared to the UPL. A SSL has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If all Appendix III and IV constituents are below the GWPS for two consecutive sampling events, the facility will return to Detection Monitoring. If the concentrations of detected constituents in Appendices III and IV are above background, but below the established GWPS, Assessment Monitoring will continue.

### 4.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or downgradient data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size ($n$). A wider confidence interval will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of confidence intervals is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band does also to reflect this change at that point in time.

Linear regression will be used when background or downgradient data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

$$\hat{b} = \sum_{i=1}^{n} (t_i - \bar{t}) \cdot x_i / (n-1) \cdot s_t^2$$

$x_i$ = $i^{th}$ concentration value and

$t_i$ = $i^{th}$ sampling date

$\bar{t}$ = sampling mean date

$s_t^2$ = variance of the sampling dates

This estimate leads to the following regression equation:

$$\hat{x} = \bar{x} + \hat{b} \cdot (t - \bar{t})$$

$\bar{x}$ = mean concentration level

$\hat{x}$ = estimated mean concentration at time $t$

The regression residuals will also be computed at each sampling event to ensure uniformity and lack of significant skewness. Regression residuals will be computed at each sampling event as follows:

$$r_i = x_i - \hat{x}_i$$

The estimated variance around the regression line, or mean squared error (MSE) will be computed as follows:

$$s_e^2 = \frac{1}{n-2} \sum_{i=1}^{n} r_i^2$$

The confidence intervals around a linear regression trend line given confidence level (1-α) and a point in time ($t_0$), will be computed as follows:

$$LCL_{1-\alpha} = \hat{x}_0 - \sqrt{2s_e^2 \cdot F_{1-2\alpha,2,n-1} \cdot \left[\frac{1}{n} + \frac{\left(t_0 - \bar{t}\right)^2}{(n-1) \cdot s_t^2}\right]}$$

$$UCL_{1-\alpha} = \hat{x}_0 - \sqrt{2s_e^2 \cdot F_{1-2\alpha,2,n-2} \cdot \left[\frac{1}{n} + \frac{\left(t_0 - \bar{t}\right)^2}{(n-1) \cdot s_t^2}\right]}$$

$\hat{x}_0$ = estimated mean concentration from the regression equation at time $t_0$

$F_{1-2\alpha,2,n-2}$ = upper $(1\text{-}2\alpha)^{th}$ percentage point from an $F$-distribution with 2 and ($n$-2) degrees of freedom

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For downgradient data, confidence bands around the linear regression line will be compared to the GWPS. The CCR site is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected Appendix IV constituents at all downgradient wells. An SSL is confirmed when the LCL based on the trend line first exceeds the GWPS.

### 4.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or downgradient data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or downgradient data. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line, the data will first be ordered by sampling event $x_1$, $x_2$, $x_n$. All possible distinct pairs of measurements ($x_i$, $x_j$) for $j > i$ will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

$$m_{ij} = (x_j - x_i)/(j - i)$$

With a sample size of $n$, there will be a total of $N = n(n\text{-}1)/2$ pairwise estimates $m_{ij}$. If a given observation is a non-detect, half the RL will be substituted. The $N$ pairwise slope estimates ($m_{ij}$) will be ordered from least to greatest (renamed $m_{(1)}$, $m_{(2)}$,..$m_{(N)}$). The Thiel-Sen estimate of slope ($Q$) will be calculated as the median value of the list depending on whether $N$ is even or odd as follows:

$$Q = \begin{cases} m_{([N+1]/2)} \; if\ N\ is\ odd \\ (m_{(N/2)} + m_{([N+2]/2)})/2 \; if\ N\ is\ even \end{cases}$$

The sample concentration magnitude will be ordered from least to greatest, $x_{(1)}$, $x_{(2)}$, to $x_{(n)}$ and the median concentration will be calculated as follows:

$$\tilde{x} = \begin{cases} x_{([n+1]/2)} \; if\ n\ is\ odd \\ (x_{(n/2)} + x_{([n+2]/2)})/2 \; if\ n\ is\ even \end{cases}$$

The median sampling date ($\tilde{t}$) with ordered times ($t_{(1)}$, $t_{(2)}$, to $t_{(n)}$) will also be determined in this way. The Thiel-Sen trend line will then be computed for an estimate at any time ($t$) of the expected median concentration ($x$) as follows:

$$x = \tilde{x} + Q \cdot (\mathrm{t} - \tilde{t}) = (\tilde{x} - Q \cdot \tilde{t}) + Q \cdot \mathrm{t}$$

To construct a confidence band around the Thiel-Sen line, sample pairs ($t_i$, $x_i$) will be formed with a sample date ($t_i$) and the concentration measurement from that date ($x_i$). Bootstrap samples ($B$) will be formed by repeatedly sampling $n$ pairs at random with replacement from the original sample pairs. This will be repeated 500 times. For each bootstrap sample, a Thiel-Sen trend line will be constructed using the equation above. A series of equally spaced time points ($t_j$) will be identified along the range of sampling dates represented in the original sample, $j$ =1 to $m$. The Thiel-Sen trend line associated with each bootstrap replicate will be used to compute an estimated concentration ($\hat{x}_j^B$). An LCL will be constructed for the lower $\alpha^{th}$ percentile $\hat{x}_j^{[\alpha]}$ from the distribution of estimated concentrations at each time point ($t_j$). For an UCL, compute the upper $(1-\alpha)^{th}$ percentile, $\hat{x}_j^{[1-\alpha]}$ at each time point ($t_j$).

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For downgradient data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR site is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected Appendix IV constituents at all downgradient wells. An SSL is confirmed when the LCL based on the trend line first exceeds the GWPS.

### 4.3 ALTERNATIVE SOURCE DEMONSTRATION

If an SSL is confirmed, an ASD may be conducted to indicate a source other than the CCR unit as the cause of contamination. The ASD may also identify the SSL to be a result of error in sampling procedures, laboratory procedures, statistical analyses, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified by a qualified professional engineer. The demonstration must be included in the annual groundwater monitoring report and corrective action report.

### 4.4 REQUIRED RESPONSE ACTION

In the event of a confirmed SSL, the following actions will be taken:

- A notification of the GWPS exceedance will be placed in the operating record within 30 days of the SSL, and on the public internet site within 30 days of placement in the operating record.
- Additional monitoring wells will be installed to characterize the nature and extent of the release, including a minimum of one at the property boundary.
- Property owners will be notified within 30 days if a plume has extended off-site, as identified by the characterization of the nature and extent of the release.
- An ASD will be submitted within 90 days of the SSL determination. If an ASD is not submitted, assessment of corrective action measures will be initiated within 90 days of the SSL determination, including the required notification and closure or retrofitting, if the facility is an unlined impoundment.

Table 2 below lists the statistical methods for Assessment Monitoring.

**Table 2.** Statistical Methods for Assessment Monitoring

| Assessment Monitoring | | | | | | |
|---|---|---|---|---|---|---|
| **Significant Trend?** | Background | | | Downgradient | | |
| | % Non-Detects | Distribution | GWPS Determination | % Non-Detects | Distribution | Test to Determine SSL |
| No | 0 ≤ 50% | Normal | MCL or The Upper Tolerance Limit | ≤75% | Normal | Parametric Lower Confidence Interval around a Normal Mean |
| | | | | ≤75% | Log-Normal | Parametric Lower Confidence Interval around a Lognormal Geometric Mean |
| | | | | NA | Non-Normal | Non-Parametric Lower Confidence Interval around a Median |
| | | | | >75% | Unknown/Cannot be determined | |
| | 50 ≤ 70% | Normal | The Upper Prediction Limit for a Future Mean | NA | NA | Future mean |
| | >70% | Non-Normal | Upper Prediction Limit for a Future Median | NA | NA | Future median |
| | 100% | Non-Normal | Double Quantification Rule | NA | NA | Individual Retesting Values |
| Yes | 0 ≤ 50% | Normal | UCL of Confidence Band around Linear Regression | ≤75% | Residuals after subtracting trend are normal, equal variance | Lower Confidence Band around Linear Regression |
| | 50 ≤ 100% | Non-Normal | UCL of Confidence Band around Thiel-Sen trend line | ≤75% | Residuals not normal | Lower Confidence Band around Thiel-Sen |

## 5. CORRECTIVE ACTION MONITORING PROGRAM

The fourth phase of the groundwater monitoring program is Corrective Action. Corrective Action Monitoring is performed after a corrective action remedy has been selected and implemented. The CCR Rule specifies that the corrective action program must meet all the requirements of an Assessment Monitoring program, address any interim measures that might be needed to reduce the contaminants leaching from the CCR unit, and document the effectiveness of the selected remedy. While both Appendix III and Appendix IV constituents are analyzed in Corrective Action Monitoring, compliance with the GWPS will be based only on Appendix IV constituents detected in the Corrective Action Monitoring wells. During this monitoring phase, Detection Monitoring and Assessment Monitoring will continue. Data evaluation for Corrective Action Monitoring however, will be conducted separately. Assessment of corrective measure(s) will be initiated within 90 days of a confirmed Appendix IV SSL to prevent further releases, as well as begin remediation to restore the affected area to original conditions. Corrective Action does not use the same monitoring system as Detection and Assessment Monitoring. The Corrective Action Monitoring system will include all or a subset of the monitoring wells installed to evaluate the nature and extent of the plume after a SSL is documented.

Statistical methods used for Corrective Action Monitoring data will be similar to those used for Assessment Monitoring. One major exception to these analyses is the use of the UCL (when the GWPS is based on the MCL or UTL) to evaluate whether a well is in compliance, rather than the LCL as used in Assessment Monitoring. A facility is considered to be in compliance when the UCL is lower than the GWPS for all detected Appendix IV constituents at all Corrective Action Monitoring wells for 3 consecutive years. Corrective Action Monitoring will continue if the UCL for any Appendix IV constituent at any Corrective Action Monitoring well is equal to or higher than the GWPS.

When the GWPS is based on a UPL for a future mean or median, the facility will be considered to be in compliance when all Corrective Action Monitoring well means or medians (depending on the use of parametric or non-parametric UPLs) are lower than the GWPS for all detected Appendix IV constituents for 3 consecutive years. Corrective Action Monitoring will continue if the mean or median for any Appendix IV constituent at any Corrective Action Monitoring well is higher than the GWPS.

Table 3 below lists the statistical methods for Corrective Action Monitoring.

**Table 3.** Statistical Methods for Corrective Action Monitoring

| Corrective Action Monitoring | | | | | | |
|---|---|---|---|---|---|---|
| **Significant Trend?** | Background | | | Downgradient | | |
| | % Non-Detects | Distribution | GWPS Determination | % Non-Detects | Distribution | Test to Determine SSL |
| No | 0 ≤ 50% | Normal | MCL or The Upper Tolerance Limit | ≤75% | Normal | Parametric Upper Confidence Interval around a Normal Mean |
| | | | | ≤75% | Log-Normal | Parametric Upper Confidence Interval around a Lognormal Geometric Mean |
| | | | | NA | Non-Normal | Non-Parametric Upper Confidence Interval around a Median |
| | | | | >75% | Unknown/Cannot be determined | |
| | 50 ≤ 70% | Normal | The Upper Prediction Limit for a Future Mean | NA | NA | Future mean |
| | >70% | Non-Normal | Upper Prediction Limit for a Future Median | NA | NA | Future median |
| | 100% | Non-Normal | Double Quantification Rule | NA | NA | Individual Retesting Values |
| Yes | 0 ≤ 50% | Normal | UCL of Confidence Band around Linear Regression | ≤75% | Residuals after subtracting trend are normal, equal variance | Upper Confidence Band around Linear Regression |
| | 50 ≤ 100% | Non-Normal | UCL of Confidence Band around Thiel-Sen trend line | ≤75% | Residuals not normal | Upper Confidence Band around Thiel-Sen |

## 6. SUMMARY AND REPORTING REQUIREMENTS

### 6.1 PRIOR TO DETECTION MONITORING

The following records will be completed and placed in the operating record no later than October 17th, 2017 or prior to first receipt of CCR for new facilities:

- Monitoring well records including all documentation on design, installation, development, decommissioning, piezometers, measurement, sampling, and analytical devices.
- Monitoring system certifications
- Statistical method certifications

### 6.2 ALL MONITORING PHASES

The "Annual Groundwater Monitoring and Corrective Action Report" (Annual Report) will be placed in the operating record by January 31, 2018 for existing facilities, or January 31 of the year following first receipt of CCR for new facilities, and annually thereafter. For the preceding calendar year, the Annual Report will include:

- The status of the groundwater monitoring program phase for the CCR unit
- Key activities planned for the upcoming year
- A map, aerial image, or diagram indicating the CCR unit and monitoring well network
- Identification and explanation of monitoring wells installed or abandoned during the preceding year
- Summary of wells and dates for groundwater sampling for detection, assessment, or corrective action monitoring, depending on the current phase of the groundwater monitoring program
- Analytical results (Appendix III for Detection Monitoring and both Appendix III and Appendix IV for Assessment and Corrective Action Monitoring)
- Reasoning for transitions between phases of the groundwater monitoring program (detection vs. assessment vs corrective action monitoring)
- A demonstration for alternative groundwater sampling frequency, if needed

### 6.3 DETECTION MONITORING

Detection Monitoring includes the collection of eight initial samples from both background/upgradient and downgradient monitoring wells. When the collection period for these initial samples is complete, an SSI determination for Appendix III constituents will be conducted with subsequent semi-annual monitoring and statistical analyses. If there is an SSI that cannot be attributed to an ASD, the facility will initiate Assessment Monitoring. In addition to those items listed in section 6.2, the Annual Report will include:

- Explanation and certification of an SSI attributed to an ASD by a qualified professional engineer, when appropriate

Notifications of establishing an Assessment Monitoring program or of a return to Detection Monitoring will also be placed in the operating record within 30 days of the event.

### 6.4 ASSESSMENT MONITORING

Assessment Monitoring will include both Appendix III and Appendix IV constituents, on the same monitoring wells as Detection Monitoring. Under Assessment Monitoring, a facility is assumed to be in compliance until an SSL is confirmed. If an SSL of an Appendix IV constituent is confirmed, a notification and an assessment of the nature and extent of the release will be placed in the operating record regardless of whether an ASD is identified. If an ASD is identified, no further action is required and the facility will remain in Assessment Monitoring. If the release cannot be attributed to an ASD, Corrective Action will be triggered. Additional monitoring wells will then be installed to monitor the performance of the Corrective Action Remedy. In addition to items listed in sections 6.2 and 6.3, the Annual Report will include:

- Background concentrations for Appendix III and Appendix IV constituents
- Analytical results for Appendix III and detected Appendix IV constituents
- GWPS established for detected Appendix IV constituents
- Explanation and certification of *new* SSI concentrations attributed to an ASD by a qualified professional engineer, when appropriate
- Explanation and certification of an SSL attributed to an ASD by a qualified professional engineer, when appropriate
- Demonstration and certification by a qualified engineer that more than 90 days are needed to complete an evaluation of corrective measures to prevent future releases

Semi-annual analytical results for Appendix III and detected Appendix IV constituents will be placed in the facility's operating record within 90 days of receipt. Notifications of an SSL and initiation of assessment of Corrective Actions will also be placed in the operating record within 30 days of determination of an SSL above the GWPS.

### 6.5 CORRECTIVE ACTION MONITORING

Detection monitoring and Assessment Monitoring continue during the Corrective Action Monitoring period. Similar to Assessment Monitoring, Appendix III constituents are monitored and Appendix IV constituents are used as the basis for compliance. Corrective Action Monitoring will use a different set of monitoring wells, likely located downgradient of the Detection and Assessment Monitoring well system. Under Corrective Action Monitoring, a release is assumed to have had occurred at a facility. Therefore, the null hypothesis is reversed and a facility is considered to be out of compliance until all constituents at Corrective Action Monitoring wells are statistically lower than the GWPS for 3 consecutive years. In addition to the items listed in sections 6.2, 6,3, and 6.4, the following additional items will be included in the Annual Report:

- A list of GWPS for both Assessment and Corrective Action Monitoring
- Explanation and certification of *new* SSL concentrations attributed to an ASD by a qualified professional engineer, when appropriate

Notifications of *new* SSLs and the completion of the Corrective Action remedy, as certified by a qualified professional engineer, will also be placed in the operating record within 30 days of determination of the *new* SSLs or completing the remedy.

## 7. REFERENCES

Electric Power Research Institute (EPRI). Groundwater Monitoring Guidance for the Coal Combustion Residuals Rule. EPRI, Palo Alto, CA: 2015. 3002006287. November 2015.

U.S. Environmental Protection Agency. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance. EPA 530-R-09-007. March 2009.

**40 CFR Part 257.93(f)(6) Statistical Method Certification**
**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

In accordance with Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, Section 257.93(f)(6), the owner or operator of a coal combustion residual (CCR) unit must obtain a certification from a qualified professional engineer that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area.

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the *Statistical Analysis Plan*, prepared for Coleto Creek Power, LP, and dated October 17, 2017. The procedures described in the plan will be used to establish background conditions and implement detection, assessment, and corrective action monitoring as necessary and required by 40 CFR §257.93-257.95. The *Statistical Analysis Plan* was prepared in accordance with the requirements of 40 CFR §257.93, with reference to the acceptable statistical procedures provided in USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring. In accordance with 40 CFR §257.93(f), the statistical method chosen for analysis of groundwater monitoring data will initially be the prediction interval procedure or control chart approach for each Appendix III constituent, and either the tolerance interval or the prediction interval procedure for each Appendix IV constituent at this CCR unit per 40 CFR §257.93(f)(3), in which the interval is established from the background data and compared to the level of each Appendix III constituent in each compliance well, or a confidence interval for each Appendix IV constituent in each compliance well.

**Narrative Description of Statistical Methods**
A narrative description of the statistical methods chosen for analysis of groundwater monitoring data are provided below. Application of these methods for determining a statistically significant increase (SSI) for Appendix III constituents or statistically significant levels (SSLs) for Appendix IV constituents is provided in the *Statistical Analysis Plan*.

Parametric and Non-Parametric Prediction Limit
Parametric upper prediction limits (UPLs) for future values will be utilized when background data contains less than 50% non-detects, and can be normalized. Parametric UPL for individual future values will be calculated from normally-distributed background data as follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\overline{x}$ = sample mean of background data
$s$ = standard deviation of background data
$\kappa$ = multiplier based on the number of downgradient compliance wells to be tested ($w$), the background sample size ($n$) the number ($c$) of constituents of concern (COCs), the "1-of-$m$" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Tabulated in Table 19-1 in Appendix D of the *Unified Guidance*.

Non-parametric UPLs for future values will be utilized when background data cannot be normalized, or contains a large percentage of non-detects. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate ($\alpha_{const}$) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

$\alpha$ = the SWFPR of 0.10
$c$ = the number of monitoring constituents

For a target SWFPR of 10%, and 7 monitoring constituents, the target per-constituent false positive rate ($\alpha_{const}$) will be 0.015%.

UPLs will be compared to individual future downgradient values for detection monitoring and either future downgradient means when using the parametric UPLs method or future downgradient medians when using the non-parametric UPL method for Assessment Monitoring.

Parametric Shewhart-CUSUM Control Chart
Combined Shewhart-CUSUM control charts may also be used when pooled background data contains less than 50% non-detects, and can be normalized. This method can be used to determine whether downgradient data plotted on the control chart follow the same distribution as the background data used to compute the baseline control limit. Combined control charts use both the new individual measurement and the cumulative sum (CUSUM) of past and current measurements at every sampling event. This technique gives control charts increased sensitivity to detect trends and shifts in concentration levels. The Shewhart portion of the chart is ideal for detecting sudden concentration increases, and the CUSUM portion is preferred for detecting slower, steady increases.

Parametric Tolerance Limit
The upper tolerance limit (UTL) will be used to calculate the groundwater protection standard (GWPS) when pooled background data are normally distributed, with a non-detect frequency of 15% or less. When non-detect frequency is 15% or less, half the reporting limit (RL) will be substituted for non-detects. The *Unified Guidance* recommends 95% confidence level and 95% coverage (95/95 tolerance interval). The non-detect data will be replaced with half the RL (simple substitution), and the normal mean and standard deviation will be calculated.

$$UTL = \overline{x} + \kappa\,(n, \gamma, \alpha - 1) \cdot s$$

$\overline{x}$ = background sample mean

*s* = background sample standard deviation

$\kappa\,(n, \gamma, \alpha - 1)$ =one-sided normal tolerance factor based on the chosen coverage (*γ)* and confidence level (*α* -1) and the size of the background dataset (*n*). Values are tabulated in Table 17-3 in Appendix D of the *Unified Guidance*.

The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15% and 50%. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation. If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95% coverage).

UTLs will be compared to the upper confidence interval around a mean for parametric downgradient constituents in each compliance well. When downgradient constituents are non-parametric, UTLs will be compared the upper confidence interval around a median.

A linear regression, coupled with a t-test for slope significance may be used on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test for slope significance, will be used for datasets with frequent non-detects or non-normal variance. If either the t-test for a parametric linear regression line or Mann-Kendall test for a Thiel-Sen line detect a significant trend, confidence bands will be constructed around the trend line. The upper confidence band will then be used as the GWPS.

**Performance Standards**
As specified by 40 CFR §257.93(g), the prediction limit, control chart, and tolerance limit statistical method chosen complies with the following performance standards:

(1) The statistical method to evaluate groundwater monitoring data will use parametric methods for normal distributions of data and non-parametric methods for non-normal distributions of data. If the distribution of constituents is inappropriate for a normal theory test, then the data must be transformed, or a distribution-free (non-parametric) theory test will be used. If the distributions for the constituents differ, more than one statistical test may be needed.
(2) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. The parameter values shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.
(3) The levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any other approach listed in 40 CFR §257.93 for evaluating groundwater data. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentrations values for each constituent of concern.
(4) The statistical method must account for data below the limit of detection with one or more statistical procedures that shall be at least as effective as any other approach in 40 CFR §257.93 for evaluating groundwater data. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.
(5) The statistical method must include, if necessary, procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

If the prediction limit, tolerance interval, or control chart statistical test chosen for analysis of groundwater monitoring data does not meet the above performance standards, one of the following alternative statistical methods may be substituted in order to meet the performance criteria of 40 CFR §257.93(g): parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination; analysis of variance based on ranks followed by multiple comparison procedures to identify evidence of contamination; control chart approach that gives control limits for each constituent; or, another statistical test method that meets the performance standards. In the event one of these alternative statistical methods is used, an updated certification will be provided.

Based on the analysis of the first eight rounds of background groundwater monitoring data at this CCR unit, the statistical approach and methods described in this certification, and as detailed in the *Statistical Analysis Plan*, are appropriate for evaluating the groundwater monitoring data.

*I, Maureen T. Hoke, a qualified professional engineer in good standing in the State of Texas, certify that the statistical methods described in this document, as supported by the Statistical Analysis Plan in the facility's Operating Record, are appropriate for evaluating the groundwater monitoring data for the CCR management area.*

Maureen T. Hoke
Qualified Professional Engineer
117550
Texas
Date: October 17, 2017


*I, Stuart J. Cravens, a qualified professional, certify that the statistical methods described in this document, as supported by the Statistical Analysis Plan in the facility's Operating Record, are appropriate for evaluating the groundwater monitoring data for the CCR management area.*

Stuart J. Cravens
Principal Hydrogeologist
Date: October 17, 2017

*I, Kendall L. Simon, a qualified professional, certify that the statistical methods described in this document, as supported by the Statistical Analysis Plan in the facility's Operating Record, are appropriate for evaluating the groundwater monitoring data for the CCR management area.*

Kendall L. Simon, PhD
Project Statistician
Date: October 17, 2017

# 2020 Annual Groundwater Monitoring and Corrective Action Report

*Coleto Creek Primary Ash Pond - Fannin, Texas*

Prepared for:

**Coleto Creek Power, LLC**

Prepared by:

**Golder Associates Inc.**

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January 29, 2021

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CCR | Coal Combustion Residuals |
| CFR | Code of Federal Regulations |
| GWPS | Groundwater Protection Standard |
| MCL | Maximum Concentration Level |
| mg/L | Milligrams per Liter |
| NA | Not Applicable |
| OBG | O’Brien & Gere Engineers, Inc. |
| SSI | Statistically Significant Increase |
| SSL | Statistically Significant Level |
| USEPA | United States Environmental Protection Agency |

# EXECUTIVE SUMMARY

Golder Associates, Inc. (Golder) has prepared this report on behalf of Coleto Creek Power, LLC to satisfy the 2020 annual groundwater monitoring and corrective action reporting requirements of the Coal Combustion Residuals (CCR) Rule (40 CFR 257, Subpart D) for the Primary Ash Pond (the “CCR unit”) at the Coleto Creek Power Station in Fannin, Texas. The CCR unit and CCR monitoring well network are shown on Figure 1.

At the beginning and end of the 2020 reporting period, the CCR unit was operating under an Assessment Monitoring Program as described in 40 CFR § 257.95. The Assessment Monitoring Program was established on May 9, 2018. No constituents listed in Appendix IV to Part 257 were detected at statistically significant levels (SSLs) above groundwater protection standards during 2020. The Assessment Monitoring Program will continue during 2021 in accordance with § 257.95.

# 1.0 INTRODUCTION

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) was promulgated by the United States Environmental Protection Agency (USEPA) to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. For existing CCR landfills and surface impoundments, the CCR Rule requires that the owner or operator prepare an annual groundwater monitoring and corrective action report to document the status of the groundwater monitoring and corrective action program for the CCR unit for the previous calendar year. Per 40 CFR 257.90(e) of the CCR Rule, the report should contain the following information, to the extent available:

(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

(4) A narrative discussion of any transition between monitoring programs (*e.g.,* the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

(6) A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. At a minimum, the summary must specify all of the following:

   (i) At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95;

   (ii) At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95;

   (iii) If it was determined that there was a statistically significant increase over background for one or more constituents listed in appendix III to this part pursuant to § 257.94(e):

      (A) Identify those constituents listed in appendix III to this part and the names of the monitoring wells associated with such an increase; and

      (B) Provide the date when the assessment monitoring program was initiated for the CCR unit.

(iv) If it was determined that there was a SSL above the groundwater protection standard for one or more constituents listed in appendix IV to this part pursuant to § 257.95(g) include all of the following:

(A) Identify those constituents listed in appendix IV to this part and the names of the monitoring wells associated with such an increase;

(B) Provide the date when the assessment of corrective measures was initiated for the CCR unit;

(C) Provide the date when the public meeting was held for the assessment of corrective measures for the CCR unit; and

(D) Provide the date when the assessment of corrective measures was completed for the CCR unit.

(v) Whether a remedy was selected pursuant to § 257.97 during the current annual reporting period, and if so, the date of remedy selection; and

(vi) Whether remedial activities were initiated or are ongoing pursuant to § 257.98 during the current annual reporting period.

# 2.0 MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

O'Brien & Gere Engineers, Inc. (OBG) collected the initial Detection Monitoring Program groundwater samples from the Primary Ash Pond CCR monitoring well network in November 2017. OBG completed an evaluation of those data in 2018 to identify statistically significant increases (SSIs) of Appendix III parameters over background concentrations. The Detection Monitoring Program sampling dates and parameters are summarized in the following table:

**Detection Monitoring Program Summary**

| Sampling Dates | Parameters | SSIs | Assessment Monitoring Program Established |
|---|---|---|---|
| November 7-8, 2017 | Appendix III | Yes | May 9, 2018 |

Alternate source evaluations were inconclusive for one or more of the SSIs. Consequently, an Assessment Monitoring Program was initiated and established for the Primary Ash Pond CCR unit in 2018 in accordance with 40 CFR § 257.94(e)(2).

Assessment Monitoring Program groundwater samples were collected from the CCR groundwater monitoring network in 2018, as required by the CCR Rule. OBG collected the initial 2018 Assessment Monitoring Program groundwater samples in June 2018. Subsequent Assessment Monitoring Program sampling events have been conducted by Golder on a semi-annual basis, as required by the CCR Rule. All CCR groundwater monitoring wells were sampled for Appendix III and Appendix IV constituents during the first and second semi-annual sampling events of each year. The Assessment Monitoring Program sampling dates and results are summarized in the following table:

**Assessment Monitoring Program Summary**

| Sampling Dates | Analytical Data Receipt Date | Parameters Collected | SSL(s) | SSL(s) Determination Date | Corrective Measures Assessment Initiated |
|---|---|---|---|---|---|
| June 19-25, 2018 | August 7, 2018 | Appendix III<br>Appendix IV | No | NA | NA |
| Sept. 18, 2018 | October 12, 2018 | Appendix III<br>Appendix IV | No | NA | NA |
| June 3-5, 2019 | July 12, 2019 | Appendix III<br>Appendix IV | No | NA | NA |
| October 2-3, 2019 | November 5, 2019 | Appendix III<br>Appendix IV | No | NA | NA |
| June 9, 2020 | July 15, 2020 | Appendix III<br>Appendix IV | No | NA | NA |
| October 6, 2020 | November 9, 2020 | Appendix III<br>Appendix IV | No | NA | NA |

Notes:

NA - not applicable

The statistical background prediction limits used to assess Appendix III data and the Groundwater Protection Standards (GWPSs) used to assess Appendix IV data are summarized in Tables 1 and 2, respectively. Appendix III and Appendix IV sample analytical data are summarized in Tables 3 and 4, respectively. Statistical analysis of the 2020 sample data was performed in accordance with the Statistical Analysis Plan for CCR Groundwater Monitoring (PBW 2017) and the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-Unified Guidance (USEPA 2009). The statistical analysis included an evaluation of statistical confidence intervals based on Appendix IV sample data collected from downgradient monitoring wells. Statistically significant levels (SSLs) above GWPSs are indicated if the 95% lower confidence limit of a particular parameter's data population exceeds the GWPS. Based on the current Appendix IV sample data, none of the Appendix IV parameters are currently present at SSLs above GWPSs.

## 3.0 KEY ACTIONS COMPLETED IN 2020

Assessment Monitoring Program groundwater monitoring events were completed in June and October 2020. The number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and the analytical results for the groundwater samples are summarized in Table 3 (Appendix III parameters) and Table 4 (Appendix IV parameters).

No CCR wells were installed or decommissioned in 2020.

# 4.0 PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the CCR groundwater monitoring program in 2020.

# 5.0 KEY ACTIVITIES PLANNED FOR 2021

The following key activities are planned for 2021:

- Continue the Assessment Monitoring Program in accordance with 40 CFR § 257.95.
- Complete statistical evaluation of Appendix IV analytical data from the downgradient wells and compare results to GWPSs to determine whether an SSL has occurred.
- If an SSL is identified, notification will be prepared as required under 40 CFR § 257.95(g). The notification will be placed in the operating record per 40 CFR § 257.105(h)(8) and will be subsequently placed on the public website per 40 CFR § 257.107(d). Potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated. If an alternate source is identified to be the cause of the SSL, a written demonstration will be completed within 90 days of SSL determination and included in the subsequent Annual Groundwater Monitoring and Corrective Action Report.
- If an alternate source is not identified to be the cause of the SSL, the applicable requirements of 40 CFR §§ 257.94 through 257.98 (e.g., assessment of corrective measures) will be met, including associated recordkeeping/notifications required by 40 CFR §§ 257.105 through 257.108.

# 6.0 REFERENCES

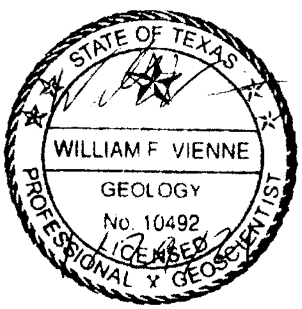
O'Brien and Gere Engineers, Inc. (OBG), 2017. Statistical Analysis Plan, Coleto Creek Power Station.

# Signature Page

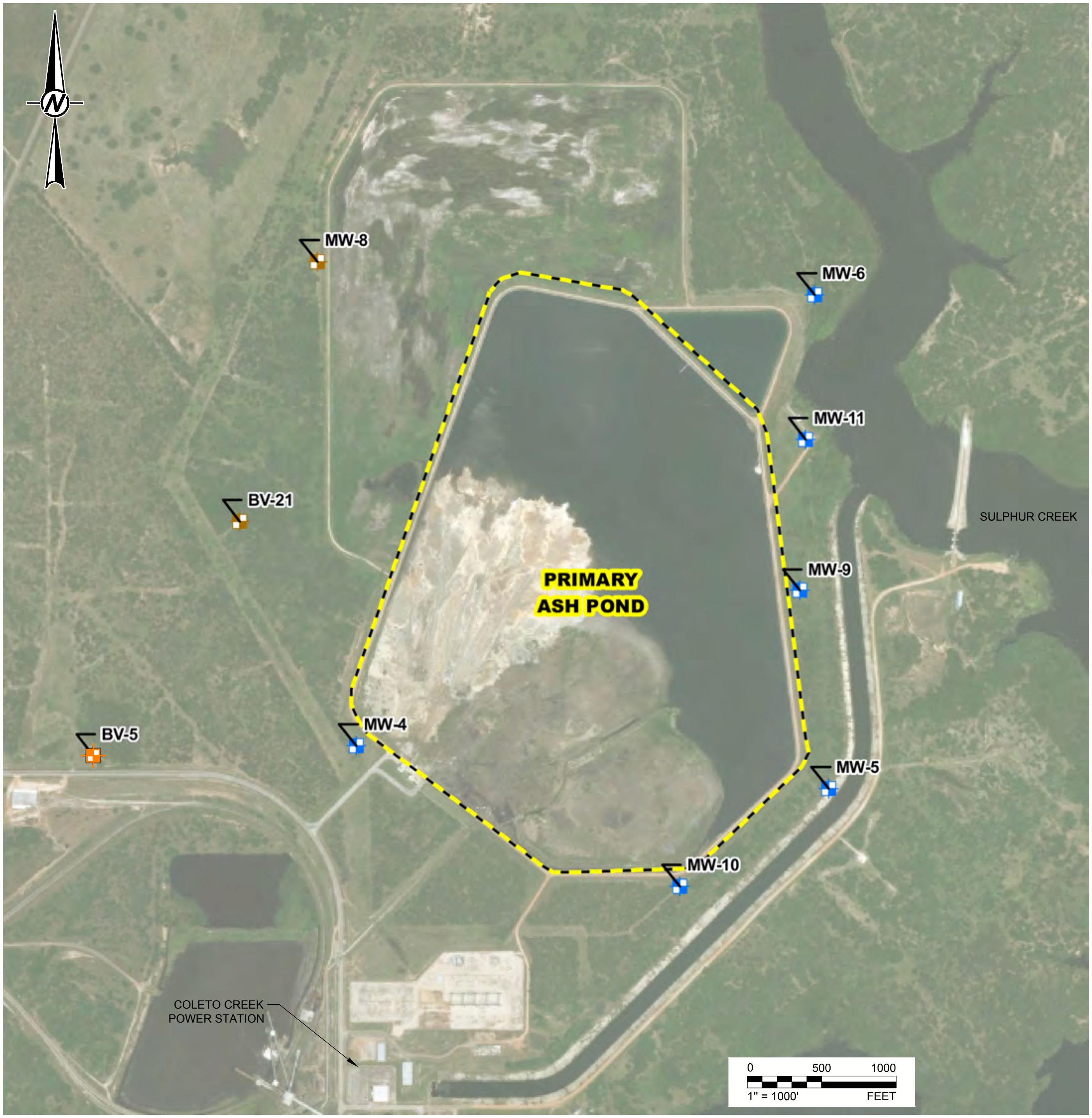
**Golder Associates Inc.**

William F. Vienne
*Senior Hydrogeologist*

Patrick J. Behling
*Principal Engineer*




# FIGURES




LEGEND

DOWNGRADIENT MONITORING WELL LOCATION

UPGRADIENT MONITORING WELL LOCATION

CCR MONITORING UNIT

CLIENT
COLETO CREEK POWER LP

PROJECT
COLETO CREEK POWER STATION
FANNIN, TEXAS

TITLE
**DETAILED SITE PLAN - COLETO CREEK PRIMARY ASH POND**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2019-01-14 |
| DESIGNED | AJD |
| PREPARED | AJD |
| REVIEWED | WFV |
| APPROVED | WFV |

PROJECT NO. 18106453 REV. 0 FIGURE 1

# TABLES

**Table 1**
**Appendix III Statistical Background Values**
**Coleto Creek Primary Ash Pond**

| Parameter | Statistical Background Value |
|---|---|
| Boron (mg/L) | 1.26 |
| Calcium (mg/L) | 143 |
| Chloride (mg/L) | 118 |
| Fluoride (mg/L) | 0.61 |
| field pH (s.u.) | 6.51<br>7.33 |
| Sulfate (mg/L) | 148 |
| Total Dissolved Solids (mg/L) | 966 |

**Table 2**
**Groundwater Protection Standards**
**Coleto Creek Primary Ash Pond**

| Parameter | Groundwater Protection Standard |
|---|---|
| Antimony (mg/L) | 0.006 |
| Arsenic (mg/L) | 0.128 |
| Barium (mg/L) | 2.0 |
| Beryllium (mg/L) | 0.004 |
| Cadmium (mg/L) | 0.005 |
| Chromium (mg/L) | 0.10 |
| Cobalt (mg/L) | 0.0499 |
| Fluoride (mg/L) | 4.0 |
| Lead (mg/L) | 0.015 |
| Lithium (mg/L) | 0.04 |
| Mercury (mg/L) | 0.002 |
| Molybdenum (mg/L) | 0.10 |
| Selenium (mg/L) | 0.05 |
| Thallium (mg/L) | 0.002 |
| Radium 226+228 (pCi/L) | 5.0 |

**TABLE 3**
**APPENDIX III ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| **Upgradient Wells** | | | | | | | | |
| BV-5 | 03/29/17 | 1.15 | 90.5 | 118 | 0.54 | 7.01 | 147 | 860 |
| | 05/11/17 | 1.03 | 81.6 | 106 | 0.57 | 6.89 | 148 | 862 |
| | 05/16/17 | 1.17 | 99 | 107 | 0.55 | 6.9 | 145 | 832 |
| | 06/07/17 | 1.11 | 88.8 | 109 | 0.56 | 6.64 | 147 | 810 |
| | 06/20/17 | 1.02 | 90.7 | 106 | 0.58 | 6.54 | 145 | 716 |
| | 06/27/17 | 1.14 | 100 | 114 | 0.55 | 6.76 | 144 | 743 |
| | 07/12/17 | 1.07 | 96.8 | 112 | 0.56 | 6.88 | 140 | 430 |
| | 07/18/17 | 1.17 | 143 | 117 | 0.56 | 6.68 | 142 | 817 |
| | 11/07/17 | 1.10 | 94.2 | 109 | 0.62 | 6.96 | 136 | 850 |
| | 06/19/18 | 1.18 | 56.4 | 112 | 0.97 | -- | 147 | 775 |
| | 09/18/18 | 1.27 | 86.2 | 145 | 0.667 | 6.53 | 146 | 904 |
| | 06/05/19 | 1.26 | 82.9 | 123 | 0.769 | 6.89 | 146 | 828 |
| | 10/03/19 | 1.31 | 72.2 | 141 | 0.753 | 7.11 | 145 | 806 |
| | 06/09/20 | 1.35 | 90.4 | 171 | 0.498 | 6.97 | 159 | 951 |
| | 10/06/20 | 1.26 | 80.2 | 133 | 1.01 | 6.54 | 155 | 843 |
| BV-21 | 03/28/17 | 0.651 | 6.89 | 36 | 0.61 | 7.09 | 69 | 490 |
| | 05/09/17 | 0.687 | 65.2 | 38 | 0.61 | 7.04 | 55 | 410 |
| | 05/17/17 | 0.709 | 74.3 | 39 | 0.58 | 7.05 | 53 | 454 |
| | 06/06/17 | 0.657 | 69 | 40 | 0.59 | 7.11 | 49 | 452 |
| | 06/20/17 | 0.642 | 77 | 40 | 0.61 | 6.7 | 45 | 356 |
| | 06/27/17 | 0.727 | 84.9 | 40 | 0.6 | 6.97 | 46 | 420 |
| | 07/10/17 | 0.674 | 90.6 | 39 | 0.58 | 7.22 | 45 | 427 |
| | 07/18/17 | 0.618 | 84.4 | 39 | 0.6 | 6.91 | 44 | 380 |
| | 11/07/17 | 0.515 | 73.6 | 42 | 0.64 | 7.12 | 46 | 423 |
| | 06/25/18 | 0.543 | 69.3 | 38.4 | 0.62 | -- | 38.4 | 380 |
| | 09/18/18 | 0.624 | 72.1 | 33.3 | 0.479 | 6.64 | 36.4 | 416 |
| | 06/05/19 | 0.576 | 61.3 | 30.3 | 0.602 | 7.1 | 34.2 | 379 |
| | 10/03/19 | 0.534 | 63.4 | 23.9 | 0.588 | 6.82 | 33.2 | 342 |
| | 06/09/20 | 0.447 | 72.5 | 34.2 | 0.522 | 6.96 | 18.5 | 362 |
| | 10/06/20 | 0.480 | 84.0 | 40.4 | 0.677 | 6.72 | 14.5 | 390 |
| MW-8 | 03/28/17 | 1.2 | 7.76 | 79 | 0.49 | 7.06 | 76 | 626 |
| | 05/09/17 | 1.21 | 77.5 | 77 | 0.44 | 7.15 | 79 | 564 |
| | 05/15/17 | 1.16 | 81.2 | 76 | 0.44 | 7.01 | 79 | 558 |
| | 06/06/17 | 1.26 | 78.1 | 72 | 0.45 | 6.92 | 83.5 | 570 |
| | 06/20/17 | 1.24 | 86.5 | 67 | 0.43 | 6.7 | 89 | 476 |
| | 06/27/17 | 1.23 | 89.6 | 66 | 0.44 | 6.85 | 97 | 533 |
| | 07/10/17 | 1.24 | 92.6 | 63 | 0.44 | 7.13 | 97 | 533 |
| | 07/18/17 | 1.25 | 92.9 | 61 | 0.46 | 6.91 | 100 | 533 |
| | 11/07/17 | 1.21 | 78.8 | 61 | 0.49 | 7.08 | 100 | 540 |
| | 06/25/18 | 1.25 | 80.3 | 65.9 | 0.52 | -- | 95.2 | 565 |
| | 09/18/18 | 1.29 | 76.5 | 53.7 | 0.402 | 6.70 | 94.8 | 543 |
| | 06/05/19 | 1.11 | 65.2 | 51.4 | 0.497 | 7.10 | 79 | 515 |
| | 10/03/19 | 1.2 | 76.7 | 58.3 | 0.419 | 6.76 | 90.1 | 541 |
| | 06/09/20 | 1.33 | 73.1 | 46.4 | 0.392 J | 7.04 | 72.3 | 511 |
| | 10/06/20 | 1.18 | 81.1 | 49.5 | 0.652 | 6.84 | 72.2 | 510 |

# TABLE 3
# APPENDIX III ANALYTICAL RESULTS
# COLETO CREEK PRIMARY ASH POND

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| **Downgradient Wells** | | | | | | | | |
| MW-4 | 03/28/17 | 0.287 | 9.14 | 102 | 0.61 | 9.81 | 157 | 794 |
| | 05/09/17 | 0.395 | 88.7 | 101 | 0.61 | 7.27 | 156 | 668 |
| | 05/17/17 | 0.251 | 92.1 | 101 | 0.6 | 6.93 | 157 | 702 |
| | 06/06/17 | 0.243 | 90.7 | 101 | 0.63 | 7.13 | 157 | 728 |
| | 06/20/17 | 0.254 | 99.3 | 101 | 0.62 | 6.71 | 157 | 626 |
| | 06/27/17 | 0.254 | 102 | 101 | 0.63 | 6.87 | 157 | 690 |
| | 07/10/17 | 0.271 | 111 | 101 | 0.62 | 7.16 | 158 | 670 |
| | 07/18/17 | 0.292 | 108 | 101 | 0.63 | 6.82 | 157 | 717 |
| | 11/07/17 | 0.255 | 94.5 | 99 | 0.62 | 7.12 | 155 | 700 |
| | 06/21/18 | 0.267 | 92.5 | 104 | 0.6 | -- | 159 | 665 |
| | 09/18/18 | 0.28 | 91.8 | 102 | 0.582 | 6.63 | 155 | 720 |
| | 06/05/19 | 0.379 | 85.3 | 108 | 0.67 | 6.92 | 161 | 718 |
| | 10/03/19 | 0.367 | 93.1 | 102 | 0.559 | 6.7 | 155 | 693 |
| | 06/09/20 | 0.241 | 94.9 | 24.6 | 0.205 J | 6.88 | 26.8 | 400 |
| | 10/06/20 | 0.328 | 103 | 101 | 0.736 | 6.75 | 151 | 731 |
| MW-5 | 03/30/17 | 0.11 | 110 | 140 | 0.51 | 6.85 | 184 | 830 |
| | 05/10/17 | 0.115 | 114 | 139 | 0.54 | 6.86 | 183 | 900 |
| | 05/16/17 | 0.215 | 121 | 139 | 0.5 | 6.81 | 183 | 848 |
| | 06/08/17 | 0.122 | 118 | 139 | 0.55 | 6.8 | 182 | 862 |
| | 06/21/17 | 0.122 | 124 | 138 | 0.53 | 6.6 | 182 | 813 |
| | 06/26/17 | 0.121 | 129 | 139 | 0.54 | 6.79 | 184 | 900 |
| | 07/11/17 | 0.111 | 120 | 138 | 0.52 | 6.91 | 184 | 797 |
| | 07/19/17 | 0.001 | 0.005 | 137 | 0.53 | 6.84 | 181 | 857 |
| | 11/08/17 | 0.149 | 116 | 138 | 0.52 | 6.92 | 183 | 883 |
| | 06/25/18 | 0.119 | 114 | 140 | 0.56 | -- | 183 | 820 |
| | 09/18/18 | 0.146 | 114 | 136 | 0.493 | 6.70 | 183 | 824 |
| | 06/03/19 | 0.146 | 113 | 143 | 0.596 | 7.06 | 187 | 864 |
| | 10/02/19 | 0.179 | 111 | 147 | 0.543 | 7.06 | 202 | 842 |
| | 09/06/20 | 0.152 | 117 | 138 | 0.370 J | 6.84 | 182 | 858 |
| | 10/6/2020 | 0.160 | 125 | 133 | 0.662 | 6.91 | 178 | 841 |
| MW-6 | 03/29/17 | 1.67 | 73.9 | 69 | 0.38 | 7.34 | 99 | 510 |
| | 05/11/17 | 1.94 | 70.6 | 70 | 0.37 | 7.1 | 110 | 490 |
| | 05/16/17 | 1.84 | 76.3 | 70 | 0.36 | 7.23 | 107 | 506 |
| | 06/07/17 | 1.8 | 73.8 | 70 | 0.37 | 6.97 | 103 | 492 |
| | 06/22/17 | 1.97 | 79.9 | 69 | 0.37 | 7.11 | 100 | 510 |
| | 06/28/17 | 1.74 | 81.8 | 69 | 0.37 | 7.16 | 99 | 570 |
| | 07/12/17 | 1.76 | 81.6 | 69 | 0.35 | 7.24 | 98 | 557 |
| | 07/20/17 | 0.005 | 0.0002 | 69 | 0.39 | 6.9 | 97 | 530 |
| | 11/07/17 | 1.72 | 76.4 | 69 | 0.39 | 7.41 | 101 | 483 |
| | 06/22/18 | 0.0171 | 76.6 | 70.7 | 0.41 | -- | 107 | 490 |
| | 09/18/18 | 2.09 | 70.8 | 72.5 | 0.353 J | 6.97 | 114 | 505 |
| | 06/03/19 | 1.9 | 73.9 | 73 | 0.043 | 7.31 | 103 | 514 |
| | 10/02/19 | 1.83 | 73.6 | 76.4 | 0.357 J | 7.29 | 115 | 507 |
| | 06/09/20 | 2.51 | 69.7 | 80.9 | 0.4 | 6.95 | 122 | 507 |
| | 10/06/20 | 1.92 | 81.9 | 73.4 | 0.512 | 6.97 | 87.9 | 510 |

**TABLE 3**
**APPENDIX III ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | B | Ca | Cl | Fl | field pH | $SO_4$ | TDS |
|---|---|---|---|---|---|---|---|---|
| MW-9 | 03/30/17 | 3.38 | 54.5 | 71 | 1.13 | 7.35 | 62 | 406 |
| | 05/10/17 | 3.16 | 52.7 | 66 | 1.29 | 7.48 | 59 | 410 |
| | 05/17/17 | 3.18 | 53.3 | 67 | 1.26 | 7.34 | 58 | 440 |
| | 06/07/17 | 3.12 | 52 | 67 | 1.26 | 7.03 | 57 | 380 |
| | 06/21/17 | 3.44 | 60.7 | 66 | 1.39 | 7.09 | 60 | 393 |
| | 06/26/17 | 3.31 | 60.6 | 67 | 1.4 | 7.23 | 61 | 407 |
| | 07/11/17 | 3.35 | 52.1 | 64 | 1.3 | 7.51 | 60 | 927 |
| | 07/19/17 | 3.4 | 50.2 | 63 | 1.4 | 7.29 | 62 | 407 |
| | 11/08/17 | 2.84 | 49.4 | 62 | 1.56 | 7.54 | 50 | 397 |
| | 06/21/18 | 2.94 | 46.9 | 71.5 | 1.5 | -- | 35.7 | 370 |
| | 09/18/18 | 2.79 | 51.7 | 71.4 | 1.1 | 6.99 | 49.1 | 394 |
| | 06/05/19 | 4.26 | 48 | 74.7 | 1.38 | 7.4 | 66.3 | 421 |
| | 10/03/19 | 3.97 | 71.3 | 70.9 | 1.41 | 7.37 | 63.6 | 462 |
| | 09/06/20 | 4.10 | 47.4 | 63.7 | 1.58 | 7.21 | 54.9 | 397 |
| | 10/06/20 | 3.78 | 50.1 | 49.6 | 1.73 | 7.47 | 51.7 | 366 |
| MW-10 | 03/30/17 | 3.74 | 92.1 | 151 | 0.54 | 6.99 | 130 | 804 |
| | 05/10/17 | 7.32 | 56.1 | 82 | 0.83 | 7.23 | 96 | 582 |
| | 05/16/17 | 7.45 | 62.7 | 81 | 0.81 | 7.28 | 95 | 612 |
| | 06/08/17 | 7.54 | 58.1 | 77 | 0.84 | 7.23 | 92 | 604 |
| | 06/21/17 | 9.22 | 60.7 | 77 | 0.84 | 6.97 | 92 | 550 |
| | 06/26/17 | 8.21 | 63.4 | 78 | 0.84 | 7.14 | 92 | 530 |
| | 07/11/17 | 7.99 | 49.5 | 76 | 0.84 | 7.4 | 88 | 617 |
| | 07/19/17 | 8.74 | 56.6 | 74 | 0.86 | 7.25 | 86 | 533 |
| | 11/08/17 | 8.72 | 77.7 | 74 | 0.88 | 7.35 | 81 | 590 |
| | 06/22/18 | 8.47 | 84.4 | 76.7 | 0.88 | -- | | 550 |
| | 09/18/18 | 8.45 | 51.9 | 81.4 | 0.759 | 6.98 | 95.1 | 577 |
| | 06/03/19 | 8.28 | 43.1 | 87.2 | 0.953 | 7.52 | 97.7 | 587 |
| | 10/02/19 | 8.28 | 44.2 | 85.5 | 0.891 | 7.46 | 104 | 575 |
| | 06/09/20 | 7.58 | 46.9 | 76.9 | 0.818 | 7.13 | 96.5 | 575 |
| | 10/06/20 | 6.94 | 49.0 | 73.7 | 1.05 | 7.35 | 92.3 | 575 |
| MW-11 | 05/10/17 | 1.35 | 64.1 | 55 | 0.82 | 7.27 | 61 | 394 |
| | 05/16/17 | 1.39 | 62.3 | 52 | 0.85 | 7.29 | 58 | 362 |
| | 05/18/17 | 1.27 | 61.6 | 47.8 | 0.94 | -- | 52.4 | 390 |
| | 06/07/17 | 1.23 | 59.8 | 48 | 0.93 | 7.25 | 50 | 372 |
| | 06/21/17 | 1.19 | 73.1 | 43.7 | 1.04 | 7.15 | 44 | 373 |
| | 06/26/17 | 1.15 | 82 | 44 | 1 | 7.3 | 43 | 407 |
| | 07/11/17 | 1.23 | 44.7 | 44 | 1 | 7.55 | 42 | 603 |
| | 07/19/17 | 1.17 | 48.6 | 43 | 1.01 | 7.21 | 42 | 360 |
| | 11/08/17 | 1.13 | 52.2 | 43 | 1.02 | 7.61 | 56 | 367 |
| | 06/21/18 | 1.07 | 69.6 | 44.3 | 0.96 | -- | 61.4 | 355 |
| | 09/18/18 | 1.12 | 39.3 | 44.6 | 0.754 | 7.00 | 44.4 | 354 |
| | 06/03/19 | 1.27 | 43.4 | 42.2 | 0.837 | 7.55 | 44.8 | 372 |
| | 10/02/19 | 1.22 | 43.4 | 41.4 | 0.768 | 7.43 | 10.8 | 355 |
| | 06/09/20 | 1.20 | 56.6 | 44.4 | 0.571 | 6.88 | 67.7 | 414 |
| | 10/06/20 | 1.05 | 66.8 | 58.6 | 0.767 | 7.05 | 85.9 | 453 |

Notes:
1. All concentrations in mg/L. pH in standard units.
2. J - concentration is below sample quantitation limit; result is an estimate.

**TABLE 4**
**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upgradient Wells | | | | | | | | | | | | | | | | | | |
| BV-5 | 03/29/17 | <0.0025 | 0.00856 | 0.04510 | <0.001 | <0.001 | <0.005 | 0.0497 | 0.540 | <0.001 | 0.0206 | <0.0002 | 0.00925 | <0.005 | <0.0015 | -- | -- | 1.503 |
| | 05/11/17 | <0.0025 | 0.00786 | 0.03680 | <0.001 | <0.001 | <0.005 | 0.0462 | 0.570 | <0.001 | 0.018 | <0.0002 | 0.0101 | <0.005 | <0.0015 | -- | -- | 1.555 |
| | 05/16/17 | <0.0025 | 0.00885 | 0.04520 | <0.001 | <0.001 | <0.005 | 0.0495 | 0.550 | 0.00151 | 0.0171 | <0.0002 | 0.0102 | <0.005 | <0.0015 | -- | -- | 0.7550 |
| | 06/07/17 | <0.0025 | 0.00829 | 0.03760 | <0.001 | <0.001 | <0.005 | 0.0483 | 0.560 | <0.001 | 0.0207 | <0.0002 | 0.01 | <0.005 | <0.0015 | -- | -- | 1.457 |
| | 06/20/17 | <0.0025 | 0.00841 | 0.04010 | <0.001 | <0.001 | <0.005 | 0.0499 | 0.580 | <0.001 | 0.0208 | <0.0002 | 0.0114 | <0.005 | <0.0015 | -- | -- | 0.4920 |
| | 06/27/17 | <0.0025 | 0.0083 | 0.04120 | <0.001 | <0.001 | <0.005 | 0.046 | 0.550 | <0.001 | 0.0198 | <0.0002 | 0.00942 | <0.005 | <0.0015 | -- | -- | 2.247 |
| | 07/12/17 | <0.0025 | 0.00849 | 0.04160 | <0.001 | <0.001 | <0.005 | 0.0484 | 0.560 | <0.001 | 0.0188 | <0.0002 | 0.0096 | <0.005 | <0.0015 | -- | -- | 2.139 |
| | 07/18/17 | <0.0025 | 0.00951 | 0.05780 | <0.001 | <0.001 | 0.00739 | 0.0453 | 0.560 | 0.00288 | 0.022 | <0.0002 | 0.0083 | <0.005 | <0.0015 | -- | -- | 1.260 |
| | 06/19/18 | <0.0025 | 0.0106 | 0.0336 | <0.001 | <0.001 | 0.0022 J | 0.0513 J | 0.970 | <0.00074 J | 0.016 | <0.0002 | 0.0139 | <0.005 | <0.0015 | 0.327 | <1.680 | 2.01 |
| | 09/18/18 | NA | 0.00949 | 0.0436 | NA | NA | 0.00228 J | 0.0487 | 0.667 | 0.00039 J | 0.0206 | NA | 0.0102 | NA | NA | 0.302 | <0.608 | 0.91 |
| | 06/05/19 | <0.0008 | 0.0092 | 0.042 | <0.0003 | 0.00092 J | <0.002 | 0.0466 | 0.769 | 0.00144 | 0.0201 | <0.00008 | 0.0109 | <0.0020 | <0.0005 | <0.687 | <1.130 | <1.82 |
| | 10/03/19 | <0.0008 | 0.00941 | 0.0441 | <0.0003 | <0.0003 | 0.00285 J | 0.0437 | 0.753 | 0.0039 | 0.0172 | <0.00008 | 0.0122 | <0.0020 | <0.0005 | 0.928 | 1.35 | 2.28 |
| | 06/09/20 | <0.0008 | 0.00879 | 0.0462 | <0.0003 | <0.0003 | 0.00818 | 0.0486 | 0.498 | 0.00162 | 0.0201 | <0.0000800 | 0.0120 | <0.00200 | <0.000500 | 0.363 | 0 | 0.363 |
| | 10/06/20 | <0.000800 | 0.00982 | 0.0387 | <0.000300 | <0.000300 | 0.00226 | 0.0449 | 1.01 | <0.000300 | 0.0174 | <0.0000800 | 0.0105 | <0.00200 | <0.000500 | 0.293 | 0.709 | 1 |
| BV-21 | 03/28/17 | <0.0025 | 0.0954 | 0.09630 | <0.001 | <0.001 | <0.005 | 0.0083 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.390 |
| | 05/09/17 | <0.0025 | 0.108 | 0.09720 | <0.001 | <0.001 | <0.005 | 0.00852 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.7460 |
| | 05/17/17 | <0.0025 | 0.117 | 0.09440 | <0.001 | <0.001 | <0.005 | 0.00878 | 0.580 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.9190 |
| | 06/06/17 | <0.0025 | 0.118 | 0.09540 | <0.001 | <0.001 | <0.005 | 0.00806 | 0.590 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6710 |
| | 06/20/17 | <0.0025 | 0.121 | 0.1010 | <0.001 | <0.001 | <0.005 | 0.00744 | 0.610 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.672 |
| | 06/27/17 | <0.0025 | 0.128 | 0.1040 | <0.001 | <0.001 | <0.005 | 0.00841 | 0.600 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5200 |
| | 07/10/17 | <0.0025 | 0.123 | 0.1100 | <0.001 | <0.001 | <0.005 | 0.0086 | 0.580 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.8050 |
| | 07/18/17 | <0.0025 | 0.115 | 0.1010 | <0.001 | <0.001 | <0.005 | 0.00784 | 0.600 | <0.001 | <0.010 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 4.812 |
| | 06/25/18 | <0.0025 | 0.0697 | 0.104 | <0.001 | <0.001 | <0.005 | 0.00682 | 0.620 | <0.00074 J | 0.00513 J | <0.0002 | 0.00428 J | <0.005 | <0.0015 | 0.267 | <1.417 | 1.68 |
| | 09/18/18 | NA | 0.0625 | 0.109 | NA | NA | <0.002 | 0.0064 | 0.479 | 0.000555 J | 0.00624 J | NA | 0.00450 J | NA | NA | <0.31 | <0.528 | <0.838 |
| | 06/05/19 | <0.0008 | 0.0531 | 0.105 | <0.0003 | <0.0003 | <0.002 | 0.00574 | 0.602 | 0.000354 | 0.00558 J | <0.00008 | 0.00685 | <0.0020 | <0.0005 | 0.65 | <0.687 | 1.337 |
| | 10/03/19 | <0.0008 | 0.049 | 0.0963 | <0.0003 | <0.0003 | <0.002 | 0.00542 | 0.588 | 0.000333 J | <0.005 | <0.00008 | 0.00784 | <0.0020 | <0.0005 | 0.346 | 1.54 | 1.89 |
| | 06/09/20 | <0.0008 | 0.0793 | 0.132 | <0.0003 | <0.0003 | 0.007 | 0.00437 J | 0.522 | 0.00033 J | <0.005 | <0.00008 | 0.00698 | <0.0020 | <0.0005 | 0.211 | 1.15 | 1.36 |
| | 10/6/2020 | <0.000800 | 0.0815 | 0.157 | <0.000300 | <0.000300 | <0.00200 | 0.00411 J | 0.677 | <0.000300 | 0.00532 J | <0.0000800 | 0.00523 | <0.00200 | <0.000500 | 0.37 | -0.112 | 0.37 |
| MW-8 | 03/28/17 | <0.0025 | 0.00839 | 0.0623 | <0.001 | <0.001 | <0.005 | 0.0236 | 0.490 | <0.001 | 0.0111 | <0.0002 | 0.0154 | <0.005 | <0.0015 | -- | -- | 0.4520 |
| | 05/09/17 | <0.0025 | 0.00848 | 0.064 | <0.001 | <0.001 | <0.005 | 0.0272 | 0.440 | <0.001 | 0.0111 | <0.0002 | 0.0157 | <0.005 | <0.0015 | -- | -- | 0.4740 |
| | 05/15/17 | <0.0025 | 0.00926 | 0.064 | <0.001 | <0.001 | <0.005 | 0.0311 | 0.440 | <0.001 | 0.0112 | <0.0002 | 0.016 | <0.005 | <0.0015 | -- | -- | 0.6140 |
| | 06/06/17 | <0.0025 | 0.00912 | 0.0616 | <0.001 | <0.001 | 0.00744 | 0.0308 | 0.450 | <0.001 | 0.0107 | <0.0002 | 0.0157 | <0.005 | <0.0015 | -- | -- | 0.1320 |
| | 06/20/17 | <0.0025 | 0.00885 | 0.0669 | <0.001 | <0.001 | <0.005 | 0.0297 | 0.430 | <0.001 | 0.0121 | <0.0002 | 0.0171 | <0.005 | <0.0015 | -- | -- | 0.5380 |
| | 06/27/17 | <0.0025 | 0.00939 | 0.0633 | <0.001 | <0.001 | <0.005 | 0.0314 | 0.440 | <0.001 | 0.0115 | <0.0002 | 0.0163 | <0.005 | <0.0015 | -- | -- | 0.9390 |
| | 07/10/17 | <0.0025 | 0.00902 | 0.0631 | <0.001 | <0.001 | <0.005 | 0.031 | 0.440 | <0.001 | 0.0112 | <0.0002 | 0.0165 | <0.005 | <0.0015 | -- | -- | 0.8040 |
| | 07/18/17 | <0.0025 | 0.00937 | 0.0635 | <0.001 | <0.001 | <0.005 | 0.0352 | 0.460 | <0.001 | 0.0118 | <0.0002 | 0.0185 | <0.005 | <0.0015 | -- | -- | 2.113 |
| | 06/25/18 | <0.0025 | 0.0101 | 0.0632 | <0.001 | <0.001 | <0.005 | 0.029 | 0.520 | 0.0011 | 0.0107 | <0.0002 | 0.017 | <0.005 | <0.0015 | <0.234 | <1.204 | <1.44 |
| | 09/18/18 | NA | 0.00896 | 0.0582 | NA | NA | <0.00200 | 0.0237 | 0.402 | <0.0003 | 0.0117 | NA | 0.0178 | NA | NA | <0.281 | <0.558 | <0.84 |
| | 06/05/19 | <0.0008 | 0.00946 | 0.0596 | <0.0003 | <0.0003 | <0.002 | 0.0217 | 0.497 | 0.000355 J | 0.011 | <0.00008 | 0.0156 | <0.0020 | <0.0005 | 0.528 | <0.619 | 1.147 |
| | 10/03/19 | <0.0008 | 0.0083 | 0.0607 | <0.0003 | <0.0003 | <0.002 | 0.231 | 0.419 | <0.0003 | 0.0106 | <0.00008 | 0.0144 | <0.0020 | <0.0005 | 0.224 | 0.241 | 0.465 |
| | 06/09/20 | <0.0008 | 0.00856 | 0.0599 | <0.0003 | <0.0003 | <0.002 | 0.0174 | 0.392 J | 0.000479 J | 0.0104 | <0.00008 | 0.0158 | <0.002 | <0.0005 | 0.304 | 2.64 | 2.94 |
| | 10/6/2020 | <0.000800 | 0.00862 | 0.0647 | <0.000300 | <0.000300 | <0.00200 | 0.0162 | 0.652 | <0.000300 | 0.0107 | <0.0000800 | 0.0148 | <0.00200 | <0.000500 | 1.08 | 1.65 | 2.73 |

**TABLE 4**
**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Downgradient Wells | | | | | | | | | | | | | | | | | | |
| MW-4 | 03/28/17 | <0.0025 | 0.00738 | 0.0575 | <0.001 | <0.001 | <0.005 | 0.007 | 0.610 | <0.001 | 0.0192 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.4600 |
| | 05/09/17 | <0.0025 | 0.00733 | 0.0576 | <0.001 | <0.001 | <0.005 | 0.007 | 0.610 | <0.001 | 0.0182 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6940 |
| | 05/15/17 | <0.0025 | 0.00794 | 0.0556 | <0.001 | <0.001 | <0.005 | 0.007 | 0.600 | <0.001 | 0.0166 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.451 |
| | 06/06/17 | <0.0025 | 0.0077 | 0.0556 | <0.001 | <0.001 | <0.005 | 0.007 | 0.630 | <0.001 | 0.0179 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1740 |
| | 06/20/17 | <0.0025 | 0.0081 | 0.0596 | <0.001 | <0.001 | 0.00877 | 0.008 | 0.620 | <0.001 | 0.0195 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5430 |
| | 06/27/17 | <0.0025 | 0.00786 | 0.0554 | <0.001 | <0.001 | <0.005 | 0.007 | 0.630 | <0.001 | 0.0185 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6390 |
| | 07/10/17 | <0.0025 | 0.00846 | 0.0582 | <0.001 | <0.001 | <0.005 | 0.009 | 0.620 | <0.001 | 0.0187 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.069 |
| | 07/18/17 | <0.0025 | 0.00815 | 0.0549 | <0.001 | <0.001 | <0.005 | 0.008 | 0.630 | <0.001 | 0.0183 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1910 |
| | 06/21/18 | <0.0025 | 0.00843 | 0.0591 | <0.001 | <0.001 | <0.005 | 0.00711 | 0.600 | <0.00072 J | 0.0175 | <0.0002 | <0.005 | <0.005 | <0.0015 | 0.370 | 1.705 | 2.08 |
| | 09/18/18 | NA | 0.00793 | 0.0577 | NA | NA | <0.002 | 0.00673 | 0.582 | <0.0003 | 0.019 | NA | <0.002 | NA | NA | 1.610 | <0.543 | 2.15 |
| | 06/05/19 | <0.0008 | 0.0079 | 0.0571 | <0.0003 | <0.0003 | <0.002 | 0.00729 | 0.670 | <0.0003 | 0.0195 | <0.00008 | <0.002 | <0.0020 | <0.0005 | 0.436 | <0.547 | 0.98 |
| | 10/03/19 | <0.0008 | 0.00764 | 0.0532 | <0.0003 | <0.0003 | <0.002 | 0.00699 | 0.559 | 0.00101 | 0.017 | <0.00008 | <0.002 | <0.002 | <0.0005 | 1.85 | -0.102 | 1.85 |
| | 06/09/20 | <0.0008 | <0.002 | 0.0376 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.205 J | <0.0003 | 0.00751 J | <0.00008 | 0.0021 J | <0.002 | <0.0005 | 0.0553 | 0.264 | 0.319 |
| | 10/06/20 | <0.000800 | 0.00754 | 0.0586 | <0.000300 | <0.000300 | <0.00200 | 0.00862 | 0.736 | 0.000375 J | 0.0186 | <0.0000800 | <0.00200 | <0.00200 | <0.000500 | 0.0684 | -0.16 | 0.0684 |
| MW-5 | 03/30/17 | <0.0025 | 0.00953 | 0.0748 | <0.001 | <0.001 | <0.005 | <0.005 | 0.510 | <0.001 | 0.0192 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.443 |
| | 05/10/17 | <0.0025 | 0.00955 | 0.0706 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0179 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6150 |
| | 05/16/17 | <0.0025 | 0.00967 | 0.0708 | <0.001 | <0.001 | <0.005 | <0.005 | 0.500 | <0.001 | 0.0181 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.6410 |
| | 06/08/17 | <0.0025 | 0.00908 | 0.0701 | <0.001 | <0.001 | <0.005 | <0.005 | 0.550 | <0.001 | 0.0200 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1790 |
| | 06/21/17 | <0.0025 | 0.00917 | 0.0767 | <0.001 | <0.001 | <0.005 | <0.005 | 0.530 | <0.001 | 0.0197 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1060 |
| | 06/26/17 | <0.0025 | 0.00955 | 0.0735 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0204 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 1.112 |
| | 07/11/17 | <0.0025 | 0.00945 | 0.0712 | <0.001 | <0.001 | <0.005 | <0.005 | 0.520 | <0.001 | 0.0183 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.5120 |
| | 07/19/17 | <0.0025 | 0.00941 | 0.0735 | <0.001 | <0.001 | <0.005 | <0.005 | 0.530 | <0.001 | 0.0186 | <0.0002 | <0.005 | <0.005 | <0.0015 | -- | -- | 0.1910 |
| | 06/25/18 | <0.0025 | 0.00998 | 0.0733 | <0.001 | <0.001 | <0.005 | <0.005 | 0.560 | <0.001 | 0.0182 | <0.0002 | <0.005 | <0.005 | <0.0015 | <0.251 | <1.369 | <1.62 |
| | 09/18/18 | NA | 0.00945 | 0.0697 | NA | NA | <0.002 | <0.003 | 0.493 | <0.0003 | 0.0195 | NA | <0.002 | NA | NA | <0.282 | <0.606 | <0.89 |
| | 06/03/19 | <0.0008 | 0.00948 | 0.0678 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.596 | <0.0003 | 0.0206 | <0.00008 | <0.002 | <0.002 | <0.0005 | <0.619 | <0.917 | <1.54 |
| | 10/02/19 | <0.0008 | 0.00918 | 0.067 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.543 | <0.0003 | 0.0187 | <0.00008 | <0.002 | <0.002 | <0.0005 | 0.47 | 0.117 | 0.587 |
| | 06/09/20 | <0.0008 | 0.00891 | 0.0689 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.370 J | <0.0003 | 0.0192 | <0.00008 | <0.002 | <0.002 | <0.0005 | 0.171 | 0.211 | 0.382 |
| | 10/6/2020 | <0.000800 | 0.00927 | 0.0708 | <0.000300 | <0.000300 | <0.00200 | <0.00300 | 0.662 | <0.000300 | 0.0190 | <0.0000800 | <0.00200 | <0.00200 | <0.000500 | 0.0604 | 0.0798 | 0.14 |
| MW-6 | 03/29/17 | <0.0025 | 0.00827 | 0.0900 | <0.001 | <0.001 | <0.005 | <0.005 | 0.380 | <0.001 | <0.010 | <0.0002 | 0.00749 | <0.005 | <0.0015 | -- | -- | 1.009 |
| | 05/11/17 | <0.0025 | 0.00738 | 0.0758 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | 0.0101 | <0.0002 | 0.0176 | <0.005 | <0.0015 | -- | -- | 0.8250 |
| | 05/16/17 | <0.0025 | 0.00803 | 0.0784 | <0.001 | <0.001 | <0.005 | <0.005 | 0.360 | <0.001 | <0.010 | <0.0002 | 0.0131 | <0.005 | <0.0015 | -- | -- | 0.7740 |
| | 06/07/17 | <0.0025 | 0.00772 | 0.0798 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | <0.010 | <0.0002 | 0.00949 | <0.005 | <0.0015 | -- | -- | 0.6640 |
| | 06/22/17 | <0.0025 | 0.00764 | 0.083 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | 0.0109 | <0.0002 | 0.0084 | <0.005 | <0.0015 | -- | -- | 0.2150 |
| | 06/28/17 | <0.0025 | 0.00779 | 0.0842 | <0.001 | <0.001 | <0.005 | <0.005 | 0.370 | <0.001 | <0.010 | <0.0002 | 0.00806 | <0.005 | <0.0015 | -- | -- | 1.730 |
| | 07/12/17 | <0.0025 | 0.0077 | 0.0819 | <0.001 | <0.001 | <0.005 | <0.005 | 0.350 | <0.001 | <0.010 | <0.0002 | 0.0076 | <0.005 | <0.0015 | -- | -- | 1.012 |
| | 07/20/17 | <0.0025 | 0.001 | 0.0010 | <0.001 | <0.001 | <0.005 | <0.005 | 0.390 | <0.001 | <0.010 | <0.0002 | 0.001 | <0.005 | <0.0015 | -- | -- | 0.3660 |
| | 06/22/18 | <0.0025 | 0.00861 | 0.0912 | <0.001 | <0.001 | <0.005 | <0.005 | 0.410 | <0.001 | 0.00924 J | <0.0002 | 0.00837 | <0.005 | <0.0015 | <0.309 | <1.243 | <1.55 |
| | 09/18/18 | NA | 0.008 | 0.0828 | NA | NA | <0.002 | <0.003 | 0.353 J | 0.000349 J | 0.0107 | NA | 0.0274 | NA | NA | <0.196 | 1.06 | 1.256 |
| | 06/03/19 | <0.0008 | 0.00799 | 0.0894 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.438 | <0.0003 | 0.00968 J | <0.00008 | 0.00884 | <0.0020 | <0.0005 | <0.407 | <0.623 | <1.03 |
| | 10/02/19 | <0.0008 | 0.00775 | 0.0876 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.357 J | <0.0003 | 0.00875 J | <0.00008 | 0.00875 | <0.0020 | <0.0005 | 0.715 | 1.23 | 1.94 |
| | 06/09/20 | <0.0008 | 0.00799 | 0.078 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.4 | <0.0003 | 0.0113 | <0.00008 | 0.0357 | <0.002 | <0.0005 | 0.00643 | 0.127 | 0.134 |
| | 10/6/2020 | <0.000800 | 0.00768 | 0.0912 | <0.000300 | <0.000300 | <0.00200 | 0.00319 J | 0.512 | <0.000300 | 0.00900 J | <0.0000800 | 0.00924 | <0.00200 | <0.000500 | 1.02 | 0.621 | 1.64 |

**TABLE 4**
**APPENDIX IV ANALYTICAL RESULTS**
**COLETO CREEK PRIMARY ASH POND**

| Sample Location | Date Sampled | Sb | As | Ba | Be | Cd | Cr | Co | Fl | Pb | Li | Hg | Mo | Se | Tl | Ra 226 | Ra 228 | Ra 226/228 Combined |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-9 | 03/30/17 | <0.0025 | 0.00909 | 0.121 | <0.001 | <0.001 | <0.005 | <0.005 | 1.130 | 0.00217 | <0.010 | <0.0002 | 0.0747 | <0.005 | <0.0015 | -- | -- | 1.353 |
| | 05/10/17 | <0.0025 | 0.00996 | 0.105 | <0.001 | <0.001 | <0.005 | <0.005 | 1.290 | 0.00433 | <0.010 | <0.0002 | 0.0900 | <0.005 | <0.0015 | -- | -- | 0.4800 |
| | 05/17/17 | <0.0025 | 0.00958 | 0.101 | <0.001 | <0.001 | <0.005 | <0.005 | 1.260 | 0.00377 | <0.010 | <0.0002 | 0.0899 | <0.005 | <0.0015 | -- | -- | 0.3600 |
| | 06/07/17 | <0.0025 | 0.0093 | 0.100 | <0.001 | <0.001 | <0.005 | <0.005 | 1.260 | <0.001000 | <0.010 | <0.0002 | 0.0926 | <0.005 | <0.0015 | -- | -- | 0.4760 |
| | 06/21/17 | <0.0025 | 0.00937 | 0.119 | <0.001 | <0.001 | <0.005 | <0.005 | 1.390 | 0.00136 | <0.010 | <0.0002 | 0.1020 | <0.005 | <0.0015 | -- | -- | 1.579 |
| | 06/26/17 | <0.0025 | 0.0107 | 0.114 | <0.001 | <0.001 | 0.0102 | <0.005 | 1.400 | 0.00217 | <0.010 | <0.0002 | 0.1060 | <0.005 | <0.0015 | -- | -- | 1.023 |
| | 07/11/17 | <0.0025 | 0.0105 | 0.103 | <0.001 | <0.001 | 0.00566 | <0.005 | 1.300 | 0.00124 | <0.010 | <0.0002 | 0.1050 | <0.005 | <0.0015 | -- | -- | 0.8630 |
| | 07/19/17 | <0.0025 | 0.0103 | 0.101 | <0.001 | <0.001 | <0.005 | <0.005 | 1.400 | <0.001000 | <0.010 | <0.0002 | 0.1130 | <0.005 | <0.0015 | -- | -- | 0.5840 |
| | 06/21/18 | <0.0025 | 0.0104 | 0.100 | <0.001 | <0.001 | <0.005 | <0.005 | 1.500 | <0.00072 J | <0.01 | <0.0002 | 0.0617 | <0.005 | <0.0015 | 0.608 | <1.303 | 1.91 |
| | 09/18/18 | NA | 0.0103 | 0.0985 | NA | NA | <0.002 | <0.003 | 1.100 | <0.000300 | 0.00639 J | NA | 0.0502 | NA | NA | 0.618 | <0.638 | 1.26 |
| | 06/05/19 | <0.0008 | 0.0109 | 0.102 | <0.0003 | <0.0003 | <0.002 | <0.003 | 1.380 | <0.0003 | 0.00545 J | <0.00008 | 0.0683 | <0.002 | <0.0005 | <0.402 | <0.683 | <1.085 |
| | 10/03/19 | <0.0008 | 0.0109 | 0.128 | 0.00069 J | <0.0003 | <0.002 | 0.00337 J | 1.410 | 0.00876 | 0.0064 J | <0.00008 | 0.0507 | 0.0041 J | <0.0005 | 0.577 | 0.747 | 1.32 |
| | 06/09/20 | <0.0008 | 0.0126 | 0.0865 | <0.0003 | <0.0003 | <0.002 | <0.003 | 1.58 | 0.000577 J | <0.005 | <0.00008 | 0.0774 | <0.002 | <0.0005 | 0.132 | -0.0432 | 0.132 |
| | 10/6/2020 | <0.000800 | 0.0225 | 0.0786 | <0.000300 | <0.000300 | <0.00200 | <0.00300 | 1.73 | <0.000300 | <0.00500 | <0.0000800 | 0.0616 | <0.00200 | <0.000500 | 0.14 | 1.51 | 1.65 |
| MW-10 | 03/30/17 | <0.0025 | 0.0110 | 0.0844 | <0.001 | <0.001 | <0.005 | <0.005 | 0.540 | <0.001 | 0.0179 | <0.0002 | 0.0342 | <0.005 | <0.0015 | -- | -- | 1.439 |
| | 05/10/17 | <0.0025 | 0.0146 | 0.0554 | <0.001 | <0.001 | 0.00533 | <0.005 | 0.830 | <0.001 | 0.0122 | <0.0002 | 0.102 | <0.005 | <0.0015 | -- | -- | 0.8880 |
| | 05/16/17 | <0.0025 | 0.0150 | 0.0598 | <0.001 | <0.001 | <0.005 | <0.005 | 0.810 | <0.001 | 0.0123 | <0.0002 | 0.0987 | <0.005 | <0.0015 | -- | -- | 0.1830 |
| | 06/08/17 | <0.0025 | 0.0144 | 0.0544 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0115 | <0.0002 | 0.106 | <0.005 | <0.0015 | -- | -- | 0.06700 |
| | 06/21/17 | <0.0025 | 0.0149 | 0.054 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0133 | <0.0002 | 0.113 | <0.005 | <0.0015 | -- | -- | 0.7090 |
| | 06/26/17 | <0.0025 | 0.0160 | 0.0587 | <0.001 | <0.001 | 0.0177 | <0.005 | 0.840 | <0.001 | 0.0137 | <0.0002 | 0.116 | <0.005 | <0.0015 | -- | -- | 0.7180 |
| | 07/11/17 | <0.0025 | 0.0149 | 0.0508 | <0.001 | <0.001 | <0.005 | <0.005 | 0.840 | <0.001 | 0.0119 | <0.0002 | 0.114 | <0.005 | <0.0015 | -- | -- | 1.713 |
| | 07/19/17 | <0.0025 | 0.0146 | 0.0633 | <0.001 | <0.001 | 0.00963 | <0.005 | 0.860 | <0.001 | 0.0127 | <0.0002 | 0.121 | <0.005 | <0.0015 | -- | -- | 2.132 |
| | 06/22/18 | <0.0025 | 0.0154 | 0.0692 | <0.001 | <0.001 | <0.005 | <0.005 | 0.88 | <0.00095 J | 0.0122 | <0.0002 | 0.134 | <0.005 | <0.0015 | <0.212 | <1.192 | <1.40 |
| | 09/18/18 | NA | 0.0140 | 0.0446 | NA | NA | <0.002 | <0.003 | 0.759 | <0.0003 | 0.0141 | NA | 0.125 | NA | NA | 0.151 | <0.848 | 0.999 |
| | 06/03/19 | <0.0008 | 0.0142 | 0.0420 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.953 | <0.0003 | 0.0139 | <0.00008 | 0.109 | <0.002 | <0.0005 | <0.203 | 0.814 | 1.017 |
| | 10/02/19 | <0.0008 | 0.0139 | 0.0406 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.891 | <0.0003 | 0.0127 | <0.00008 | 0.106 | <0.002 | <0.0005 | -0.0288 | 0.901 | 0.901 |
| | 06/09/20 | <0.0008 | 0.014 | 0.0444 | <0.0003 | <0.0003 | <0.002 | 0.00334 J | 0.818 | <0.0003 | 0.013 | <0.00008 | 0.088 | <0.002 | <0.0005 | 0.0959 | 1.22 | 1.31 |
| | 10/6/2020 | <0.000800 | 0.0139 | 0.0411 | <0.000300 | <0.000300 | <0.00200 | 0.00390 J | 1.05 | <0.000300 | 0.0127 | <0.0000800 | 0.0865 | <0.00200 | <0.000500 | 0.0332 | 1.68 | 1.71 |
| MW-11 | 05/10/17 | <0.0025 | 0.0156 | 0.0899 | <0.001 | <0.001 | <0.005 | <0.005 | 0.82 | 0.00239 | 0.0125 | <0.0002 | 0.0082 | <0.005 | <0.0015 | -- | -- | 0.4560 |
| | 05/16/17 | <0.0025 | 0.018 | 0.0869 | <0.001 | <0.001 | 0.00731 | <0.005 | 0.85 | 0.0113 | 0.0144 | <0.0002 | 0.00841 | <0.005 | <0.0015 | -- | -- | 1.418 |
| | 05/18/17 | <0.0025 | 0.0188 | 0.0779 | <0.001 | <0.001 | <0.005 | <0.005 | 0.94 | 0.00204 | 0.0122 | <0.0002 | 0.00781 | <0.005 | <0.0015 | -- | -- | 0.6390 |
| | 06/07/17 | <0.0025 | 0.0175 | 0.0835 | <0.001 | <0.001 | <0.005 | <0.005 | 0.93 | 0.00171 | 0.0137 | <0.0002 | 0.00744 | <0.005 | <0.0015 | -- | -- | 0.5020 |
| | 06/21/17 | <0.0025 | 0.0203 | 0.0822 | <0.001 | <0.001 | <0.005 | <0.005 | 1.04 | 0.00322 | 0.0136 | <0.0002 | 0.00659 | <0.005 | <0.0015 | -- | -- | 1.084 |
| | 06/26/17 | <0.0025 | 0.0237 | 0.0954 | <0.001 | <0.001 | 0.0131 | <0.005 | 1.00 | 0.00593 | 0.0176 | <0.0002 | 0.00796 | <0.005 | <0.0015 | -- | -- | 3.067 |
| | 07/11/17 | <0.0025 | 0.0212 | 0.0725 | <0.001 | <0.001 | <0.005 | <0.005 | 1.00 | <0.001 | 0.012 | <0.0002 | 0.00765 | <0.005 | <0.0015 | -- | -- | 0.7530 |
| | 07/19/17 | <0.0025 | 0.0224 | 0.0709 | <0.001 | <0.001 | 0.00762 | <0.005 | 1.01 | 0.0018 | 0.0137 | <0.0002 | 0.00783 | <0.005 | <0.0015 | -- | -- | 1.551 |
| | 06/21/18 | <0.0025 | 0.0367 | 0.0805 | <0.001 | <0.001 | <0.005 | <0.005 | 0.96 | 0.00241 | 0.0135 | <0.0002 | 0.00465 | <0.005 | <0.0015 | <0.234 | <1.312 | <1.55 |
| | 09/18/18 | NA | 0.0382 | 0.0645 | NA | NA | <0.002 | <0.003 | 0.754 | <0.0003 | 0.0139 | NA | 0.00445 J | NA | NA | <0.188 | 0.597 | 0.785 |
| | 06/03/19 | <0.0008 | 0.0379 | 0.0834 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.0837 | <0.0003 | 0.0154 | <0.00008 | 0.00316 J | <0.002 | <0.0005 | <0.481 | 0.991 | 1.472 |
| | 10/02/19 | <0.0008 | 0.0379 | 0.0744 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.768 | 0.000391 J | 0.014 | <0.00008 | 0.00259 J | <0.002 | <0.0005 | 1.57 | 0.478 | 2.040 |
| | 06/09/20 | <0.0008 | 0.0293 | 0.0948 | <0.0003 | <0.0003 | <0.002 | <0.003 | 0.571 | 0.000675 J | 0.0156 | <0.00008 | 0.00215 J | <0.002 | <0.0005 | 0.163 | 1.31 | 1.480 |
| | 10/6/2020 | <0.000800 | 0.0159 | 0.105 | <0.000300 | <0.000300 | <0.00200 | <0.00300 | 0.767 | 0.000320 J | 0.0165 | <0.0000800 | 0.00340 J | <0.00200 | <0.000500 | 0.354 | 0.53 | 0.884 |

Notes:
1. Ra 226/228 concentrations in pCi/L. All other concentrations in mg/L.
2. J - concentration is below sample quantitation limit; result is an estimate.
3. Non-detect Ra isotope results were assigned a value equal to the minimum detectable concentration.
4. NA = Not analyzed (groundwater sample analyses for the second semi-annual sampling events were limited to Appendix IV parameters detected during the preceding first semi-annual sampling event in accordance with 40 CFR § 257.95(d)(1)).

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# APPENDIX F – CLOSURE AND POST-CLOSURE CARE

**Closure Plan**
**Closure Plan Addendum No. 1**
**Post-Closure Plan**

## SITE INFORMATION

| | | | |
|---|---|---|---|
| Site Name / Address | Coleto Creek Power Station, 45 FM 2987 Fannin, Goliad County, TX | | |
| Owner Name / Address | Coleto Creek Power, LP 1500 Eastport Plaza Drive Collinsville, IL 62234 | | |
| CCR Unit | Primary Ash Pond | Final Cover Type | Soil/Synthetic Liner System |
| Reason for Initiating Closure | Known final receipt of waste/Final removal of beneficial reuse materials | Closure Method | Close In-Place |

## CLOSURE PLAN DESCRIPTION

| | |
|---|---|
| (b)(1)(i) – Narrative description of how the CCR unit will be closed in accordance with this section. | The Primary Ash Pond will be closed such that contained CCR solids will remain in-place. In accordance with §257.102(b)(3), this written closure plan will be amended to provide additional details after the final engineering design for the grading and cover system is completed. This closure plan reflects the best information available to date, and the plan may be amended in the future. |
| (b)(1)(iii) – If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system and methods and procedures used to install the final cover. | First, the Primary Ash Pond will be dewatered with the resulting water to be discharged through existing TPDES Outfall No. 003. CCR solids will be graded and leveled, then covered with a final cover system as described below. Existing perimeter dikes will remain intact and the final cover system will tie into these dikes. The cover system will consist of the following elements, listed in order from contact with the CCR to the top: 1) subgrade leveling fill (as needed); 2) 1 foot thick soil liner with a permeability not to exceed the permeability of 1 x $10^{-5}$ cm/sec; 3) Synthetic Liner System consisting of: Geosynthetic Clay Liner (GCL), Textured (both sides) 40 Mil Linear-Low Density Polyethylene Flexible Membrane Liner (LLDPE-FML), Double Sided (geotextile fabric on both sides) Geonet Drainage Layer; and 4) 24-inch Protective/Vegetative Soil Layer. The top of the final cover system will be vegetated to minimize erosion. The final cover will be sloped to promote drainage and storm water runoff. |

(b)(1)(iii) – How the final cover system will achieve the performance standards in §257.102(d).

| | |
|---|---|
| (d)(1)(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere. | The permeability of the final cover will be equal to or less than the permeability of the bottom liner or a permeability no greater than 1 x $10^{-5}$ cm/sec, whichever is less, and will be graded to prevent ponding and promote drainage. |
| (d)(1)(ii) – Preclude the probability of future impoundment of water, sediment, or slurry. | The final cover will be sloped across the unit as needed to preclude the probability of future impoundment of water, sediment, or slurry. |
| (d)(1)(iii) – Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period. | The top of the vegetated final cover system will be sloped and the outsides of the perimeter dikes will be vegetated as necessary to minimize the potential for erosion. The cap system will be designed by a Qualified Professional Engineer in a manner to prevent sloughing or movement of the final cover system and geotechnical testing and evaluation will be performed as needed during and after construction to confirm that engineering slope stability standards have been achieved. |
| (d)(1)(iv) – Minimize the need for further maintenance of the CCR unit. | The vegetative cover will be regularly mowed and maintained to minimize the potential for erosion or other structural issues that would cause more extensive and long-term maintenance issues. The storm water control system will be regularly inspected for proper operation. |
| (d)(1)(v) – Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices. | Construction would occur in a phased approach as sections of the impoundment are prepared, enabling expedited capping of portions of the CCR impoundment. |
| (d)(2)(i) – Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residue. | The unit will be dewatered sufficiently to remove the free liquids to provide a stable base for the construction of the final cover system. |
| (d)(2)(ii) – Remaining wastes must be stabilized sufficiently to support the final cover system. | Dewatering and regrading of existing in-place CCR will sufficiently stabilize the waste such that the final cover will be supported. |
| (d)(3) – A final cover system must be installed to minimize infiltration and erosion, and at minimum, meets the requirements of (d)(3)(i). | The final cover system will be constructed as described above in accordance with (d)(3)(i) and will minimize infiltration and erosion. |
| (d)(3)(i) – The design of the final cover system must be included in the written closure plan. | When the final design of the final cover system is completed, the written closure plan will be amended to include the detailed final design. |
| (d)(3)(i)(A) – The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1x$10^{-5}$ cm/sec, whichever is less. | The permeability of the final cover will be equal to or less than the permeability of the existing bottom liner or no greater than 1x$10^{-5}$ cm/sec, whichever is less. This will be verified during construction per the construction quality assurance plan to be developed in conjunction with the detailed amended closure plan. |
| (d)(3)(i)(B) – The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer than contains a minimum of 18 inches of earthen material. | Infiltration of liquids through the closed CCR unit will be minimized by the placement of a 24-inch thick protective/vegetated soil layer over the Geonet drainage layer. |
| (d)(3)(i)(C) – The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth. | The final cover will include a minimum 24-inch protective/vegetated soil layer that is capable of sustaining native plant growth. The vegetative cover will be regularly maintained to prevent erosion. |
| (d)(3)(i)(D) – The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence. | The final cover system will be designed to account for expected settlement and subsidence. |

## INVENTORY AND AREA ESTIMATES

| | |
|---|---|
| (b)(1)(iv) – Estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit | Approx. 10 million cubic yards |
| (b)(1)(v) – Estimate of the largest area of the CCR unit ever requiring a final cover | Approx. 190 acres |

## CLOSURE SCHEDULE

(b)(1)(vi) – Schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including major milestones …and the estimated timeframes to complete each step or phase of CCR unit closure.

Note: At the time of this Written Closure Plan, there are no immediate plans to close the Primary Ash Pond. The Primary Ash Pond is currently actively managing CCR wastes generated during operation of the coal-fired power plant. CCR waste is also actively removed from the Primary Ash Pond for off-site beneficial use. This practice is expected to continue after the pond no longer accepts CCR solids. The milestones presented in this plan, therefore, provide an overview of major tasks associated with final closure of the Primary Ash Pond and a schedule relative to the timeframes specified in the rule. This Closure Plan will be amended with more specific information once closure activities have been initiated.

| | |
|---|---|
| (b)(2) - Initial Written Closure Plan Placed in Permanent Record | By October 17, 2016 |

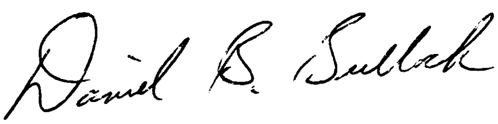
| | |
|---|---|
| (e)(1)(ii) – The owner or operator must commence closure of the CCR unit no later than 30 days after the date on which the CCR unit…: Removed the known final volume of CCR from the CCR unit for the purpose of beneficial use of CCR. | Closure activities will commence 30 days after known final receipt of CCR waste and removal of the last known quantity of CCR from the Primary Ash Pond for the purpose of beneficial reuse, which for the purposes of this plan is assumed to be the year 2045. Closure activities will consist of the following components which will be implemented between 2045 and 2050:<br>1) §257.102(g) Preparation of Notice of Intent to close a CCR Unit<br>2) Agency coordination<br>3) Mobilization<br>4) Reroute plant process water pipes and dewater and stabilize CCR<br>5) Grading of CCR material to final design grades<br>6) Installation of cap system<br>7) §257.102(h) Preparation of Notification of Closure of a CCR Unit<br>8) §257.102(h)(i) Deed Notation |
| f(2)(ii) – …the owner or operator must complete closure of the CCR unit: For existing and new CCR surface impoundments and any lateral expansion of a CCR surface impoundment, within five years of commencing closure activities pursuant to…paragraph (e)(2) of this section. | Final closure of the Primary Ash Pond will occur within 5 years of commencing closure activities. |

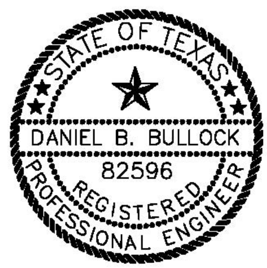
**Certification by qualified professional engineer appended to this plan.**

**Certification Statement 40 *CFR* § 257.102 (b)(4) – Written Closure Plan for a CCR Surface Impoundment or Landfill**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the written closure plan, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.102.






1/24/2018

Daniel Bullock, P.E. (TX 82596)
Bullock, Bennett & Associates, LLC
Firm Registrations: Engineering F-8542, Geoscience 50127

**Certification Statement 40 *CFR* § 257.102 (d)(3)(iii) – Design of the Final Cover System for a CCR Surface Impoundment or Landfill**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the conceptual-level design of the final cover system as included in the written closure plan, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.102.

STATE OF TEXAS
DANIEL B. BULLOCK
82596
REGISTERED
PROFESSIONAL ENGINEER

1/24/2018

---

Daniel Bullock, P.E. (TX 82596)
Bullock, Bennett & Associates, LLC
Firm Registrations: Engineering F-8542, Geoscience 50127

# ADDENDUM NO. 1 COLETO CREEK EXISTING CCR SURFACE IMPOUNDMENT CLOSURE PLAN

This Addendum No. 1 to the Closure Plan for Existing Coal Combustion Residuals (CCR) Impoundment for the Coleto Creek Primary Ash Pond at the Coleto Creek Power Station, Revision 1 - January 24, 2018 has been prepared to meet the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R. Section 257.103(f)(2)(v)(D)) as a component of the demonstration that the Coleto Creek Primary Ash Pond qualifies for a site-specific alternative deadline to initiate closure due to permanent cessation of a coal-fired boiler by a certain date.

The Coleto Creek Primary Ash Pond will begin construction of closure by April 17, 2025 and cease receipt and placement of CCR and non-CCR wastestreams by no later than September 17, 2027 as indicated in the Coleto Creek Power Plant Alternative Closure Demonstration dated November 30, 2020. Closure will be completed by October 17, 2028 within the 5-year timeframe included in the Closure Schedule identified in the Coleto Creek Existing CCR Surface Impoundment Closure Plan in accordance with 40 C.F.R. § 257.102(f)(1)(ii).

All other aspects of the Closure Plan remain unchanged.

## CERTIFICATION

I, Maureen T. Warren, a Qualified Professional Engineer in good standing in the State of Texas, certify that the information in this addendum is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

STATE OF TEXAS
MAUREEN T WARREN
117550
LICENSED
PROFESSIONAL ENGINEER

Maureen T. Warren
Qualified Professional Engineer
117550
Texas
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: November 30, 2020

| POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT §257.104(d) | Rev 1 Page 1 of 1<br>January 24, 2018 |
|---|---|

## SITE INFORMATION

| | | | |
|---|---|---|---|
| Site Name / Address | Coleto Creek Power Station, 45 FM 2987 Fannin, Goliad County, TX | | |
| Owner Name / Address | Coleto Creek Power, LP 1500 Eastport Plaza Drive Collinsville, IL 62234 | | |
| CCR Unit | Primary Ash Pond | Final Cover Type | Soil/Synthetic Liner System |
| Reason for Initiating Closure | Known final receipt of waste/Final removal of beneficial reuse materials | Closure Method | Close In-Place |

## CONTACT INFORMATION (d)(1)(ii)

| | | | |
|---|---|---|---|
| Contact Name | CCR Office, Coleto Creek Power, LP | | |
| Address | 601 Travis Street, Suite 1400, Houston, TX 77002 | | |
| Phone Number | 800-633-4704 | Email | ccr@dynegy.com |

## POST-CLOSURE PLAN DESCRIPTION

| | |
|---|---|
| (d)(1)(i) Description of the monitoring and maintenance activities required in paragraph (b) of this section for the CCR unit, and the frequency at which these activities will be performed; | (b)(1) Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;<br>(3) Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§ 257.90 through 257.98.<br>Descriptions of maintenance activities and frequencies are provided below. |
| (d)(1)(iii) A description of the planned uses of the property during the post-closure period. | The property will continue to be operated as a coal-fired power plant. If operation of the power plant is discontinued, post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart. Any other disturbance will only be allowed if the owner or operator of the CCR unit demonstrates that disturbance of the final cover, liner, or other component of the containment system, including any removal of CCR, will not increase the potential threat to human health or the environment. The demonstration will be certified by a qualified professional engineer, and notification shall be provided to the Texas Commission on Environmental Quality (TCEQ) that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible Internet site.<br><br>Following closure of the Primary Ash Pond, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 CFR 257.102(i). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements per 40 CFR 257.104(d)(1)(iii). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be placed in the facility's operating record. The notification will be placed on the owner or operator's publicly accessible CCR Web site in accordance with 40 CFR 257.107. |

### Post Closure Care Requirements §257.104(b)

| | |
|---|---|
| (b)(1) Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover; | In accordance with TCEQ guidelines, cover and drainage system inspections will be conducted semi-annually and after severe storms to check the condition of the facilities. The following items will be checked: Erosion of closure cover, deterioration of vegetative cover, damage to erosion control facilities, settlement, and drainage from operation of the seepage collection system. A description of the condition of the facility will be recorded in a logbook during each inspection. Any deterioration will be documented by photographs. In addition, settlement will be evaluated by topographic survey the first 5 years after closure. All records will be maintained in the facility's Permanent Record. |
| (b)(3) Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§ 257.90 through 257.98. | Groundwater monitoring is conducted in accordance with the requirements of §257.90 through §257.98 as detailed in the certified Coleto Creek Power Station Groundwater Sampling and Analysis Plan (October 17, 2017) and Groundwater Hydrogeologic Monitoring Plan (October 17, 2017). |

## NOTIFICATION AND RECORDKEEPING REQUIREMENTS

| | |
|---|---|
| 257.105(i) *Closure and post-closure care.* The owner or operator of a CCR unit subject to this subpart must place the information, as it becomes available, in the facility's operating record: | The following post-closure care information will be placed in the facility's operating record as it becomes available:<br>• The written post-closure plan, and any amendment of the plan, as required by § 257.104(d), except that only the most recent closure plan must be maintained in the facility's operating record irrespective of the time requirement specified in paragraph (b) of this section.<br>• The notification of completion of post-closure care period as required by § 257.104(e). |
| §§257.106(i) *Closure and post-closure care.* The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible Internet site. | TCEQ will be notified when information has been placed in the facility's operating record. Notification will be submitted as follows:<br>• Notification of the availability of the written post-closure plan, and any amendment of the plan, specified under § 257.105(i)(12).<br>• Notification of completion of post-closure care specified under §257.105(i)(13). |
| 257.107(i) *Closure and post-closure care.* The owner or operator of a CCR unit subject to this subpart must place the information on the owner or operator's CCR Web site: | The following information will be placed in the facility's Web site:<br>• The written post-closure plan, and any amendment of the plan, specified under § 257.105(i)(12).<br>• The notification of completion of post-closure care specified under § 257.105(i)(13). |

## POST-CLOSURE SCHEDULE

(c) *Post-closure care period.* (1) Except as provided by paragraph (c)(2) of this section, the owner or operator of the CCR unit must conduct post-closure care for 30 years. (2) If at the end of the post-closure care period the owner or operator of the CCR unit is operating under assessment monitoring in accordance with § 257.95, the owner or operator must continue to conduct post-closure care until the owner or operator returns to detection monitoring in accordance with § 257.95.

Note: At the time of this Written Post-Closure Plan, there are no immediate plans to close the Primary Ash Pond. The Primary Ash Pond is currently actively managing CCR wastes generated during operation of the coal-fired power plant. CCR waste is also actively removed from the Primary Ash Pond for off-site beneficial use. This practice is expected to continue after the pond no longer accepts CCR solids. The information presented in this plan, therefore, provides an overview of major tasks associated with final post-closure monitoring of the Primary Ash Pond and a schedule relative to the timeframes specified in the rule. This Post-Closure Plan will be amended with more specific information once closure activities have been initiated.

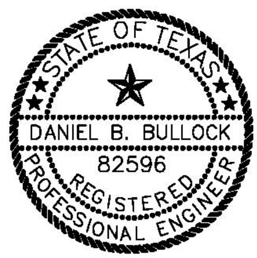
| | |
|---|---|
| (d)(2)(i) - Initial Written Post-Closure Plan Placed in Permanent Record | October 17, 2016 |

| | |
|---|---|
| ((e) *Notification of completion of post-closure care period.* No later than 60 days following the completion of the post-closure care period, the owner or operator of the CCR unit must prepare a notification verifying that post-closure care has been completed. The notification must include the certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the closure plan specified in paragraph (d) of this section and the requirements of this section. The owner or operator has completed the notification when it has been placed in the facility's operating record as required by § 257.105(i)(13). | Notification of the completion of post-closure care activities will be placed in the facility's Permanent Record no later than 60 days following the completion of the post-closure care period. |
| **Certification by qualified professional engineer appended to this plan.** | |

**Certification Statement 40 CFR § 257.104(d) – Written Post-Closure Plan for a CCR Surface Impoundment or Landfill**

**CCR Unit: Coleto Creek Power, LP; Coleto Creek Power Station; Coleto Creek Primary Ash Pond**

I, Daniel Bullock, being a Registered Professional Engineer in good standing in the State of Texas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the written post-closure plan, dated January 24, 2018, meets the requirements of 40 *CFR* § 257.104.




1/24/2018

Daniel Bullock, P.E. (TX 82596)
Bullock, Bennett & Associates, LLC
Firm Registrations: Engineering F-8542, Geoscience 50127

# APPENDIX G – FINANCIAL ASSURANCE

## Post-Closure Care Cost Estimate Memo

# TECHNICAL MEMORANDUM

**DATE** January 7, 2022 **Project No.** 20142034

**TO** Mr. Eric Chavers
Luminant

**FROM** Patrick J. Behling, PE/Jeffrey B. Fassett, PE **EMAIL Patrick_Behling@golder.com**

**ESTIMATED POST CLOSURE CARE COSTS**
**MARTIN LAKE, OAK GROVE, SANDOW AND COLETO CREEK POWER PLANTS**
**TCEQ POST CLOSURE CARE COST ESTIMATES**

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Luminant operates the following coal/lignite-fired power plants located in Texas:

- Martin Lake Steam Electric Station
- Oak Grove Steam Electric Station
- Sandow Steam Electric Station
- Coleto Creek Power Plant

Coal combustion residuals (CCR) are generated as by-products of power generation and are managed at the following existing CCR Units at each power plant:

- Martin Lake Steam Electric Station
  - Permanent Disposal Pond No. 5 (PDP-5)
  - Ash Ponds (East Ash Pond, West Ash Pond and New Scrubber Pond)
  - A-1 Area Landfill
- Oak Grove Steam Electric Station
  - Flue Gas Desulfurization Ponds (FGD-A, FGD-B and FGD-C)
  - Ash Landfill 1
- Sandow Steam Electric Station
  - AX Landfill
- Coleto Creek Power Plant
  - Primary Ash Pond

These CCR Units are regulated under 40 CFR 257, Subpart D (the "Federal CCR Rule") and 30 Texas Administrative Code (TAC) Chapter 352 (The "TCEQ CCR Rule"). In accordance with 30 TAC §352.201, Luminant is required to submit an application to TCEQ to obtain a registration for each of these CCR Units.

Golder Associates USA Inc. (Golder) has been retained by Luminant to assist with preparation of Post Closure Care Cost Estimates (PCCE) for these CCR Units in accordance with §352.1101. This technical memorandum presents the PCCEs estimated by Golder for the CCR Units. The PCCEs were prepared using TCEQ Technical Guidance Documents TG-30 and TG-31 and related documents.

## 1.0 CCR Unit Closure Assumptions

The PCCEs were prepared based on the following closure assumptions for the CCR Units.

### 1.1 Martin Lake Steam Electric Station

- PDP-5:
  - CCR Unit Closure:
    - Closure in Place with low permeability cap
    - Cap Area: 40 acres
  - Groundwater Closure:
    - No evidence of a release to groundwater to date
    - Continuation of Detection Monitoring for Groundwater
    - Nine (9) monitoring wells sampled semi-annually
  - Existing Leachate Collection System operated throughout post closure care period

- Ash Ponds:
  - West Ash Pond (WAP), East Ash Pond (EAP) and New Scrubber Pond (NSP) managed as one CCR Unit
  - CCR Unit Closure:
    - Closure in Place with low permeability cap
    - Cap Areas:
      - WAP and EAP Cap Area: 25 acres
      - NSP Cap Area: 36 acres
      - Total: 61 acres
  - Groundwater Closure:
    - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
    - Continuation of Detection and Assessment Monitoring for Groundwater
    - Seven (7) monitoring wells sampled semi-annually

- A-1 Area Landfill:
  - CCR Unit Closure:
    - Closure in Place with low permeability cap
    - Cap Areas:
      - Existing Cap Area: 464 acres
      - Future Cap Area: 321 acres
      - Total: 785 acres
  - Groundwater Closure:
    - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
    - Continuation of Detection and Assessment Monitoring for Groundwater
    - Twelve (12) monitoring wells sampled semi-annually

1.2 Oak Grove Steam Electric Station

- FGD Ponds:
  - FGD-A, FGD-B and FGD-C managed as one CCR Unit
  - CCR Unit Closure:
    - Closure in Place with vegetated, low permeability cap
    - Cap Areas:
      - FGD-A Cap Area: 9 acres
      - FGD-B Cap Area: 11.2 acres
      - FGD-C Cap Area: 15.2 acres
      - Total: 35.4 acres
  - Groundwater Closure:
    - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
    - Continuation of Detection and Assessment Monitoring for Groundwater
    - Nine (9) monitoring wells sampled semi-annually

- Ash Landfill 1:
  - CCR Unit Closure:
    - Closure in Place with vegetated, low permeability cap
    - Cap Area: 128 acres
  - Groundwater Closure:
    - No evidence of a release to groundwater to date
    - Continuation of Detection Monitoring for Groundwater
    - Six (6) monitoring wells sampled semi-annually

1.3 Sandow Steam Electric Station

- AX Landfill:
  - CCR Unit Closure:
    - Closure in Place with vegetated, low permeability cap
    - Cap Area: 150 acres
  - Groundwater Closure:
    - No evidence of a release to groundwater to date
    - Continuation of Detection Monitoring for Groundwater
    - Nine (9) monitoring wells sampled semi-annually

1.4 Coleto Creek Power Plant

- Primary Ash Pond (PAP):
  - CCR Unit Closure:
    - Closure in Place with vegetated, low permeability cap
    - Cap Area: 190 acres
  - Groundwater Closure:
    - No evidence of a release to groundwater to date
    - Continuation of Detection Monitoring for Groundwater
    - Nine (9) monitoring wells sampled semi-annually

## 2.0 Post Closure Care Cost Assumptions

The following general assumptions were incorporated into the PCCEs:

- Post Closure Care Period. A post-closure care period of 30 years is assumed in accordance with 30 TAC §352.1241 and 40 CFR § 257.104(c).
- CCR Unit Inspections. Weekly and annual inspections of the CCR Units are required under §352.831 and §352.841. It is assumed that these inspections will continue throughout the Post Closure Care Period.
- Final Cover Maintenance. It is likely that some level of maintenance/repair will be required for the final cover systems used to close the CCR Units. The PCCEs include the following assumptions for final cover maintenance/repair:
  - Years 1-5 After Closure - it is assumed that erosion damage on 5% of the cap soil will be repaired each year. The thickness of each repair is assumed to average 6 inches of soil. In addition, the repaired areas will be revegetated.
  - Years 6-30 After Closure - it is assumed that erosion damage on 5% of the cap soil will be repaired three times during this period. The thickness of each repair is assumed to average 6 inches of soil. In addition, the repaired areas will be revegetated.
  - Estimated engineering/mobilization costs associated with the repairs/revegetation are included in the PCCEs.
  - Annual mowing costs for the final cover are included in the PCCEs.
- General Site Maintenance. Maintenance of run-off/drainage structures, access roads, fencing, signs, etc. are included in the PCCEs.
- Groundwater Monitoring. Semi-annual groundwater monitoring in accordance with the Federal/TCEQ CCR Rules (detection monitoring or assessment monitoring) is on-going for each CCR Unit. It is assumed that the current groundwater monitoring program at each CCR Unit will continue throughout the Post Closure Care Period.

  In addition, several of the CCR Units incorporate MNA as a groundwater remedy as part of closure. For those CCR Units, it is assumed that MNA analyses will be included in the semi-annual groundwater monitoring events.

  It is also likely that maintenance of the monitoring well system at each CCR Unit will be required during the post closure care period. The PCCEs assume that one monitoring well will be replaced every 10 years at each CCR Unit.
- One Time Post Closure Care Costs. The following on time activities associated with post closure care are included in the PCCEs for each CCR Unit:
  - Deed Notices/Surveys
  - Monitoring Well Plugging and Abandonment
- Leachate Collection – PDP-5. Martin Lake PDP-5 is constructed with a leachate collection system to remove leachate from the unit after closure. For the PDP-5 PCCE, it is assumed that all free liquids in PDP-5 will be removed during closure and the existing leachate collection system will be operated throughout the post closure care period to remove water that infiltrates through the low permeability cap. For the PCEE, the average annual volume of leachate generated following closure was estimated to be approximately 1,000 gallons per year using the Hydrologic Evaluation of Landfill Performance (HELP)

Model (see Attachment A). Costs to dispose of this estimated volume of leachate as Class II Industrial Waste and maintain the leachate collection system through the post closure care period are included in the PCCE for PDP-5.

- Contingency. A 10% contingency factor is included in each PCCE.

## 3.0 Post Closure Care Cost Estimates

Based on the assumptions listed above, 30-Year post closure care cost estimates for the Luminant CCR Units are as follows (see Tables 1 through 7 for details):

| CCR Unit | 30-Year Post Closure Care Cost Estimate |
|---|---|
| MLSES PDP-5 | $2,026,787 |
| MLSES Ash Ponds | $2,228,065 |
| MLSES A-1 Area Landfill | $8,273,063 |
| OGSES FGD Ponds | $2,168,817 |
| OGSES Ash Landfill 1 | $2,326,837 |
| SASES AX Landfill | $2,591,600 |
| CCPP PAP | $3,117,987 |

It should be noted that the PCCEs presented herein are considered Opinions of Probable Cost and represent Golder's best judgement based on the assumptions stated, information available at the time the estimates were prepared, and Golder's experience with similar sites. The PCCEs are susceptible to variations in future cost of materials, labor, and equipment and should not be considered guaranteed maximum prices for post closure care activities.

Please do not hesitate to contact us if you have any questions or comments.

Patrick J. Behling, P.E.
Principal

Jeffrey B. Fassett, PE
Associate

# TABLES

**Table 1**

**Martin Lake Steam Electric Station - PDP-5**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 1,613 | $8,067 | 5 | $40,333 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 1,613 | $8,067 | 3 | $24,200 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 2.0 | $3,000 | 5 | $15,000 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 2.0 | $3,000 | 3 | $9,000 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $5,000 | 1 | $5,000 | 8 | $40,000 |
| - Mowing, per year | AC | $150 | 40 | $6,000 | 30 | $180,000 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $2,000 | 1 | $2,000 | 30 | $60,000 |
| - Access Roads, fencing, signs, etc. | LS | $1,000 | 1 | $1,000 | 30 | $30,000 |
| Leachate Management (Annually) | | | | | | |
| - Leachate Disposal (Class II) | Gal | $10 | 1,000 | $10,000 | 30 | $300,000 |
| - Leachate System Maintenance | LS | $2,000 | 1 | $2,000 | 30 | $60,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (9 MWs, 1 Dup) | EA | $500 | 10 | $5,000 | 60 | $300,000 |
| - Annual Report | LS | $10,000 | 1 | $10,000 | 30 | $300,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $10,000 | 1 | $10,000 | 1 | $10,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 9 | $9,000 | 1 | $9,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $1,842,533 |
| Contingency (10%): | | | | | | $184,253 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$2,026,787** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 2

**Martin Lake Steam Electric Station - Ash Ponds**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 2,460 | $12,302 | 5 | $61,508 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 2,460 | $12,302 | 3 | $36,905 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 3.1 | $4,575 | 5 | $22,875 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 3.1 | $4,575 | 3 | $13,725 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $5,000 | 1 | $5,000 | 8 | $40,000 |
| - Mowing, per year | AC | $150 | 61 | $9,150 | 30 | $274,500 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $3,000 | 1 | $3,000 | 30 | $90,000 |
| - Access Roads, fencing, signs, etc. | LS | $1,500 | 1 | $1,500 | 30 | $45,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (7 MWs, 1 Dup) | EA | $500 | 8 | $4,000 | 60 | $240,000 |
| - Assessment Monitoring - Semi-annual Analysis, (7 MWs, 1 Dup) | EA | $350 | 8 | $2,800 | 60 | $168,000 |
| - MNA Monitoring - Semi-annual Analysis, (7 MWs, 1 Dup) | EA | $200 | 8 | $1,600 | 60 | $96,000 |
| - Annual Report (Including MNA) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $15,000 | 1 | $15,000 | 1 | $15,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 7 | $7,000 | 1 | $7,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $2,025,513 |
| Contingency (10%): | | | | | | $202,551 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$2,228,065** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

**Table 3**

**Martin Lake Steam Electric Station - A1 Area Landfill**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 31,662 | $158,308 | 5 | $791,542 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 31,662 | $158,308 | 3 | $474,925 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 39.3 | $58,875 | 5 | $294,375 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 39.3 | $58,875 | 3 | $176,625 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $15,000 | 1 | $15,000 | 8 | $120,000 |
| - Mowing, per year | AC | $150 | 785 | $117,750 | 30 | $3,532,500 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $8,000 | 1 | $8,000 | 30 | $240,000 |
| - Access Roads, fencing, signs, etc. | LS | $4,000 | 1 | $4,000 | 30 | $120,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (12 MWs, 1 Dup) | EA | $500 | 13 | $6,500 | 60 | $390,000 |
| - Assessment Monitoring - Semi-annual Analysis, (12 MWs, 1 Dup) | EA | $350 | 13 | $4,550 | 60 | $273,000 |
| - MNA Monitoring - Semi-annual Analysis, (12 MWs, 1 Dup) | EA | $200 | 13 | $2,600 | 60 | $156,000 |
| - Annual Report (Including MNA) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $25,000 | 1 | $25,000 | 1 | $25,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 12 | $12,000 | 1 | $12,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $7,520,967 |
| Contingency (10%): | | | | | | $752,097 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$8,273,063** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 4

**Oak Grove Steam Electric Station - FGD Ponds**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 1,428 | $7,139 | 5 | $35,695 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 1,428 | $7,139 | 3 | $21,417 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 1.8 | $2,655 | 5 | $13,275 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 1.8 | $2,655 | 3 | $7,965 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $10,000 | 1 | $10,000 | 8 | $80,000 |
| - Mowing, per year | AC | $150 | 35 | $5,310 | 30 | $159,300 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $2,000 | 1 | $2,000 | 30 | $60,000 |
| - Access Roads, fencing, signs, etc. | LS | $1,000 | 1 | $1,000 | 30 | $30,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (9 MWs, 1 Dup) | EA | $500 | 10 | $5,000 | 60 | $300,000 |
| - Assessment Monitoring - Semi-annual Analysis, (9 MWs, 1 Dup) | EA | $350 | 10 | $3,500 | 60 | $210,000 |
| - MNA Monitoring - Semi-annual Analysis, (9 MWs, 1 Dup) | EA | $200 | 10 | $2,000 | 60 | $120,000 |
| - Annual Report (Including MNA) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $10,000 | 1 | $10,000 | 1 | $10,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 9 | $9,000 | 1 | $9,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $1,971,652 |
| Contingency (10%): | | | | | | $197,165 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$2,168,817** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 5

**Oak Grove Steam Electric Station - Ash Landfill 1**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 5,163 | $25,813 | 5 | $129,067 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 5,163 | $25,813 | 3 | $77,440 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 6.4 | $9,600 | 5 | $48,000 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 6.4 | $9,600 | 3 | $28,800 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $10,000 | 1 | $10,000 | 8 | $80,000 |
| - Mowing, per year | AC | $150 | 128 | $19,200 | 30 | $576,000 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $4,000 | 1 | $4,000 | 30 | $120,000 |
| - Access Roads, fencing, signs, etc. | LS | $2,000 | 1 | $2,000 | 30 | $60,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (6 MWs, 1 Dup) | EA | $500 | 7 | $3,500 | 60 | $210,000 |
| - Annual Report | LS | $10,000 | 1 | $10,000 | 30 | $300,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $15,000 | 1 | $15,000 | 1 | $15,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 6 | $6,000 | 1 | $6,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $2,115,307 |
| Contingency (10%): | | | | | | $211,531 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$2,326,837** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

**Table 6**

**Sandow Steam Electric Station - AX Landfill**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 6,050 | $30,250 | 5 | $151,250 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 6,050 | $30,250 | 3 | $90,750 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 7.5 | $11,250 | 5 | $56,250 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 7.5 | $11,250 | 3 | $33,750 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $10,000 | 1 | $10,000 | 8 | $80,000 |
| - Mowing, per year | AC | $150 | 150 | $22,500 | 30 | $675,000 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $4,000 | 1 | $4,000 | 30 | $120,000 |
| - Access Roads, fencing, signs, etc. | LS | $2,000 | 1 | $2,000 | 30 | $60,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (9 MWs, 1 Dup) | EA | $500 | 10 | $5,000 | 60 | $300,000 |
| - Annual Report | LS | $10,000 | 1 | $10,000 | 30 | $300,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $15,000 | 1 | $15,000 | 1 | $15,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 9 | $9,000 | 1 | $9,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $2,356,000 |
| Contingency (10%): | | | | | | $235,600 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$2,591,600** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 7

**Coleto Creek Power Plant - Primary Ash Pond**
**Post Closure Care Cost Estimate - 30 TAC 352.1101**

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|---|---|---|---|---|---|
| CCR Unit Inspections (Annually) | LS | $15,000 | 1 | $15,000 | 30 | $450,000 |
| Final Cover Maintenance | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | $5 | 7,663 | $38,317 | 5 | $191,583 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | $5 | 7,663 | $38,317 | 3 | $114,950 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | $1,500 | 9.5 | $14,250 | 5 | $71,250 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | $1,500 | 9.5 | $14,250 | 3 | $42,750 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | $10,000 | 1 | $10,000 | 8 | $80,000 |
| - Mowing, per year | AC | $150 | 190 | $28,500 | 30 | $855,000 |
| General Site Maintenance (Annually) | | | | | | |
| - Run-off/Drainage Structures | LS | $4,000 | 1 | $4,000 | 30 | $120,000 |
| - Access Roads, fencing, signs, etc. | LS | $2,000 | 1 | $2,000 | 30 | $60,000 |
| GW Monitoring (Annually) | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (9 MWs, 1 Dup) | EA | $500 | 10 | $5,000 | 60 | $300,000 |
| - Assessment Monitoring - Semi-annual Analysis, (9 MWs, 1 Dup) | EA | $350 | 10 | $3,500 | 60 | $210,000 |
| - Annual Report | LS | $10,000 | 1 | $10,000 | 30 | $300,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | $5,000 | 1 | $5,000 | 3 | $15,000 |
| One Time Post Closure Care Costs | | | | | | |
| - Deed Notices/Surveys | LS | $15,000 | 1 | $15,000 | 1 | $15,000 |
| - Monitoring Well Plugging and Abandonment | EA | $1,000 | 9 | $9,000 | 1 | $9,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | $2,834,533 |
| Contingency (10%): | | | | | | $283,453 |
| **30-Year Post Closure Cost Estimate:** | | | | | | **$3,117,987** |

**Notes:**
1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

# ATTACHMENT A

# PDP-5 HELP MODEL RESULTS

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**HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE**
**HELP MODEL VERSION 4.0 BETA (2018)**
**DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY**

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**Title:** Martin Lake PDP 5 **Simulated On:** 1/3/2022 14:52

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**Layer 1**

Type 1 - Vertical Percolation Layer (Cover Soil)
SiL - Silty Loam(Moderate)
Material Texture Number 23

| | | | |
|---|---|---|---|
| Thickness | = | 18 | inches |
| Porosity | = | 0.461 | vol/vol |
| Field Capacity | = | 0.36 | vol/vol |
| Wilting Point | = | 0.203 | vol/vol |
| Initial Soil Water Content | = | 0.2798 | vol/vol |
| Effective Sat. Hyd. Conductivity | = | 9.00E-06 | cm/sec |

**Layer 2**

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

| | | | |
|---|---|---|---|
| Thickness | = | 0.04 | inches |
| Effective Sat. Hyd. Conductivity | = | 4.00E-13 | cm/sec |
| FML Pinhole Density | = | 1 | Holes/Acre |
| FML Installation Defects | = | 4 | Holes/Acre |
| FML Placement Quality | = | 2 | Excellent |

**Layer 3**

Type 1 - Vertical Percolation Layer
Clay
Material Texture Number 43

| | | | |
|---|---|---|---|
| Thickness | = | 24 | inches |
| Porosity | = | 0.451 | vol/vol |
| Field Capacity | = | 0.419 | vol/vol |
| Wilting Point | = | 0.332 | vol/vol |
| Initial Soil Water Content | = | 0.4174 | vol/vol |
| Effective Sat. Hyd. Conductivity | = | 1.00E-07 | cm/sec |

**Layer 4**

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

| | | | |
|---|---|---|---|
| Thickness | = | 720 | inches |
| Porosity | = | 0.541 | vol/vol |
| Field Capacity | = | 0.187 | vol/vol |
| Wilting Point | = | 0.047 | vol/vol |
| Initial Soil Water Content | = | 0.187 | vol/vol |
| Effective Sat. Hyd. Conductivity | = | 5.00E-05 | cm/sec |

**Layer 5**

Type 3 - Barrier Soil Liner

C (Moderate)

Material Texture Number 29

| | | | |
|---|---|---|---|
| Thickness | = | 48 | inches |
| Porosity | = | 0.451 | vol/vol |
| Field Capacity | = | 0.419 | vol/vol |
| Wilting Point | = | 0.332 | vol/vol |
| Initial Soil Water Content | = | 0.451 | vol/vol |
| Effective Sat. Hyd. Conductivity | = | 6.80E-07 | cm/sec |

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Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

**General Design and Evaporative Zone Data**

| | | | |
|---|---|---|---|
| SCS Runoff Curve Number | = | 84.2 | |
| Fraction of Area Allowing Runoff | = | 100 | % |
| Area projected on a horizontal plane | = | 40 | acres |
| Evaporative Zone Depth | = | 18 | inches |
| Initial Water in Evaporative Zone | = | 5.037 | inches |
| Upper Limit of Evaporative Storage | = | 8.298 | inches |
| Lower Limit of Evaporative Storage | = | 3.654 | inches |
| Initial Snow Water | = | 0 | inches |
| Initial Water in Layer Materials | = | 171.343 | inches |
| Total Initial Water | = | 171.343 | inches |
| Total Subsurface Inflow | = | 0 | inches/year |

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Note: SCS Runoff Curve Number was calculated by HELP.

**Evapotranspiration and Weather Data**

| | | | |
|---|---|---|---|
| Station Latitude | = | 32.31 | Degrees |
| Maximum Leaf Area Index | = | 5 | |
| Start of Growing Season (Julian Date) | = | 0 | days |
| End of Growing Season (Julian Date) | = | 367 | days |
| Average Wind Speed | = | 6 | mph |

| | | |
|---|---|---|
| Average 1st Quarter Relative Humidity | = | 1 % |
| Average 2nd Quarter Relative Humidity | = | 22 % |
| Average 3rd Quarter Relative Humidity | = | 88 % |
| Average 4th Quarter Relative Humidity | = | 22 % |

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Note: Evapotranspiration data was obtained for Dirgin, Texas

**Normal Mean Monthly Precipitation (inches)**

| Jan/Jul | Feb/Aug | Mar/Sep | Apr/Oct | May/Nov | Jun/Dec |
|---|---|---|---|---|---|
| 3.940712 | 3.384053 | 4.449471 | 3.632658 | 4.152557 | 5.603921 |
| 3.172363 | 2.83961 | 2.855806 | 4.403743 | 4.552789 | 4.108209 |

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Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 32.31/-94.55

**Normal Mean Monthly Temperature (Degrees Fahrenheit)**

| Jan/Jul | Feb/Aug | Mar/Sep | Apr/Oct | May/Nov | Jun/Dec |
|---|---|---|---|---|---|
| 51.6 | 52.5 | 64.1 | 73 | 79.7 | 89.4 |
| 92.3 | 89.7 | 84.1 | 74 | 66.1 | 57.1 |

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Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 32.31/-94.55
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 32.31/-94.55

**Average Annual Totals Summary**

**Title:** Martin Lake PDP 5
**Simulated on:** 1/6/2022 8:32

| | Average Annual Totals for Years 1 - 30* | | | | |
|---|---|---|---|---|---|
| | (inches) | [std dev] | (cubic feet) | (gallons) | (percent) |
| Precipitation | 47.10 | [5.76] | 6,838,323.4 | 51,154,215.3 | 100.00 |
| Runoff | 4.062 | [2.566] | 589,755.5 | 4,411,677.7 | 8.62 |
| Evapotranspiration | 42.959 | [5.448] | 6,237,618.8 | 46,660,632.2 | 91.22 |
| Subprofile1 | | | | | |
| Percolation/leakage through Layer 2 | 0.000690 | [0.000293] | 100.1 | 749.1 | 0.00 |
| Average Head on Top of Layer 2 | 2.5255 | [1.058] | --- | --- | --- |
| Subprofile2 | | | | | |
| Percolation/leakage through Layer 5 | 0.000690 | [0.000293] | 100.1 | 749.1 | 0.00 |
| Average Head on Top of Layer 5 | 0.0000 | [0] | --- | --- | --- |
| Water storage | | | | | |
| Change in water storage | 0.0747 | [1.8339] | 10,849.0 | 81,156.3 | 0.16 |

* Note: Average inches are converted to volume based on the user-specified area.

**Peak Annual Totals Summary**

| Year | Percolation/leakage through Layer 2 (cubic feet) | Percolation/leakage through Layer 2 (gallons) |
|---|---|---|
| 1 | 94.36 | 705.86 |
| 2 | 90.86 | 679.71 |
| 3 | 114.98 | 860.12 |
| 4 | 133.94 | 1001.98 |
| 5 | 68.53 | 512.66 |
| 6 | 72.73 | 544.05 |
| 7 | 65.14 | 487.29 |
| 8 | 129.67 | 969.97 |
| 9 | 145.04 | 1084.99 |
| 10 | 96.08 | 718.70 |
| 11 | 113.33 | 847.75 |
| 12 | 127.05 | 950.38 |
| 13 | 170.85 | 1278.05 |
| 14 | 110.62 | 827.46 |
| 15 | 176.37 | 1319.34 |
| 16 | 32.26 | 241.34 |
| 17 | 135.53 | 1013.81 |
| 18 | 114.29 | 854.96 |
| 19 | 124.03 | 927.84 |
| 20 | 9.75 | 72.90 |
| 21 | 36.21 | 270.86 |
| 22 | 65.90 | 492.99 |
| 23 | 79.54 | 594.98 |
| 24 | 31.83 | 238.14 |
| 25 | 99.15 | 741.70 |
| 26 | 78.99 | 590.87 |
| 27 | 111.77 | 836.07 |
| 28 | 180.88 | 1353.09 |
| 29 | 76.11 | 569.33 |
| 30 | 118.42 | 885.85 |